2021 Annual Report

Massachusetts Division of Fisheries & Wildlife

Annual Report 2021

Massachusetts Division of Fisheries & Wildlife

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An agency of the Department of Fish & Game

MASSWILDLIFE

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1 The Board Report

Dr. Joseph S. Larson, Chair

Overview

The Massachusetts Fisheries and Wildlife Board consists of seven persons appointed by the Governor to 5-year terms. By law, the individuals appointed to the Board are volunteers, receiving no remuneration for their service to the Commonwealth. Five of the seven are selected on a regional basis, with one member, by statute, representing agricultural interests. The two remaining seats are held by a professional wildlife biologist or wildlife manager and one representative with a specific interest in the management and restoration of wildlife populations not classified as game species. The Board oversees operations of the Massachusetts Division of Fisheries and Wildlife (MassWildlife); reviews the agency's programs; approves all personnel appointments; sets policy and regulations pertinent to wildlife in the Commonwealth; and approves expenditures from the Wildlands Fund for and votes to accept care, custody, and control of wildlife lands acquired through the Department of Fish and Game's Land Protection Program.

The Board has a tradition of holding some of its monthly meetings at locations around the state when possible, but, again this year, it was not possible to meet in person more tan once. The COVID-19 pandemic that began in early 2020 and forced Governor Baker to execute various executive orders to protect staff and public health and safety continued into FY 2021. The modifications to portions of the state's Open Meeting laws that enabled municipal and state boards, including the Fisheries and Wildlife Board, to hold public meetings via open conference calls and virtual meeting video platforms (i.e., Zoom) were effective throughout most of the fiscal year. The Board also held a number of public listening sessions and several public hearings on proposed regulatory changes virtually during the year; details of those sessions and hearings are below. The only variation in this pattern occurred at the end of the fiscal year when the Chair had to cancel and reschedule the June meeting to be held in person because the Open Meeting law provisions were set to expire just days before the scheduled meeting. Those provisions were subsequently renewed through July 15, 2022.

While many different matters and issues are brought before the Board each year, most of its meeting time is spent in review and scrutiny of proposals for regulatory changes; of agency programs and policies; and of possible land and conservation-restriction acquisitions, usually, given the confidential nature of land-purchase negotiations, in executive session. Anyone interested in the details of the monthly meetings of the Fisheries and Wildlife Board is referred to the archive of approved Board meeting minutes the staff maintains on MassWildlife's website (Mass.Gov/Service-Details/Fisheries-and-Wildlife-Board-Meeting-Minutes).

This report is organized topically, then roughly chronologically within each topic. This predictable structure allows relatively easy searching and comparison of the Board's annual reports year over year.

Fiscal Year Highlights

Certainly, from the Board's perspective, the most absorbing and important work of FY 2021 was the process of developing and proposing MassWildlife's first license, stamp, and permit fee-structure increase in 24 years. Following a thorough review by MassWildlife staff and the Fisheries and Wildlife Board, an extensive, 6-month public engagement effort was conducted to allow the agency to gather feedback from hunters, anglers, and trappers. Details of the intensive outreach and regulatory process MassWildlife has followed in this effort thus far are given below.

The COVID-19 pandemic, which had begun the previous fiscal year, continued to bring unique challenges to state government and all citizens during the fiscal year. The changes to daily operations that MassWildlife

managers and their staff had made the previous year to allow for social (i.e., physical) distancing; provide a safe and deep-cleaned working environment when staff did need to be in the office or in vehicles; and provide the digital tools required for telework, or working from home or other remote location, largely continued through waves of COVID-19 variants that were less life-threatening but more and more contagious. With the development of effective vaccines and gradually loosening restrictions on the size of public gatherings, state office building capacity, and requirements to wear masks in public settings, including the office, most MassWildlife staff continued to work remotely (i.e., telework) throughout the fiscal year, except for those who could not do their jobs remotely, such as Clerks and Hatchery and District staff, and had to report to their duty stations. Continued social distancing, deep-cleaning measures, and altered schedules when feasible contributed to keeping most staff safe and healthy. I am pleased and proud to report that MassWildlife's staff once again stepped up in its best cooperative spirit to meet the challenges, and none of the installations was forced to close due to a COVID-19 outbreak. The entire Board joins me in thanking and congratulating the managers and staff on a job very well done again this year. At the end of the fiscal year the pandemic is still ongoing, though most of the Governor's orders, such as limits on gathering sizes and business closings, have been gradually reduced or rescinded.

Administrative Matters

The Board held its annual election of officers during the November business meeting, reelecting Dr. Joseph S. Larson to the Chair, Mr. Michael Roche as the Vice Chair, and Ms. Bonnie Booth as the Secretary of the Board.

MassWildlife has been able to maintain its high level of services and programs through careful and responsible management of its funds for over 24 years without raising license fees. But with inflation up nearly 65% since 1996 (the last year license fees were increased); new and increased agency responsibilities; and the steadily rising costs of employee health insurance, retirement benefits, payroll taxes, and mandated salary increases, MassWildlife expenses have been exceeding revenues for the past several years. Recognizing this fact, Chair Larson formed a subcommittee comprised of three Board members, Michael Roche, Vice Chair of the Board; Ernie Foster, Board member representing the Southeast District; and Bonnie Booth, Board member for the Central District and representative of agricultural interests, to work with Director Mark S. Tisa to conduct a comprehensive review of the agency's finances. Upon completion of the review, the subcommittee was charged with reporting its findings and recommendations to the full Board.

The subcommittee met several times with the Director between January and June of 2019 to review agency programs, operating costs, and current license fees. The subcommittee noted that over the past 20 years, MassWildlife has been able to significantly expand hunting opportunities for our sporting constituents because of successful restoration and management of various game species, providing more days afield and time to enjoy the outdoors. MassWildlife has also created three new hunting programs specifically for youth to hunt pheasant, deer, and turkey. In addition, with 365 days a year to enjoy fishing in the Commonwealth, MassWildlife added a fall trout stocking program and significantly enhanced both the size and quality of the trout being reared in our hatcheries. More than 70% of the trout annually stocked average 12 inches or greater, up from less than 50% in 1996 and many weigh a pound or more at the time of stocking.

In summary, the subcommittee's review concluded, first, that MassWildlife's wildlife management operations and wildlife-related recreational programs and services are of the highest quality and should be maintained moving forward. Second, absent a license fee increase, MassWildlife will only be able to sustain its high-quality programs and services for another two years. Third, without additional source(s) of revenue, even with a license fee increase, MassWildlife's operations will be unsustainable in the long term, i.e., 5 years and beyond.

Therefore, the subcommittee's recommendation was that MassWildlife begin the process of reaching out to anglers, hunters, and trappers to seek their support for a license fee increase to maintain the agency's current level and quality of programs and services as a first step towards building a sustainable funding model for the agency. The Fisheries and Wildlife Board voted unanimously to adopt the recommendation at its December 2019 monthly meeting.

In January of this fiscal year, after having consulted with the Department of Fish and Game and the Executive Office of Energy and Environmental Affairs, Director Tisa provided the Board with the results of his and the subcommittee's in-depth analysis of the agency's finances. At the February meeting, the Director presented a draft fee structure that was designed to address MassWildlife's revenue shortfall; sustain the Inland Fish and Game Fund for another decade; fund core operations; and maintain MassWildlife's popular, high-quality programs and services. The Director also reported that, after consulting with the Department, it was decided that he and his staff would conduct three public listening sessions (March) and three public hearings (April) on behalf of the Executive Office of Administration and Finance, to gather public feedback on the proposed fee structure.

As of the close of the fiscal year, the proposed license increase process was ongoing.

Adopted Regulations and Other Votes of the Board

2021-2022 Migratory Game Bird Season Regulations: Public Hearing, Comment Review, and Vote

In March, Assistant Director for Wildlife Michael Huguenin provided the Board with a preview of the expected federal frameworks for the 2021-2022 Migratory Game Bird hunting seasons, which had not yet been finalized. Mr. Huguenin then reported the staff's preliminary proposals for Massachusetts' seasons, which were developed from the federal frameworks with consideration of the input and preferences of Massachusetts bird hunters. In April, the staff held the public hearing; at the close of the hearing, the Board voted to adopt the final regulation package as recommended. There was no written comment period after the hearing (which is normal for these regulations) because federal regulations require that states report their seasons by April 30, so that they can be recorded in the Federal Register by the end of May. For details of the final regulations, see the Waterfowl sub-report in the Wildlife Program of this Annual Report on Page 46).

2020 Annual Deer Review and 2021 Antlerless Deer Permit Allocation Recommendations

At the June meeting, Assistant Director for Willdife Michael Huguenin introduced MassWildlife's new Deer and Moose Project Leader, Martin Feehan, who had started in his position during the previous month, and presented the annual Deer Review to the Board. Mr. Huguenin also presented the staff recommendation for the 2021 Antlerless Deer Permit (ADP) allocations, which were unchanged from the previous year and were approved by the Board. Please refer to Page 51 in the Wildlife Program of this Annual Report for the details of the review and of the ADP allocations for 2021.

Proposals for New, Updated, or Amended Regulations

There were no proposals for changes to the regulations that were not finalized before the end of the fiscal year.

Agency Program Reviews

July Meeting

Coldwater Climate Change Refugia (Stream Biology Project Leader Rebecca Quiñones)

August Meeting

Avian Ecology and Conservation Project Update (State Ornithologist Andrew Vitz)

September Meeting

Presentation of the Draft R3 (Recruitment, Retention, and Reengagement) Plan (Introduction: CFO Kris McCarthy; Plan: R3 Coordinator Astrid Huseby)

October Meeting

Implementing the 5-year Plan (Introduction: Director Mark S. Tisa; Plan: R3 Coordinator Astrid Huseby)

November Meeting

Social Media While Social Distancing (Outreach and Marketing Manager Nicole McSweeney)

December Meeting

MassWildlife Habitat Management: Past, Present, and Future (Habitat Project Leader John Scanlon)

May Meeting

Coldwater Refugia as Cornerstones of Aquatic Conservation (Stream Biology Project Leader Rebecca Quiñones)

Massachusetts Fisheries and Wildlife Board Members

Joseph S. Larson, Pelham (Chair)

Michael Roche, Orange (Vice Chair)

Bonnie Booth, Spencer (Secretary)

Brandi Van Roo, Douglas

Ernest W. Foster IV, Scituate

Stephen A. Sears, Dalton

Bob Durand, Marlborough

2 The Fisheries Program

Todd Richards, Assistant Director of Fisheries

Overview

Fiscal Year 2021 was certainly challenging for the Fisheries Program, a group of biologists very dedicated to field work, data collection, and using that data to improve fishing and conservation. The pandemic restricted crew sizes and made large, coordinated projects nearly impossible. Instead, the group pivoted to smaller projects, management plans, and data analysis. In the end, they were able to continue altered and repurposed field work to collect new information, develop the nuts and bolts of a wild trout management plan outline, set the stage for aquatic biodiversity metric to be used in several MassWildlife projects, and think of creative ways to engage field staff to improve fisheries outreach projects like GoFishMA!

Throughout the year we were also able to increase our work as leaders in climate science through relationships with the Cooperative Fish and Wildlife Research Unit and the Northeast Climate Science Center. Work focused on understanding coldwater climate refugia, the relationship between climate change and biodiversity, and how lake and pond management activities will affect those resources under the impacts of climate change.

Recreational fisheries management through lake and pond research and our high-quality trout stocking practices continued to provide opportunities to anglers across the state from out most rural to our most urban settings. This year also saw 8 new state records entered through our very popular Sportfishing Awards Program.

Reports from our aquatic biologists in the following pages will highlight these projects and much more as we continue to monitor, manage, and restore aquatic habitats throughout the Commonwealth for all to enjoy.

Aquatic Core Development for BioMap3

Rebecca Quiñones, in collaboration with Jason Stolarski, Todd Richards, Jason Carmignani (NHESP), and James DeNormandie (LandVest)

MassWildlife evaluated aquatic resources across the state, including fishes, and freshwater mussels to evaluate aquatic biodiversity for use in projects like the revisions to Biomap2 (i.e., Biomap3). Although much is known about the distribution of individual fish species, the information has not yet been consolidated into a more holistic analysis of biodiversity. Fish species biodiversity, using a percent similarity index and species richness, were calculated by stream order and major basin, or in individual lakes and ponds, to understand patterns of biodiversity statewide. Fish assemblages in Massachusetts rivers and streams differ by stream size and major basin. Assemblages also reflect the basic hydrology of habitats, so data were also broken up into fishes in rivers and streams (lotic habitats) versus lakes and ponds (lentic habitats).

Percent Similarity Index: a comparison between current and predicted fish community assemblages in stream orders 1-4

The goal of the Percent Similarity Index (%SI) is to provide a relative measure of how closely existing fish assemblages (current community) resemble recent historical counterparts (predicted community ca. 1996). We propose that stream reaches with high %SI scores are less altered, and therefore represent higher-quality habitats, than those with lower scores. We also assume that fish assemblages provide an accurate measure of aquatic biodiversity across the state and can be used to prioritize land protection and restoration. Although our evaluation will reflect changes in assemblages occurring prior to 1996, this timeframe (1996-2020) provides a realistic conservation target given shifting baseline conditions, especially those associated with climate change. Reaches with %SI scores in the 90th percentile (statewide scale) and 50th percentile

(municipal scale) were used as primary components of Aquatic Cores in BioMap3. Additionally, reaches within the 80th percentile of biodiversity rankings contiguous to the 90th percentile reaches were also included.

Fish distributions have been historically affected by land use, fisheries management, and, increasingly, climatic forcing. With centuries of anthropogenic alteration, it is difficult to establish a true reference condition for aquatic habitats in Massachusetts. However, we can identify relatively good-quality habitat based on the composition of fish assemblages. Assemblages were identified using species and abundance data collected by MassWildlife via electrofishing surveys from 1996 to 2020 (MassWildlife unpublished data; N >12,000). Data were edited prior to analysis to reduce potential bias from overly abundant juveniles, transient fishes, or stocked trout. For these reasons, individuals <40 mm, most anadromous species, and stocked trout, were removed from further analysis.

The diversity of fish species in Massachusetts varies naturally by stream order as well as by major basin, largely as a reflection of habitat variability and past colonization events. Our analysis evaluates fish assemblages by unique stream order and major basin pairs to facilitate meaningful comparisons. Otherwise, results could favor sites with higher biodiversity, usually in higher stream orders, even in areas with low conservation value. For instance, only two species are often found in Massachusetts first order coldwater streams (Brook Trout and Slimy Sculpin). When other species are also found (e.g., Pumpkinseed, a native species not naturally found in small flowing streams), it is often due to fishes dispersing from man-made reservoirs near the site. In this example, reaches with two species are a better expression of exemplary biodiversity, which is counter to most discussions of biodiversity that consider higher diversity better by default. In our example, reaches with current communities of Brook Trout and Slimy Sculpin would have higher %SI scores than reaches also including Pumpkinseed because they would resemble the predicted community more closely than reaches will all three species.

Both current and predicted communities were created using methods modified from Bain and Meixler (2008) and Meixler (2011). These studies evaluated species assemblages using ranked species and abundance data. Assemblages between sites were then compared using a percent similarity measure described by Novak and Bode (1992). However, the data we used to build the baseline (predicted community) was a modified subset of the data used to build the current community, rather than from reference streams outside the study area. Our goal was for %SI scores to reflect a gradient of most- to least-altered habitats rather than a proximation of pristine reference condition.

Calculations

Predicted community: We based predicted communities on the knowledge that present-day fish distributions in North America reflect historical vicariant events (e.g., tectonics, glaciation), ecological processes (e.g., dispersal, competition, predation), and human alteration. For example, we expect Creek Chubs in western but not eastern watersheds due to postglacial recolonization.

Predicted communities were created by pooling species within major basin groups (Table 1) that share geologic history and past hydrologic connections.

Table 1. Major basin groupings used to develop predicted communities (modified from Hartel et al. 2002, Inland Fishes of Massachusetts, Massachusetts Audubon Society, 328 pp.)

Group	Major Basin
A	Deerfield, Westfield
B	Connecticut, Millers, Chicopee
C	Quinebaug, French, Blackstone
D	Merrimack, Concord, Nashua, Shawsheen
E	Neponset, Mystic, Weymouth & Weir, Charles
F	Ipswich, Parker, North Coastal
G	South Coastal, Taunton, Ten Mile, Narragansett Bay, Buzzards Bay, Islands, Mt. Hope Bay, Cape Cod

The one exception to groups described in Hartel et al. (2002) was the addition of the Housatonic Basin to Group A. This was done to increase sample sizes in our analysis. We felt this was reasonable because the Housatonic Basin shares similar habitats, and directly borders, the basins in Group A. Once data were pooled by major basin group and stream order pairs, all non-native species were removed from the data. Consequently, predicted communities were comprised solely of native species specific to stream order (1-4) and basin group. We also removed all native Pond Dependent individuals < 100 mm from lotic samples because we sought to describe predicted communities of least altered habitats. Relative species proportions were calculated as the total number of individuals in each species divided by the total number of individuals in the pooled data, multiplied by 100. For species in the predicted community, percent composition was then ranked; the species with the highest composition was ranked as 1, the second highest composition as 2 and so on. Next, the inverse rank was calculated for each species. For example, the inverse rank for species ranked 2 is calculated as ½ or 0.5. All inverse ranks were then added. And finally, the predicted proportion of each species (Predicted P) was calculated by dividing the original ranks (1, 2, 3…) by the sum total of the inverse ranks.

Current Community: Current communities were created by pooling all fish species collected within each waterbody, stratified by stream order (1-4) and major basin combinations (e.g., all second order reaches of the Ware River in the Chicopee Basin). Only stream orders with three or more surveys were evaluated. As in Bain and Meixler (2008), the relative proportion (Current P) of each species was calculated as the total number of individuals of each species divided by the total number of fishes in the pooled data, multiplied by 100.

Finally, the similarity between current and predicted communities (%SI) was calculated as:

%SI = 100 - 0.5 (sum|Predicted P – Current P|).

Eastern Brook Trout—Slimy Sculpin Complex

Brook trout and/or Slimy Sculpin dominated samples were identified from MassWildlife backpack electrofishing surveys from 1998 to present day. Data were screened and hybrid species, anadromous species, stocked trout, and young-of-the-year (<40mm) were removed. Sites were selected that resided in the 90th percentile (statewide) and the top 50th percentile (municipal level) for both proportional abundance and total abundance of Brook Trout and Slimy Sculpin.

Large River Species Richness for Stream Orders >4

Species richness was developed from lotic fish sampling data collected via backpack, boat, and barge electrofishing between 1998 and present day. Hybrid species, anadromous species, stocked trout, and young of the year fish (<40mm) were removed. Sampling sites were then stratified by stream order (5-8) based on NHD Plus stream order designation, richness was calculated as the number of unique native species within each stream-order combination. Sites were selected as part of the aquatic core if richness values fell within the 90th percentile (statewide) and 50th percentile (municipal scale).

Lakes and Ponds Analysis (Lentic Habitats)

Sites important to biodiversity within lakes and ponds were identified using either fish species composition or abiotic condition. Species richness was calculated using data collected over the period 1978 to present day. Prior to analysis, stocked trout and hybrid species were removed and data were pooled within lakes/ponds. Two story ponds were identified as ponds with portions of the water column sufficiently cold (<20°C) and oxygenated (>5mg\liter) to support coldwater fishes. A relative condition factor was calculated from lentic fish data collected as part of updated sampling protocols developed and implemented beginning in 2016. Individual fish length and weight were used to develop statewide species-specific log weight-log length polynomial regressions for game and selected forage fish with adequate sample size. Individual condition factors were calculated as the residual from the statewide species- specific regressions, corrected for seasonality using analysis of covariance and averaged among species and within lake. Lakes and ponds were selected as part of the aquatic core if richness values fell within the 90th percentile (statewide) and 50th percentile (municipal scale).

Freshwater Mussel Richness

To identify areas that support viable mussel habitat, we selected sites with ≥2 mussel species or with at least 1 mussel SGCN observed after 1970. Mussel data encompass sampling efforts in streams, lakes, and pond ecosystems from routine monitoring or directed project efforts.

Imperiled Aquatic Species

Sites identified as important to the persistence of imperiled aquatic species by the Natural Heritage and Endangered Species Program will also be incorporated as components of aquatic core. Species can fall into several taxonomic groups including damselflies, beetles, and turtles.

Class A and Class B Wild Brook Trout Streams

Class A wild Brook Trout streams were chosen if trout assemblages consisted of at least 90% Brook Trout and had Brook Trout abundances in the 90th percentile and above, relative to other wild Brook Trout streams of the same order across the state. Class B streams are similarly identified but fall in the 75-89th percentile (from Kautza, unpublished data)

Sportfishing Awards Program

Rebecca Quiñones, in collaboration with Debra Chamberlain

Each year, hundreds of anglers submit entries to each of three categories, Adult Catch & Keep, Youth Catch & Keep, and Catch & Release, in the Sportfishing Awards Program. Entries are tracked throughout the calendar year to acknowledge anglers' efforts. All anglers that submit entries meeting minimum size requirements receive a bronze pin (Table 2). Anglers with the largest fish of 21 species in each category are recognized with a gold pin (Table 3), trophy and plaque, usually at a ceremony in the following spring. The angler with the greatest number of species caught, regardless of size, is recognized as Angler of the Year with a prize, trophy and plaque. This year's ceremony was held virtually on March 20 with over 80 anglers and friends attending. Nine new state records were set in 2020, including Bowfin (9 lbs, 10 oz), Channel Catfish (34.5 inches), and Lake Trout (34 inches).

Table 2. Number of bronze pin winners per species in 2020.

Species	No. of bronze pins
Bowfin	9
Brook Trout	66
Brown Trout	72
Bullhead	64
Carp	147
Chain Pickerel	104
Channel Catfish	143
Crappie	180
Lake Trout	9
Landlocked Salmon	131
Largemouth Bass	477
Northern Pike	58
Rainbow Trout	50
Shad	21
Smallmouth Bass	158
Sunfish	124
Tiger Trout	31
Walleye	8
White Catfish	35
White Perch	35
Yellow Perch	106
Total	**2,028**

Highlights (at www.mass.gov/service-details/gold-pin-winners) include:

- Joshua Christman of Pittsfield is the Catch & Keep Adult Angler of the Year. He caught 14 of the 22 eligible species.
- Philip Prieur of South Hamilton is the Catch & Keep Youth Angler of the Year. He caught 10 of the 22 eligible species.
- Andrew Langley of Peabody and David Desimone of Amherst are the Catch & Release Anglers of the Year. Both Andrew and David caught 18 of 22 species.
- One new state record was awarded in the Catch & Keep category.
- Eight new state records were awarded in the Catch & Release category.

Table 3. Species, size, and location(s) of fishes winning gold pins in 2020 (available at www.mass.gov/service-details/gold-pin-winners).

Adult Catch and Keep	Pounds	Ounces	Location
Bowfin	9	10	Taunton River
Brook Trout	4	5	Stockbridge Bowl
Brown Trout	12	15	Walden Pond
Bullhead	3	6	Plugs Pond
Carp	21	1	Pontoosuc Lake, Laurel Lake
Chain Pickerel	5	12	Little Cliff Pond
Channel Catfish	15	4	Connecticut River
Crappie	2	2	Quacumquasit Pond
Lake Trout	14	8	Quabbin Reservoir
Landlocked salmon	6	8	Quabbin Reservoir
Largemouth Bass	9	0	Ponkapog Pond
Northern Pike	27	11	Buel Lake
Rainbow Trout	5	0	Swift River
Smallmouth Bass	5	11	Onota Lake
Sunfish	1	7	Richmond Pond
Tiger Trout	2	12	Onota Lake
Walleye	4	7	Connecticut River
White Catfish	6	8	Mashpee-Wakeby Lake
White Perch	2	8	Quabbin Reservoir
Yellow Perch	1	14	Johnsons Pond
Youth Catch and Keep	**Pounds**	**Ounces**	**Location**
Brook Trout	2	8	Little Pond
Brown Trout	3	2	Little Pond
Bullhead	2	4	Pleasant Pond
Carp	21	7	Mill Pond
Chain Pickerel	6	0	Norwich Pond
Channel Catfish	8	4	Deerfield River
Crappie	1	3	Ashmere Lake
Landlocked Salmon	4	12	Quabbin Reservoir
Largemouth Bass	5	5	Connecticut River
Rainbow Trout	3	8	Wachusett Reservoir
Smallmouth Bass	4	6	Onota Lake
Sunfish	1	2	Richmond Pond
Tiger Trout	1	1	Goose Pond
White Catfish	5	15	Charles River
White Perch	1	5	Pontoosuc Lake
Yellow Perch	1	7	Russell Pond
Catch and Release	**Inches**		**Location**
Bowfin	28.5		Connecticut River, Taunton River
Brook Trout	19.5		Hamblin Pond
Brown Trout	32		Littleville Reservoir
Bullhead	19.5		Plugs Pond, Charles River
Carp	40.5		Merrimack River
Chain Pickerel	28.75		Leverett Pond
Channel Catfish	34.5		Connecticut River

Crappie	18.25	Putnamville Reservoir
Lake Trout	34	Wachusett Reservoir
Landlocked Salmon	27	Quabbin Reservoir
Largemouth Bass	24.25	Buffumville Reservoir
Northern Pike	43	Onota Lake
Rainbow Trout	23	Littleville Reservoir
Shad	24	Chicopee River
Smallmouth Bass	23.5	Wachusett Reservoir
Sunfish	12	Quabbin Reservoir
Tiger Trout	23	Westfield River
Walleye	28.25	Connecticut River
White Catfish	22	Charles River
White Perch	17	Wachusett Reservoir
Yellow Perch	16	Sheep Pond

Climate Adaptation

Rebecca Quiñones

Resilient Massachusetts

Several products were completed at the request of the state's Resilient Massachusetts Action Team (RMAT). The RMAT is tasked with implementing the 2018 State Hazard Mitigation and Climate Adaption Plan (SHMCAP) in which MassWildlife identified 11 Priority Actions to increase climate resiliency agencywide (Table 4). Progress on MassWildlife Priority Actions was provided in November 2020.

MassWildlife also participated in the Scientific and Natural Resources Working Groups associated with RMAT activities. One major task for the working groups was to provide feedback on the development of a standards and guidelines web-based tool used to evaluate the climate change resiliency of projects requesting capital funding. The standards and guidelines tool is being tested with a beta version of the tool available in fall 2021. In November 2020, MassWildlife submitted a proposal for capital funding for the continued development of BioMap3, a Priority Action in the SHMCAP. Some $275,000 of SHMCAP funds were allocated for the second year of BioMap3 (E. Schlüter, lead). Two other projects were awarded funds, the development of a coldwater climate change refugia protocol ($35,000, R. Quiñones, lead), and a project to begin restoration in the Great Marsh ($180,000, P. Huckery, lead).

Table 4. Priority Actions identified as important to increase climate change resiliency of MassWildlife assets and services (State Hazard Mitigation and Climate Adaptation Plan, 2018; mass.gov).

▪ Evaluation of climate change impacts on common species.
▪ Updates to BioMap2.
▪ Work with MassDOT to incorporate habitat and coldwater fisheries considerations.
▪ Evaluation of shifts in habitats and species distributions.
▪ Management of beach nourishment projects and other shoreline protection strategies.
▪ Study impact of climate change on fish hatcheries held by MassWildlife.
▪ Identification of areas with high native aquatic biodiversity.
▪ Identification of coldwater climate refugia and transitional waters.
▪ Dam removals at the Merrill Ponds Wildlife Management Area.
▪ Mapping and control of invasive plant species.
▪ Great Marsh Pilot Ditch Remediation Project.

Coldwater Climate Change Refugia

Rebecca Quiñones (in collaboration with Matt O'Donnell, U.S. Geological Survey)

Coldwater streams in deep canyons, poleward-facing slopes, thick canopy cover, groundwater-fed areas, and areas with fewer anthropogenic impacts, are more likely to persist with climate change. Such areas may act as coldwater climate change refugia, providing long-term habitat to ecologically and economically important species such as Brook Trout. The efficacy of conservation strategies to protect coldwater streams and the coldwater-adapted species that rely on them will depend largely on understanding the potential persistence and transition of habitats.

We have used existing models (SHEDS-ICE) to map stream reaches in Massachusetts that are likely to remain coldwater habitats, or transition to cool- or warm water habitats, under different climate scenarios (increases in average July temperatures of 2°C, 4°C, 6°C). This collaborative effort was completed in 2020 and provided MassWildlife with the potential location of coldwater refuges. Actual coldwater *refugia*, however, remain to be identified. The key difference is that refugia are made up of a *network of refuges that support viable populations* rather than just individuals. Most conservation actions target populations, a large group of individuals, because they provide a higher likelihood of species persistence under changing, and often unpredictable, environmental conditions. Not only do we need to validate the predicted locations of refuges (at small scales) but also the network of refuges that create refugia.

In FY 2021, we began a collaboration with the U.S. Geological Survey (USGS) on a project to identify the characteristics of coldwater climate change refugia. This effort differs from previous work in that it will evaluate refugia in the field instead of relying on modeled results. However, we will use the existing modeled results as a starting point for our investigations. First, a subset of sites modeled as potential coldwater climate refuges will be thermally mapped using an infrared camera (Figure 1a). This will allow us to quantify the size, connectivity and temperature ranges associated with each refuge. Sites will be visited throughout the summer and into fall so that the contraction and expansion of coldwater refuges (Figure 1b) can be quantified. Fishes (trout and slimy sculpin) collected from each site will be tagged using passive integrated transponders (PIT tags).

Repeated scanning of tags will allow us to document the location of individual fishes during the time of the study. By superimposing the location of fishes onto thermal images, we can begin to understand the number of fishes that each refuge can support as well as infer the connectivity needed between sites necessary to support populations. The end product will be an evaluation of the spatial relationship of refugia in order to guide land protection and resource management, including BioMap3.

Figure 1a. FLIR image of Dry Brook and Fisheries staff.

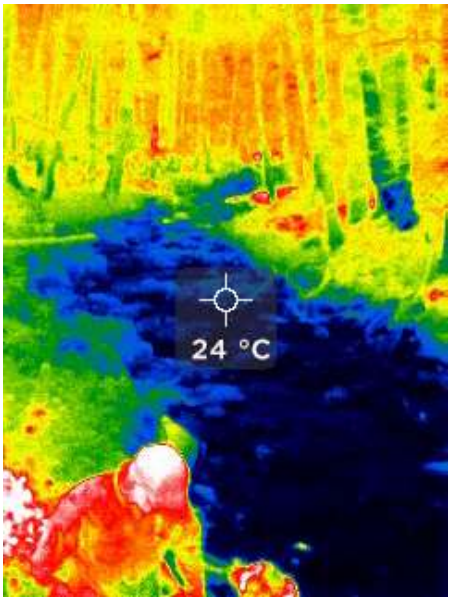
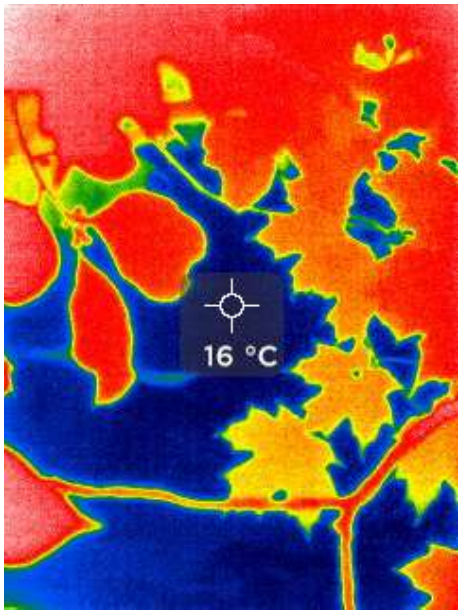


Figure 1b. Same location as Figure 1a., coldwater climate refugia (ambient water temperature 19 °C)



Northeast Climate Adaptation Science Center Grants

In FY 2021, MassWildlife was awarded two Research Awards through the NECASC. One project will study effects of draw-down on lake ecology, including incidence of cyanobacterial blooms; the other project will look at the effects of climate change on patterns of aquatic biodiversity at the regional scale. Both projects are collaborations between researchers (NECASC, UMass-Amherst) and state resource managers (e.g., MassWildlife, New Hampshire Department of Fish and Game, Rhode Island Division of Fish and Wildlife).

Working Groups

MassWildlife continues to participate in several climate adaption working groups. At the national level, the National Fish, Wildlife, and Plants Climate Adaptation Network is continuing to update the 2015 [National] Climate Adaptation Strategy. MassWildlife also participates in meetings of the Association of Fish and Wildlife Agencies' Climate Adaption Committee. At the regional level, the Northeast Climate Change Working Group brings together practitioners to share climate-smart projects and discuss challenges. Lastly, at the state level, the Massachusetts Ecosystem Climate Adaptation Network provides managers with tools to facilitate coordination across disciplines, primarily through an annual conference and monthly newsletters.

Collaborations and Presentations

Dr. Quiñones continued to collaborate with other agencies on several efforts, including in the role of Secretary for the Instream Flow Council, and reviewer of grants funded by the Culvert Replacement Municipal Assistance Grant Program (led by the Division of Ecological Restoration) and the Massachusetts Environmental Trust.

Dr. Quiñones also continues to share MassWildlife's mission and work with interested groups. In FY 2021, nine presentations were given with climate adaptation and big river management as central themes, including one, in May, to MassWildlife's own Fisheries and Wildlife Board.

Presentations were also given to Trout Unlimited (August), a UMass/Amherst Ecology class (September), the Association of Fish and Wildlife Agencies (September), the Blackstone River Watershed Association (November), the Massachusetts Water Resources Authority (December), MassECAN (March), the Nashua River Watershed Association (May), and the Mount Grace Land Conservation Trust (May).

Lake and Pond Sampling

Jason Stolarski

Examination of the MassWildlife fisheries database showed that, over the past 20 years, lake and pond habitats have been sampled at a much lower frequency than have stream habitats. To fill data gaps, but also to update pond summaries with current fisheries data, the Fisheries Program has begun to focus on conducting lake and pond samples with greater frequency. Waterbodies are selected based upon access, stocking, and use and are then sampled using minnow traps, fyke net, beach seine, gillnet, and/or boat electrofishing, depending upon accessibility.

Where boat access is limited, minnow traps and fyke nets are deployed on the first day within littoral habitats of the waterbody. All gear is marked with reflective buoys and left to fish overnight. Dissolved oxygen, temperature, conductivity, and pH are then measured at 1-meter intervals at the deepest point in the waterbody. The following day, sampling gear is pulled, and all fish captured are identified to species, weighed to the nearest gram, and measured to the nearest millimeter. Fish may also be captured using beach seine during this time as well. When access permits, boat electrofishing is used to sample littoral habitats of the pond and fish are processed as before. In general, the entire shoreline is sampled or as much of the shore as time permits.

Data are entered into a database and checked for errors. Linear modeling is used to determine the relationship between log-transformed weight and length for each species within and among (statewide) waterbodies. Residuals from statewide regressions for each species are used to eliminate outliers using quartile ranges. Relative weight is calculated from statewide weight-length regressions for each species and pond and, in conjunction with catch-per-unit-effort (CPUE; measured as number of individuals per hour of electrofishing), is used to evaluate the health of the fisheries community. As data are collected on additional waterbodies, these analyses will become

more precise and permit more complex modeling. During the 2020 fiscal year, the Fisheries Program has conducted fisheries surveys on six waterbodies throughout the commonwealth (Table 5).

Table 5. Lakes and ponds where fisheries samples were conducted by MassWildlife in fiscal year 2020 including date, town, district, and watershed.

Waterbody	Palis	Date Sampled	Town	District	Watershed
Mossy Pond	81087	5/7/2021	Clinton	Central	Nashua
Leverett Pond	34042	5/25/2021	Leverett	Connecticut Valley	Connecticut
Five Mile Pond	36061	6/7/2021	Springfield	Connecticut Valley	Chicopee
Chapin (Haviland) Pond	36069	6/8/2021	Ludlow	Connecticut Valley	Chicopee
Onota Lake	21078	6/9/2021	Pittsfield	Western	Housatonic
Laurel Lake	21057	6/23/2021	Lee	Western	Housatonic

Lake Trout Sampling

Jason Stolarski

Lake Trout were initially stocked in Quabbin Reservoir in 1952 and began to enter the creel in 1956. Since then, populations have expanded into Wachusett Reservoir, and comprise arguably one of the most popular sport fisheries in the Commonwealth. Since the initial stocking, Lake Trout in Quabbin Reservoir have been monitored almost continually using various mark recapture methods most recently employing passive integrated transponder (PIT) tags beginning in 2006. Similar efforts commenced in Wachusett Reservoir in 2014. Each fall, spawning Lake Trout are sampled using 100 ft experimental gillnets set at night over known spawning locations. Nets fish for approximately 30 minutes and captured Lake Trout are gently removed from the net and scanned for the presence of a PIT tag using a PIT tag reader. If no tag is present, a 10mm PIT tag is implanted within the pelvic girdle of the fish. The unique tag number is recorded along with the length, and weight of the fish. Prior to release, the adipose fin is clipped to serve as a visual secondary mark.

Data are entered into a database, checked for consistency and general linear modeling is used to determine the relationship between log transformed weight and length within waterbodies and sexes. Relative weight is then calculated among waterbodies and sexes and used to evaluate and track changes in condition over time in both waterbodies. Growth rates are calculated from length changes garnered from recaptured fish and expressed as relative and absolute annual growth. However, because fall gill netting captures predominately male fish analysis of growth and condition data are restricted to mature male lake trout.

In FY 2020, a total of 208 Lake trout were captured, 94 within Quabbin Reservoir and 114 within Wachusett Reservoir (Table 6). Handheld PIT tag readers malfunctioned prior to the sampling period and had to be serviced thus no new PIT tags were implanted in FY 2020 and sampling was restricted to measuring length and weight only.

Table 6. Quabbin and Wachusett reservoir Lake Trout tag and recapture data from 2006 to 2020.

	Quabbin Reservoir				Wachusett Reservoir		
Year	Tagged	Recaptured	Total		Tagged	Recaptured	Total
2006	279	NA	279				
2007	55	2	57				
2008	102	7	109				
2009	178	13	191				
2010	147	30	177				
2011	6	0	6				

2012	0	0	0				
2013	238	16	254				
2014	276	14	290		110	NA	110
2015	366	32	398		155	6	161
2016	286	32	318		64	3	67
2017	158	29	187		74	9	83
2018	133	30	163		66	5	71
2019	146	23	169		156	6	162
2020	94*	NA	94		114*	NA	114
Total	**2359**	**178**	**2537**		**487**	**23**	**510**

* Lake Trout measured length and weight only; not tagged.

Between 2014 and 2017, Lake Trout relative condition rose steadily within Quabbin Reservoir. However, since this time condition has leveled off and declined slightly. Over the long term, relative condition and mean length at catch have declined from historical highs in the 1970s but within decades oscillate fairly regularly (Figures 2 and 3). Interdecadal oscillations in these measures are likely a function of changes in forage fish abundance within Quabbin Reservoir. For example, one qualitative measure of forage fish abundance decreased 10-fold between 2009 and 2011, which corresponds to a dramatic swing in Lake Trout relative condition during that time. Similar patterns observed in the number of landlocked salmon submitted to the Sportfishing Awards Program suggest this species responds to forage fish abundance as well. Within Wachusett Reservoir, Lake Trout condition rose relative to 2019 while length at catch remained stable (Figures 4 and 5).

Figure 2. Mean relative condition of male Lake Trout collected from Quabbin Reservoir from 1974 to 2020; please note the axis break. Grey bars on secondary Y-axis depict the number of landlocked salmon submitted to the Massachusetts Sportfishing Awards Program over the same time interval that met minimum size requirements.

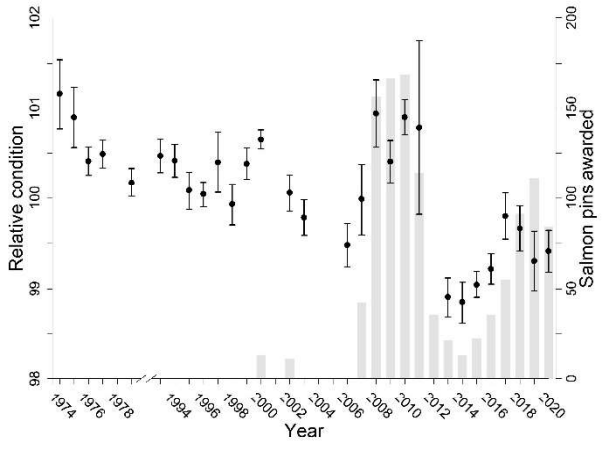


Figure 3. Mean length (in millimeters) at catch with sample sizes of male Lake Trout collected from Quabbin Reservoir from 1964 to 2020; please note the axis break.

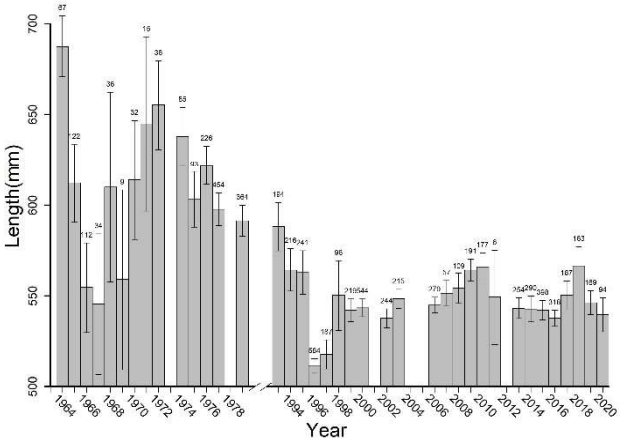


Figure 4. Mean relative condition (black points) of male Lake Trout collected from Wachusett Reservoir from 2014 to 2020. Grey bars on secondary Y-axis depicts the number of landlocked salmon submitted to the Massachusetts Sportfishing Awards Program over the same time interval that met minimum size requirements.

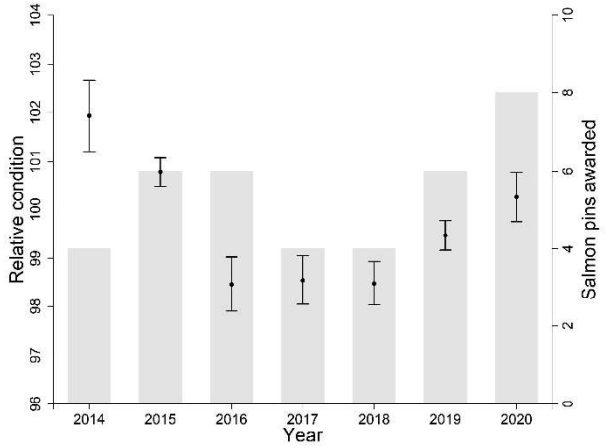
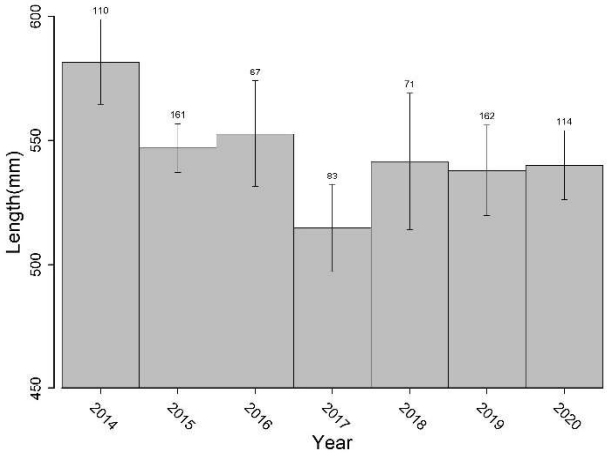


Figure 5: Mean length (in millimeters) at catch, with sample sizes, of male Lake Trout collected from Wachusett Reservoir from 2014 to 2020.



Unlike in the Quabbin, where large numbers of fish congregate on Windsor dam and Goodnough Dike to spawn, spawning areas in Wachusett Reservoir seem to be smaller in size, fewer in number, and unequally distributed in space. In 2019, a new spawning aggregation was located in Wachusett Reservoir, which bolstered catch. This aggregation was sampled again in 2020 with similar results and may serve to stabilize catches in Wachusett Reservoir moving forward. Efforts to locate additional spawning habitat will continue in the future.

Quabbin Salmon Marking

Jason Stolarski

Each spring, approximately 10,000 salmon smolts are reared at the Palmer Hatchery and stocked into Quabbin Reservoir by MassWildlife staff. In past analyses, these fish reach 15 inches (legal size) within 2 to 4 years after stocking and are a popular recreational species in the Quabbin Reservoir. Mature salmon are also known to reproduce successfully in tributary and shoal habitats in the reservoir. Juvenile salmon spend 1 to 3 years rearing in tributary habitats before out-migrating as smolts in unknown numbers. Thus, landlocked salmon entering the creel are an unknown ratio of hatchery-reared and naturally produced fish. In spring 2016, the Fisheries Program began a project marking (adipose fin clip) all salmon stocked into the reservoir. Once all non-marked hatchery reared salmon leave the population, creel data will be collected to determine the ratio of tagged to untagged fish in the creel. These data will inform hatchery personnel about the relative contribution of stocked fish to the creel which over time could inform future stocking actions and provide anglers a means to identify naturally produced fish. Otoliths of legal fish continue to be obtained via incidental mortalities during Lake Trout netting to update our understanding of the age that salmon enter the creel and the maximum age of fish in the population. These data will be used to determine when the majority of non-tagged hatchery-raised fish have left the population and thus when to initiate survey efforts. A pilot creel census was planned for the spring of 2019 but was postponed due to the COVID-19 pandemic.

Fisheries Database and Fisheries GIS Layers

Jason Stolarski

This year, roughly 20 historical stream and lake surveys spanning from 1940 to the latter 1980s were added to the fisheries database. These samples were either contained in old basin reports or were stored in lake and pond paper files that were discovered. Prior to their inclusion into the database, these records existed only on paper. As such, this information was not searchable or considered when assessing the fisheries resources of a particular lake or stream. These efforts now permit biologists to review data collected over a roughly 80-year time span when assessing the ecological character of a waterbody. Furthermore, biologists can compare the fish community of a particular lake or stream over long time periods. Since our efforts to digitize and catalog all our historical sampling data began in the winter of 2014, over 4,500 samples have been entered into an electronic database, scanned, and can be rapidly accessed by biologists from their computers.

As modern fisheries surveys are conducted and historical surveys are converted to electronic form, these data are entered into the fisheries database. Several GIS products are created from these data and each time new information is added to the fisheries database these GIS layers must be updated. Following the addition of samples into the fisheries database, R scripts are used to create a table of summary data for each sampling point (MassWildlife Annual Report 2018; Appendix B). Such information includes, species, abundances, sample type, date, presence of coldwater fish, hyperlinks to raw datasheets and scanned historical documents and other information that biologists can use to rapidly access the character of a stream or waterbody. These data are exported from the database and imported as points into ArcGIS where they are cross-referenced with National Hydrography dataset (NHD) stream linework and waterbody polygons that have been sampled by Masswildlife in the past. Using the unique identifier of each stream and waterbody, the sampling point data and stream and waterbody line and polygon data are rectified. Errors are identified as instances where the unique identifier of a point is not in agreement with the unique identifier of the closest line or polygon to that point. Via this process, errors in coordinates or identifiers are found and resolved, and streams and waterbodies that have not been previously sampled are added to the hydrography dataset. Finally, sampling points are snapped to stream lines and polygons, and snapped coordinates are exported from ArcGIS and imported back to the fisheries database via R scripts (MassWildlife Annual Report 2018; Appendix B). Once the fisheries data are plotted and errors are fixed, value-added spatial data layers and products such as the coldwater fisheries resource layer may be easily generated by sub-setting these master layers using simple queries in ArcGIS.

Robust GIS analyses require accurate boundaries from which to calculate physical habitat metrics. Watershed boundaries of lotic systems are typically delineated using digital elevation models. While this approach can be used for lentic systems as well, anthropogenic effects proximal to the shorelines may also be important in structuring fish communities in these systems. To capture shoreline habitat data effectively, accurate shorelines are paramount. Current shorelines contained within the National hydrography dataset were delineated from topographic maps and are not precise. Following the initial efforts to redelineate all the lake and pond shorelines in 2017, efforts are ongoing to continue to update shorelines where appropriate. Furthermore, watershed boundaries continue to be delineated for all sampling points as needed and land use characteristics and impervious cover summarized. To date, sub-watersheds have been delineated for all samples conducted between 2000 and 2020, which equates to more than 7,000 unique polygons.

Fish Kill Response

Jason Stolarski

Masswildlife responded to 31 fish kills in FY 2020, which is slightly below the 10-year average of 36 (Figure 6). All but one of the reported kills were of natural origin and were caused by a mix of low dissolved oxygen, disease, and physiologically stressful behaviors, such as spawning.

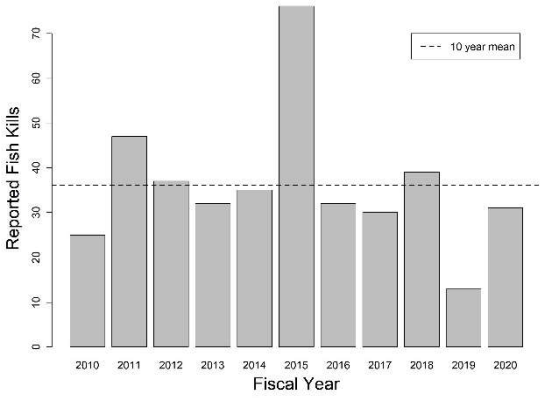


Figure 6: Number of fish kills reported to Masswildlife between 2010 and 2020, with the 10-year running average.

Smaller Projects

In other work in FY 2020, Dr. Stolarski combined relevant data sources to develop a comprehensive list of fishing locations throughout the state. He continues to coordinate with District staff to collect and organize pictures and written narratives of access locations such as boat ramps, piers, and parking areas at selected lakes and rivers. He then produces custom exports and analysis of fisheries and other databases to support ongoing efforts to create an online tool to help anglers find information on fishing locations. Dr. Stolarski also surveyed 15 lakes and ponds for bathymetry and interpolated depth surfaces (Table 7).

References in Dr. Stolarski's Report

Bridges, C.H., and L.S. Hambly. 1971. A summary of eighteen years of salmonid management at Quabbin Reservoir, Massachusetts. American Fisheries Society Special Publication 8:243–259.

MassWildlife Annual Report. 2018. Massachusetts Division of Fisheries and Wildlife, Westborough Ma. 145 pp.

Stolarski, J.T. 2019. Observations on the Growth, Condition, and Ecology of Lake Trout in Quabbin Reservoir, Massachusetts. Northeastern Naturalist 26(2): 362-378

Table 7. Lakes and ponds where bathymetry surveys were conducted by MassWildlife in fiscal year 2020 including town, district, and watershed.

Waterbody	Town	Palis	District	Watershed
Peter Carr Pond	Holden	81077	Central	Nashua
Lancaster Mill Pond	Clinton	81065	Central	Nashua
Mossy Pond	Clinton	81087	Central	Nashua
South Meadow Pond	Clinton	81165	Central	Nashua
Coachlace Pond	Clinton	81019	Central	Nashua
Spectacle Pond	Lancaster	81132	Central	Nashua
Mirror Lake	Devins	81085	Central	Nashua
Forest Lake	Palmer	36063	Connecticut Valley	Chicopee
Cranberry Pond	Sunderland	34018	Connecticut Valley	Connecticut
Lake Lorraine	Springfield	36084	Connecticut Valley	Chicopee
Five Mile Pond	Springfield	36061	Connecticut Valley	Chicopee
Chapin (Haviland) Pond	Ludlow	36069	Connecticut Valley	Chicopee
Nine Mile Pond	Wilbraham	36107	Connecticut Valley	Connecticut
Silver Lake	Wilmington	92059	Northeast	Ipswich
Squibnocket Pond	Chilmark	97092	Southeast	Islands

Fisheries GIS

David Szczebak

Activities included in this project in FY 2021 focused primarily on the development and enhancement of fisheries-related online mapping and data applications. These applications included the trout-stocked waters application, the pond maps/bathymetry viewer, and the continued development of a web-based fishing application, GoFishMA!. The other principal effort was not fisheries-centered but benefited MassWildlife as a whole: the creation of maps to accompany freestanding kiosk displays at our Wildlife Management Areas.

Trout-stocked Waters Application

David Szczebak

In FY 2021, there was continued effort to improve our trout stocking web application. The internal component, an online Google-based database, was designed to house annual stocking schedules, orders, and allocations in one repository. Information from the database automatically populates the public stocking list accessible on MassWildlife's website. The resulting system has eliminated much of the manually generated orders, lists, and emails that were previously used to generate the same stocking orders and schedules.

Improvements to the online stocking application in FY 2021 included a review of all currently stocked waters by Fisheries Program and District staff. The resulting lists were then included on both the website and in hardcopy lists circulated by the Districts. With most COVID-19 social-distancing requirements relaxed by Spring 2021, we resumed that review, including the 'Last Stocked Date' information in the public application. We also updated a spatial data layer for internal use that depicts trout stocking since the inception of the new stocking application in 2016. This GIS layer show stocking by species, numbers, and seasons. Biologists can now use this information to better inform aquatic survey, management, and protection efforts. There were a handful of changes to the trout stocking spatial footprint, mainly in the Southeast and Connecticut Valley districts, that reflected changes in stocking patterns.

The web application on www.masswildlife.org/trout continued to show a very positive reception from the public. For the periods of fall and spring trout stocking, August 1, 2020—June 30, 2021, the stocking application web pages received a total of 591,000 unique page views (this excludes people logging in from state accounts). This figure is up from 500,599 the previous year. Users spent about 4 minutes on the page, which represents very good engagement. The steadily increasing number of visitors to the trout stocking pages indicates a positive and growing appreciation for the application by the public.

Pond Maps and Bathymetry

David Szczebak

In FY 2021, because of the COVID-19 pandemic, the Fisheries Program was hampered in much of its fieldwork, including bathymetric surveys of lakes and ponds. For FY 2021, bathymetric surveys were conducted on fifteen ponds (Table 8).

Pond map fact sheets, which describe fisheries resources, aquatic habitat, and recreational access, were updated based on the most recent sampling as well as information provided by the District offices. New pond maps begun in FY 2019 and accompanying writeups were posted to the website. A total of 21 new pond maps were posted to the website in FY 2021 (Table 9). In addition to the pond maps and fact sheets available to the public, we also updated the GIS layer of bathymetry collected during our surveys. This data was made available to the public as both an interactive and downloadable GIS layer. The downloadable bathymetric contour layer allows users to display the data at 5-foot contour intervals, and is available from MassGIS at: http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/dfwbathy.html

The interactive bathymetry layer is called 'Inland Waters Bathymetry' and is available through the MassGIS OLIVER application at: maps.massgis.state.ma.us/map_ol/oliver.php.

Table 8. Bathymetric surveys conducted FY 2021.

Pond Name	Town
Mirror lake	Devins
Chapin (Haviland) Pond	Ludlow
Nine Mile Pond	Wilbraham
Five Mile Pond	Springfield
Lake Lorraine	Springfield
Cranberry Pond	Sunderland
Squibnocket Pond	Aquinnah
Mossy Pond	Clinton
S. Meadow/Mossy/Coachlace Ponds	Clinton
Silver Lake	Wilmington
Forest Lake	Palmer
Lancaster Mill Pond	Clinton
Coachlace Pond	Clinton
Spectacle Pond	Lancaster
Peter Carr Pond	Holden

Table 9. Pond maps posted during FY 2021.

Pond	Town
Agawam Mill Pond	Wareham
Ames Long Pond	Stoughton
Billington Sea/Little Pond	Plymouth
Buffumville Reservoir	Charlton
Farm Pond	Framingham
Glen Charlie Pond	Wareham
Leadmine Pond	Sturbridge
Long Pond	Barnstable
Long Pond (Lakeville-Freetown)	Lakeville
Nippenicket Lake	Bridgewater
Norton Reservoir	Norton
Puffers Pond	Amherst
Rocky Pond	Boylston
Rohunta Lake	Orange
Walker Pond	Sturbridge
York Lake	Sandisfield

Online Applications

David Szczebak

In addition to the Trout Stocking web application mentioned above, the Fisheries Program maintains other online maps designed to guide the public to waters that offer good angling experiences and other recreational opportunities.

The web application called GoFishMA! is the product of collaboration between the Fisheries Program and the I&E Program. The foundation of this online application is a layer of fishing sites, which is produced through input from both Fisheries and District staff. The first version of this fishing application is now available through the website, in the Freshwater Fishing section: https://www.mass.gov/service-details/find-freshwater-fishing-spots.

In addition to the fishing sites data layer, the application currently includes shaded bathymetry for lakes and ponds, where available; links to pond maps and writeups; indications of trout-stocking; access points, including both shore access and boat ramps; and catch-and-release areas. In FY 2021, we added driving directions to a large number of sites, which open Google Maps when the user clicks on a given site. While some access is obvious (e.g., a boat ramp), other access needed local input from the District offices, especially for shore fishing areas and carry-in access. In FY 2021, we also experimented with storing photos in an online database; the photos represent access sites mapped in the GoFishMA! Application. In a future iteration of the application, the public will be able to click on a site and get photos of the ramp or other access site, to better determine whether they can launch a boat or fish from shore.

Another popular online map the Fisheries Program maintains is the Pond Map Viewer page. It is a pared-down web app showing ponds where fact sheets with maps and digital bathymetry are available. As updated pond descriptions and bathymetry are available, they are posted to the application.

Fisheries Data Collection and Agency Collaboration

David Szczebak

In FY 2021, MassWildlife embarked on a project to create freestanding information signs for our most-visited Wildlife Management Areas. The sign kiosks consist of two panels: an informational section and a separate map panel. Fisheries GIS was tapped to produce the maps for these signs. Working with I&E staff and the District offices, we identified candidate Wildlife Management Areas and then went through a process of identifying the spatial information to include. We wanted to include as much detail as possible in the maps without having them be overwhelming. The final versions incorporated the most important information for the public, including vegetation; areas of active habitat management; and features such as roads, trails, parking areas, and gates. There was a total of 17 WMA signs produced in FY 2021 (Table 10). Now that the process of map/sign production has been established, MassWildlife will be adding to the series of maps on an ongoing basis.

In FY 2021, the Fisheries Program contributed general GIS support to MassWildlife staff, with emphasis on the updating and support of aquatic data. Fisheries GIS is part of the National Hydrographic Dataset (NHD) network, and in FY 2021 participated in collaborative working groups on the direction of hydrographic data development as well as adding new, field-verified streams that were incorporated into the national data. Since the NHD data were originally developed at a 1:24,000 scale, many smaller streams are missing from the data, some of which may be of conservation concern. As the Fisheries Program samples these new streams, they may be incorporated into the national data, providing better protection for these resources.

Fisheries GIS also participated in stream and pond sampling throughout the state.

Table 10. Informational kiosk maps created for WMAs in FY 2021

Wildlife Management Area	District	Status
Birch Hill	Central	Complete
Bolton Flats	Central	Complete
High Ridge	Central	Complete
MacCallum	Central	Complete
Quaboag	Central	In progress
Crane Pond	Northeast	Complete
Delaney	Northeast	In progress
Martin Burns	Northeast	Complete
Nissitissit River	Northeast	Complete
Squannacook	Northeast	Complete
Burrage Pond	Southeast	Complete
Frances Crane	Southeast	Complete
Old Sandwich Game Farm	Southeast	Complete
Quashnet River	Southeast	Complete
East Mountain	Valley	In progress
Herm Covey	Valley	Complete
Montague Plains	Valley	In progress
Southwick	Valley	Complete
Eugene Moran	Western	Complete
George Darey	Western	Complete
Hinsdale	Western	Complete
Stafford Hill	Western	Complete

MassWildlife-owned Dams

Caleb Slater

In FY 2021, MassWildlife continued to receive the annual $1.5 million in capital funds to bring MassWildlife-owned dams into compliance with state regulations.

FY 2021 was marked by significant advancements with the initiation of construction of Upper Flint Pond Dam, Tyngsborough. This project, which has been in design and permitting since 2016, is the third major project undertaken by the program, the first project in excess of $1 million, and the first dam rehabilitation, with the program's other two major projects being dam removals, Welsh Pond Dam and Putnam Pond Dam, both in Sutton. The Flint Pond Dam project used the majority of the FY 2021 funding and will also continue to use the majority of FY 2022 funding. Construction to date has included responses to several significant site flooding events (caused by major rainfall and an upstream beaver dam breach), and unanticipated bedrock conditions requiring design changes. These challenges required the diversion of funds from other engineering and permitting tasks underway in order to stay within the FY 2021 engineering budget.

Despite these challenges, MassWildlife made significant progress on maintaining compliance and preparation for future projects by undertaking the following work:

- McLaughlin State Fish Hatchery, Upper Dam (Palmer): Design of improvements to this dam and replacement of at-risk portions of the pipeline supplying water to the hatchery continued, with the work ready to begin permitting. This work supports continued critical fish hatchery operations.
- Adams Pond Dam (Sutton): Permit-level design was completed for this project, and the body of the first major permit application (the 401 Water Quality Certification application to MassDEP) was prepared.
- Nye Pond Dam (Sandwich): Tighe & Bond prepared renderings of future conditions at this dam for the proposed project and presented the renderings at an informal site meeting of abutters and residents.
- White Island Pond Dam (Wareham): A geotechnical evaluation report was prepared with the intent of planning to replace the dam's downstream walls. However, soils at the site were found to be subject to liquefaction, which suggests that wall replacement will not address the deficiencies to the extent anticipated, and a more significant project is likely needed.
- Schoolhouse Pond Dam (Sutton): Removal design was advanced and additional sediment management planning work was performed to address resident concerns.
- Post-construction monitoring in support of Welsh and Putnam Pond Dams (Sutton) removal project permit close-out continued.
- MassWildlife continued performing dam safety inspections as required, including:
    - Phase I Inspections of Burnshirt River Dam and Putnam Pond Dam (the latter of which documents its removal).
    - Follow-up Inspections of Poor- and Unsafe-conditions dams, including Adams Pond Dam, Cusky Pond Dam, Nye Pond Dam, Schoolhouse Pond Dam, Upper Flint Pond Dam, and White Island Pond Dam.
- MassWildlife prepared annual updates of the Emergency Action Plans (EAPs) for its 10 Significant-hazard dams.
- MassWildlife collected sediment samples from Patrill Hollow Pond to gather information for a potential future dam removal project there.
- Current plans for FY 2022 are to focus on construction of Upper Flint Pond Dam, work to complete the McLaughlin State Fish Hatchery, Upper Dam, design and permitting with the goal to begin construction later this fiscal year and completing design and permitting of Adams Pond Dam for construction beginning in FY 2023. Later in FY 2022, additional engineering work is anticipated to further support the Nye Pond Dam project, the Schoolhouse Pond Dam project, and other projects.

Hatchery/Trout Program

Caleb Slater

Trout Production and Stocking

The total number and pounds of each size category for each species of trout produced and stocked by MassWildlife's five hatcheries in FY 2021 are listed in Tables 11 and 12 (Appendix A), respectively. A total of 509,690 Brook Trout, Brown Trout, Rainbow Trout and Tiger Trout with a combined weight of 446,136 pounds were stocked, which met MassWildlife's annual trout production goal of 400,000 fish, and its 450,000-pound goal as well.

The production goal is based on the rearing capacity of each hatchery, which is determined by a combination of the quantity and quality of the water supply, rearing space, and limits imposed by the National Pollution Discharge Elimination System permits that each hatchery is issued by the Massachusetts DEP and the U.S. EPA. A second production goal of the hatchery trout program is for 50% of the fish that are stocked to be in the 12+ size category (average length of 12 inches). This goal was achieved in FY 2021 as well; when 80% (405,935 fish) met or exceeded this goal, including 305,080 Rainbow Trout, 44,641 Brook Trout, 53,031 Brown Trout and 3,051 Tiger Trout.MassWildlife

has both a fall and spring trout stocking season. During the FY 2021 fall season, which ran from late September through mid-October 2020, 98 ponds and lakes and 6 rivers and streams in 86 cities and towns across the five Wildlife Districts were stocked. A total of 64,752 trout composed of 27,250 14+ Rainbow Trout, 33,502 12+ Rainbow trout, and 4,000 9+ Brown Trout with a combined weight of 62,468 pounds were stocked. 94% of the fish stocked during the fall were in the 12+ or larger size category.

In the spring stocking season, which ran from March through early June 2021, a total of 455,415 trout with a combined weight of 406,865 pounds were stocked in 175 lakes and ponds and 231 rivers and streams in 250 cities and towns. Overall, 78% of the fish that were stocked met or exceeded the 12+ size category. A total of 258,330 Rainbow Trout were stocked, of which 248,330 (99%) were in the 12+ category or larger and 183,626 (71%) were 14+ and weighed an average of 1.2 pounds each. Many of the rainbows were over 16 inches long and weighed more than a pound and a half apiece. A total of 78,006 Brook Trout were stocked in spring FY 2021, of which 44,641 (57%) were in the 12+ size category or larger. More than 850 Brook Trout longer than 14 inches, with some individuals weighing more than 2.5 pounds, were stocked. The total poundage of Brook Trout stocked was 45,358 pounds. A total of 120,096 Brown Trout between 6 inches and 18+ inches with a total weight of 81,465 pounds were also stocked. 44% (53,231 fish) of the Brown Trout were at least 2 ½ years old and 12 inches or larger with an average weight of 1.1 pound apiece. Almost 600 of these Brown Trout were longer than 18 inches and weighed more than 4 pounds apiece. Sandwich Hatchery produced 2,983 Tiger Trout, which averaged 14+ inches and weighed an average of 1 pound apiece (Tables 11 and 12; Appendix A). Tiger Trout are a cross between a Brown Trout female and Brook Trout male and are called Tiger Trout because of their striking tiger-like stripes.

The Roger Reed Hatchery produced a total of 472,112 fertilized Brown Trout eggs and 747,902 fertilized Brook Trout eggs in FY 2021 (Table 13; Appendix A). During the spring season, the Roger Reed Hatchery stocked a total of 892 Brown Trout and 621 Brook Trout surplus brood stock with total weights of 2,656 pounds and 1,087 pounds, respectively.

Sandwich Hatchery produced a total of 243,648 fertilized Brook Trout eggs, 233,560 fertilized Brown Trout eggs, and 200,400 fertilized Tiger Trout eggs in FY 2021. During the spring season, the Sandwich Hatchery stocked a total of 584 Brown Trout and 405 Brook Trout surplus brood stock with total weights of 2,006 pounds and 978 pounds, respectively. (Table 13; Appendix A).

A small collection of fertilized eggs from each female fish (189 Brown Trout, 191 Brook Trout), from both hatcheries, were retained as a future brood line. The resulting fingerling from these eggs were incubated separately from production eggs and remain on station for egg production in 2023.

Landlocked Salmon Production and Stocking

The Roger Reed Hatchery produced a total of 13,296 landlocked Atlantic Salmon in FY 2021 (Table 13; Appendix A). In September 2021, staff transferred 3,280 of these salmon, which weighed a total of 141 pounds, to the New Jersey Division of Fish and Wildlife's Charles Hayford State Fish Hatchery in Hackettstown, New Jersey, in exchange for Northern Pike fingerlings. The remaining 10,016 salmon, which averaged 8.3 inches and weighed a total of 2,211 pounds, were stocked in Quabbin Reservoir in May 2021.

Northern Pike Stocking

In September 2020, 490 pounds (approximately 2,000 fish) of Northern Pike yearlings between 8 and 12 inches long were stocked in the Lake Quinsigamond system (Worcester, Shrewsbury, Grafton). The usual April stocking of Northern Pike fry did not take place in 2021 due to COVID-19 travel restrictions. The Northern Pike were obtained from the New Jersey Division of Fish and Wildlife's Hackettstown Hatchery.

Fish Health Monitoring

MassWildlife has maintained an active fish health monitoring program for its five hatcheries since the 1980s. Since that time, MassWildlife's Fish Pathologist conducts an annual comprehensive fish health examination of each species of fish at each hatchery following the protocols of the American Fisheries Society and the Northeast Fish Health Committee (NEFHC; NEFHC 2015). MassWildlife is an active participant in the NEFHC. The fish are screened for fish pathogens that the NEFHC considers a risk to trout and salmon (NEFHC 2015). In addition, diagnostic examinations were performed as needed on any hatchery fish that exhibited symptoms of illness.

Results of the fish health inspections and diagnostic testing conducted in FY 2021 are in Table 14 (Appendix A). No NEFHC-listed pathogens were diagnosed in FY 2021. Cold water disease (*Flavobacterium psychrophilum*) was diagnosed in the Erwin/Arlee and Shasta strains of Rainbow Trout at McLaughlin Hatchery (Table 14; Appendix A). Cold water disease is a ubiquitous pathogen of trout throughout much of the United States, but it is not listed by the NEFHC (FEFHC 2015). The CWD-infected Rainbow Trout at McLaughlin Hatchery were successfully treated with a Food and Drug Administration-approved antibiotic for CWD that was prescribed by a veterinarian in accordance with the Food and Drug Administration's Veterinary Feed Directive (VFD).

Teaching with Trout Program

The program this year supported 21 tanks located in 18 schools throughout Massachusetts. Approximately 3,600 eyed Brook Trout eggs were provided to the various schools and organizations for the program. Due to the COVID-19 pandemic and subsequent school closures, the program was not as well utilized in the classroom environment as is generally the case.

Capital Improvement Projects

MassWildlife was awarded $164,047 in capital funding in FY 2021 for infrastructure improvements at hatcheries to improve efficiency and maintain our overall coldwater fish production goals. Hatchery capital projects conducted in FY 2021 included:

McLaughlin Hatchery: $72,530 for installation of a magnetic flow meter on the #4 well.

Sandwich Hatchery: $46,460 for installation of magnetic flow meters on two wells.

Sandwich Hatchery: $37,057 for installation of electric surge protection on two wells.

Bitzer Hatchery: $8,000 for lumber to rebuild failing rearing pond retaining walls.

Palmer Hatchery: $50,000 for design, engineering, and permit work by Tighe & Bond to repair/replace the hatchery reservoir dam and reservoir water supply pipeline. This project was funded through the $1.5 million in capital funds directed to MassWildlife-owned dam repair and removal.

Hatchery Program Personnel

Jim Hahn, longtime McLaughlin Hatchery Manager, retired at the end of FY 2020 after more than 38 years of service. Kurt Palmateer, McLaughlin Assistant Hatchery Manager, was promoted to Hatchery Manager. Chet Thomas has been hired to fill the vacant Assistant Manager position and will start August 30, 2021. Joshua Freniere was hired to fill the vacant Technician position at Sunderland and Jacob Rawlings was hired to fill the vacant Technician position at McLaughlin.

References in Dr. Slater's Report

Northeast Fish Health Committee. 2015. Guidelines for Fish Health Management in Northeastern States. 67 pp.

Coldwater Fisheries Management

Adam Kautza

Coldwater Fisheries Project activities in FY 2021 included the continuation of several ongoing projects related to the management of two very important and popular coldwater fisheries and the development of a comprehensive Wild Trout Management Plan (WTMP). Activities during this fiscal year also included outreach, such as the long-standing Teaching with Trout program, and several virtual presentations.

Deerfield River

FY 2021 marked the completion of the second year and the beginning of the third year of a multi-year tag-recapture project on the Brown Trout fishery in the Deerfield River tailwater from Fife Brook Dam to the town of Charlemont. The project was designed to gather data on important fisheries metrics – population size, growth rates, recruitment, and mortality – and to determine the proportion of Brown Trout in the river that are wild. All hatchery Brown Trout stocked into, and adjacent to, the study area had their adipose fin clipped to designate them as *stocked* not *wild*. FY 2021 was also the first year of monitoring Brown Trout young-of-year (YOY) abundance.

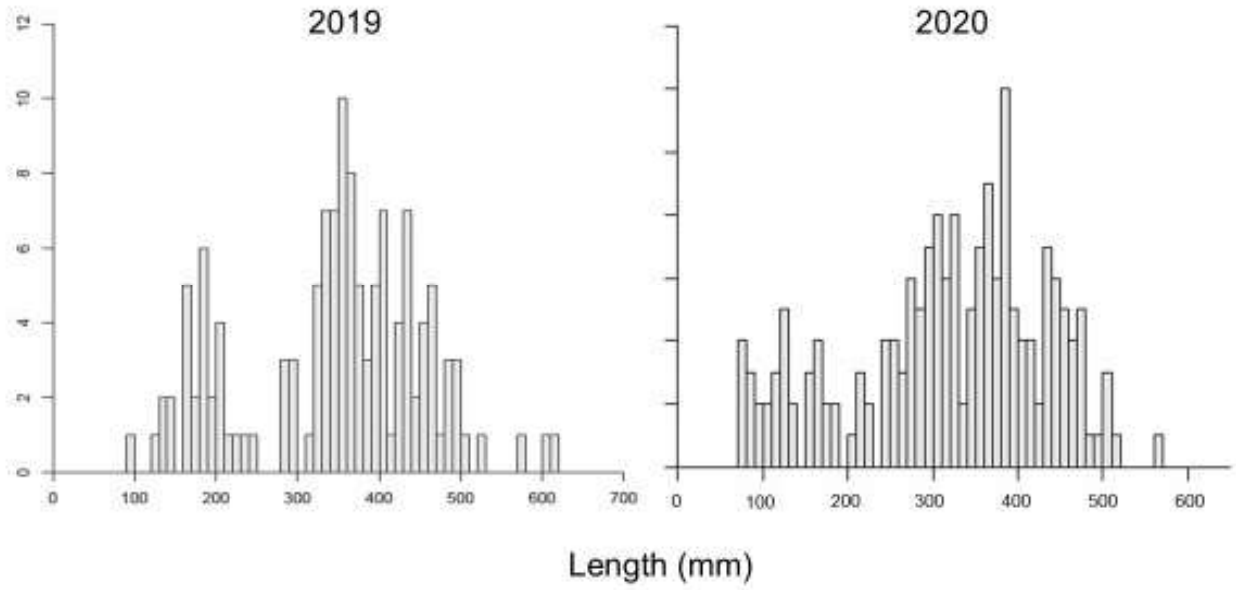
There have been 276 Brown Trout tagged (of 332 individuals surveyed) and 23 recaptures over the 2½ field seasons of this project so far. Overall, wild Brown Trout (i.e., no adipose clip) make up approximately 75% of the population surveyed.

Peak population size of Brown Trout tended to occur in the study reach during late summer and according to

the population estimates there were 523 Brown Trout in 2019 and 417 Brown Trout in 2020. The Brown Trout population estimate for 2021 only includes data from surveys through June, so will not be included here. This is a seemingly low population abundance overall, ~35-50 adult Brown Trout/km, but still around the 35th-50th percentile for Brown Trout abundance across all Massachusetts Brown Trout fisheries. The population size is likely underestimated to some degree given that survey methods do not completely sample the entire breadth of available habitat.

Surveys indicate that much of the population is made up of larger size-class fish (i.e., older age classes), even when adding YOY-specific surveys starting in 2020 (Figure 7). This suggests that either reproduction is minimal and/or survival and recruitment in younger age-class Brown Trout is relatively poor, or that the selected survey methods are missing younger/smaller Brown Trout. Early results from the Brown Trout YOY surveys corroborate both observations. 18 YOY Brown Trout per kilometer and 28 1-YOY Brown Trout per kilometer were sampled in 2020 and 28 YOY Brown Trout per kilometer and 8 1-YOY Brown Trout per kilometer were sampled in 2021; suggesting that there is likely relatively poor survival of eggs and/or of very early life stages among Brown Trout in the mainstem Deerfield River study area. Only one YOY Brown Trout has been surveyed using raft electrofishing methods.

Figure 7. Length-frequency histograms for Brown Trout captured during electrofishing surveys in 2019 and 2020. YOY surveys were added in 2020.

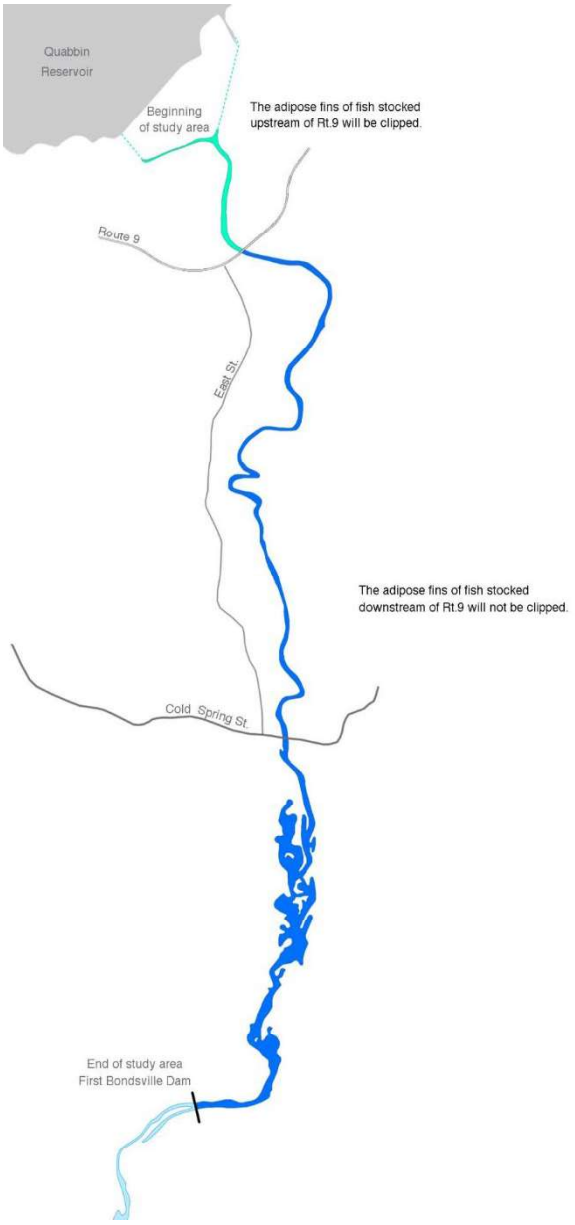


This project is expected to continue for an additional three years. Higher winter baseflows (~250 cfs, which is double the usual 125 cfs) to begin in winter 2021-2022 provide the impetus for a before-after assessment of Brown Trout population metrics. Higher winter baseflow conditions may be one of the missing elements necessary for improved survival of Brown Trout eggs and newly hatched fry.

Swift River

FY 2021 marked the fifth year of annual comprehensive surveys on the Swift River tailwater fishery, the first year of specifically monitoring Brook Trout young-of-year (YOY) abundance, and the first year of an extensive mark-recapture project on survival and movement of stocked Brown and Rainbow trout. The Swift River tailwater refers to the river between Windsor Dam at Quabbin Reservoir and the Bondsville Dam, downstream, which is a complete barrier to upstream fish passage (Figure 8).

Figure 8. Map of Swift River tailwater study area: Quabbin Reservoir to Bondsville Dam.



Comprehensive Surveys

FY 2020 was the first year that comprehensive surveys were done using the electrofishing raft and boat, rather than backpacks and boat. This survey methodology has continued into this fiscal year. Using the raft was follow necessary to get work done with a smaller crew and to pandemic guidelines in place at the time. The raft also enabled surveying of the deeper-water habitats encountered in much of the river that, in previous years, limited our ability to survey some sections of the river. Electrofishing catch rates have fluctuated somewhat over the five years of surveys, although, outside of two extreme values, the CPUE for Brook Trout has been remarkably similar during this timeframe (Table 15). Catch rates for stocked Rainbow Trout and Brown Trout have fluctuated as well but have mostly shown a general rising trend even though stocking rates have not changed (Table 15).

Brook Trout YOY Abundance

In addition to the general comprehensive surveys, four 50-meter bankside transects were selected for Brook Trout YOY monitoring surveys. Specific YOY surveys have become necessary to fill in the bias against small fish and shallow habitat that affects the current raft electrofishing methods now employed. In addition, ongoing long-term tracking of YOY abundance can lead to insights into the dynamics structuring the wild Brook Trout population as a whole. Based on the initial YOY surveys last year there were an estimated 2,673 YOY Brook Trout per kilometer (SD = 864.5) in the Swift River. In 2021, the YOY Brook Trout density jumped to 3,395 per kilometer (SD = 1740.3). Brook Trout rearing habitat is plentiful in the Swift River tailwater so individual reaches for YOY Brook Trout surveys were selected to be 1) representative of Brook Trout rearing habitat typical in the Swift River tailwater (e.g., low-gradient, shallow, abundant cover) and 2) located in each of the major river sections (e.g., upstream of Route 9, between Route 9 and Valley District Office downstream, and in the lower river before it reaches the impoundment). More data are needed to identify trends and uncover potential influences, both density-dependent and density-independent factors, on YOY abundance from year to year.

Consistent annual surveys of the entire adult population, as well as targeted YOY surveys, will continue to be important to allow future analysis of trends in catch rates, trout abundance, and size/age structure of wild Brook Trout populations in relation to environmental factors.

Table 15. Catch-per-unit-effort (CPUE; measured as number of individuals per hour of electrofishing) for wild Brook Trout and stocked Brown and Rainbow Trout across five years (2017-2021) of comprehensive fish surveys in the Swift River tailwater. Also shown are the other fish species encountered during the surveys.

	Brook Trout	Brown Trout	Rainbow Trout	Other species present
CPUE (2021)	176.96/hr	5.83/hr	15.17/hr	American Eel, Chain Pickerel, Golden Shiner, Largemouth Bass, Landlocked Atlantic Salmon, White Sucker, Yellow Perch
CPUE (2020)	176.43/hr	20.20/hr	61.69/hr	American Eel, Golden Shiner, Landlocked Atlantic Salmon, Pumpkinseed, Rock Bass, Smallmouth Bass, White Sucker, Yellow Perch
CPUE (2019)	72.89/hr	4.59/hr	8.00/hr	Chain Pickerel, Golden Shiner, Rock Bass, Smallmouth Bass, Tessellated Darter, White Sucker, Yellow Perch
CPUE (2018)	176.40/hr	3.97/hr	3.70/hr	American Eel, Brown Bullhead, Chain Pickerel, Golden Shiner, Rock Bass, Smallmouth Bass, Tessellated Darter, White Sucker, Yellow Perch
CPUE (2017)	231.34/hr	1.97/hr	6.06/hr	NA

Mark-recapture Project

Beginning in spring 2021, all Brown and Rainbow trout stocked into the Swift River tailwater are receiving a colored Visible Implant Elastomer (VIE) tag (Figure 9) to identify the month and year they are released (Blue: March; Red: April; May: Orange; June: Yellow).

Figure 9. Visible Implant Elastomer (VIE) tag – in this case, blue – injected behind the left eye to mark each cohort of stocked trout in the Swift River.

In addition, all trout stocked into the year-round catch-and-release section upstream of the Route 9 bridge also receive an adipose fin clip to designate stocking location. Surveys are done one week, one month, and three months post-stocking to assess the number of marked fish from each cohort remaining in the river and to assess whether or not adipose-clipped fish from the catch-and-release section have moved. All population estimates for the number of individuals encountered in these surveys are from an extrapolation calculated based on catchability or capture efficiency estimates from mark-recapture electrofishing trials done last summer.

On average, 52% of Rainbow Trout stocked into the Swift River remain after one week. Although this varies with stocking cohort and location stocked (Figure 10). Over 90% of the Rainbow Trout stocked into the catch-and-release area upstream of Route 9 in June remain in that section after one week. In contrast, only 20% of the rainbows stocked into this same section in March remain after one week. Overall, the stocked Rainbow Trout fare better after one week in the catch-and-release section of the river (58% remain across all cohorts) than in the section downstream (40% remain across all cohorts). After one month, for the March, April, and May cohorts, 33% of the original number of stocked Rainbow Trout remain in the river on average; 46% in the catch-and-release area and 27% elsewhere in the river. While we can assess the abundance of trout that remain in the Swift River tailwater post-stocking, we are unable to assess the fate of the missing trout, whether they died from natural causes, were harvested by anglers, or passed over the Bondsville Dam and exited the study area.

Overall, based on the current study design, we are only able to assess movement of stocked trout into and out

Figure 10. Trends in abundance of hatchery Rainbow Trout at select time periods post-stocking in different sections of the Swift River, downstream of Route 9, upstream of Route 9, and the entire river from Windsor Dam through the impoundment.

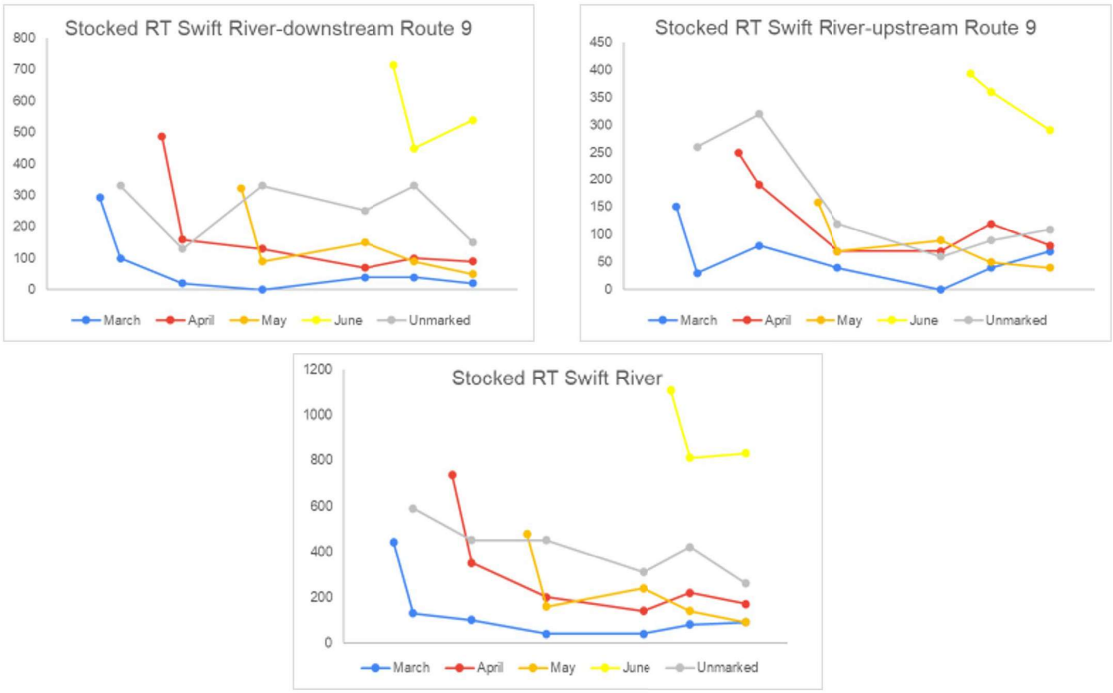


Figure 11. Trends in abundance of hatchery Brown Trout at select time periods post-stocking in different sections of the Swift River, downstream of Route 9, upstream of Route 9, and the entire river from Windsor Dam through the impoundment.

of the year-round catch-and-release area at this time. In general, across most cohorts, the movement of stocked Rainbow Trout has been relatively minimal into and out of the year-round catch-and-release area. However, a fair number of April (~50 individuals) and June (~70 individuals) rainbows, stocked in the catch-and-release area, were found downstream. Very few fish stocked into the downstream section have been found in the catch-and-release area upstream.

In contrast to the relatively rapid decline in Rainbow Trout immediately following stocking, a greater proportion (68%) of Brown Trout are present in the Swift River tailwater one week post stocking (Figure 11). However, there is only one cohort of Brown Trout stocked, in May.

Comparing the May cohorts of Rainbow Trout and Brown Trout the differences in abundance after one week (31% for Rainbow Trout and 68% for Brown Trout) and one month (30% and 45%) are just as large. Movement of Brown Trout, especially the rapid movement out of the catch-and-release area shortly after stocking was a surprise. Only one out of six of the adipose-clipped Brown Trout surveyed one week post stocking were still present in the catch-and-release area where they were initially stocked. Later surveys show that a proportion of these fish moved back upstream, however.

This mark-recapture project is likely to continue for an additional two years to integrate any potential variability in survival and movement patterns of trout stocked into the Swift River.

Wild Trout Management Plan

A complete draft of the Massachusetts Wild Trout Management Plan was reviewed by Fisheries staff and District staff in late 2020—early 2021. Abundant feedback was obtained through this process. Revisions were made to the WTMP over the spring of 2021 and a final working draft was recently submitted for another round of review. The WTMP will have a large amount of utility as a working document for organizing and disseminating current data and knowledge regarding wild trout resources across Massachusetts, suggesting management activities for wild trout fisheries, classifying wild trout fisheries for anglers as well as for prioritizing land acquisition and restoration projects, and also guiding and clarifying MassWildlife's overall philosophy on wild trout and wild trout management moving forward.

Wild Trout Stream Surveys

As part of the WTMP, a group of potential Premier Wild Trout Streams are being surveyed to confirm, or deny, inclusion into this select group. To be considered for Premier Wild Trout Stream status, specific criteria for abundance (meets Class A or B for trout abundance), size structure (greater-than-median abundance of Brook Trout over 150 millimeters and/or Brown Trout over 200 millimeters), stream size (greater than 3.5 meters wide), and angler access (parking, public access) all need to be met.

Table 16. Coldwater streams (to date) that were selected as potential high-profile fisheries and have been confirmed to meet criteria for recognition as Premier Wild Trout fisheries or Premier Wild-Stocked Trout fisheries.

1100550	Hemlock Brook	3208825	Munn Brook
1100575	Buxton Brook	3208975	Dickinson Brook
1100650	Green River (1)	3209900	Freeland Brook
1100675	Hopper Brook	3209925	Nye Brook
1100700	Money Brook	3210000	Roaring Brook (1)
1100725	West Branch Green River	3211525	West Branch Brook
1100900	Notch Brook	3211550	Bronson Brook
1101250	Tophet Brook	3211625	Kearney Brook
1101350	Hoxie Brook	3211700	Tower Brook (1)
1202150	Kinderhook Creek	3313950	Bear River
1302800	Bashbish Brook	3315175	Mill Brook (2)
2103950	Green River	3315950	Tower Brook (1)
2104025	Alford Brook	3316425	Dunbar Brook
2104075	Scribner Brook	3420200	Cushman Brook
2104125	Cone Brook	3420925	Fall River
2104275	Furnace Brook	3626525	Swift River
2104775	Goose Pond Brook	3626800	West Branch Swift River
2104800	Greenwater Brook	4129280	Freeman's Brook
2105200	Ashley Brook	5133015	Ararat Brook
3208375	Great Brook	8145650	South Wachusett Brook

To date, eighty-two wild trout streams with the potential for being Premier Wild Trout Streams have been surveyed. Twenty-six reaches on twenty-one of these wild trout streams were surveyed in late summer—early fall 2020. Ten of these streams met the criteria for Premier status. To date there are now forty confirmed Premier wild trout fisheries across the state (Table 16, Figure 12). Several more will likely be added as forty-two additional wild trout streams are set to be assessed in the upcoming FY 2022 and FY 2023.

Figure 12. Map of streams recognized (to date) as Premier Wild Trout fisheries or Premier Wild-Stocked Trout fisheries.

Teaching with Trout

The Teaching with Trout program continued for FY 2021. However, only about one-third of the usual number of participating schools were able to be part of the program given the widespread school closures and uncertainty surrounding reopening. The in-person orientation program for new schools was also cancelled. In total, there were twenty schools, spread across seventeen towns, participating in the program this past year (Figure 13).

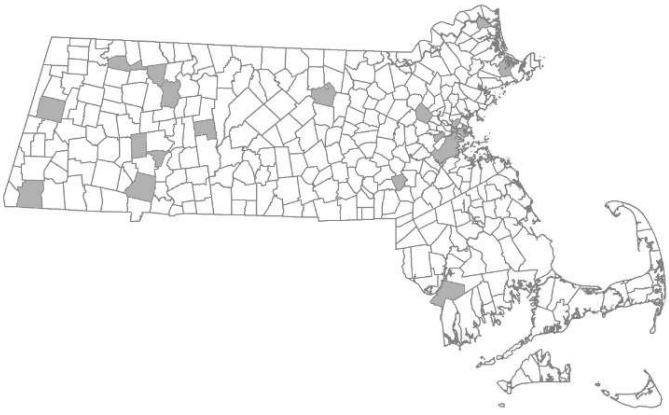


Figure 13. Map of towns where schools participating in the 2020-2021 Teaching with Trout program are located.

Outreach Opportunities

As was the case in the latter half of the previous fiscal year, FY 2021 saw a general downward trend in the number of outreach opportunities because of pandemic-related closures and precautions. Still, there were a few opportunities to present information and data on wild trout and wild trout management in Massachusetts.

September 2020: Presentation on Massachusetts Coldwater Fisheries Management as part of a guest lecture for Dr. Alison Roy's Aquatic Ecology course at UMass-Amherst (remote)

March 2021: Presentation on Wild Trout and Wild Trout Management in Massachusetts with an emphasis on the Deerfield River Brown Trout Fishery for the Squan-a-Tissit Chapter of Trout Unlimited (remote)

April 2021: Moderator for the Wild Trout Management Symposium at the 2021 Northeast Association of Fish and Wildlife Agencies (NEAFWA) annual conference (remote)

April 2021: Presentation as part of the Wild Trout Symposium at NEAFWA 2021 detailing ongoing research and preliminary results from the Deerfield River Brown Trout project (remote)

Anadromous Fish Investigations

Steven Mattocks

Holyoke Gas & Electric Department (HG&E), as directed by the conditions of its Federal Energy Regulatory Commission (FERC) hydroelectric license, continued to staff the Holyoke fishway, and Firstlight Power monitored fish passage at the Turners Falls fishways. MassWildlife coordinates with HG&E and state and federal resource agencies during these activities.

During FY 2021, MassWildlife was actively involved in FERC Hydroelectric proceedings concerning:

- Application for a license at the Pepperell Paper dam on the Nashua River in Pepperell
- Application for a license for the Turners Falls Project, on the Turners Falls Power Canal
- Application for relicensing of the Northfield Mountain Pumped Storage Project on the Connecticut River
- Application for relicensing of the Turners Falls Project on the Connecticut River
- Application for relicensing of the Fife Brook project on the Deerfield River
- Application for relicensing of the Lowell Hydroelectric Project on the Merrimack River
- Application for relicensing of the Chicopee River Projects on the Chicopee River

MassWildlife works with the Massachusetts Department of Energy Resources, coordinates with resource agencies and proponents, and comments on the applications of numerous hydroelectric projects seeking to qualify for "Low Impact Hydroelectric Certification" and/or "Green Energy" credits in Massachusetts. In FY 2021, those projects were as follows:

- Red Bridge Project, Chicopee River
- Indian Orchard Project, Chicopee River
- Putts Bridge, Chicopee River
- Dwight, Chicopee River
- Woronoco Project, Westfield River
- Deerfield River Project, Deerfield River
- Texon Project, Westfield River

The Fisheries Program is responsible for fisheries Environmental Review in coordination with the Heritage Program, which in FY 2021 involved review of MassDOT projects, NPDES permits, NOIs from local conservation commissions, and MEAP projects, and coordination of comments with the Heritage Program. The Fisheries Program is also represented on MassWildlife's land acquisition program, attending two rounds of parcel meetings and ranking parcels for purchase priority.

The Fisheries Program also coordinates all activities related to the repair and removal of dams on MassWildlife lands. MassWildlife previously identified 35 dams on its properties, including 10 rated as "Significant Hazard" by the Massachusetts office of Dam Safety. The estimated cost to properly repair or remove and operate these dams is $12.4 million; $1.5 million was allocated for dam repair and/or removal projects in FY 2021. FY 2021 accomplishments included commencing reconstruction of Upper Flint Pond Dam, Tyngsboro, and participating in meetings to discuss progress on projects at Adams Pond Dam, Nye Pond Dam, and Fish Hatchery Dam. Fisheries also collects, logs, and reviews scientific collection permits in coordination with biological staff and the Permit Specialist in the Boston office.

Fish Passage Oversight: Connecticut River

MassWildlife actively participates in the Connecticut River Atlantic Salmon Commission (CRASC). The FERC relicensing of five hydroelectric projects on the Connecticut River, at Northfield Mountain, Turners Falls, Vernon, Bellow Falls, and Wilder, continued this year. This is a 5-year process that will require close attention.

Because 2021 fish passage operations are ongoing, this report summarizes the 2020 calendar year fish passage activities.

Holyoke

The City of Holyoke (i.e., HG&E) bought the Holyoke Hydroelectric project from Northeast Utilities in 2002. Previously, negotiations with the new owner concerning outstanding issues were finalized along with the FERC license for the project (awarded in 2001). HG&E, as directed by the conditions of their new FERC hydroelectric license, hired seasonal employees for operating the Holyoke fishway. MassWildlife coordinated with HG&E and the state and federal agencies to monitor Holyoke fish passage activities.

Lift operations commenced on April 21, 2020. On May 4, water temperature averaged 11.5°C and 7,291 American Shad were passed, triggering fish passage operations from 8:00 a.m.–6:00 p.m. On May 18, passage of 28,162 American Shad triggered both extended lift operating hours (7:00 p.m.) as well as initiating early lift operations (7:00 a.m.) as per standard procedures. Extended lift operating hours continued through May 23, while early lift operations extended through May 27 and also occurred on May 30. Normal operations were maintained April 21 to June 30 with a few exceptions, including April 23 and April 24, when debris buildup prevented the tailrace lift from operating; April 25 through April 28, when both lifts were inoperable while the tailrace channel was cleared and the lift was repaired; and May 2 and May 3, due to high flows and poor visibility. Lift operations ended early on June 29 (2:00 p.m.) and June 30 (12:00 p.m.) due to severe weather and the initiation of Shortnose Sturgeon lift modifications, respectively. After June 30, the fish lifts were operated for Shortnose Sturgeon passage through November 13, 2020, with the exception of weekends, the July 1 to July 5 outage to complete Shortnose Sturgeon lift modifications, and the September 21 to September 28 scheduled canal outage. Operational problems were reviewed as needed on an ongoing basis and at the conclusion of the spring/summer lifting season by MassWildlife and USFWS personnel and by HG&E.

The Holyoke fish passage facility operated for 71 days during in the spring season, passing a total of 397,233 anadromous fish (Table 17; Appendix A). The number of days that passage was greater than 1% of the seasonal total was considerably less than 71. The number of days that passage was greater than 1% of the seasonal total, and the percentage of the total run that these days comprise, is a measure the temporal distribution of the run. The "over-1%-daily-passage" totals were: American Shad, 90% of 362,244 in 21 days; Blueback Herring, 94% of 763 in 14 days; Sea Lamprey, 94% of 33,739 in 13 days; Striped Bass, 92% of 389 in 25 days; Gizzard Shad, 100% of 64 in 31 days (Table 17; Appendix A).

American Shad

In CY 2020, 362,244 American shad were passed upstream. This was 50% of the record high passage of 1992. CY 2020 passage was 94% of the previous five-year mean, and 101% of the previous 10-year mean (Table 18; Appendix A). In 2020, no shad were transferred to trucks for transport or removed for biological sampling and agency studies due to the COVID-19 pandemic. Examining the cumulative percent of shad passed at Holyoke, 50% of fish passed this project on the 31st day of passage, May 21 (Table 19).

Table 19. Temporal characteristics of American shad passage at the Holyoke fish lift, 2020. Cumulative percentage of total American shad passage.

	25%	50%	75%	90%	Highest Day
Day*	29	31	35	41	
Date	5/19	5/21	5/25	5/31	5/21

* Day one is April 20, the first day shad were lifted at the Holyoke fish passage facility.

Shortnose Sturgeon

Eighteen Shortnose Sturgeon were lifted in 2020 (Table 18; Appendix A).

American Eel

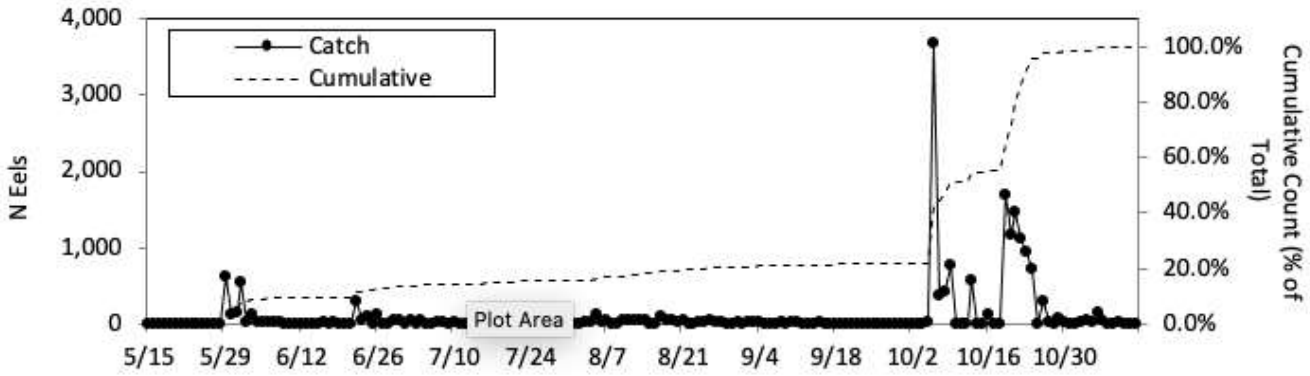
Eel ramps were deployed in the tailrace fish lift entrance and upper stilling basin on May 14. High flows and necessary repairs to the attraction water system

kept the South Hadley eel ramp from being installed until July 15. The South Hadley, upper stilling basin and tailrace fish lift entrance eel ramps operated until November 13.

Juvenile eel collections totaled 17,689 in 2020, a decrease from 2019 (n=27,050) and ranked 7th highest out of the 18 years since 2003 when specific eel collection and upstream passage efforts began. The South Hadley ramp contributed 36.5% of the annual total collections and 63.5% were collected from the ramps in the Holyoke fish lift structures, 60.5% from the tailrace fish lift entrance ramp, and 3% from the stilling basin ramp (Table 20; Appendix A).

The 2020 season was characterized by a regional drought contributing to relatively low late spring and summer flows through September and increasing flows through October and November. The majority (73.2%) of eels were collected on just 11 dates in October, each contributing 2% or more of the annual total (Figure 14).

Figure 14. 2020 Combined daily eel collections (catch) and cumulative proportion of annual total collections (dashed line).



Other Anadromous Fish Species

Blueback Herring passage in 2020 (720) was 53% of the previous five-year mean and 84% of the previous ten-year mean (Table 18; Appendix A).

Sea Lamprey passage in 2020 (33,739) was 34% of the record passage of in 1998 and was 157% of the previous five-year mean and 150% of the previous ten-year mean (Table 18; Appendix A).

Gizzard Shad passage in 2020 was 64. This was 18% of the previous five-year mean and 15% of the previous ten-year mean (Table 18; Appendix A).

Resident Fish

A total of 1,959 fish representing 19 non-anadromous resident species (omitting American Eel but including juvenile Sea Lamprey) were counted using the fish lifts during the anadromous fish passage season. The most common species were juvenile Sea Lamprey (35% of resident fish count), White Sucker (32%), and Smallmouth Bass (22%).

Turners Falls

The fish ladders at Turners Falls were operated for a total of 64 days from April 3 through July 2, 2020. Operational problems were reviewed as needed on an ongoing basis by MassWildlife and USFWS, and by Firstlight Power, the dam owner.

Upstream fish passage counts were made at the Spillway, Gatehouse, and Cabot fish ladders by review of recorded passage. Digital recordings were reviewed by employees of Firstlight Power. All ladders were monitored twenty-four hours each day unless technical problems occurred. All fish ladders remained open for passage twenty-four hours each day.

American Shad and Sea Lamprey were identified and enumerated at the Spillway, Gatehouse and Cabot ladders (Table 21; Appendix A).

American Shad

The number of shad passing the Gatehouse fish ladder in 2020 (41,252) was 69% of the maximum passage of 1992 (Tables 21 and 22; Appendix A), 83%

of the previous 5-year mean and 108% of the previous 10-year mean.

The number of shad passing the Spillway fish ladder in 2020 (23,022) was 55% of the maximum passage of 2015 (Tables 21 and 22; Appendix A), 80% of the previous 5-year mean and 119% of the previous 10-year mean.

The number of shad passing the Cabot fish ladder in 2020 (34,868) was 37% of the maximum passage of 1992 (Tables 21 and 22; Appendix A), 100% of the previous 5-year mean and 94% of the previous 10-year mean.

Examining the cumulative percent of shad passed at Gatehouse, 50% of fish passed this ladder on the 29th day of the migration, May 28, 2020 (Table 23; Appendix A).

Examining the cumulative percent of shad passed at Spillway, 50% of fish passed this ladder on the 29th day of the migration, May 28, 2020 (Table 23; Appendix A).

Examining the cumulative percent of shad passed at Cabot, 50% of fish passed this ladder on the 28th day of the migration, May 27, 2020 (Table 23; Appendix A).

Only 11% of the shad lifted at Holyoke (362,244) passed the Gatehouse observation window, well below the restoration goal of 50%.

Other Anadromous Fish Species

No Atlantic Salmon were recorded passing the gatehouse fishway in 2020.

17,525 Sea Lamprey passed the gatehouse fishway in 2020. This represents an all-time high for Sea Lamprey passage (Tables 21 and 22; Appendix A), 234% of the previous 5-year mean and 283% of the previous 10-year mean.

Fish Passage Oversight: Westfield River

In 2020, a fish ladder was operated at the A&D Hydroelectric dam in West Springfield. The fishway and associated downstream bypass facilities were constructed in the fall of 1995.

Due to the COVID-19 pandemic, the West Springfield fishway was opened about 1 month late in 2020. However, the wet, cold spring weather may have delayed fish migration, so that this late opening had a smaller effect on the passage season than in a normal year. In 2020, the fishway was not staffed; fish passage was recorded and enumerated later from digital video. Video was recorded 24 hours a day with the aid of a near-infrared camera and infrared illuminator. Due to staff time and video quality, only American shad passage was enumerated in 2020 (Table 24; Appendix A). Many White Sucker and Sea Lamprey were recorded passing the fishway in 2020.

A total of 5,567 adult American Shad were counted passing the fishway in 2020 (Table 24; Appendix A). 50% of the American shad passage had occurred by the 7th day of the run, May 18 (Table 26; Appendix A).

Anadromous Fish

The West Springfield fish passage facility operated for 46 days in the spring of 2020. The number of days that passage was greater than 1% of the seasonal total was considerably less than 46. The number of days that passage is greater than 1% of the seasonal total, and the percentage of the total run that these days comprise, is a measure the temporal distribution of the run. The "over-1%-daily-passage" totals were: American shad, 90% of 5,567 in 20 days (Table 26; Appendix A).

A total of 5,567 American Shad, and 0 Atlantic salmon upstream in spring 2020 (Table 25; Appendix A). The 2020 shad passage was 54% of the record high of 10,373 in 2012 (Table 25; Appendix A).

Non-anadromous Fish

Sea Lamprey, White Sucker, Brook Trout, Brown Trout, Rainbow Trout, Tiger Trout, and Smallmouth Bass were seen passing upstream through the West Springfield fish passage facility in 2020 but not enumerated.

Fish Passage Oversight: Merrimack River

Essex Dam

The Essex Dam fish elevator operated for 78 days between April 15 and July 1 (Table 27; Appendix A). During the spring migration period the Essex Dam

fish elevator was operated seven days per week. Hours of operation were generally 8:00 a.m. to 4:00 p.m. throughout the season. During the peak of the herring migration lifting would start earlier and continue later in the evening. During the fall four lifts were made per weekday. Fish passage was recorded and enumerated later from the video.

Atlantic Salmon

Four adult Atlantic Salmon were lifted at the Essex fishlift during spring 2020. This was 1% of the record passage of 2011 (402; Table 28; Appendix A). Salmon returns were 42% of the previous 5-year mean, and 5% of the previous 10-year mean. No salmon were captured in the fall.

American Shad

The total number of shad lifted in 2020 (52,239) was 58% of the record passage (89,421) of 2015 (Table 28; Appendix A). 2020 shad passage was 98% of the previous 5-year mean and 136% of the previous 10-year mean.

River Herring

The total number of herring lifted in 2020 (87,150) was 19% of the record passage (449,356) of 2018 (Table 28; Appendix A). 2020 herring passage was 36% of the previous 5-year mean and 69% of the previous 10-year mean.

Other Anadromous Fish

The total number of Sea Lamprey, Striped Bass, and Gizzard Shad passing through the Lawrence fishlift were 9,733, 62, and 0, respectively.

American Eel

An estimated 92,786 elvers were passed in the lift hopper or the eelways at the dam. 14 yellow eels were observed passing upstream at the counting window.

Pawtucket Dam

Operation of the Pawtucket Dam fish elevator began May 1 and concluded on July 1. The system was operated seven days per week, generally from 7:00 a.m. to 6:00 p.m. Frequency of lifts varied between 0.5 to 2 hours based on the density of fish observed in the hopper bucket. Estimates of fish passage were made by employees who observed the hopper bucket during each lift. Maintenance of the facility was satisfactory throughout the fish passage season.

The Lowell Ladder was operated from May 1 and concluded on July 1 per agreement with the dam owners and the Merrimack River Technical Committee. The SalmonSoft video system was used to record fish passage. Videos were reviewed with Windows Media player or VLC software.

American Shad

The estimated total number of American Shad passed at the Lowell lift in 2020 was 7,561 (Table 29; Appendix A). 799 American Shad were counted passing the ladder. Therefore, we estimate the entire Lowell project passed about 8,360 American Shad.

River Herring

The estimated total number of River Herring passed at the Lowell lift in 2020 was 40,125 (Table 29; Appendix A). 141,845 River Herring were counted passing the ladder. Therefore, we estimate the Lowell Project as a whole passed about 181,979 River Herring.

Other Anadromous fish

The estimated total number of Sea Lamprey passed at the Lowell lift in 2020 was 1,014 (Table 29; Appendix A). 3,200 Sea Lamprey were counted passing the ladder. Therefore, we estimate the entire Lowell Project passed about 4,214 Sea Lamprey.

Table 30 (Appendix A) lists the annual runs of anadromous fish counted at the facility from 1986, the first year of operation, through 2020.

Assorted riverine species have been noted but not counted.

Fisheries Program Staff

Westborough Field Headquarters

Todd A. Richards, M.S., Assistant Director, Fisheries
Adam Kautza, Ph.D., Coldwater Fishery Resource Project Leader
Steven Mattocks, M.S., Fisheries Operations/Aquatic Connectivity Biologist
Rebecca Quiñones, Ph.D., Stream and River Project Leader
Caleb Slater, Ph.D., Hatchery Supervisor
Jason Stolarski, Ph.D., Watershed Project Leader
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Nicole Harmon, Seasonal Employee
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Vacant, Wildlife Technician

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Roger Reed Hatchery

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Sandwich Hatchery

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Michael Clark, Wildlife Technician

Sunderland Hatchery

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Andrew Ostrowski, Wildlife Technician
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Heather Sadler, Wildlife Technician
Vacant, Wildlife Technician

3 The Wildlife Program

Michael Huguenin, Assistant Director of Wildlife

Overview

The Wildlife Section is responsible for the conservation, management, and research of wildlife populations within the Commonwealth of Massachusetts and has one Assistant Director, one Habitat Program Supervisor, seven Game Biologists, six Habitat Biologists, one Population Ecologist/GIS Specialist, one Ornithologist, and two vacancies. The goals of the Wildlife Section are to maintain healthy wildlife populations, enhance wildlife-based recreation, reduce negative interactions between people and wildlife, and to forward MassWildlife's mission of wildlife conservation and management.

We accomplish our goals by conducting research to develop and implement regulatory, policy, and programmatic management recommendations, which are ultimately reviewed by Senior Staff and potentially approved and/or endorsed by the Fisheries and Wildlife Board. Specifically, the Game Biologists (4 Project Leaders and 3 Wildlife Biologists) in the Wildlife Section are responsible for the management and conservation of dozens of species that include, but are not limited to black bears, white-tailed deer, wild turkey, waterfowl, cottontail rabbit, furbearers, woodcock, ruffed grouse, and moose. Game biologists manage hunting and trapping seasons (i.e., dates and bag limits) and allocate, and issue permits for antlerless deer, wild turkey, and black bear. Hunting and trapping seasons and the allocation of permits are designed to conserve and/or manage populations, and to provide quality hunting and trapping opportunities for the public. Related to that, the Wildlife Section also coordinates the agency's special 3-day hunt for paraplegic deer hunters, and the agency's pheasant stocking program to provide more accessible hunting opportunities throughout the state to new and current hunters. Habitat biologists in the Wildlife Section are responsible for developing and implementing habitat management plans to maintain and enhance biodiversity (of both game and nongame species) on state Wildlife Management Areas (WMA). Habitat staff also spend significant time consulting on management and conservation strategies, land acquisition, and public outreach.

Wildlife Section staff also coordinate the Large Animal Response Team (LART), partner with federal, state, municipal and private organizations, represent the agency on the Northeast Association of Fish and Wildlife Agencies' various technical committees and Northeast Association of Wildlife Administrators. Staff also provide presentations to the public and Universities, fulfill public records requests, and conduct media interviews.

During fiscal year 2021, many agency staff worked from home due to COVID-19 protocols. Wildlife Section staff adapted well to this situation and quickly embraced the necessary technology to continue working productively on the many projects outlined throughout this report. Despite the complexities associated with working remotely related to communication and productivity, staff went above and beyond to ensure that good communication was maintained both internally and externally, and that productivity on important projects did not fall through the cracks. Staff also spent significant time adapting procedures and adjusting processes to continue to provide our agency's services to the public.

Habitat Program

Brian Hawthorne

Overview

Fiscal year 2021 brought dramatic changes to MassWildlife's Habitat Program. After more than two decades of leading this program and its predecessors, John Scanlon took a well-deserved retirement from his role as Habitat Program Leader. His vision and direction left an experienced team ready to take-on the challenges of coordinating habitat management and restoration in the Commonwealth. The Fisheries and Wildlife Board approved the promotion of Habitat Planning Coordinator Brian Hawthorne to the position of Habitat Program Manager in February 2021, and senior staff directed him to work with all the agency's sections and programs to coordinate habitat activities in MassWildlife. To aid in the transition, MassWildlife retained John Scanlon for the remainder of calendar year 2021 as a part-time consulting Habitat Biologist.

Staffing

The Habitat Program staff at the conclusion of FY 2021 included the habitat program manager and consulting habitat biologist, five habitat biologists from MassWildlife's Wildlife Section (not including two positions left unfilled after promotions), as well as the Prescribed Fire Program Manager and three restoration ecologists from the Natural Heritage and Endangered Species Program (NHESP). Staff members from the Fisheries Program collaborate on aquatic habitat issues, and the habitat program works closely with MassWildlife District staff on local Wildlife Management Area issues, I&E staff on outreach related to habitat management, NHESP environmental review biologists, and DFG Realty and the DFG Lands Committee on acquisition and protection of new lands across the Commonwealth. The Habitat Program is involved in cooperative habitat management and monitoring projects with the DCR and with the joint MassWildlife-MassDOT Linking Landscapes project, and staff also assist with reviewing and prioritizing applications for funding under the MassWildlife Habitat Management Grant Program.

Goals

The Habitat Program facilitates ecological restoration and adaptive habitat management of native habitat types and natural communities across a range of upland, wetland, and aquatic sites on both public and private lands to conserve the full diversity of birds, mammals, fish, and other wildlife, especially those identified as species of greatest conservation need (SGCN) in the Massachusetts State Wildlife Action Plan (SWAP). SGCN includes species listed under the Massachusetts Endangered Species Act (MESA). Upland sites include grasslands, shrublands, barrens, woodlands, and forestlands. Wetland sites include marshes, fens, shrub swamps, and forested swamps. Aquatic sites include cold-water fisheries and their adjacent wetlands and uplands.

Private lands habitat biologists within the Habitat Program work under contract with the USDA Natural Resource Conservation Service (NRCS) to conduct public outreach, provide technical assistance, and apply habitat management for rare and declining species on cooperating private lands through programs such as Working Lands for Wildlife, Northeast Turtles, the Young Forest Regional Conservation Partnership Program, and the Massachusetts Collaborative for Private Forestland Regional Conservation Partnership Program (RCPPs).

Objectives

The Habitat Program's objectives are to

- Provide a spatial and temporal distribution of habitats for birds, mammals, and other species of conservation concern (including but not limited to grassland, marshland, shrubland, barrens, young forest, and biologically mature forest habitats) on WMA and WCE lands throughout Massachusetts, by restoring and maintaining appropriate natural communities.
- Provide technical assistance to other public and private landowners and conservation organizations on management of natural communities and habitat types such as grassland, marshland, shrubland, barrens, and young forest. Public and private

landowners and conservation organizations include, but are not limited to, the U.S. Army Corps of Engineers (USACE), the Massachusetts Department of Conservation and Recreation (DCR) state forest and state watershed lands, town conservation lands, and private conservation lands (e.g., land trusts).
- Promote the benefits of habitat management and restoration as a necessary component of improving climate resiliency and protecting biodiversity in the Commonwealth.

The Habitat Program applies landscape composition goals for WMAs approved by the Massachusetts Fisheries and Wildlife Board that include 20-25% open habitats (consisting of 1-2% grassland, 8-9% shrubland, and 11-14% young forest habitat ≤30 years old), 65-75% closed canopy forest habitat between 30-150 years old, and 10-15% biologically mature forest habitat over 150 years old. The specific management practices applied at any given site are based on an analysis of the natural communities present and/or desired, based on factors such as bedrock, soils, moisture regime, topography, and existing vegetation.

Actions

Habitat Program staff conduct, contract, and administer tree cutting, mowing, mulching, stumping, harrowing, seeding, prescribed fire, and invasive plant control to restore and enhance grassland, shrubland, barrens, and young forest habitats on WMAs with MassWildlife staff, and through existing statewide contracts and procurement procedures in compliance with all local, state, and federal permitting requirements. Staff also contract and administer tree cutting designed to create young forest habitat or other forested habitats through wood products sales through a public, competitive bidding process in compliance with all local, state, and federal permitting requirements.

Habitat Program staff conduct, contract, and administer these practices across more than 175,000 acres of Wildlife Management Areas (WMAs) and provide technical assistance to other public and private landowners interested in applied management to conserve wildlife. In addition, Habitat Program staff members assist the MassWildlife Realty Program and District offices with their monitoring of more than 150 Wildlife Conservation Easements (WCEs) on over 50,000 acres of private lands.

Project Administration

Habitat Program staff administered, contracted, and directed biological monitoring, management planning, and applied management practices at more than a dozen sites in FY 2021 to help achieve landscape composition goals for a spatial and temporal diversity of habitats at the landscape level (Tables 31 and-32a-f; Appendix B). Activities included preparation and/or updating of habitat site plans and prescribed burn plans, administration of habitat management contracts with private vendors, and conducting or contracting biological monitoring. Habitat Program staff also maintained GIS databases of management and monitoring data for all sites.

Biological Monitoring

Regular monitoring is essential for practicing adaptive natural resource management and includes surveys such as:

- vegetation sampling to determine the relative abundance of all vascular plants in the forest understory and overstory and to determine regeneration success of desired tree species on harvested sites and trajectory towards desired natural communities;
- identification and location of invasive plants for subsequent control efforts and to evaluate the success of past control efforts;
- identification and location of rare plants in order to design appropriate mitigation during habitat activities and to determine success of restoration efforts;
- photo documentation of pre- and post-treatment conditions;
- wildlife sampling to determine habitat use (e.g., breeding birds, butterflies/moths, pollinators).

In FY 2021, Habitat Program staff contracted and oversaw monitoring of grassland breeding birds on two sites totaling 610 acres (Table 31; Appendix B). Under the 2018 EEA Interim Policy on the Use of Unmanned Aircraft Systems (UAS), in FY 2021, Habitat Program staff worked with other

MassWildlife staff and MassDOT Aeronautics Division to conduct low-altitude aerial photography of sites at six locations totaling approximately 3,145 acres (Table 31, Appendix B).

Program Accomplishments

Despite the changes in the Habitat Program's organization and the vicissitudes of a global pandemic, the program exceeded its goals in FY 2021, completing biological monitoring at 12 sites totaling over 5,500 acres, writing habitat and fire plans for 15 sites covering over 9,300 acres, applying habitat management practices at 40 sites on nearly 3,000 acres, assisting with WMA and WCE compliance monitoring at 6 sites totaling over 430 acres, and providing technical assistance to over 50 private landowners across the Commonwealth.

Habitat Planning

Habitat Site Plans are prepared for all MassWildlife properties where active habitat management will occur. In addition to these habitat plans, those properties that include fire-associated natural communities such as native warm-season grasslands or scrub oak barrens also have Prescribed Burn Unit Plans developed as required by the MassWildlife Prescribed Fire Policy and Handbook (https://www.mass.gov/files/documents/2017/09/20/fire-policy-handbook-4-19-17.pdf). Unit plans provide details on fuel types, fuel loads, fuel breaks, and required fire prescription parameters such as wind speed and direction, relative humidity, fuel moisture content, crew composition and fire equipment. For the small subset of MassWildlife properties that *both* support fire-associated natural communities *and* occur within a regional landscape where human safety and development are at risk due to additional fire-associated natural communities that occur nearby but outside the WMA, Fire Management Plans are prepared to coordinate prescribed burning on MassWildlife lands with wildfire control on adjacent fire-prone lands and associated development. Initial restoration concept and preliminary restoration design plans provide an overview of the resource values at a site and are incorporated into Habitat Site Plans.

MassWildlife conducted field assessments and produced prescribed fire plans for wildlife management areas across the state in FY 2021, bringing the total of wildlife management areas with prescribed fire plans to twenty statewide and over 7,000 acres in prescription. This year, plans were completed for multiple sites within the Myles Standish Pine Barren Complex including tracts within Camp Cachalot WCE, Maple Springs WMA, and Southeast Pine Barrens WMA. Over 1,000 acres were included in this recent planning effort. All three sites are located adjacent to Myles Standish State Forest and are part of a 10-year pine barren restoration effort undertaken in collaboration with the Massachusetts Department of Conservation and Recreation. Prescribed fire plans were also completed for two management units within the Montague Plains WMA in the Connecticut River Valley. All five plans follow National Wildfire Coordinating Group (NWCG) and MassWildlife prescribed fire planning guidance. The planning involved field assessments and plan contributions by SE and CT Valley Districts, the Habitat Program, Natural Heritage Ecologists, and experienced contracted fire planners. These plans were produced and technically reviewed by qualified prescribed burn bosses and the MassWildlife prescribed fire manager. Plans provide details on management goals, fuel types, fuel loads, fire breaks, prescription parameters, crew composition, burn logistics, and risk assessment and mitigation strategies. In addition, several low complexity prescribed fire plans for small units within Frances A. Crane WMA and Herm Covey WMA were completed as a training exercise in prescribed fire planning for MassWildlife staff.

Given increasing drought and fire danger during the summer of 2020 and early 2021, numerous wildfires of undetermined origin were reported on MassWildlife lands including wildfires at Mt Toby WMA, Tully Mountain WMA, Frances A. Crane WMA, Maple Springs WMA, Mashpee Pine Barrens WMA, and Southwick WMA. MassWildlife trained and qualified staff assisted local and state fire control officials in response to these incidents. To facilitate quick response by local fire control, address frequent questions, and ensure protection of resources on our wildlife management areas, MassWildlife developed Wildfire Response Abstracts for several wildlife management areas with a history of recent wildfires. The Wildfire Response Abstracts were designed to provide pertinent information including detailed maps with location of key access points, internal road networks, infrastructure, and nearby water sources. The abstracts also identified contacts for site and fire management, and other information

deemed necessary for response at the site. Wildfire Response Abstracts were completed for seven wildlife management areas in FY 2021; see Table 32, Appendix B.

Habitat Management Practices

Nearly 3,000 acres were treated with one or more management practices across 40 different sites by Habitat Program staff and contractors in FY 2021 (Tables 33a-33f, Appendix B).

Prescribed Fire

Caren Caljouw, Prescribed Fire Program Manager

MassWildlife promotes the safe use of prescribed fire as an important habitat management tool. This includes using prescribed fire to manage wildlife habitats and restore natural communities and landscapes where fire has been absent for many years. A great diversity of wildlife and plants, including game and non-game species as well as numerous rare and declining species benefit from prescribed fire. Over 40% of the 570 taxa documented as "Species of Greatest Conservation Need" in the Massachusetts State Wildlife Action Plan are known to occur in fire-influenced habitats during part of their life cycle and many species benefit from the careful application of prescribed fire to restore and maintain important habitats. The sound application of prescribed fire can also significantly enhance opportunities for recreational activities, such as hunting, birdwatching, hiking, and nature photography.

Application of prescribed fire requires detailed planning, awareness, and coordination and a thorough knowledge of weather, fuels, and terrain. Prescribed fire implementation requires specialized equipment, trained and capable staff, and strong working relationships with fire management partners. It involves on-going risk assessment and mitigation, and comprehensive strategies to obtain successful outcomes for wildlife management. Thoughtful use of prescribed fire also decreases threats to life and property posed by wildfire through active fuels management on wildlife management areas and wildlife conservation easements. The MassWildlife Prescribed Fire Policy was approved by the Fish and Wildlife Board in 2017 and the Prescribed Fire Handbook outlines goals and objectives for the use of prescribed fire on MassWildife lands (https://www.mass.gov/files/documents/2017/09/20/fire-policy-handbook-4-19-17.pdf).

To ensure personnel are qualified and use safe working practices while participating on prescribed burns, MassWildlife offered several trainings and workshops throughout FY 2021. During the early fall of 2020, qualified staff participated in a wildfire severity mobilization in the White Mountains National Forest, providing valuable service to our partners within the USDA Forest Service and gaining valuable skills for advanced prescribed fire positions. MassWildlife also worked collaboratively with DCR Bureau of Forest Fire Control and conducted an annual fireline safety refresher in May 2021 for over 100 participants including MassWildlife Prescribed Burn Crew, DCR Fire Control and Watershed staff, and numerous volunteers. This refresher was offered virtually with online prework, a virtual live presentation, and followed by fitness and fire shelter practices around the state to ensure COVID-19 protocols were followed in mitigate risk and exposure. Habitat and the NHESP staff served as cadre for this training and facilitated the successful completion of the refresher. Additional trainings conducted during this period included complexity analysis and low complexity burn planning and an introduction to LANDFIRE and the wildland fire fuel assessments and mapping system.

As prescription parameters for weather and fuels improved in the spring 2021, MassWildlife engaged in prescribed fire activities on 11 wildlife management areas. A total of 17 prescribed burns occurred on our wildlife management areas and 568 acres were treated with prescribed fire from March through June 2021; see Table 33e (Appendix B), Prescribed Fires completed by MassWildlife in FY 2021, for more details regarding the schedule of prescribed fires, habitats targeted, and acres burned. Prescribed burns were carefully timed and sequenced with other habitat management activities such as mowing, invasive species control, and forestry operations to maximize the effectiveness of these important treatments, and to reduce fuel loads and potential for extreme fire behavior. Prescribed burns were also carefully planned and timed to meet ecological objectives, avoid impacts to sensitive wildlife and plants, and allow for hunting and seasonal recreational activities occurring at wildlife management areas. In many cases only a certain percentage of available habitat received

prescribed fire treatment to accommodate multiple uses and protect sensitive species. MassWildlife also provided technical prescribed fire assistance to fire management partners including the Mass Department of Conservation and Recreation at Barre Heath, Manuel Correllus State Forest, Myles Standish State Forest, and SE Mass Bioreserve, the National Park Service at Cape Cod National Seashore, the Massachusetts Army National Guard at Camp Edwards, and the US Fish and Wildlife Service at Mashpee National Wildlife Refuge.

Wildlife Conservation Easement and Fee Ownership Compliance Monitoring

Compliance monitoring for WCEs involves site visits to timber sales and other forest cutting operations on private lands where MassWildlife owns development and public access rights. In FY 2020, monitoring of Forest Management Plans and/or active Forest Cutting operations occurred at seven properties totaling over 1,500 acres (Table 34, Appendix B). Habitat Program staff advocated for felling of low-quality stems to provide some coarse woody debris and additional sunlight for oak regeneration, inclusion of >2-hectare young forests openings, and retention of large, downed woody debris and other biological legacies (den trees, mast trees, and winter cover trees) where feasible.

Technical Assistance and Coordination to Private Landowners

Marianne Piché and Patrick Conlin

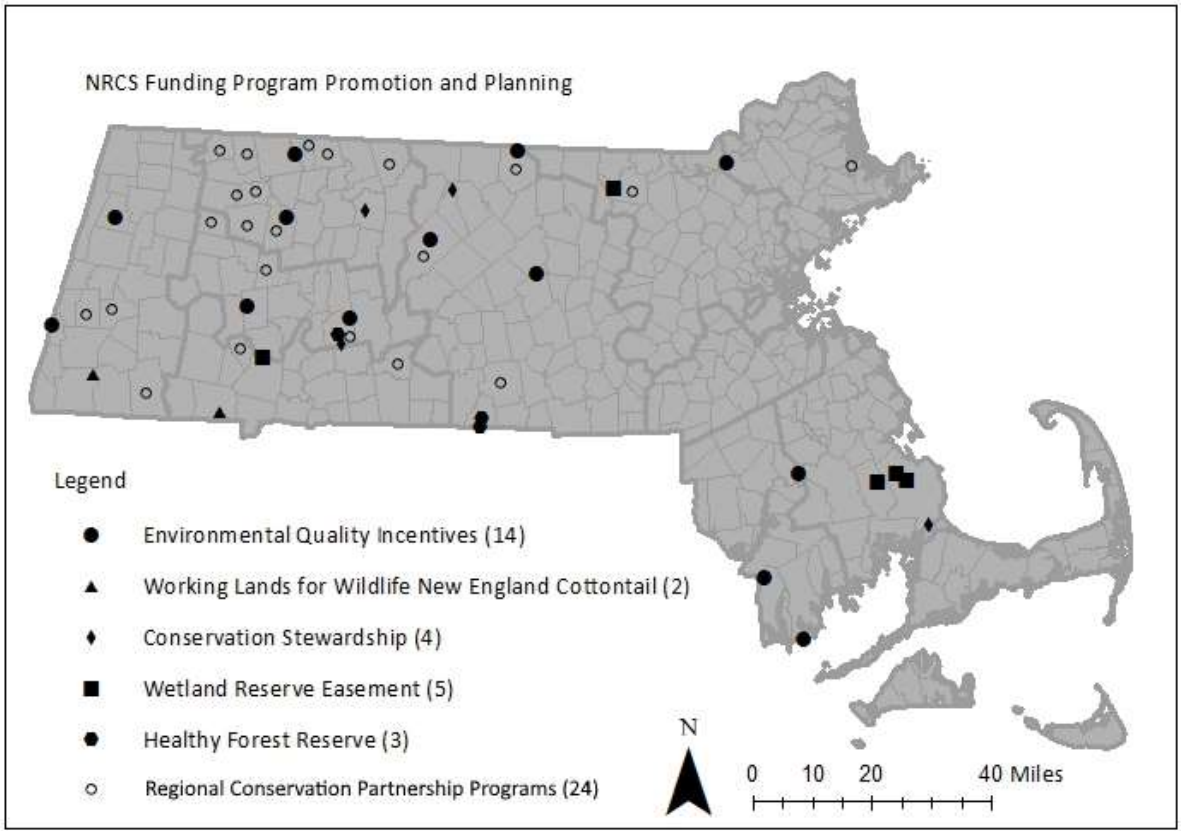
Private Lands Habitat Biologists contracting with NRCS conducted outreach and facilitated management planning and implementation on numerous ownerships. Most projects involved creation of young forest habitat or maintenance of shrubland habitats that support both declining songbirds and game species.

Eighty percent of the land base in Massachusetts is privately owned, and many Massachusetts State Wildlife Action Plan (SWAP) Species occur on these lands. The SWAP identifies habitat restoration and management as a strategy essential to the conservation of these species. The United States Department of Agriculture's Natural Resources Conservation Service (NRCS) provides financial and technical assistance to landowners to address natural resource concerns including wildlife habitat. To ensure that Massachusetts NRCS activities and resources result in maximum benefits to SWAP Species, MassWildlife and NRCS have developed strong partnerships. Because MassWildlife is the state agency responsible for the restoration, conservation, and management of fish and wildlife resources in Massachusetts, and NRCS has financial assistance programs that can enhance wildlife habitat, both agencies benefit.

Under cooperative agreements, MassWildlife provides NRCS with the services of one full-time and one contract Habitat Biologist, who are responsible for preparing site specific habitat management recommendations for NRCS staff to develop conservation plans benefitting State Wildlife Action Plan Species. The full-time Habitat Biologist is responsible for assisting NRCS staff in the development of funding applications for Farm Bill Programs, and the contract Habitat Biologist works under two NRCS Regional Conservation Partnership Programs (RCPP): the Northeast Regional Young Forest RCPP (RCPP-1519) and the Massachusetts Collaborative for Private Forestland RCPP (RCPP-1734). In coordination with other MassWildlife staff, these biologists bring a range of taxonomic, habitat management, and species protection expertise to NRCS. In addition, staff provide guidance and technical assistance to NRCS in the development of programmatic materials specific to habitat management aimed at benefitting State Wildlife Action Plan species and incorporating BioMap2.

During FY 2021, the Habitat Program promoted or assisted in planning habitat management and protection at 52 private properties (Figure 15). The number of Farm Bill programs under which activities may take place include 14 for the Environmental Quality Incentive, two for New England Cottontail, four for Conservation Stewardship, five for the Wetland Reserve Easement including the Northeast Turtles Project, and three for Healthy Forest Reserve. Through the RCPP programs, we assisted 24 landowners in 22 towns covering 6,705 acres across the Commonwealth. Of these landowners, we drafted habitat reports for 14 (2,980 acres), applied for cost-share funding for seven (2,440 acres), and assisted in obtaining environmental compliance permitting for two (439 acres). Cost-share funding was applied to complete management activities that provide important habitat features to complement traditional forestry operations. Snag recruitment, brush piles, downed large wood, wood duck nest boxes, young forest creation, and invasive plant controls are examples of some of those funded activities.

Figure 15. NRCS Funding Program promotion and planning conducted on 28 private properties in FY 2021.



We promoted the use of NRCS Farm Bill Programs at several outreach events in FY 2021, including the Massachusetts Forest Council Meeting, the Department of Conservation and Recreation Town Forest Event, a Franklin Land Trust habitat walk, and by attending MassWildlife public site walks at Montague Plains, Muddy Brook, Herm Covey, and the Southeast Pine Barrens, and by attending MassWildlife public site walks at Muddy Brook, Herm Covey, and the Southeast Pine Barrens.

In FY 2021, one Habitat Biologist continued to serve as liaison between NRCS and MassWildlife on the Conservation Strategy for the New England Cottontail and promoting the NRCS Northeast Turtle Project. The Habitat Biologist also represented MassWildlife at NRCS State Technical Committee meetings to communicate MassWildlife's interests in restoring and managing habitats. The Habitat Biologist, serving as the Chair of the Association of Fish and Wildlife Agency (AFWA) Northeast Habitat Technical Committee (NEHTC), held a virtual meeting in FY 2021. The NEHTC has a charge to coordinate on implementation of Farm Bill Programs and the Habitat Biologist continued to serve as the AFWA Farm Bill Coordinator for Massachusetts.

This Habitat Biologist continued to coordinate with members of the New England Cottontail Conservation Initiative in FY 2021 by participating in monthly Technical Committee calls, actively promoting the use of NRCS funding for habitat management on private land and engaging in the habitat management and outreach work groups.

One activity of the Outreach Work Group in FY 2021 was training in and implementation of a pilot outreach effort, Tools for Engaging Landowners Effectively. It was developed by a team consisting of individuals from the Yale School of Forestry and Environmental Studies, the Center for Nonprofit Strategies, the Family Forest Research Center of the USDA Forest Service, and the University of Massachusetts. The process is a way to reach and engage private landowners more effectively and efficiently encouraging them to take stewardship actions.

In addition, the Habitat Biologist reached out directly to landowners to inquire about their interested in participating in an NRCS Conservation Effects Assessment Program research project titled "Evaluating NRCS's Golden-winged Warbler and New England Cottontail Working Lands for Wildlife Partnerships' Contribution toward Eastern Whip-poor-will Conservation". Researchers from the U.S. Forest Service, Antioch University New England, the University of Massachusetts, and Indiana University of Pennsylvania/American Bird Conservancy received these NRCS funds to monitor for birds in NRCS funded young forest habitat patches. Some MassWildlife Wildlife Management Areas are also being include in the project. The study will provide insight as to the degree to which NRCS partnerships contribute to Whip-poor-will conservation via the creation of breeding habitat. Additionally, it will produce habitat- and region-specific management recommendations for Whip-poor-will, that along with New England Cottontail and Golden-winged Warbler recommendations, can fulfill the NRCS goal to help landowners provide high quality habitat for threatened and declining wildlife.

The Habitat Biologist also coordinated with the Research Foundation of the State University of New York College of Environmental Science and Forestry and partners from the University of New Hampshire and the University of Connecticut to successfully develop an NRCS Conservation Innovation Grant application. This project will implement demonstration habitat management plots, develop a guide to best management practices for wildlife habitat in mid-successional shrublands, conduct a workshop for regional land managers on the benefits and limitations of the proposed practices, develop outreach events and materials, and a prepare a peer reviewed publication on the response of New England Cottontail, birds, bats, and other forest wildlife to management practices. It is aimed at ensuring the successful recovery of the New England Cottontail.

Technical Assistance and Outreach Coordination with Other State Agencies

Habitat Program staff also provided direct technical assistance to DCR by reviewing seven proposed harvesting operations totaling 1,213 acres on state forest lands across Massachusetts in FY 2021 (Table 35; Appendix B). MassWildlife Habitat Program staff advocated for inclusion of young forest openings greater than 2 hectares (approximately 5 acres) to meet the needs of additional young-forest-dependent wildlife species, for retention of young ash trees in salvage and sanitation cuts, and for consideration of barrens and pitch pine-oak woodlands restoration efforts where appropriate.

In FY 2021, the Habitat Program also began working with representatives from DCR, Ruffed Grouse Society, National Wild Turkey Federation, and Mt. Grace Land Trust on a coordinated outreach program for dynamic forest habitat management aimed at increasing the diversity of age classes and native species in Massachusetts forests, from biologically mature forest stands to regenerating young forest stands.

Upland Game Program

Dave Scarpitti

Wild Turkey

Hunter participation

Hunting participation for wild turkey was quite varied during the 2020-2021 fiscal year. In the fall of 2020, a record 5,133 fall-only turkey permits (turkey permit purchased after the spring season closed) were issued, an increase of over 700 permits from the previous year. The spring 2021season saw a second consecutive year with a record number of turkey permits issued, with approximately 23,184 permits sold. This was nearly identical to the previous record set in 2020 of 21182 permits sold. The extremely high permit issuance in 2020 was likely attributed to widespread COVID-19 closures which afforded hunters more time and opportunity to spend time afield. That trend continued in 2021; hunter surveys are being conducted to better understand the recent increases in spring and fall permit issuance and corresponding hunter effort.

Fall 2020 Harvest

New regulations promulgated during 2020 changed and expanded the structure of the fall season. Now, hunters have a 12 day fall wild turkey hunting season where shotguns and archery equipment were allowed, in addition to either 4 weeks (Zones 1-9) or 6 weeks (Zones 10-13) of additional archery only fall

turkey hunting. Previously, the season length was expanded from a 6-day to a 12-day season shotgun/archery season statewide and expanded into WMZ's 10-12 in 2012. A total of 256 wild turkeys were harvested, which is the highest total since 1999; mostly attributed to the expanded season length/opportunity.

There were 143 female and 58 male wild turkeys harvested during the 2020 fall hunting season. The proportion of females harvested in 2020 was slightly higher (55%) compared to recent years (52% average over past 10 years). However, it is likely that due to the difficulties of sex identification of juvenile turkeys in the fall some hunters likely report female harvest when actually they have harvested a juvenile male.

Archery hunters (including crossbow under special permit) continued to contribute a significant portion of the total harvest, accounting for a record 55.1% of

the total fall harvest; spring season archery hunters typically account for 7-8% of the total harvest. A large portion of this archery harvest can likely be attributed to archery deer hunters who are opportunistically harvesting turkeys, and particularly in 2020, when a new expanded archery-only season was created that provided 4-6 extra weeks of archery only fall turkey hunting. Survey data indicates that approximately 50% of fall turkey hunting occurs concurrently with archery deer hunting. The high prevalence of archery harvest during the fall season, and the substantial amount of fall permits issued indicates continued high demand for fall turkey hunting opportunities albeit not to the same level as spring turkey hunting which ranks as the second most popular hunting season in the Commonwealth.

Hunter participation, weather conditions, and food availability may all influence the fall turkey harvest. Turkey population size, distribution, and particularly poult production and survival during the preceding summer months are factors that also greatly influence fall wild turkey harvest. However, archery deer season hunters appear to be opportunistically harvesting turkeys when the seasons overlap each fall. New regulations for the 2021 fall season will expand archery hunting opportunity for wild turkeys during the entire archery deer hunting season.

Spring 2021 Harvest

The 4-week spring wild turkey hunting season occurred from April 26 – May 22, 2021. A total of 2,924 wild turkeys were harvested during the regular spring season, representing the 6th highest spring harvest total since spring turkey hunting began in Massachusetts in 1980. This outstanding spring harvest represents a slight decline from the record year in 2020. New regulations introduced during the 2020 season allowed hunters to harvest their season limit of 2 spring birds on the same day, yet despite the change the proportion of hunters who harvested 2 turkeys during the spring season was similar to that in previous years.

Bearded hens perennially account for less than 1% of the total spring wild turkey harvest; 6 hens were reported during the spring season and 2 were not able to be positively identified. Approximately 2.48 adult turkeys were harvested per juvenile male turkey which was lower than the previous three years (3.45-5.27).

In spring 2020, harvest was highest in Worcester (n = 718), Franklin (n = 433), and Berkshire (n = 345 counties). Suffolk County (4 towns) is nominally within the open zone but is heavily urbanized and many areas are closed to hunting and firearm discharge by local ordinances. Spring turkey hunting season is now open for 4 weeks statewide, except for Nantucket which lacks evidence of wild turkeys and is closed to spring turkey hunting.

Spring turkey hunters continue to make use of archery equipment; approximately 8.5% harvested

turkeys with archery equipment in 2021; archery hunting for wild turkeys and other big game continues to increase in popularity particularly in areas of eastern Massachusetts where many towns and properties will only allow archery equipment as an acceptable means of take.

Overall, wild turkey hunting opportunities remain excellent across the state, as the relatively high turkey population statewide continues to offer quality hunting experiences.

2021 Spring Youth Turkey Hunt

The annual mentored youth wild turkey hunt was held on 24 April 2021, on the Saturday immediately preceding the opening date of the spring hunting

season. In order to participate, youths (ages 12-17) were required to complete a standardized training program and field exercise (pre-hunt workshop) conducted by participating sportsmen clubs and National Wild Turkey Federation chapters. Online and in-person youth seminars were held in 2021 unlike 2020 when COVID-19 related restricted resulted in the cancellations of all seminars. Youths aged 12-14 were given a special 1-day turkey tag and youths 15-17 are required to be licensed and obtain a regular turkey permit to be eligible for the mentored youth hunt day. Regulatory changes allowed youth to hunt from ½ hour before sunrise until 5:00 p.m.

An estimated 208 youths received permits for the youth turkey hunt day. Youths harvested a total of 94 turkeys (38 immature, 57 adult) on youth day, representing a success rate of approximately 45%. Youth success rates are typically greater than regular spring season hunter success rates that average approximately 15%.

Ruffed Grouse Drumming Surveys

In order to assess the statewide/regional abundance of Ruffed Grouse, a spring-time survey to detect their conspicuous drumming sounds is conducted each year by MassWildlife staff. In 2021, 23 drumming survey routes were surveyed across the state. Numerous “constant zero” routes were not surveyed and consist of routes where no grouse had been recorded in 5 consecutive years. All routes were surveyed between April 15 – May 5. All but one (Route #3 Ashfield) constant zero route occurred in either the Northeast, Southeast, or Central wildlife district. Two types of routes are surveyed, “random” routes are surveys randomly located in suitable habitat across the state, whereas “subjective” routes are ones that are intentionally placed in areas of high-quality habitat.

Overall, the average number of drums heard per stop (ANDS) per route on all random routes statewide has been slightly declining over the past several years; in 2021 the ANDS was 0.07 equal to the 3-year average. The ANDS per route in the Western District in 2021 remained stable at 0.14. ANDS decreased for the 4th straight year in the Conn. Valley district compared to an all-time low of 0.02. Several constant zero routes were surveyed in the Northeast and Southeast districts; however, no grouse were detected.

The ANDS per route for subjective routes completed statewide in 2021 was up slightly to 0.19 despite several long term, productive routes where not grouse were heard drumming. No grouse were heard on a subjective route in the Northeast District, yet in previous years grouse were previously detected. Grouse continue to be detected on subjective routes in the Southeast District; grouse are not widespread in these districts but can be locally abundant in areas with suitable habitat. These subjective routes demonstrate the potential for much higher grouse abundance across the state where forest management can improve the abundance of young forest habitat.

The abundance of grouse on randomly located routes statewide declined from 2014-2017, but grouse abundance is low but relatively stable from 2018-2021. The abundance of drumming grouse on subjective routes has been stable (and somewhat variable) up through 2019, however, the last 2 years (2020-2021) have seen substantial decline on subjective drumming routes. Subjective routes continue to demonstrate the potential for increased grouse abundance in areas with suitable habitat but may still be experiencing decline from changes in habitat conditions over the long term, or more acute issues such as infections and mortality associated with West Nile Virus.

American Woodcock Singing-Ground Survey

Woodcock singing ground surveys are conducted from April 20– May 10 each year. Routes all are 3.6 miles long and consist of 10 stops that are surveyed each for 2 minutes. Survey routes are sampled approximately 20 minutes after sunset within the survey period and must be completed within 38 minutes.

Currently, there are 19 randomized singing-ground survey routes in Massachusetts. Of those 11 were active in 2021. The average number of woodcock heard peenting per route (including constant zero routes) in 2021 was 1.26, slightly above the 3 year average (1.24). Overall, woodcock are located statewide, and although most constant zero routes exist in the eastern portion of the state, numerous productive surveys are conducted in other developed landscapes.

The U.S. Fish and Wildlife Service publishes an annual report utilizing data from the Harvest

Information Program (HIP) in addition to the Singing Ground Survey. However, COVID-19 conditions have delayed the publication of this and other reports associated with Migratory Birds. Many jurisdictions were unable to complete any surveys in 2020 and the 2021 report is not yet available.

New England Cottontail/Eastern Cottontail

Fecal pellet samples were collected from wild cottontail rabbits on 29 sites across areas of Barnstable, Plymouth, and Berkshire counties From January – April 2021. All areas were surveyed 1-2 times within a 3-week period with 0–20 samples collected per site. Results of the 2021 winter sampling period are still pending, but overwhelmingly most samples were collected from sites on Cape Cod (>90%), with an abundance of samples also prioritized within the Berkshire County survey area.

No live trapping of rabbits occurred due to COVID-19-related constraints and conditions at captive rearing zoos. It is anticipated that live trapping founders for zoo-based husbandry will occur in January 2022.

Waterfowl Program

H W Heusmann

MassWildlife personnel conducted nest-box checks on 50 study sites used to monitor wood duck populations across the state. The winter of 2019-20 was relatively mild and wood ducks and hooded mergansers began nesting earlier than normal. April, however, was unusually cold with frequent precipitation. While there was no cold snap that resulted in frozen eggs, there was an unusually large number of dump nests with clutches exceeding 30 or more wood duck eggs on both study and non-study sites. Most often these clutches were abandoned and while some were incubated, the presence of few membranes indicated only a few ducklings successfully hatched from such large clutches. Hundreds of eggs were discarded. In addition, more dead ducklings were left in boxes than during a normal year.

Wood duck nesting attempts increased with 298 nest starts compared to 285 last year and 237 in 2018 but well below the 321 recorded in 2013. There were only 203 hatches; low compared to 218 last year but similar to 20 hatches in 2018. There were also 91 hooded merganser nest starts with 74 successful hatches. Wood duck use of boxes continues to decline in the western third of the state with most box use being by hooded mergansers.

The COVID 19 pandemic restricted Massachusetts' participation in the Atlantic Flyway Resident-goose Banding Program. Normally, 800 Canada geese are banded in Massachusetts during roundups from mid-June to July when adult geese are flightless and goslings have not yet begun to fly. However, due to the need for social distancing, goose banding had to be suspended for 2020. The Connecticut Valley District game biologist did not get this information until after they had banded 45 geese at 4 sites in 4 towns in that district.

The 2020 airboating season was complicated by the requirement that only one person was allowed in a vehicle and 3 people are needed on the crew. We enlisted district personnel and volunteers who arrived in separate vehicles on some sites, but it was impractical to do so for sites in the western reaches of the state. More limiting was the fact that, while April was unusually wet, Massachusetts then had low precipitation the rest of the summer and most of the state experienced drought conditions limiting the number of sites available for airboat nightlight banding. We were able to boat only 8 sites in 9 nights of boating (Table 36; Appendix B)

In a strong effort to band resident mallards, we used a tub net launcher borrowed from USDA APHIS-WS to band ducks at sites where they were used to being fed at 25 sites during 13 days of effort in our Northeast, Southeast, Central, Connecticut Valley, and Western districts. We captured 260 mallards, some from which we took feather samples for an isotope study being conducted by a researcher at SUNY and blood samples for a genetics study for a researcher at the University of Texas, El Paso. We also collected oral and cloacal swabs for Avian Influenza sampling in western Massachusetts for USDA's APHIS-WS.

During the period of September 8-25, Massachusetts conducted a statewide resident Canada Goose hunting season, with a daily bag of 15. Duck-hunting seasons in the Atlantic Flyway continued with the liberal option of 60-day seasons and a six-bird bag limit. The Canada Goose season was 60 days with a

two-bird daily bag limit in the Central and Coastal waterfowl hunting zones as we have moved into the moderate hunting season package for North Atlantic Population (NAP) geese and a restrictive season of 30 days with a two-bird bag limit in the Berkshire zone for Atlantic Population (AP) geese.

During the period January 15—February 15, 2021, Massachusetts held a late resident Canada Goose season in the Central Zone, while the season ran January 26 – February 15 in the North Coastal Zone with a five-bird daily bag in each zone.

At the 2020 winter meeting of the Atlantic Flyway Council's Technical Section in Portsmouth, New Hampshire, the decision was made to suspend winter banding of black ducks after 11 years until current data analysis has been completed. At that same meeting it was recommended that two-season mallard banding be continued for 2 more years to determine if reducing the daily bag from 4 to 2 improves mallard survival and while a new management plan for mallards is developed.

While operational winter black duck banding was suspended, Massachusetts was one of 3 New England states to participate in a pilot study involving placing solar powered satellite radio transmitters on wintering hen black ducks to better understand reproductive behavior of black ducks in the Atlantic Flyway. Three transmitters were placed on hens, two on hens in Harwichport on Cape Cod and one on a hen captured in Duxbury. All three hens successfully migrated north into Canada and were transmitting data at the close of the project segment.

The bulk of postseason banding of wintering concentrated on mallards. Using the tub net launcher, we targeted sites where ducks were being fed by visitors. We made 24 shots at 22 sites with captures ranging from 3 to 45 and averaging 18. In addition, bait traps were used on 5 sites and accounted for 105 banded mallards. In total, 499 mallards, 56 black ducks, 6 mallard plumaged hybrids, 4 black plumaged hybrids, and 2 intermediate hybrids. In addition, there were 20 previously banded birds captured. Mallards captured in the Connecticut River Watershed and in Berkshire County were swabbed for Avian Influenza testing by APHIS-WS.

All 11 states participated in the 2021 Northeastern states' waterfowl breeding survey though some plots could not be surveyed because of COVID 19 restrictions on access. The survey is based on sampling previously randomly selected 1-kilometer-square plots for waterfowl during April and May. A total of 1,233 plots were surveyed. The population estimate for mallards was 243,928 pairs $\pm$ 34,312. The estimate for black ducks was 18,637 pairs $\pm$ 6,896; for wood ducks, 202,084 pairs $\pm$ 36,946 and Canada geese, 364,486 pairs $\pm$ 49,360.

Massachusetts' portion of the survey was slightly incomplete as we were unable to check some offshore plots due to being unable to social distance in the Cessna 172 that would normally be used to fly the plots. We were, however, able to check by boat three of the seven plots normally flown. Data from this survey is used to set hunting season regulations tailored to the Atlantic Flyway.

We suspended eider banding this spring due to a combination of COVID 19 restrictions and concern about disturbing nesting females, especially on Boston Harbor islands as the National Park Service was slated to conduct its nesting bird survey which is done every 3 years and our banding efforts would be an additional disturbance.

We again ran a hunter survey to determine whether hunters preferred a new system changing our zoning system from the current 3 zones (Berkshire, Central, Coastal) each of which could be divided into two segments, or a new system of an Inland and a Coastal zone each of which could be divided into 3 segments. The results of last year's survey were unclear as responses to the choices were similar with a plurality of hunters (38.6%) having no preference. It was decided to run the survey again but provide actual proposed dates for the various combinations to allow hunters to better visualize the possibilities.

A survey of 6,000 Massachusetts state waterfowl stamp buyers with known e-mail addresses were conducted through an on-line survey. We received 1884 usable responses, 86.7% of whom had bought for the stamp for hunting purposes and had done so in at least 1 of the last 3 years. The major question was whether hunters preferred to continue with our current system of 3 each split into two segments or opt for the new option of 2 zones each of which could be divided into 3 segments. Overall, 35.7%preferred the new option, but 36.4% wanted to keep the current system while 28.0% had no preference. Adding proposed dates reduced

undecided hunter numbers but the added votes split equally between the two choices.

All groups preferred the new option of 2 zones with 3 segments except for those hunters who hunted in both the Central and Coastal zones (33.0% vs. 44.7%) but the degree of preference for the new option varied from high for Berkshire zone hunters (50.0% vs. 29.0%) and Berkshire/Central zone hunters (50.0% vs. 37.0%) to only moderate for hunters who hunted only in the Central zone (37.0% vs. 33.8%) or only in the Coastal zone (36.0% vs. 33.7%). No change was recommended to the Fisheries and Wildlife Board.

Participation in Youth Hunt days remained low with only 5.5% of adults mentoring a youth during the 2020 season. While 12.6% of respondents were eligible for the new Active Military/Veterans Day hunts, only 26.9% of them took advantage of doing so. Holding the special Military/Veterans on the same days as the Youth hunts was favored by 28.2% compared to 14.1% for on different days, 57.7% had no preference.

Massachusetts issues individual egg-addling permits for resident Canada goose control under a federal program begun in March 2007. In 2020, we issued 68 such permits of which 65 returned. The permittees reported addling 1,603 eggs in 343 nests, while USDA/APHIS Wildlife Services addled 305 eggs in 62 nests under their statewide permit.

This year both the summer meeting of the Atlantic Flyway Council technical and council meetings and the winter meeting of the Technical Section were held virtually. In addition, the various committees of the Technical Section held virtual meetings in advance of the official meeting because of limited time available at the actual meetings The project leader is a member on the Mallard, Black Duck, and Canada goose committees as well as voting representative for Massachusetts.

Black Bear Program

Dave Wattles

Black Bear Distribution and Harvest Investigations

A record of 16,150 bear-hunting permits were issued for the 2020 hunting season. A record total of 325 bears were taken during the 48-day season, including 236 during the 17-day September segment, 57 during the 18-day November segment, and 32 during the 12-day deer shotgun season segment (Figures 16 and 17). One hundred and fifty-one males, 171 females and 3 unknown bears were taken in Berkshire (n=113), Franklin (n=80), Hampden (n=62), Hampshire (n=48), Worcester (n=21), and Middlesex (n=1) counties. Ninety seven percent of bears were reported through the online system in 2020, compared to 79% in 2019, 82% in 2018, 70% in 2017, 76% in 2016, 66% in 2015, 74% in 2014, and 69% in 2013; this large increase is likely attributable to the closure of many check stations due to COVID-19 restrictions.

Figure 16. Historical black bear harvest by season, 1972 to 2020.

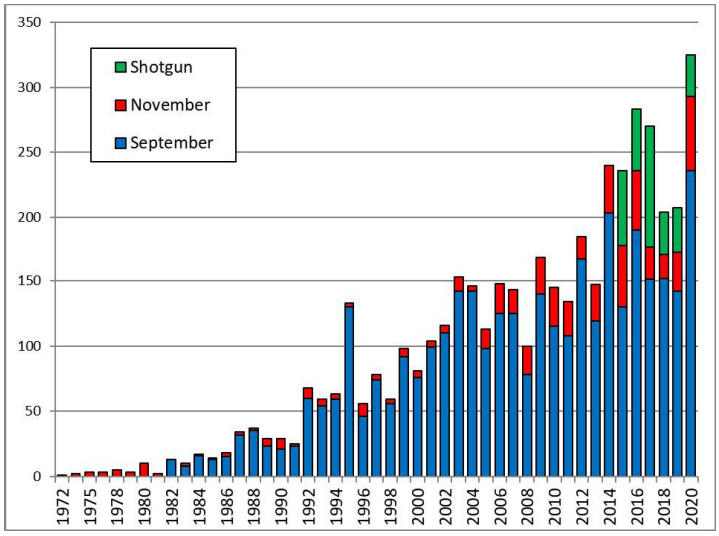
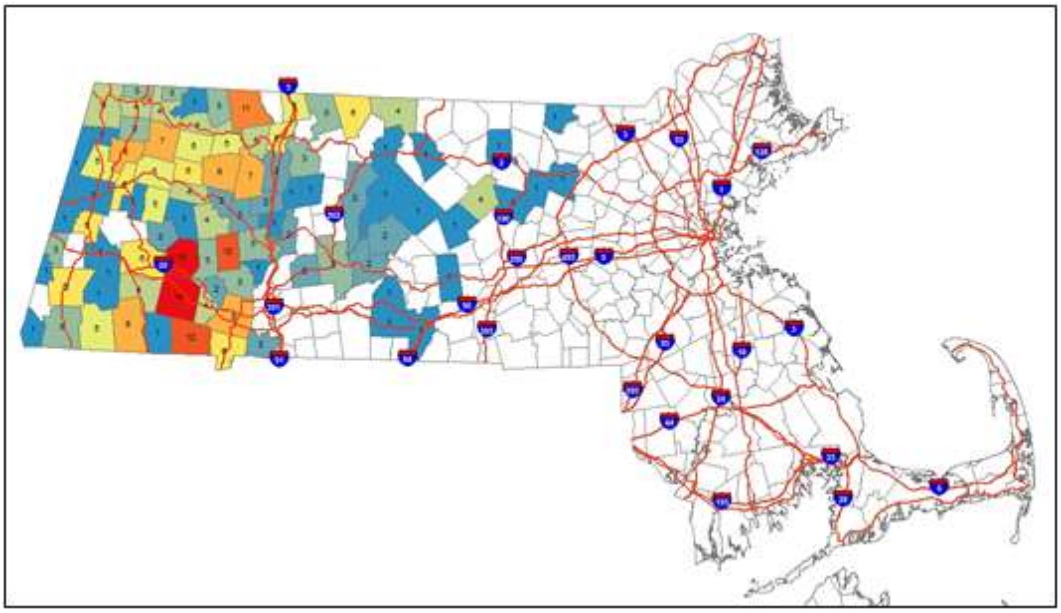


Figure 17. Distribution of 2020 black bear harvest by town.



Black Bear Research

MassWildlife continues to monitor collared female black bears as part of a cooperative research project with the Massachusetts Cooperative Fish and Wildlife Research Unit and the University of Massachusetts Amherst. The primary objectives of this research project are as follows: (1) to refine the population model for evaluating population trends of bears in Massachusetts; (2) to document black bear habitat use and movements in a fragmented landscape and to determine the effects of human-associated food sources on bears, (3) to assess the public's attitudes and perceptions of the bear population and bear management options, (4) to develop a comprehensive bear management plan to guide black bear management in Massachusetts. As of June 30, 2021, 18 female bears were being monitored with GPS collars and another 17 females with VHF collars. To date, 72 female bears have been monitored with GPS collars, of which most have been monitored for at least 2 reproductive seasons. Five females are being monitored with GPS collars for the first time this year. Additionally, 4 male bears have been monitored with GPS collars. In 2017 we began collaring bears in our Western Wildlife Management District. MassWildlife monitored cub production/yearling survival at all successful winter dens or through encounters with sows/yearlings. In May 2019 we initiated a new project to estimate the bear population and calculate bear densities throughout the state using hair snares and genetics. To accomplish this, we deployed 122 hair snares throughout western and central Massachusetts and collected 1870 hair samples at the snares in the first year. This work was scheduled to continue in the summer of 2020 but was postponed due to COVID-19. The project was renewed in 2021, with 121 hair snares deployed in late May to be sampled throughout the summer.

Furbearer Program

Dave Wattles

Overview

The Furbearer Program is responsible for the management and research of 14 species of wildlife in the Commonwealth. The group of species called furbearers includes beaver, muskrat, bobcat, eastern coyote, red and gray fox, river otter, fisher, striped skunk, mink, long-tailed and short-tailed weasel, raccoon, and opossum.

Massachusetts' furbearers are abundant and widely distributed throughout the state. The populations of these species are scientifically managed and are secure. None are listed as Threatened or Endangered. The value of the Commonwealth's furbearer resource is very diverse and includes

economic, ecological, cultural, biological, aesthetic, and educational opportunities for individuals in the state.

The Furbearer Management Program presents many challenges to wildlife managers in the state and employs various options, including habitat manipulation, public education, and regulated hunting and trapping as tools in the management of these renewable resources. A combination of techniques is used to control problem animals, regulate wildlife populations, reduce habitat degradation, reduce crop and property damage, and allow a sustainable harvest of renewable furbearer resources.

Harvest and Population

Harvest activities provide recreational and economic opportunities for citizens and households in the state. A total of 1,806 furbearers were tagged at MassWildlife check stations during the 2020-21 season. The harvest (a combination of hunted, trapped, and/or salvaged) of tagged species included 604 beaver, 104 bobcat, 583 coyote, 120 fisher, 39 gray fox, 14 mink, 36 river otter, and 74 red fox. Trapper survey results indicated that a minimum of 82 raccoons, 99 muskrat, 19 skunks, 30 opossum, and 2 weasel were trapped during the 2020-21 season (Table 37; Appendix B).

MassWildlife staff conducted a hunter survey of a random sample of license buyers that provided an email address in 2020. Coyote is the most popular furbearer that is hunted. Twenty-two percent of respondents indicated that they hunted coyote, and 40.8% of those respondents specifically targeted coyotes, 5.7% percent of all respondents hunted fox, 4.8% hunted bobcat, 2.8% hunted raccoon, and 0.9% hunted opossum. Bobcat, coyote, and fisher sighting questions were added to our annual hunter survey in order to calculate sightability rates by town and wildlife management zone. Results of those data indicate that coyote are common throughout the state, bobcat numbers appear to be increasing and expanding into more developed eastern zones (9, 10, and 11), and fisher appear well adapted to suburban areas, with our highest sighting rates currently occurring in the eastern WMZs.

Regulated trapping is an important component of wildlife management programs. It is the most feasible and effective method to control furbearer population growth. Regulated trapping conducted by a trained and licensed public is used by state wildlife professionals to regulate wildlife populations and can reduce negative effects associated with high wildlife populations and allow for a sustainable use of a valuable natural resource. Regulated trapping allows residents of the state to reduce the expenses associated with the property damage furbearers cause, which can also in turn reduce the need for residents to pay Problem Animal Control (PAC) Agents.

MassWildlife carefully regulates the harvest of furbearing animals. The Commonwealth has complex laws and regulations that govern the activity of trapping. These include mandatory licensing of trappers and trapper training, restrictions on the size of traps and on types of traps, restricted seasons for trapping and areas for trapping, and mandatory regular checking of traps and tagging of traps to identify the owner.

Wetland/Beaver Management

Between 1996 and 2000, the beaver population tripled as a result of a ban on certain types of traps enacted through a referendum in 1996. Complaints about flooding increased. Typical complaints included flooded septic systems, wells, roads, driveways, and railroad tracks. In July 2000, the Massachusetts Legislature passed, and the Governor signed, a new law that modified the restrictions on beaver and muskrat traps to provide relief for people suffering from flooding impacts caused by beaver or muskrat. An emergency permitting system was created at the town level with certain non-emergency permits for specific traps available from MassWildlife.

Licensed trappers tagged 594 trapped beaver during the 2020-21 trapping season, of which 68 were reported as taken under emergency permits. PAC Agents reported taking 79 beaver outside the trapping season (April 15, 2020 - October 31, 2020) and 105 beaver during the trapping season under emergency permit that were not tagged. Licensed trappers reported through the voluntary trapper survey that 376 beaver were taken under the local Board of Health 10-day Emergency Permit, which includes beaver taken outside the season (n=239) and only beaver taken during the season that were not sealed at a MassWildlife check station (n=137). In total, a minimum of 318 beaver were taken

outside of the trapping season as nuisance animals (there is an unknown amount of overlap between the PAC and trapper survey respondents). A minimum of 455 beaver were taken under emergency permits (either inside or outside the trapping season) for which conibear traps are legal to use and are the preferred trap type for beaver trapping.

Public education, regulated harvest, and the installation of flow devices are major components of beaver management in Massachusetts. MassWildlife management goals for beaver include managing beaver for their wetland values, regulating beaver populations within available habitat, and minimizing economic damage to public and private property by beaver.

Furbearer Depredation and Damage

MassWildlife personnel responded to complaints about furbearer species causing the loss of domestic livestock and pets. Specific furbearer species causing concern are eastern coyotes, red foxes, gray foxes, fishers, raccoons, and skunks. (See also the "Human-Wildlife Conflict Trends Project" section, below.)

Deer Management Program

Martin Feehan

Harvest and Population

The statewide 2020 harvest of 14,757 is a new record Massachusetts deer harvest, breaking the record set in 2018. This was a 6% increase over the 2017-2019 average harvest (Figure 18).

There were new records set during the archery and primitive seasons. The shotgun season did increase over 2019 but is within the stabilized range that has existed since 2009, with the exception of 2018. The recent high harvests can be attributed to rising deer numbers and the influence of increased archery harvests in eastern zones. We have kept antlerless deer permits at a low level for over 10 years in zones 1-8 to allow deer numbers to slowly rise, which they have. We are now making adjustments in many of these zones to increase antlerless deer permits to stabilize deer numbers, leading to higher harvests. Additionally, we have been issuing an increasing number of antlerless deer permits in zones 9-14 to slow the deer population growth, which is mostly caused by lack of hunting access in much of this range (Table 38).

Figure 18. Total 2020 white-tailed deer harvest by season and year in Massachusetts.

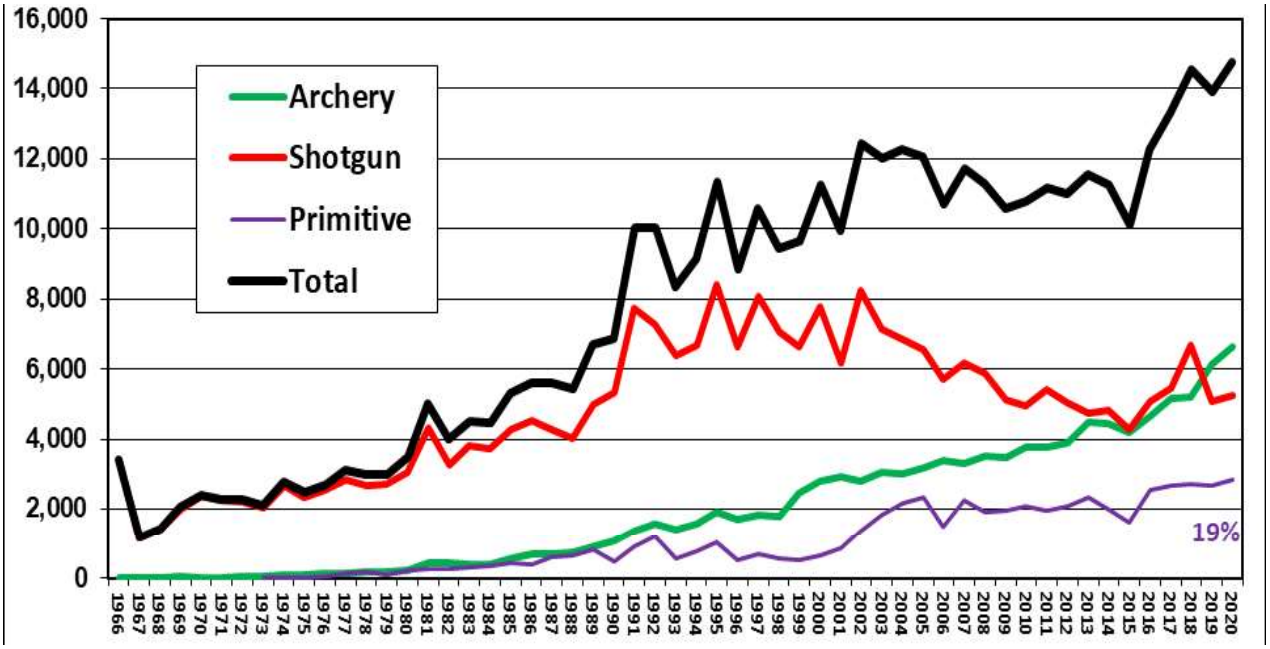


Table 38. The 2019 white-tailed deer harvest by season and sex/age class in Massachusetts, including Quabbin harvest.

Season	Adult Male	Female	Button Buck	Total	Percent Harvest
Paraplegic/Youth	51	64	16	131	1%
Archery	4,415	1,855	394	6,664	45%
Shotgun	2,791	1,871	462	5,124	35%
Primitive	1,246	1,322	270	2,838	19%
State	8,503	5,112	1,142	14,757	100%

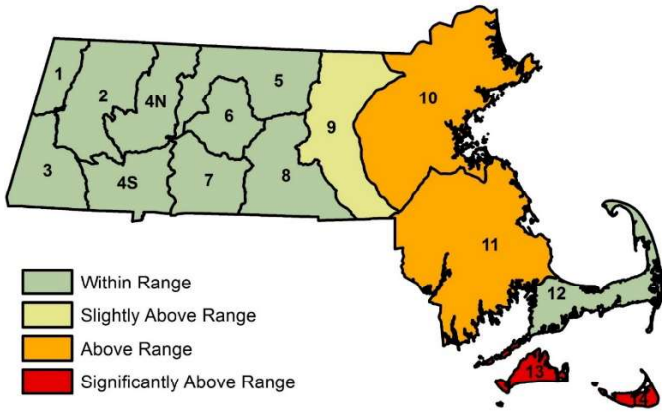
Currently, the deer population statewide is estimated to be over 100,000 deer. Density estimates (from harvest data, so estimates only apply to lands that are hunted) range from 12-18 deer per square mile of forest in western and central

Massachusetts to over 40 deer per square mile on the islands of Martha's Vineyard and Nantucket and in many suburban Boston areas. Areas with little to no hunting access anywhere in the state can see deer numbers above our estimates.

As in previous years, the Antlerless Deer Permit (ADP) system required a hunter to have an antlerless deer permit to harvest an antlerless deer in any deer season. The ADP system regulates female harvest across all Wildlife Management Zones (WMZ; Figure 19). Overall, we are close to our deer density management range of 12-18 deer per square mile of forest in the western and central parts of the state (Figure 19). Conversely, deer densities in the eastern part of the state are still above our management range, so antlerless permit allocations have remained high in an effort to increase the harvest of females. However, challenges still remain in eastern Massachusetts because of the lack of hunter-access, which limits our ability to reduce deer numbers.

The ADP allocation for 2020 was 47,300 permits. However, only 44,783 permits (95% of allocated) were purchased/issued (Table 39; Appendix B). We determined that the new online system (which started in 2012) and the free convenient way of applying for an antlerless deer permit led to more hunters applying and fewer returning to purchase than in previous years. Prior to 2012, we were typically issuing above 95% of the allocated permits in most zones. The solution adopted, beginning in 2014, was to adjust the antlerless permit allocation model to compensate for the significant proportion of applicants that do not come back to purchase and the under-harvest associated with the permit under-issuance. However, this adjustment can also mean selling slightly more than the allocation if more hunters than expected return to purchase the permits.

Figure 19. Map depicting how the current deer densities (from harvest data, which is only applicable to hunted areas) relate to the desired management range of 12-18 deer per square mile of forest for the 15 Wildlife Management Zones in Massachusetts. The statewide deer management goal is to keep deer densities below the level where major impacts are seen to the habitat, but in balance with social desires and tolerance.



Research

We assisted with a multi-university collaboration focusing on managing suburban wilds and impacts of urban deer. The research team includes staff from Boston University, University of Wisconsin, Colorado State University, and Texas A&M. During FY 2021, the primary contribution of MassWildlife was assisting with contact information for stakeholders and permitting for field work.

Chronic Wasting Disease

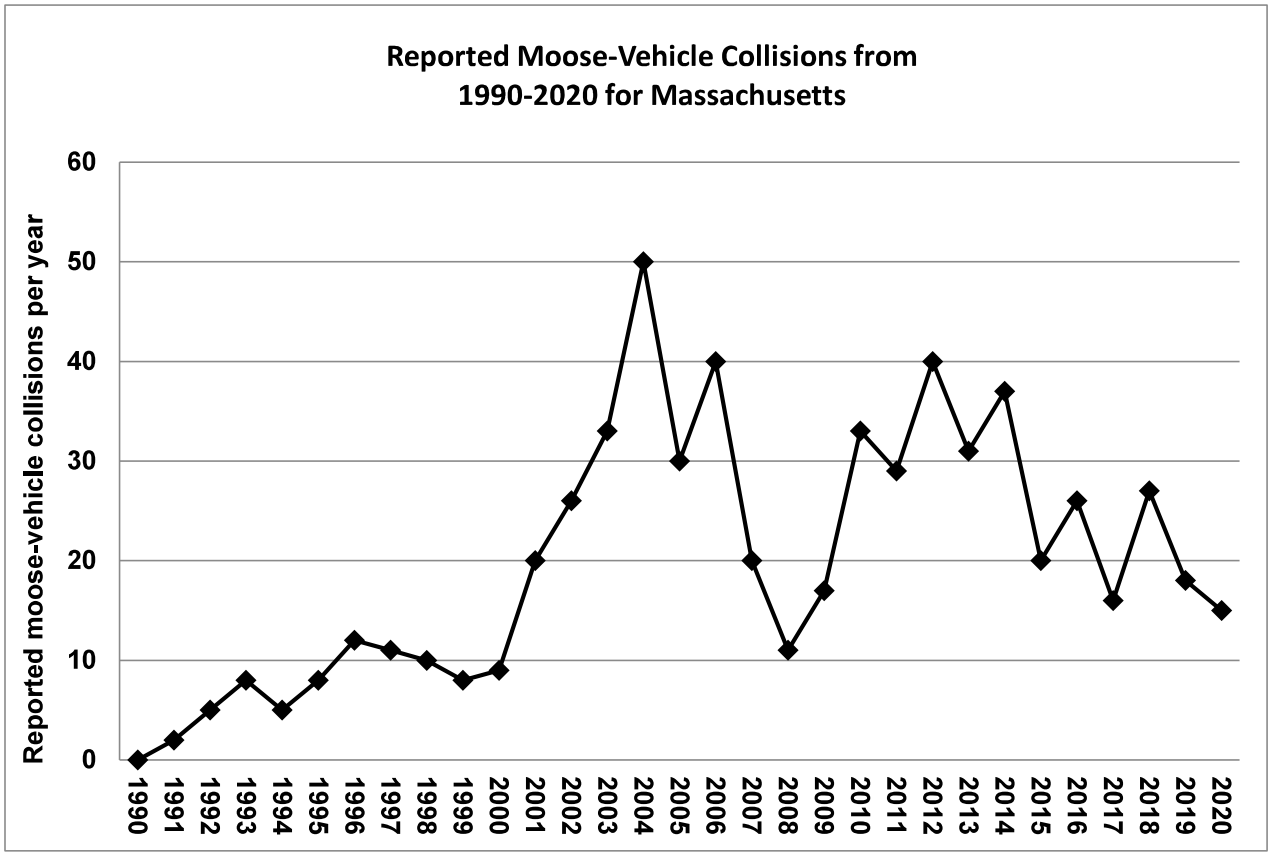
MassWildlife applied for funding from USDA APHIS to study perceptions and knowledge about CWD among Massachusetts deer-ungulate stakeholders. We were successful in being awarded funds for this research, which will be a focus of the next fiscal year.

Moose Program

Martin Feehan

Traditionally, MassWildlife has collected reported data of moose-vehicle accidents (MVA). In 2020, 15 MVAs were reported. However, MVAs are not always reported to MassWildlife or to the Massachusetts Environmental Police; thus, these reports make up an unknown fraction of the actual human-moose interactions that occur in the state. For example, many are discovered indirectly through newspaper reports or verbally from staff that drove by a dead moose along the road. Further, caution must be used when looking at the number of collisions reported from year to year because reporting rates can vary from year to year depending on many factors, e.g., in Figure 20, the reporting rate was likely low in 2007-2009. Nonetheless, these indices can be useful for biologists to use, along with other population trends, to monitor moose relative abundance and trends in Massachusetts.

Figure 20. Total moose-vehicle accidents reported per year from 1980 to 2020 in Massachusetts.



The number of reports per town can be useful when making decisions about areas to focus on with signage on highways (Figure 21). Starting in 2015, we worked with MassDOT to have large variable message boards placed along the road in many of the moose-vehicle collision hotspots during the months of September and October, when moose activity spikes related to breeding. This action may have reduced the number of collisions independent of moose population trends. The 2020 total of 15 MVAs was the lowest since 2008 when reporting was likely lower. This decrease is consistent with trends seen since 2015, but it may be further impacted by the covid-19 pandemic. Lower vehicle traffic during shutdown periods likely lowered the chances for MVAs. Reporting rates may also have been impacted by the pandemic.

The current moose population in Massachusetts is estimated to be around 1,000 animals. We have used a basic population model that incorporates standardized sighting rates from an annual deer hunter survey (we ask a random sample of deer hunters how many moose sightings they had per hour of deer hunting) and available moose habitat in the 12 WMZs that we feel have the potential for moose (we exclude Cape Cod and the Islands in our estimate, as they do not represent potential moose habitat).

Additionally, observation data from our hunter surveys can be used to map general moose distribution across the state (Figure 22). The two maps (Figures 21 and 22) were created from completely independent sources of information, yet show very similar spatial trends, thus providing more confidence in these methods.

Figure 21. Total moose-vehicle accidents reported by town from 1980 to 2019 in Massachusetts.

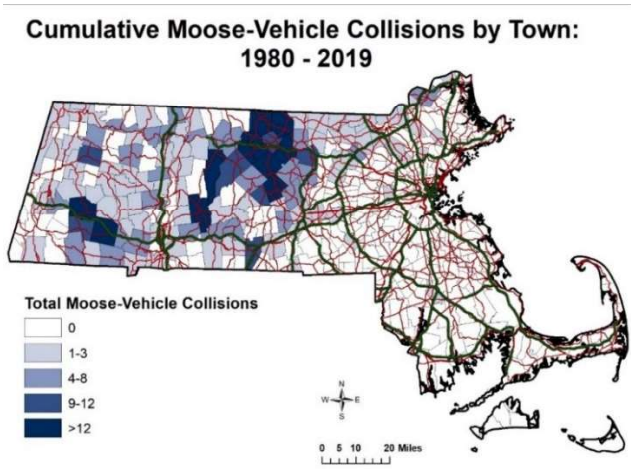
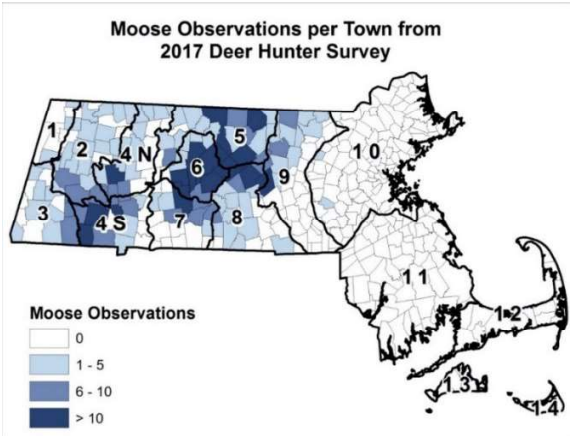


Figure 22. Observations of moose by town reported in the 2017 hunter survey in Massachusetts. The 2018 or 2019 moose sighting data by town from the hunter survey had not been mapped at time of publication, but trends are similar.



The Human-Wildlife Conflict Trends Project

Susan McCarthy

Overview

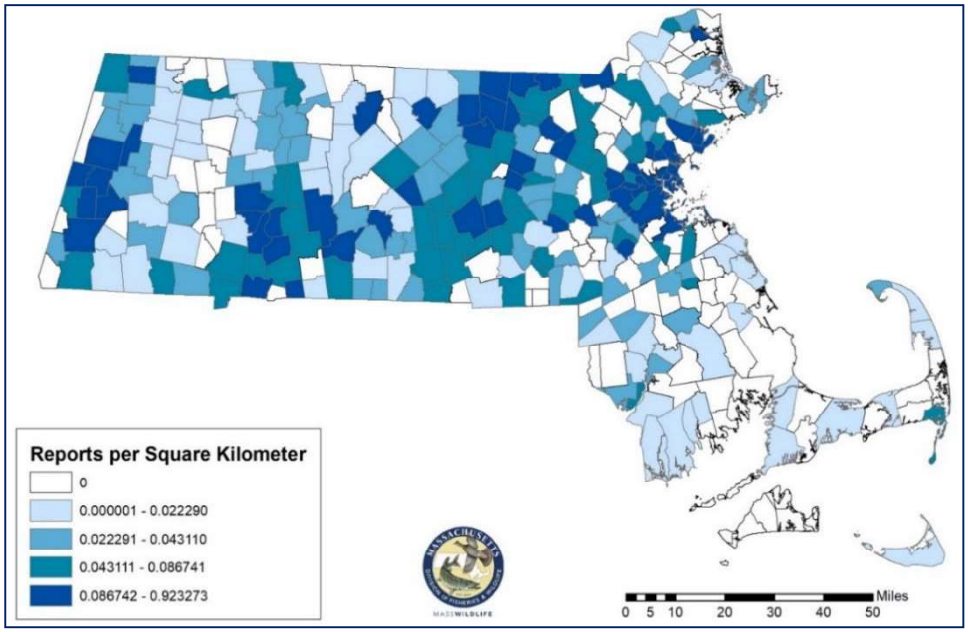
Animal report data are collected at MassWildlife offices via the Massachusetts Division of Fisheries and Wildlife Animal Report Form. The data collected include date, species, town, and report type (sick or injured animal, aggressive animal, property damage, depredation, etc.). Reports come in the form of phone calls and emails from the general public. Reports are recorded as given by the individual, therefore, are not considered accurate with regards to species identification or the circumstances of the incident. In other words, the data collected are meant to represent the public's perception of a conflict or interaction with wildlife.

In 2015, a new online data collection system was developed to emphasize the importance of rigorous data collection. This data collection system allows us to better categorize reports by providing the collector with a set of standard report types from which to choose. We are also able to collect data on the type of concern associated with the report. This system has made data collection and data entry more efficient by requiring the collector to subjectively interpret and categorize the report type. Additionally, we have emphasized the importance of collecting data for all reports regardless of species, location, report, or concern.

Summaries include, but are not limited to, graphs displaying differences in volume of report type, concern type, species, and season. Maps are developed using Massachusetts Geographic Information Systems (MassGIS) to geographically display the distribution of reports by type and species. These summaries are meant to provide Field Headquarters and district biologists with information to assist them when providing advice and management options to the general public regarding human-wildlife interactions and conflicts.

The purpose of this study is to produce information that can be used to develop proactive management strategies effective at resolving human-wildlife interactions and, more specifically, human-wildlife conflicts. This is accomplished by analyzing wildlife report data, generated through unsolicited phone calls and emails from the public received at each of the six MassWildlife offices regarding a variety of wildlife-related issues.

Figure 23. Map depicting total reports of human-wildlife interactions per square kilometer throughout Massachusetts.



Summaries

Human-wildlife interactions were recorded in 243 of 351 towns across Massachusetts, amounting to 913 total reports submitted during the fiscal year (Figure 23). Ninety-nine percent of records (906) contained one or more species (8 reports contained more than one species recorded), 99% (905) contained a report type, 86% (784) contained a concern type other than "no concern", and 91% (832) contained a town. (Fig. 8). Ninety-nine percent of records (2,077) contained one or more species (9 reports contained more than one species recorded), 99% (2,078) contained a report type, 88% (1,839) contained a concern type other than "no concern," and 94% (1,965) contained a town.

We received reports of 56 different species, of which 12 made up 81% of all reports (Figure 24). We received more reports in June (134, 15%) than any other month followed by May (128, 14%), July (118, 13%), and April (108, 12%) (Figure 25). Of the 905 reports containing a report type, the highest number of reports were animal sightings and/or requests for general information (727, 80%), the second highest number of reports were of wildlife using and/or damaging property (477, 53%), and the least number of reports were those regarding public safety (38, 4%). Reports regarding threats to public safety included: wildlife approaching humans and/or pets on a leash, aggression toward humans, and human attacks. Of the 38 reports of threats to public safety, one was reported as a human attack involving a wild turkey. It is important to note that these data represent the reporters' perception of an "attack" and that physical contact and resulting injuries sustained by people were not confirmed or documented by MassWildlife staff.

Figure 24. Top 12 species that were reported to MassWildlife offices as being involved in human-wildlife interactions in Massachusetts during FY 2021.

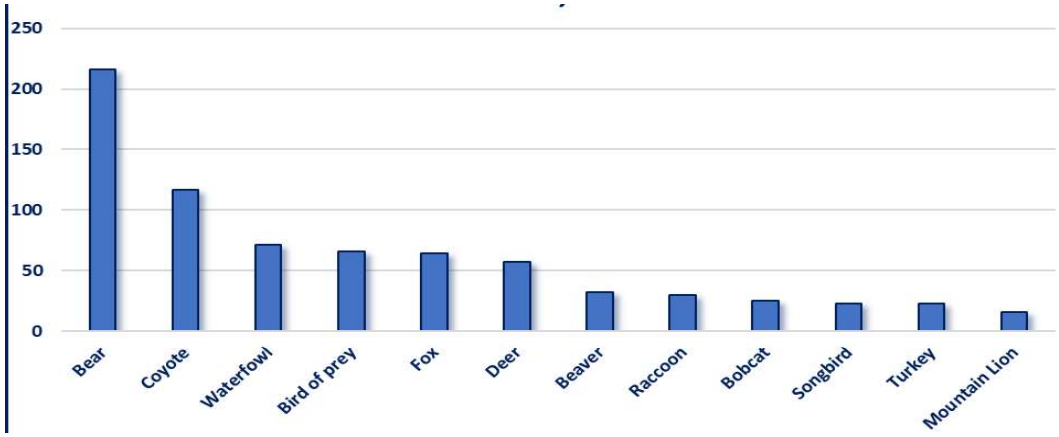
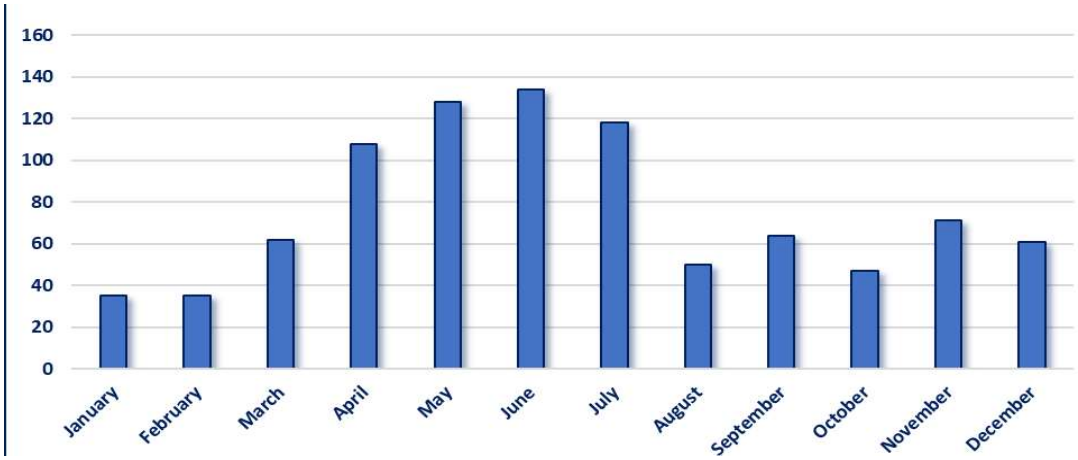


Figure 25. Total reports of human-wildlife interactions by month in Massachusetts between July1, 2020 and June 30, 2021.



Conclusion

It was noted that the total number of reports during FY 2021 (913) was significantly lower than previous years, most notably, the previous three years (1,558 reports in FY 2020; 2,091 in FY 2019; and 1,553 in FY 2018; Figure 26). A summary of the total reports by fiscal year (Figure 27) shows that the number of reports submitted by each MassWildlife office in FY 2021 was generally lower than in previous years.

Figure 26. Total reports of human-wildlife interactions, 2010 to 2021

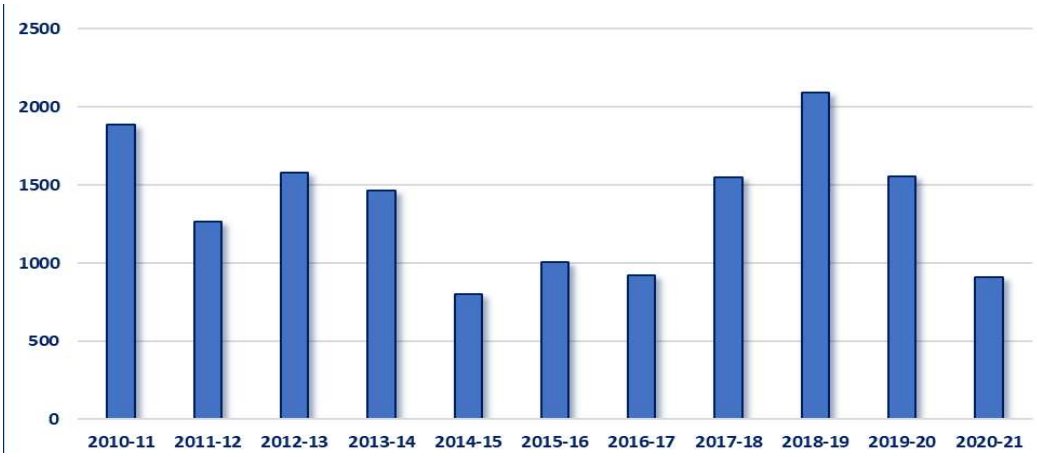
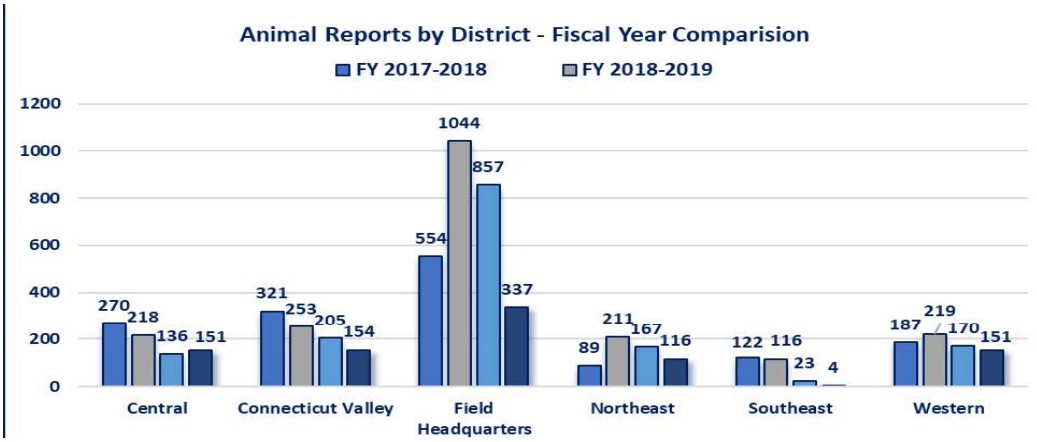
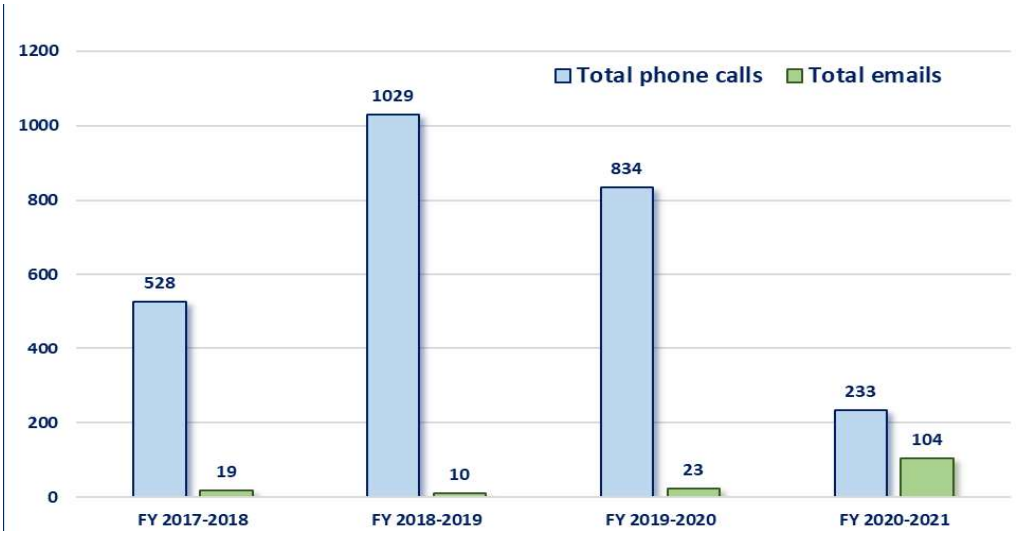


Figure 27. Total reports of human-wildlife interactions, by District, 2017 to 2021.



It is evident, however, that the greatest discrepancy was at Field Headquarters, where the total was down from FY 2020 by 61% (reports at the District offices were down an average of 37%). It is assumed that this lower reporting rate was a result of MassWildlife's Field Headquarters being closed due to the COVID-19 pandemic and the resulting initially sporadic phone coverage. When the FHQ front desk phones were being covered, callers were typically forwarded to staff members' voicemails. While voicemail greetings encouraged callers to either email the biologist directly or leave a voice message, it appears that few callers chose to do either, perhaps assuming that a return call or email would not be forthcoming. Field Headquarters biologists did, however, receive more emails from the general public regarding human/wildlife interactions than they have in previous years. In the previous 3 years, an average of 2% of the total human/wildlife interactions reports to the FHQ were received and responded to via email. In FY 2021, 31% of the total reports to FHQ were received and responded to via email (Figure 28).

Figure 28. Total reports of human interactions received at the MassWildlife Field Headquarters by email versus by phone, 2017 to 2021.



Summarizing reports of interactions gives us the power to better inform both the public and MassWildlife biologists. Summary information can also be used to detect trends in interactions both spatially and temporally. Total report density across towns has remained relatively consistent over time. In general, major metropolitan areas (Pittsfield, Springfield, Worcester, Fitchburg, and Boston) tend to report more interactions between humans and wildlife than do more rural settings.

We can, at the very least, use these data and these results to attempt to predict the occurrence of human-wildlife interactions on both a temporal and spatial scale. Beyond that, we can advise the use of proactive education and intervention at specific times of year and in key areas of the state where a high volume of human-wildlife interactions is likely to occur. Specifically, we will utilize summaries of past years' data to inform I&E staff about the type(s) of interactions the public should expect. I&E staff can then proactively provide information to the public on the species they can expect to interact with at specific times of year in certain areas of the state. Staff can further proactively educate the public on animal behavior (breeding seasons, feeding preferences, activity cycles, etc.) based on our ability to predict the timing of influxes of specific reports of interactions. It is likely that many of the negative interactions between humans and wildlife reported to our agency are accurate portrayals. That said, it is equally as likely that many of those interactions can be prevented through educating the public on what to expect and how to prevent the interaction (e.g., blocking off denning sites, eliminating food sources, and securing pets).

Ornithology

Andrew Vitz

Kestrel Research and Management

MassWildlife and partners continued the American Kestrel project that was initiated in 2013 in hopes of reversing their rapid decline in the state. Kestrels nest across Massachusetts and are most common in the Connecticut River Valley and other regions with extensive agriculture or open habitats. The focus of the project is to promote breeding productivity by deploying and monitoring nest boxes to document breeding success. Collaborators on this project have increased kestrel nesting opportunities by deploying nest boxes and include the Massachusetts Audubon Society, Keeping Company with Kestrels, Kestrel Land Trust (KLT), MassDOT, DCR, The Trustees, Essex County Ornithological Club, East Quabbin Land Trust, Grafton Land Trust, The 300 Committee, the University of Massachusetts, private landowners, and dedicated volunteers.

In May-June of 2021, MassWildlife and partners collected data on kestrel box occupancy and nesting success. Although the effort was somewhat reduced due to constraints from the coronavirus pandemic, it was another good year for nesting kestrels. This was particularly true in the Connecticut River Valley where the KLT monitors numerous nest boxes. Of the boxes they maintain and monitor, 14/24 (58%) were occupied by nesting kestrels. Of these, 10 boxes successfully fledged kestrel chicks, and 42 chicks were banded prior to fledging. This represented the best year for the KLT since beginning the kestrel box program in 2013. Kestrels also seemed to have a good nesting season in central Massachusetts, where at least 13 nest boxes were used with a minimum of 9 producing kestrel fledglings. These boxes were managed by MassWildlife, East Quabbin Land Trust, DCR, Davis Farm, and private landowners. An additional 12 chicks were banded at these boxes in central Massachusetts. In southeastern Massachusetts, Keeping Company with Kestrels reported 10 occupied kestrel boxes producing 27 fledglings that were banded. Additionally, at least 3 boxes were used by nesting kestrels in wildlife management areas in our Southeast District. There are numerous other kestrels that nest in areas of Massachusetts that we do not regularly monitor, including birds that nest in our urban areas.

Kestrels remain a species of conservation concern, and we will continue to work with partners towards conserving this species by maintain, installing, and monitoring nest boxes in suitable nesting habitat and banding young when possible, to support population tracking. Additionally, as part of a multi-state Competitive State Wildlife Grant, we plan on deploying tracking units on kestrels in 2022 to better understand their survival and movements to inform state-wide and regional conservation efforts for the species.

Young Forest/Songbird Project

Between early July and mid-August 2020, we banded birds in young forest habitat created through forestry practices to examine the use of this habitat during the nesting and post-fledging periods. We sampled birds at 3 sites all located within Worcester County and were at least 5 acres in size. Sites included the Montague Plains Wildlife Management Area (Montague), Leominster Sportsmen's Association (Leominster), and one site in Holden owned and managed by the city of Worcester. At each site, 9 mist-nets were deployed, and all nets were separated by $\geq$ 20 meters. Sampling occurred four times at each site between July 3 – August 13, with nets opened by sunrise and closed four hours later. All captured birds were extracted from the nets, banded (except hummingbirds), and data were collected including the bird's age, sex, morphological measurements, and mass. These data provide information on the species composition and abundance at each site as well as an index of the nesting success in the area (by taking a ratio young-of-the-year/ adult birds).

In total, 694 unbanded birds of 47 species were captured, with the species captured most commonly being Gray Catbird (160), Red-eyed Vireo (53), Cedar Waxwing (44), Baltimore Oriole (42), and Chestnut-sided Warbler (38). In addition, we recorded 92 recaptures of birds banded from prior years from this project. In general, an impressive diversity of early and late successional species was documented using the young forest patches, and this habitat may be especially important to birds during the post-fledging period.

Wildlife Program Staff

Michael Huguenin, Assistant Director of Wildlife
Erik Amati, Wildlife Biologist
Jonathan Brooks, Wildlife Population Ecologist
Fletcher Clark, Habitat Biologist
Patrick Conlin, Private Lands Habitat Biologist
Martin Feehan, Deer and Moose Project Leader (*partial year*)
Brain Hawthorne, Habitat Program Manager (*partial year*)
H Heusmann, Waterfowl Project Leader
Ben Mazzei, Habitat Biologist
Bridgett McAlice, Wildlife Biologist
Susan McCarthy, Wildlife Biologist
Marianne Piché, Habitat Biologist
John Scanlon, Habitat Program Leader (*partial year*)
David Scarpitti, Upland Game Project Leader
David Stainbrook, Deer and Moose Project Leader (*partial year*)
Andrew Vitz, State Ornithologist
Thomas Wansleben, Habitat Biologist
Dave Wattles, Black Bear and Furbearer Project Leader

4 The Natural Heritage and Endangered Species Program

Eve Schlüter, Ph.D., Assistant Director of Natural Heritage and Endangered Species

MassWildlife's Natural Heritage and Endangered Species Program (NHESP) conserves and protects the most vulnerable native animal and plant species of Massachusetts and the habitats upon which they depend.

NHESP currently has a total of 26 staff members distributed primarily among three sections: Conservation Science, Information Management, and Regulatory Review. Conservation Science staff are responsible for determining the abundance and distribution of rare species in Massachusetts through field inventories and biological research and the planning and implementation of conservation efforts for rare species and their habitats. The Information Management Staff are responsible for the development and management of biological data in the NHESP's expansive tabular and spatial databases. The Regulatory Review staff assesses the potential impacts of proposed projects or activities to federally- and state-listed species and their habitats and provides guidance on avoidance, minimization, and mitigation measures.

The NHESP's highest priority is protecting the native species that are listed as Endangered, Threatened, or of Special Concern in Massachusetts pursuant to the Massachusetts Endangered Species Act (MESA; M.G.L. c. 131A) and its implementing regulations (321 CMR 10.00).

Changes to the Massachusetts List of Endangered, Threatened, and Special Concern Species

The most recent update to the Massachusetts Endangered Species Act ("MESA," M.G.L. c. 131A) list occurred with official publication on January 10, 2020. This update was the culmination of the most recent comprehensive review of the MESA list, which began in November 2017. The next comprehensive review of the MESA list is anticipated to begin in October 2021.

MESA and its implementing regulations (321 CMR 10.00) require review and updating of the List of Endangered (E), Threatened (T), and Special Concern (SC) Species ("the MESA list," 321 CMR 10.90) at least once every five years. In practice, the MESA list has typically been updated every 3 to 4 years. There are three main categories of change: 1) listing (addition of a species to the list); 2) delisting (removal of a species from the list); and 3) change in listing status of a species on the list (SC ↔ T ↔ E). Needed changes are proposed on a species-by-species basis. The process leading to an update of the MESA list involves many steps, and typically takes two years to complete. The list change process, and associated information, are detailed in the document titled, "Listing Endangered Species in Massachusetts: The Basis, Criteria, and Procedure for Listing Endangered, Threatened, and Special Concern Species," available at: https://www.mass.gov/files/documents/2016/08/qd/listing-criteria.pdf.

Linking Landscapes for Massachusetts Wildlife

In 2008, MassWildlife and the NHESP entered into an interagency service agreement (ISA) with the Massachusetts Department of Transportation (MassDOT), Highway Division, to improve the efficiency of state-level environmental project review. This nationally recognized model of cooperation between state agencies has resulted in faster reviews, cost savings, and protection of endangered species and their habitats. As part of the ISA, both agencies agreed to pursue proactive projects to reduce wildlife-vehicle collisions and improve public safety where feasible. Transportation infrastructure affects wildlife through direct mortality due to vehicle collisions and by

fragmenting and degrading habitats. In addition, vehicle collisions with wildlife often result in property damage and sometimes personal injury.

In conjunction with the University of Massachusetts (UMass), Amherst, the agencies launched Linking Landscapes for Massachusetts Wildlife (LLMW), a long-term and multifaceted volunteer-based monitoring program and planning collaboration to be implemented throughout the state. Utilizing expertise from various state departments, along with collaboration with the public, LLMW's objectives are to: 1) reduce wildlife-vehicle collisions and improve public safety; 2) enhance, protect, and restore habitats impacted by roads; 3) control invasive species along road rights-of-ways; 4) incorporate conservation priorities into transportation planning; and 5) implement wildlife and transportation related research.

In 2010, four research projects were developed to collect information through volunteer participation designed to gather information on wildlife mortality along roadways. Three separate databases available on the LLMW website serve as a central location for compiling observations of vernal pool amphibians during spring migration, turtle crossing hotspots, and all other species of wildlife. LLMW has also coordinated a monitoring program for freshwater turtle mortality associated with the nesting season. From 2010 to the end of FY 2021, over 520 volunteers participated in these projects. They documented over 6,450 mortalities (representing 82 species) at 2,301 locations throughout the state, including mortality for nine currently and formerly state-listed salamander and turtle species.

In FY 2021, LLMW installed improved crossing structures and wildlife barriers to enhance public safety and protect endangered species; implemented invasive species control and habitat restoration at hotspots for biodiversity; engaged with community organizations; installed nesting structures for cliff swallows, a declining species; installed and monitored nine Peregrine Falcon (a state-listed species) nest boxes on bridges; and maintained an interactive website. Finally, MassWildlife collaborated with MassDOT Highway Division on the development of a video series entitled, “Massachusetts Rivers & Roads Training”. The training provides an overview of fluvial geomorphology, aquatic habitat, and explores limiting river and road conflicts. The goal of the training is to ultimately improve the resiliency of the transportation network.

Birds

Piping Plover; Federally Threatened

Observers reported breeding pairs of Piping Plovers (*Charadrius melodus*) present at 180 sites; 156 additional sites were surveyed at least once, but no breeding pairs were detected at them. The population increased 6.9% relative to 2019. The Index Count (statewide census conducted 1-9 June) was 779 pairs, and the Adjusted Total Count (estimated total number of breeding pairs statewide for the entire 2019 breeding season) was 794.5 pairs. A total of 1,034 chicks were reported fledged in 2020, for an overall productivity of 1.31 fledglings per pair, based on data from 99.4% of pairs.

American Oystercatcher

MassWildlife coordinated annual monitoring and protection efforts for American Oystercatchers (*Haematopus palliates*) conducted by a coastwide network of cooperators. Approximately 185 sites were surveyed during May and early June 2020. Preliminary results indicate that Massachusetts supported an estimated 189 breeding pairs of oystercatchers in 2020; the COVID-19 pandemic curtailed some survey efforts.

Terns, Laughing Gulls, and Black Skimmers

Cooperators in Massachusetts surveyed approximately 140 coastal sites in 2020 for the presence of breeding Roseate Terns (*Sterna dougallii*), Common Terns (*Sterna hirundo*), Arctic Terns (*Sterna paradisaea*), Least Terns (*Sternula antillarum*), Laughing Gulls (*Larus atricilla*), and Black Skimmers (*Rhynchops niger*). Compilation of final census results is still underway. Preliminary tallies include 3,764 pairs of Least Terns, a single Arctic Tern individual, and 15 pairs of Black Skimmers. Common Terns, Roseate Terns, and Laughing Gulls in the largest colonies were not counted due to the pandemic, so no meaningful abundance estimates are available.

Buzzards Bay Tern Restoration Project

Roseate and Common Terns on Bird and Ram were not counted in 2020 during the pandemic;

productivity was fair or good for both species at these sites. On Penikese, approximately 1,473 pairs of Common Terns, 25 pairs of Roseate Terns, and one Arctic Tern individual nested; productivity was good for these species.

*Common Loon (*Gavia immer*)*

State-wide monitoring of nesting loons was a collaborative effort among staff at MassWildlife, Massachusetts Department of Conservation and Recreation (DCR), and Biodiversity Research Institute (BRI). Prior to the nesting season, MassWildlife staff deployed a nesting raft at Cleveland Brook Reservoir (Dalton). Rafts also were deployed at the Quabbin and Wachusett Reservoirs (DCR staff), the Pine Hill Reservoir (Worcester Watershed staff), and the Assawompset Pond Complex (APC) in Lakeville (BRI staff). Surveys were conducted at waterbodies throughout the state suitable for loon nesting to determine if they were being used by loons during the breeding period. Sites were surveyed by a single observer by walking the shoreline and/or by kayak. When a loon was sighted, time was spent watching the bird through binoculars and/or a spotting scope to try and identify the bird by reading any color bands. Once territorial loons were identified, the birds were monitored to locate nests and determine nesting and fledging success.

During the 2020 nesting season, MassWildlife staff and collaborators surveyed 137 waterbodies for nesting loons. In total, 48 territorial pairs of loons were documented on 25 waterbodies. Two pairs (4%) including one nesting pair were observed in the southeast portion of the state and four pairs (8%) including one nesting pair were recorded in western Massachusetts. The remaining 42 pairs (88%) were in the region extending from Concord to Springfield. Of the total number of territorial pairs, only 30 of them (63%) attempted nesting, which is a little lower than average. Number of nesting attempts was particularly low in the Quabbin Reservoir where density-dependent factors are thought to be interrupting loon nesting behavior. For the entire state population, reproductive success was relatively low (0.38 chicks surviving/territorial pair) and dipped below the level thought to support a sustainable population (0.48). Productivity was highest on the non-DCR waterbodies with lower loon densities (0.45 successful chicks/territorial pair) compared to the high loon densities on the DCR waterbodies (0.31 successful chicks/pair). Chick survival was high with 79% (19/24) of those hatching surviving to fledging.

Much of the loon population in the state nest on the Quabbin (18 territorial pairs) and Wachusett Reservoirs (5 territorial pairs), and these birds are monitored by DCR staff. Nests were documented for 11/18 pairs on the Quabbin, and these produced 4 hatchlings with 2 surviving to fledging. Nesting productivity was better on the Wachusett Reservoir with 5 territorial pairs producing 5 nests, 5 hatchlings, and 5 fledglings. MassWildlife and BRI staff monitored loon pairs on waterbodies not managed by DCR and primarily located on lakes, ponds, and reservoirs in central Massachusetts. Of these, nesting was documented at 13 sites, producing at least 12 hatchlings and 11 fledglings.

As part of the restoration efforts supported by the Bouchard 120 Oil Spill Settlement Fund, BRI partnered with MassWildlife to continue their loon translocation project in Massachusetts. In 2020, BRI translocated a total of 12 Common Loon chicks from Maine to southeastern Massachusetts. Chicks were translocated at approximately 6-11 weeks of age. Of the 12 translocated chicks, seven were reared in aquatic enclosures for 7-20 days before being released and five older chicks were directly released onto waterbodies in southeastern Massachusetts. Additionally, the first nesting loon pair in southeast Massachusetts in over a century was documented successfully fledging young, and this pair was a result of the loon translocation effort BRI completed between 2015-2017.

*Bald Eagle (*Haliaeetus leucocephalus*)*

The 2020 Spring Nesting Eagle Survey took place on April 10, when agency staff and volunteers checked known eagle territories and explored areas with potential eagle habitat to verify continued use of “old” eagle nests and try to locate “new” nests. The elevated effort on this day helps us with the increasingly difficult effort to monitor the state’s growing numbers of breeding Bald Eagles and provides much of the information that we gather on the numbers of nesting Bald Eagles in Massachusetts. In addition to the single day count, information on nesting eagles is gathered opportunistically throughout the year. Any reports of nesting eagles are investigated by MassWildlife staff to document new nesting pairs. When possible, these nests are monitored throughout the breeding

season and staff band chicks in the nest. Due to the COVID-19 pandemic, the amount of eagle nest monitoring was reduced for both our staff and volunteers.

During the summer of 2020, there were 80 known territorial pairs of Bald Eagles in Massachusetts. This represents the highest number of documented eagle pairs in the state since the birds were reintroduced in the 1980s. The highest concentrations of nesting eagles were along the Connecticut River (15 territories) and Quabbin Reservoir (>4 territories). The total number of nests on the Quabbin Reservoir was low due to a reduced monitoring effort in that area. The Merrimack River, Westfield River, and the Assawompset Pond Complex also had multiple pairs of nesting eagles, and single nests were reported from numerous waterbodies throughout the state. New nests were documented in Barnstable, Edgartown, Fitchburg, Hudson, Concord, and Rutland. The nest in Edgartown represented the first known active nest on Martha's Vineyard, and the one in Barnstable was the first documented active nest on Cape Cod in over 100 years. In total, at least 21 successful nests fledged a minimum of 36 eagle chicks. Due to the pandemic and to promote staff safety, the Agency decided to greatly reduce the eagle monitoring effort this year, and many nests were not monitored throughout the season. Therefore, most nests had unknown fates and only the 2 nestlings (in the historic Cape Cod nest) were banded with a USGS federal band and a field readable state color band uniquely identifying each individual.

This is the 32nd year that Bald Eagles have raised young in Massachusetts since their restoration. During these 32 years, at least 873 wild-born chicks are known to have fledged, along with an additional 8 chicks that were captive-born and fostered into wild nests and an additional 18 that were captive-born and directly released.

*Peregrine Falcon (*Falco peregrinus*)*

During the 2020-2021 nesting season, 41 pairs nested (representing 72% of our known sites (57); 2 of our sites did not have pairs present and 14 sites were not monitored to determine status), but 6 pairs were not monitored enough to know their outcome. At least 35 pairs laid eggs (9 pairs failed), 26 pairs (74%) are known to have hatched eggs and all 26 fledged at least 1 chick. Fifty five chicks (24 males, 31 females) were banded from 19 nests (73% of known successful nests). 3 chicks, 2 which were banded, are known to have died near the nest site shortly after fledging. These include chicks from Amherst, Charlestown, and Chelsea. This is the 35th year that Peregrine Falcons have raised young in Massachusetts since their restoration. During these 35 years, at least 920 wild-born chicks are known to have fledged.

*Eastern Whip-poor-will (*Antrostomus vociferus*)*

MassWildlife continued a multi-year study examining the migratory and wintering ground ecology of the Eastern Whip-poor-will. In 2020, data collection occurred at three sites in Massachusetts with high densities of whip-poor-wills (Joint Base Cape Cod, Bolton Flats WMA, and Montague Plains WMA). We trapped birds and removed past season GPS tags on Eastern Whip-poor-wills (Lotek, Pinpoint) to collect location data on the wintering grounds and migratory pathways from birds nesting in Massachusetts. To capture the birds, we used playback to lure male whip-poor-wills into mist nets to band, collect biological data, and remove GPS loggers deployed in 2019. This trapping was conducted during the 3-4 hours after sunset when the birds are most active. In total, we captured and removed 19 GPS loggers that had been deployed on Eastern Whip-poor-wills in 2019 (63% of birds that were tagged in 2019). Data from these tags were downloaded, and data from the 12 tags collected in 2019 were fully analyzed.

For the 12 birds with analyzed movement data, all took a land-based route during fall migration, generally following the Appalachian Mountains south and then travelling around the Gulf of Mexico rather than flying over water. On average, these birds departed the nesting area in mid-September and arrived on the winter grounds in early November. One bird over-wintered in South Carolina, 7 in Mexico, 1 in Belize, 2 in Guatemala, and 1 in Honduras. We calculated territories for these birds and classified the habitat within the territories. The average winter territory size was 3.0 hectares, and territories contained significantly more forest and less agricultural cover than associated random locations. From recent aerial imagery where our tagged whip-poor-wills spent the wintering period, it was clear that forest habitat was being converted to agriculture at a high rate, and that loss

of forest habitat may help explain declines in this species. This is the first study in the Northeast United States to link breeding and wintering populations of Eastern Whip-poor-will and examine selection by these birds during the non-breeding period. Once all data are analyzed, results will be published in the scientific and popular literature and facilitate the development of full life-cycle conservation strategies for this species.

The statewide nightjar survey project based on the Nightjar Survey Network's protocol continued into its tenth consecutive year. Approximately 28 (still awaiting some reports) routes were run in 2021, including an overwater survey of the islands of the Quabbin Reservoir which yielded 50 calling birds. Surveys once again took place in all the Massachusetts core whip-poor-will areas (Correllus SF, Montague Plains, Joint Base Cape Cod, Myles Standish State Forest), as well as many important secondary sites. As has been the general trend, a fair number of chuck-wills-widow were detected on Cape Cod and the Islands (3 on Chappaquiddick alone). As usual, no detection of common nighthawk occurred anywhere in the state. The information gathered from these routes is being used to inform regulatory, habitat management and general conservation decisions.

Reptiles and Amphibians

Northern, Red-bellied Cooter; Federally Endangered

The Northern Red-bellied Cooter (*Pseudemys rubriventris*) is restricted to portions of Plymouth and Bristol Counties in southeastern Massachusetts and has been federally listed as Endangered since 1980. MassWildlife and key partners continued a major project that has run continuously for 36 years to headstart Northern Red-bellied Cooters, protecting their nests at known nesting areas in Plymouth County and distributing the hatchlings to participating institutions, schools, and individuals to care for during the 2020–2021 winter season, as outlined in a federal recovery subpermit.

2020 Nesting Season. Throughout the early summer nesting season, we searched for nests of Northern Red-bellied Cooter in known nesting areas. Wire cages were placed over the nests to protect them and prevent predation by red foxes, coyotes, raccoons, and skunks. Beginning in August, nests were checked daily to evaluate the emergence of hatchlings. Hatchlings were brought to MassWildlife where they were prepared for transport to headstarting facilities. Hatchlings were transported to headstarting facilities in September 2020, where they remained until the following May. During the headstarting period, turtles were raised by partners following a standardized protocol. Contracted biologist Kourtnie Bouley located 11 nests and protected them with wire cages. These included 3 nests at Assawompset Pond, 6 nests at Boot Pond, 1 nest at Myles Standish State Park, and 1 nest at Neponset Reservoir (an unusual new occurrence for the species in Massachusetts). By late summer these 11 nests resulted in 154 live hatchlings, of which 119 were headstarted by 17 schools and institutions in Massachusetts.

2021 Headstart Release

A total of 105 headstarted turtles were released in May 2020 to four separate waterbodies in southeastern Massachusetts, including Atwood Reservoir and Burrage Pond, which are owned by MassWildlife. From 1985 to 2021, a total of 4,700 headstarted Northern Red-bellied Cooters have been released by MassWildlife and partners after nine months of headstarting, contributing to the overall numerical recovery objectives in the 1994 recovery plan. MassWildlife's state herpetologist assisted the U.S. Fish and Wildlife Service (USFWS) conduct a Species Status Assessment (SSA) for the Northern Red-bellied Cooter. The core SSA team met approximately weekly throughout the reporting period. The SSA team consists of biologists from MassWildlife, and several sections of the USFWS, including the Massasoit National Wildlife Refuge, New England Field Office, Ecological Services program, and the New Jersey Field Office.

Species Status Assessment (SSA)

MassWildlife's state herpetologist continued to assist the USFWS in the completion of a Species Status Assessment (SSA) for the Northern Red-bellied Cooter. The core SSA team met approximately monthly through the end of 2020. The SSA team consists of biologists from MassWildlife, and several sections of the USFWS, including the Massasoit National Wildlife Refuge, New England Field Office, Ecological Services program, and the New Jersey Field Office.

Bog Turtle; Federally Threatened

The Bog Turtle (*Glyptemys muhlenbergii*) is the most imperiled freshwater turtle in New England and has been federally listed as Threatened in the northern part of its range since 1997. It remains one of our highest-priority focal species. In 2020, MassWildlife initiated a significant new study of this species in partnership with the Cooperative Fish and Wildlife Research Unit (CRU) at the University of Massachusetts/Amherst. A Master of Science student, Julia Vineyard, was hired by the CRU to conduct 2 years of distributional surveys, population assessments, and radiotelemetry. MassWildlife's state herpetologist collected DNA samples for a regional genetics analysis funded through the Competitive State Wildlife Grants (CSWG) program. Continuing a study initiated in 2018 in partnership with The Nature Conservancy and their AmeriCorps position, we radiotracked roughly 20 adult Bog Turtles at two sites for a second year throughout 2020 and continued tracking these turtles into 2021. Additionally, we initiated a new contract with biologist Suzanne Fowle to assess the habitat use and abundance of Bog Turtles in the context of ongoing habitat management. MassWildlife staff continued to work with state wildlife agencies in Pennsylvania, New Jersey, Connecticut, and New York to implement the regional conservation plan for the Bog Turtle with funding from the CSWG program. Our focus in the next two years will be on distributional surveys to locate new populations, intensive radiotelemetry to determine Bog Turtles' response to habitat management and their use of new fen areas.

Wood Turtle

The Wood Turtle (*Glyptemys insculpta*) has been extirpated from areas in eastern Massachusetts in recent decades and is a regional Species of Greatest Conservation Need (RSGCN) and is petitioned for federal listing. The 13 northeastern States have been working together to conserve this species for about 11 years, supported by two Competitive State Wildlife (CSWG) and three Regional Conservation Needs (RCN) grants. Having completed a Conservation Plan for the species from Maine to Virginia in 2018 (Jones et al. 2018), MassWildlife is serving as the lead state on a Competitive State Wildlife Grant to implement the Conservation Plan. Eight partner state agencies in the Northeastern United States are partnering in this initiative. MassWildlife biologists also continued to co-chair the Regional Conservation Needs "Turtles" program, which includes a Wood Turtle-focused effort led by Lori Erb, former MassWildlife Turtle Conservation Biologist, to implement the 2018 Conservation Plan. In this context, MassWildlife's state herpetologist contributed to the completion of a new book, Biology and Conservation of the Wood Turtle, which will be published by the Northeast Association of Fish and Wildlife Agencies in 2021.

A range-wide genetics study funded through a CSWG and RCN provided the basis for genetic assignment of approximately 40 confiscated Wood Turtles in 2019. Following their assignment to their most likely state of origin, the turtles were returned to state agencies in New Jersey, Pennsylvania, West Virginia, and Maryland in 2020. These placement efforts, and management decisions related to their repatriation to the wild, continued into 2021.

MassWildlife staff expanded an ongoing, three-year partnership with Zoo New England to study, restore, and manage impaired Wood Turtle populations in the several basins of eastern Massachusetts. As part of this project, 20 adult Wood Turtles were radiotracked in Middlesex and Essex Counties to locate and protect nests. 20 headstarted Wood Turtles were released into their natal site of origin to augment the local populations and were radiotracked. The project was expanded to new sites in Norfolk County.

*Eastern Box Turtle (***Terrapene carolina***)*

MassWildlife's State Herpetologist and Chief of Regulatory Review worked throughout the year with partners from The Nature Conservancy to coordinate habitat conservation for the Eastern Box Turtle using mitigation funds for offsite conservation established through MESA Conservation and Management Permits.

*Spotted Turtle (***Clemmys guttata***)*

In the third and final full year of a CSWG with Virginia and other states from Maine to Florida, MassWildlife coordinated additional field sampling for the Spotted Turtle in Dukes, Essex, and Barnstable Counties, with a major emphasis on islands in Dukes County.
Finally, MassWildlife biologists assisted with the organization and planning of a range-wide genetic

study and conservation plan for the species and collected additional samples from these three counties to support the regional effort.

*Northern Diamondback Terrapin (*Malaclemys terrapin*)*

MassWildlife's state herpetologist worked with UMass Ph.D. student Patricia Levasseur and others to initiate a working group of Massachusetts terrapin researchers and managers and continued to coordinate and standardize key methodologies elements of terrapin monitoring in Cape Cod, to Buzzards Bay, to the Taunton Watershed, the three primary areas of terrapin occurrence in Massachusetts. Partners have converged on a standardized approach to PIT-tagging and are field-testing standardized and quantitative population assessment techniques first established in Wellfleet. To date, more than 1,000 terrapins have been PIT tagged in Massachusetts by MassAudubon, UMass Amherst, MassWildlife, Bristol County Agricultural High School, and New England Coastal Wildlife Alliance. A graduate study by Patricia Levasseur was expanded to a Ph.D. at UMass Amherst with the support of funds established through MESA Conservation and Management Permits.

*Timber Rattlesnake (*Crotalus horridus*)*

Massachusetts' rattlesnakes have dwindled to five isolated populations, several of which appear to be declining. MassWildlife continues to coordinate necessary conservation actions, such as trail closures and signage and outreach, through three regional working groups in Berkshire County, Connecticut Valley, and Blue Hills. MassWildlife also coordinates three "response" teams, similar to groups in Vermont and Connecticut, to assist landowners in these regions relocate rattlesnakes from yards.

*Copperhead (*Agkistrodon contortrix*)*

In 2020, MassWildlife continued to survey for Copperheads in Hampshire County, and continued to work with partners to study a population in Norfolk County. MassWildlife again partnered with MassDOT to remove invasive black swallowwort from an important den and basking area for Copperheads in Hampden County.

*Eastern Spadefoot (*Scaphiopus holbrookii*)*

With the help of volunteer monitors, we continued implementation of Year 5 of a statewide monitoring plan for Eastern Spadefoot during July–November 2020; no breeding events were documented during that period. The Rehoboth Land Trust, Town of Rehoboth, and a private landowner worked with the NHESP in August to complete "Phase II" of a management plan to partially restore a vernal pool basin to a more viable spadefoot breeding habitat. The Phase II work, which aimed to reduce non-native invasive vegetation and restore some volume capacity lost to lawn construction and other landscaping activities of the past, involved moderate excavation work to remove (a) a wide strip of Phragmites sp. that had filled the southern margin and (b) a hump along the eastern margin that had been created via fill (asphalt and concrete chunks, bags of refuse, soil) by previous landowners.

We extended the statewide monitoring plan to a Year 6 during April–June 2021, but no natural breeding events were documented (or reported) during that time. Water tables were presumably low in many areas due to the severe droughts of summer 2020; drought and excessive heat occurred again in May and June 2021. Remote survey data from automated acoustic recording equipment deployed in, Hadley, Northampton, Southwick, Sunderland, and Wayland have yet to be analyzed to determine whether any calling activity was missed at select sites during FY 2021. As part of the continuing population introduction project at the Southwick WMA, both that site and the donor site in Westfield were monitored closely. No spadefoots were introduced to the Southwick WMA during FY 2021, given the absence of breeding at the donor site.

In continued monitoring of constructed pools and how hydrological regimes influence presence of dragonfly larvae during the spadefoot breeding season, we determined that all constructed pools at Sunderland (n=1) and Southwick (n=3) had dried completely by early October 2020 and very likely were dry again in mid-May and mid-June 2021. Hence, we presume all pools were largely free of mature dragonfly larvae during the first half of 2021 breeding season.

*Marbled Salamander (*Ambystoma opacum*)*

We conducted limited surveys (n = 1 site) for Marbled Salamander in September 2020 and did not detect the species. We conducted more extensive surveys (n = 6 sites) during February–May 2021 among the towns of Dartmouth, Dighton, Mansfield, Northbridge, and Somerset. We detected Marbled Salamander larvae in 14 wetlands during those surveys, reconfirming 5 previously documented breeding wetlands and discovering 9 others.

*Jefferson Salamander/Blue-spotted Complex (*A. laterale*)*

We continued our annual, exploratory surveys for pure populations of Blue-spotted Salamander in northern Bristol County. An extension of a previously documented population was discovered with the finding of an adult salamander in each of two wetland basins in Attleboro in October 2020. In February and March 2021, a previously undocumented population segment was discovered in Raynham, and a previously undocumented population was discovered in Norton.

We also conducted routine egg-mass surveys to renew occurrence records and improve knowledge of breeding wetlands of Jefferson Salamander and Blue-spotted Salamander during spring 2021. Visiting scores of wetlands, we documented egg masses of the species complex at 17 wetlands among 7 sites in the towns of Gill, Middlefield, Plainfield, Shirley, Whately, Wilbraham, and Williamsburg; 9 of those wetlands were previously undocumented breeding areas. We failed to detect the species complex at the scores of wetlands surveyed among 6 other sites in the towns of Concord, Hamilton, Harvard, Holliston, Manchester, Sherborn, and Wenham.

*Spring Salamander (*Gyrinophilus porphyriticus*)*

During June–October 2020, we completed the second season of a multiyear status assessment of Spring Salamander in Massachusetts (see FY 2019 and FY 2020 reports for background). Surveys during this phase of the project were concentrated mainly in northern Berkshire County and western Franklin County. Data analysis has not been completed, but detection rates were relatively high among the scores of stream segments surveyed in those regions compared to other regions of the state. We hope to complete data analysis and a written report in FY 2022.

Terrestrial Invertebrates

Southeast Pine Barrens Wildlife Management Area (WMA)

Southeast Pine Barrens WMA, adjacent to Myles Standish State Forest on the southwest side, was acquired by MassWildlife in 2014. State-listed terrestrial invertebrates at Southeast Pine Barrens WMA have benefited from substantial ecological restoration and habitat management conducted by MassWildlife at this site since 2015. Prior to restoration, the pine barrens habitat was so densely overgrown that little suitable habitat was present on the site for most of the species listed in Table 40. Therefore, most of these 11 state-listed species colonized the WMA from habitat to the north, east, and south after restoration. For example, the Endangered Buchholz's Gray Moth (*Hypomecis buchholzaria*) had not previously been documented any closer than 1.4 miles to the southeast of the 2020 record.

Camp Cachalot Wildlife Conservation Easement (WCE)

Camp Cachalot WCE is located adjacent to Myles Standish State Forest on the southeast side. Although for the most part not as densely overgrown as Southeast Pine Barrens WMA prior to restoration, the pine barrens at Camp Cachalot WCE have benefitted from substantial ecological restoration and habitat management conducted by MassWildlife since 2015, as demonstrated by the continued presence of the nine state-listed species listed in Table 41.

*Northeastern Beach Tiger Beetle (*Cicindela dorsalis*) Monitoring*

The Northeastern Beach Tiger Beetle is state-listed as Endangered, in addition to its listing as Threatened under the federal Endangered Species Act. Population monitoring of this species on Martha’s Vineyard was conducted in 2019, but not in 2020 or 2021. Monitoring is planned to resume in 2022.

Table 40. State-listed species recorded at Southeast Pine Barrens WMA in 2020.

Common name	Scientific name	MA Status
Frosted Elfin Butterfly	*Callophry irus*	SC
Herodias Underwing Moth	*Catocala herodias*	SC
Waxed Sallow Moth	*Chaetaglaea cerata*	SC
Melsheimer's Sack-bearer Moth	*Cicinnus melsheimeri*	T
Scrub Euchlaena Moth	*Euchlaena madusaria*	SC
Buchholz's Gray Moth	*Hypomecis buchholzaria*	E
Heath Metarranthis Moth	*Metarranthis pilosaria*	SC
Pink Sallow Moth	*Psectraglaea carnosa*	SC
Pine Barrens Speranza Moth	*Speranza exonerata*	SC
Pine Barrens Zale Moth	*Zale lunifera*	SC
Pine Barrens Zanclognatha Moth	*Zanclognatha martha*	SC

Table 41. State-listed species recorded at Camp Cachalot WCE in 2020.

Common name	Species	MA Status
Herodias Underwing Moth	*Catocala Herodias*	SC
Barrens Tiger Beetle	*Cicindela patruela*	E
Melsheimer's Sack-bearer Moth	*Cicinnus melsheimeri*	T
Scrub Euchlaena Moth	*Euchlaena madusaria*	SC
Heath Metarranthis Moth	*Metarranthis pilosaria*	SC
Pink Sallow Moth	*Psectraglaea carnosa*	SC
Pine Barrens Speranza Moth	*Speranza exonerate*	SC
Pine Barrens Zale Moth	*Zale lunifera*	SC
Pine Barrens Zanclognatha Moth	*Zanclognatha martha*	SC

*Puritan Tiger Beetle (*Cicindela puritana*) Cooperative Recovery Initiative*

The Cooperative Recovery Initiative (CRI) for the state Endangered, federally Threatened Puritan Tiger Beetle is led by the USFWS. Threats to the single population in Massachusetts, inhabiting Rainbow Beach on the Connecticut River, include adverse, artificial hydrology over the past decade, as well as loss of beach habitat to vegetation encroachment. Summer counts of adult beetles at Rainbow Beach remain low, and persistence of the population of Puritan Tiger Beetle at this site seems unlikely unless adverse hydrology (frequency and extent of beach inundation due to daily dam releases from late June through early September) is attenuated. Nevertheless, in 2020 the additional threat of excessive growth of vegetation at Rainbow Beach was mitigated by vegetation control efforts by NHESP staff (Chris Buelow and Daniel Bove), in consultation with Chris Davis and Neil Kapitulik (contract biologists for the CRI) and Mike Nelson (NHESP Invertebrate Zoologist).

Plants

During the 2020 field season, the State Botanist and Plant Conservation Biologist searched for, discovered, or verified over 350 plant population occurrences. Thirty-nine of these were brand new occurrences that were entered into the Biotics database with 313 plant records updated.

For FY 2021, the NHESP botanists initiated significant testing of methods to improve and advance our data collection in the field, streamlining internal workflows. These included the use of new mobile phone and iPad applications such as Collector and Survey123 as well as Google photos, and Bad Elf GPS units.

Perhaps the most significant find was the state botanist's rediscovery of crested fringed orchid (*Platanthera cristata*). This colorful but well-hidden orchid was found in Bristol County and was publicized in a MassWildlife press release, then

immediately picked up by the Boston Globe who interviewed the state botanist for the story. It was also carried by Boston news outlet and radio station WBUR as well as many other both national and international press sources.

Additional highly significant finds where two new native plant species added to the state's flora. The first was slough sedge (*Carex atherodes*) in North Adams. The second was sea purslane (Sesuvium maritimum) in Westport. For a state that has been thoroughly botanized for nearly three full centuries by many of the nation's leading botanists, new species discoveries are not expected and are quite valuable and important. The state botanist also found a new county record, recording a wild rye grass (*Elymus villosus*), the first in Franklin County despite a massive 8-year survey effort there by five other botanists. Three other 20-year-old plant occurrence records were relocated, two were state Endangered.

The following actions were accomplished for the four federally listed plants:

*Sandplain Gerardia (*Agalinis acuta*); Federally Endangered*

Population censuses or sampling procedures were conducted at 9 sites, 4 locations on Martha's Vineyard and 5 on Cape Cod. The census in Barnstable is an organized count, with a large group of volunteers using transects and quadrats, resulting in a count of 78,000 plants, down just a bit from a drought in early 2020.

*Small Whorled Pogonia (*Isotria medeoloides*); Federally Threatened*

The numbers at the previously known sites were similar to those in past years. Surveys are being monitored at 9 locations.

*Northeastern Bulrush (*Scirpus ancistrochaetus*); Federally Endangered*

A survey of both populations in Franklin County were conducted. One population has 125 plants and the other had none.

*American Chaffseed (*Schwalbea americana*); Federally Endangered*

The one large population is holding steady. It was censused with a group of volunteers using transects, resulting in a count of 9,060 plants (ramets).

General Habitat Management Projects

The Program continued its emphasis on habitat management projects for rare plants during 2020. In addition, NHESP has worked with the USFWS to control swallowwort on and near the old ski slopes at Mount Tom where the invasive species was impacting a population of state Endangered Glaucous Sedge (*Carex glaucodea*) and two state Threatened species.

A large forestry thinning operation and invasive species control was continued in 2020. This project began in 2019 to enhance habitat for state Endangered *Lonicera hirsuta*, a native honeysuckle vine in Williamstown, in cooperation with Williams College. Some improvement to the plant population did occur but more is expected in FY 2022.

Aquatic Species

During FY 2021, NHESP's Aquatic Ecologist conducted surveys for odonates, freshwater mussels, and other rare aquatic taxa in MassWildlife's Western, Connecticut Valley, Northeast, and Southeast districts. Below is a summarization of FY 2021's survey efforts.

Dragonflies and Damselflies

Scarlet Bluet (*Enallagma pictum*): Discovered at 5 sites in 3 new ponds.

Pine Barrens Bluet (*Enallagma recurvatum*): Updated at 8 sites in 8 ponds and discovered at 5 sites in 5 new ponds.

Ocellated Darner (*Boyeria grafiana*): Updated at 2 sites in 2 rivers.

Ski-tipped Emerald (*Somatochlora elongate*): Updated at 2 sites in 2 waterbodies.

Riffle Snaketail (*Ophiogomphus carolus*): Updated at 5 sites in 3 different rivers.

Brook Snaketail (*Ophiogomphus aspersus*): Updated at 1 site in 1 river.

Midland Clubtail (*Gomphus fraternus*): Discovered at 1 site in 1 new river occurrence.

Freshwater Mussels

MassWildlife is the lead agency on a multistate effort to evaluate the conservation and restoration needs of the state Endangered Brook Floater. NHESP's Aquatic Ecologist worked with the UMass Cooperative Fish and Wildlife Research Unit to coordinate partner meetings, identify conservation priorities, and to investigate habitat needs of Brook Floater rangewide. The initiative and associated surveys have resulted in multiple updates to other SGCN freshwater mussels.

Brook Floater (*Alasmidonta varicosa*): Updated presence at 5 sites in 3 rivers. Mark-recapture monitoring was conducted to evaluate population size and health at three sites, 2 sites in the Nissitissit River following a dam-removal, and one site in the Farmington River.

Yellow Lampmussel (*Lampsilis cariosa*): Updated the presence at one site in the Connecticut River.

Creeper (*Strophitus undulatus*): Updated presence at 7 sites in 5 rivers including one new population. Mark recapture monitoring was conducted at 2 sites following dam removal on the Nissitissit River

Eastern Pondmussel (*Ligumia nasuta*): Updated at 7 sites in 2 ponds.

Tidewater Mucket (State Special Concern): Presence was discovered at 3 sites in one pond representing a newly discovered population.

Triangle Floater (SGCN): Updated presence at 8 sites in 3 rivers and a new location in one pond. Mark recapture monitoring was conducted at 2 sites following dam removal on the Nissitissit River.

Eastern Pearlshell (SGCN): Updated presence at 8 sites in 4 rivers. Mark recapture monitoring was conducted at 2 sites following dam removal on the Nissitissit River

Regulatory Review

Table 42. Summary of the environmental reviews conducted during FY 2021.

Review Type	Count
CMP Application Received	20
Forest Cutting Plan	88
MESA Information Requests/Data Releases	237
MEPA Reviews	59
MESA Project Reviews	670
Notices of Intent	447
Scientific Collection Permits	129
Other	95
Total	**1,745**

Data Management and Data Products

In FY 2021, NHESP processed a total of 123 new rare species, natural community, and certified vernal pool records, and updated 659 existing records (Table 43).

Table 43. Categories of data processed by NHESP in FY 2021.

FY 2021 Totals	New Records	Updates to Existing Records
Vertebrates	30	310
Invertebrates	18	34
Plants	39	313
Communities	0*	0*
CVPs	36	2
Total	**123**	**659**

*The NHESP Community Ecologist retired from the Program on June 30, 2016, and no work has been done on the Natural Communities in the database since that time.

Vernal Pool and Rare Species Information System (VPRS)

(The VPRS system was retired in December 2020).

For the FY 2021 alone, 76 new people signed up for VPRS and a total of 834 observation reports were submitted, including 118 vernal pool certification forms, 277 plant observation forms, and 439 animal observation forms.

MassWildlife's Heritage Hub (Heritage Hub)

(MassWildlife's Heritage Hub was launched in January 2021. See Other Data Projects below for more information).

In FY 2021 alone, 523 new people signed up for Heritage Hub and a total of 1,297 observation reports were submitted, including 191 vernal pool certification forms, 553 plant observation forms, 551 animal observation forms, and 2 Natural Community forms.

Once submitted through VPRS or Heritage Hub, the information is reviewed by NHESP using standard data acceptance criteria for inclusion in our database, and the accepted records are entered into the database by NHESP Data staff. In addition to the observation reports submitted through VPRS and Heritage Hub, NHESP Data staff processed 4 large reports for Plants, Piping Plover, and Terns (including Common, Least, Arctic, and Roseate).

Other Data Projects

For FY 2021, the NHESP has continued with and initiated several projects to explore methods to improve and advance our data collection, enhance our collaboration with external groups, as well as streamline internal workflows and processes. These projects have included the use of new technologies and databases such as Collector and Survey123 mobile applications, ArcGIS Pro, and the PIPLODES/TERNODES database.

This year, our focus has been on the replacement of our Vernal Pool and Rare Species Information System (VPRS). The VPRS was retired in December 2020 when its software platform was depreciated. A new online system, MassWildlife's Heritage Hub, was developed with EEA-IT and released in January 2021 and the observation components support and replace the functionalities of VPRS for Natural Heritage. Work continued on the Heritage Hub through the end of the fiscal year in preparation of a second release at the start of FY 2022. The NHESP also leveraged our experiences of Survey123 to create a custom survey for offline data collection to streamline observation bulk uploads into Heritage Hub.

The NHESP has also continued working with EEA-IT on the development of an online filing system to streamline our Environmental Review process and provide greater transparency to the public. These workflows will also be delivered through MassWildlife's Heritage Hub. Phase two of that effort is ongoing but slowed as we shifted gears to focus on the time-sensitive replacement of VPRS. Efforts on the Environmental Review components of the Heritage Hub will ramp up again in FY 2022.

Natural Heritage and Endangered Species Program Advisory Committee

Full Members

Mark Mello (Chair)
Timothy Flanagan (Vice Chair)
Kevin Powers (Secretary)
William Brumback
Joseph Larson
Wayne Petersen
Dave Small

Associate Members

Andy Finton
Russ Hopping
Bryan Windmiller (*partial year*)

Natural Heritage and Endangered Species Program Staff Presentations to the Committee

Rediscovery of Crested Fringed Orchid with notes on the orchid family in Massachusetts; Bob Wernerehl, State Botanist

A Recap of Major Restoration Projects in 2020; Chris Buelow, Senior Restoration Ecologist

Brief Introduction to the Heritage Hub; Sarah Maier (NHESP Information Manager) and Amanda Veinotte (NHESP Project Coordinator)

Wildlife Rehabilitation Program Overview; Jennifer Longsdorf, Natural Heritage Program Coordinator

Other Presentations to the Committee

The Great Marsh Resiliency Project; Russ Hopping, Lead Ecologist, Coastal Ecology, The Trustees

Natural Heritage and Endangered Species Program Staff

Eve Schlüter, Ph.D., Assistant Director
Tara Boswell, GIS Manager
Daniel Bove, Restoration Ecologist
Chris Buelow, Senior Restoration Ecologist
Caren Caljouw, Prescribed Fire Program Manager
Jason Carmignani, Aquatic Ecologist
Melany Cheeseman, Endangered Species Review Assistant
Karen Dolan, Finance and Projects Administrator
Karro Frost, Conservation Planning Botanist
Lauren Glorioso, Endangered Species Review Biologist
Lynn Harper, Habitat Protection Specialist (*partial year*)
Peter Hazelton, Ph.D., Chief of Conservation Science (*partial year*)
Amy Hoenig, Endangered Species Review Biologist
Emily Holt, Senior Endangered Species Review Assistant
Tara Huguenin, Conservation Data Specialist
Michael Jones, Ph.D., State Herpetologist
Jacob Kubel, Conservation Scientist
Michael Lachance, Conservation Data Specialist (part-year)
Jesse Leddick, Chief of Regulatory Review
Jennifer Longsdorf, Natural Heritage Program Coordinator
Lisa MacGillivray, Habitat Mapping Biologist/Data Specialist
Sarah Maier, Information Manager
Misty-Anne Marold, Senior Endangered Species Review Biologist
Carolyn Mostello, Coastal Waterbird Biologist
Michael Nelson, Ph.D., Invertebrate Zoologist
David Paulson, Senior Endangered Species Review Biologist
Amanda Veinotte, NHESP Project Coordinator
Bob Wernerehl, Ph.D., State Botanist
Rebekah Zimmerer, Endangered Species Review Biologist

5 The Information and Education Program

Marion E. Larson, Chief of Information and Education

Overview

The Information and Education (I&E) Program has the responsibility of keeping the public apprised of regulations, laws, wildlife conservation and management activities, and recreation and education opportunities related to wildlife and nature. Staff communication and education specialists produce a variety of media utilizing multiple communications channels to inform and engage Massachusetts residents and visitors; promote hunting, fishing, wildlife viewing and other nature-based recreation; stage special events, conduct outdoor skills and wildlife conservation education programs for a variety of audiences and disseminates information about agency wildlife conservation activities.

R3 and Relevancy

Astrid Huseby

In Massachusetts and throughout the nation, our society is in the midst of a rapid and unprecedented change which has profound implications for wildlife conservation and the future of state fish and wildlife agencies. Urbanization, technology, and demographic change are leading to shifting values and perspectives related to conservation. The number of hunters and anglers—the historic base of financial support for MassWildlife and other state fish and wildlife agencies—is declining and disconnection from nature is increasing. While all Massachusetts residents and visitors benefit from MassWildlife's work to conserve wildlife, protect open space, and preserve clean air and water, MassWildlife currently relies heavily on funds generated by hunters, anglers, and trappers. In response, MassWildlife has prioritized efforts to increase participation in and support for hunting, fishing, and the shooting sports through recruitment, retention, and reactivation (R3), while also deploying strategies to better engage with all residents including those who will never hunt, fish, shoot, or trap (relevancy). Understanding public values and ensuring the public appreciates how MassWildlife's efforts are relevant to them is key to increasing broad support for conservation.

To promote a clearer understanding of the importance of R3 and Relevancy, the Engaging Staff in Relevancy & R3 Workgroup planned an employee conference on these topics. The conference titled "Charting the Course: Relevance, R3, and the Road Ahead" was held on October 20, 2020, and staff from across the agency participated virtually via Zoom video call. The conference included a presentation from Matt Dunfee, Director of Special Programs for the Wildlife Management Institute, entitled "R3 and Relevance: How Many R's Can One Agency Handle?" Other topics covered that day include an overview of R3 and Relevancy efforts already in progress and an unveiling of the new 5-year Massachusetts R3 Plan. Several staff breakout sessions were also held, and staff were encouraged to share and discuss during and after the conference.

R3 Plan Development

An R3 team drafted a 5-Year (2022 to 2026) Massachusetts R3 Plan identifying priority activities and actions associated with the five R3 strategies. The 5-Year Plan focuses on activities that MassWildlife intends to complete in the next 5 years with the help of partners. It is written as an overall summary, not a detailed accounting of all planned MassWildlife and partner R3 efforts. Considered a living document, as R3 partnerships evolve and activities are initiated and evaluated, new recommendations during this 5-year period may be developed. During FY 2021, a set of partners reviewed the Plan and provided comments. To maximize success, this 5-Year Plan will be coupled

with the development of Annual R3 Work Plans that will contain the key implementation steps, team members, and timelines for each priority activity addressed in a given year. The R3 Coordinator worked closely with partners, agency personnel and MassWildlife senior management to develop the Annual Work Plans in FY 2021.

Relevance Roadmap Development

Staff members Carolyn Mostello, Nicole McSweeney, and Jason Zimmer served as chairs of the Relevance Workgroup in FY 2021. A formal Workgroup comprised of agency staff from varied sections and offices continued to meet to find ways to increase MassWildlife's relevance to the general public and build the support necessary to ensure the future of wildlife conservation in Massachusetts. The continuation of the Relevance Workgroup demonstrates that the agency values diverse perspectives and interests in wildlife conservation and outdoor recreation.

In FY 2021, we continued to refine the agency's draft Relevance Roadmap and identify projects that will better engage and serve broad constituencies. The Workgroup identified several CY 2021 priority projects including: establishing and maintaining the Workgroup; creating the draft Roadmap; completing a public attitudes survey to understand opinions toward MassWildlife, conservation, and outdoor recreation; completing an internal evaluation of MassWildlife's strengths and needs related to relevancy; improving internal communication to better engage all staff in relevancy efforts; and promoting Wildlife Management Areas to the public.

Human Dimensions

Jody Simoes

The Human Dimensions Coordinator continued to lead the agency's efforts to better understand the constituents it serves. Information about the general public and the angling and hunting community is critical for tailoring messaging and developing communication strategies. Primary and secondary research of Massachusetts' residents will inform data-driven decision making related to programs, management, and policies. A comprehensive understanding of the behaviors and cognitions of the sporting community will inform recruitment, retention, and reactivation strategies to ultimately increase participation in outdoor recreation. Baseline and continuing research will provide a means for informing and evaluating the agency's outreach efforts and progress.

Agency Human Dimensions Plan

During FY 2021, a significant amount of time was dedicated to the development of a comprehensive plan for agency human dimensions research. The plan describes MassWildlife's current activities, future needs, and priorities related to human dimensions research for the next 3–5 years. To achieve this goal and to develop this plan, MassWildlife staff were engaged in an iterative process to provide input. These discussions underscored the need for a planning document to achieve several key objectives related to MassWildlife's human dimensions research, specifically: (1) coordination and prioritization, (2) capacity building, and (3) adoption of best practices. The plan should be finalized during the next fiscal year.

Human Dimensions Research

During FY 2021, data mining and primary and secondary research has focused largely on license database inquiries related to angling and hunting customers; the development and execution of surveys to document hunter and angler behaviors and cognitions; establishing a strategy and mechanism to document general public attitudes, opinions, and interests; evaluating the impact of COVID-19 on hunting and fishing participation; understanding our licensing structure and trends; and providing input and data support to R3 planning and program evaluation.

- License Database Inquiries. Data requests from staff continue, requiring multi-year data exports via MassWildlife's database management system (SQL). These larger data exports are then queried further to develop distinct angler and hunter customer segments to support targeted outreach and communication efforts. Similarly, license data requests were used to generate sample frames for survey efforts.

- Hunter and Angler Surveys. Multiple hunter surveys were conducted during FY 2021. In addition to generating sample frames mentioned above, the work also included guidance and support of questionnaire development and survey implementation. Survey questions were designed to capture the behaviors, attitudes, opinions and preferences of turkey hunters, waterfowl hunters, newly lapsed anglers, and other customers. Coordination, data agreements, and data exports continued for many of the national survey efforts funded by Multistate Conservation Grants (e.g., hunting mentor and mentee recruitment, evaluations of hunter education participation, new adult hunter recruitment, female hunter constraints and motivations, perceptions of access to hunting)

- COVID-19 Impact. Internal and externa data requests continue in order to track, document and understand the initial and ongoing impacts of COVID-19 on hunting and fishing participation. To support regional and national analyses, MassWildlife responded to external data requests from the Recreational Boating and Fishing Foundation, the Council to Advance Hunting and Shooting Sports, Southwick Associates, and members of the press.

- License Structure. MassWildlife continued evaluation of its license structure during FY 2021, which includes the types of licenses, permits, stamps and tags available to hunters, trappers, and anglers.

- R3 Plan and Programmatic Evaluations. During FY 2021, there has been continued input provided in the form of narrative and data analysis appearing in MassWildlife's R3 plans, reports, and presentations. Evaluations of MassWildlife's Learn to Hunt and Youth Hunt programs also continued during FY 2021. That work has expanded into a Regional R3 Program Evaluation effort which included standardizing participant data collection to support formal evaluation (i.e., formative and summative).

- Public Attitudes. During FY 2021, a significant amount of time was devoted to developing a survey instrument to support a statewide Public Attitudes Survey. This required a significant amount of time for both literature review and meetings with our internal committee, and external partners. The statewide, representative public attitudes survey will provide baseline information about residents' activities and attitudes toward the outdoors, wildlife conservation, and the agency, and inform communications and programs. The survey was finalized during FY 2021, with implementation and results expected in FY 2022.

Digital Communications

Emily Stolarski

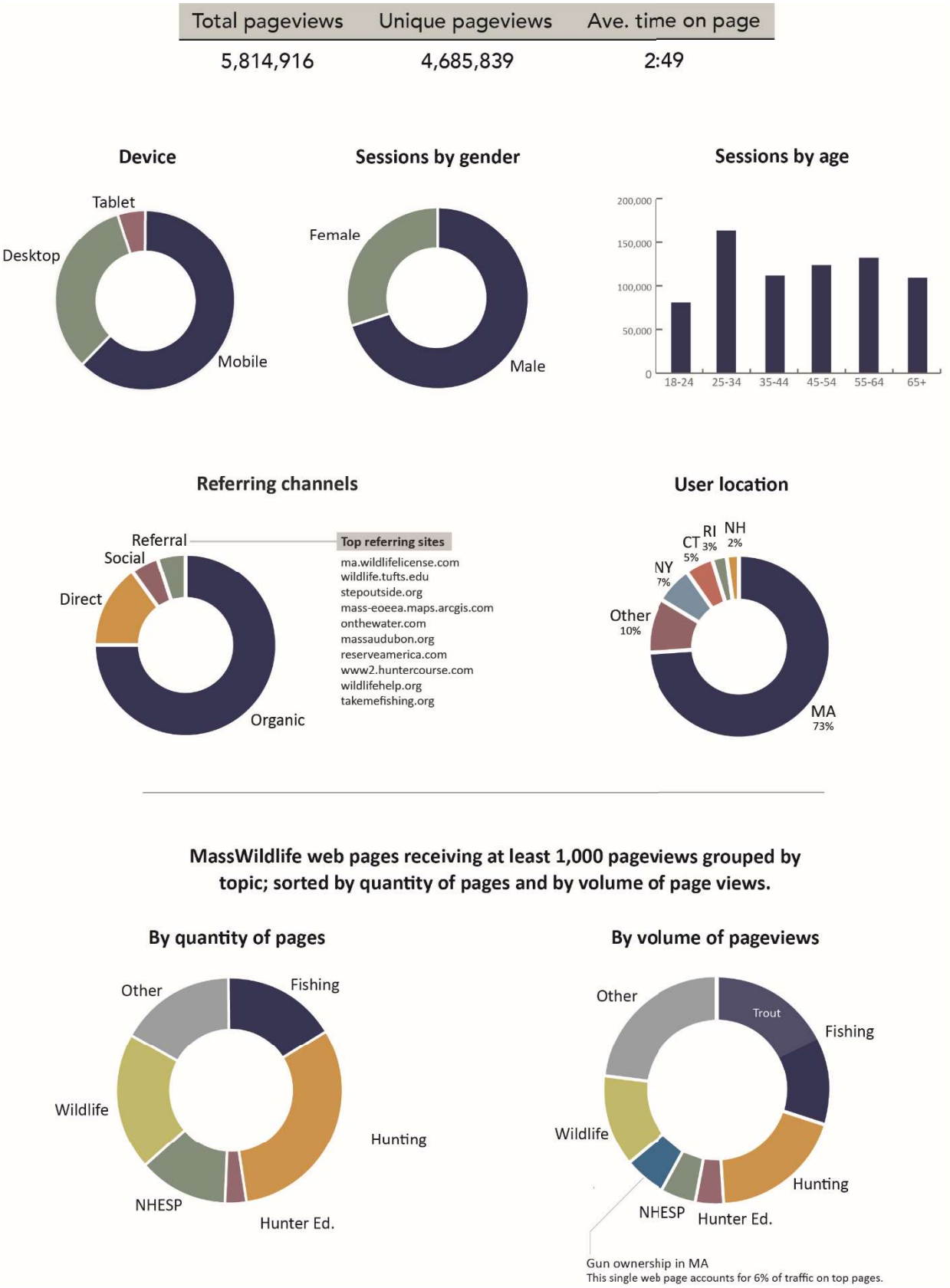
Website Analytics

The following is a brief overview of the agency website; a graphical depiction of this information can be found in Figure 29.

MassWildlife web pages were viewed about 5.8 million times. Visitors spent an average of about two and a half minutes on each page. Seventy percent of website visitors were males and 30% were female. The 25–34 age group visited the website most frequently; 18-to-24-year-olds were our smallest user group. Users from Massachusetts accounted for three-quarters of web traffic, with New York, Connecticut, and others accounting for the rest. Device usage totals continue to show that most users (over 60%) access our content using a mobile phone. All digital media created by MassWildlife is designed with a mobile user in mind.

Over 75% of traffic to the MassWildlife website originates from a search engine or from the search tool within Mass.gov. Fifteen percent of users come to our content directly. Traffic is counted as direct when users do one of the following: use a bookmark in their web browser, copy and paste a URL, or type in a shortened URL from an agency print or digital publication or that they heard about from a friend

Figure 29. MassWildlife website overview.



or MassWildlife staff over the phone. A smaller proportion of users make their way to our website by way of social media and links on other websites. Top referring websites were: ma.wildlifelicense.com (MassFishHunt), wildlife.tufts.edu, stepoutside.org, mass-eoeea.maps.arcgis.com (attributed to several of our web maps), onthewater.com, massaudubon.org, reserveamerica.com (Massachusetts campground reservations), www2.huntercourse.com, wildlifehelp.org, and takemefishing.org.

The website is large, and it can be difficult to fully report on all pages; however, evaluating MassWildlife pages that received least 1,000 pageviews accounts for nearly 95% of website traffic. The following is summary of the 348 pages that received at least 1,000 views throughout the year.

To get a sense of the structure of the website, we can look at total of individual pages by topic. Hunting-related content accounts for the most pages, followed by general wildlife pages, fishing, NHESP, and Hunter Education pages. Assessing these same topics based on the quantity of pageviews is also helpful because it shows how often the public is using the content. Fishing related content accounts for 30% of all agency website traffic; trout stocking-related content alone accounts for about 18% of all traffic. Within the hunting category, which received 19% of traffic, deer, turkey and waterfowl hunting content was very heavily trafficked as was “where to hunt”. General wildlife content accounted for 13% of traffic. Within this category, wildlife rehabilitation information was viewed most often, followed by “Wildlife as Pets.” Many “Learn about Wildlife” pages were also very popular—bobcat, coyote, black bear, wild turkey, and turtle received the most traffic. Popular NHESP content included MESA information, regulatory maps, and invasive plants. A single web page, “Gun ownership in Massachusetts,” accounted for 6% of all agency traffic.

MassFishHunt

I&E staff has been heavily engaged in the process for developing a new MassFishHunt online licensing system. I&E staff supported the procurement process by evaluating vendor presentations as they related to improved customer experience, marketing and communications functionality, data, and event management. I&E staff began participating in regular planning meetings with the selected bidder in March and continue to provide feedback on system functionality, automated outreach, user experience, data reporting and visualization, and event management. Activities are focused on preparations for launching the new system on December 1, 2021

Social Media

Nicole McSweeney

Facebook

In FY 2021, MassWildlife continued utilizing its Facebook page (Facebook.com/masswildlife) to engage with its constituents. As the most-used social media platform in the world, Facebook has been a useful tool in helping MassWildlife share information about fish and wildlife issues in the Commonwealth; communicate about research projects; and promote agency events, programs, job openings, and donation opportunities. MassWildlife typically posts to its Facebook page daily with a variety of content. MassWildlife continued to see an increase in followers in FY 2021, closing the year with 55,000 followers (up from 49,000 followers at the close of FY 2020). MassWildlife also uses Facebook to listen to what constituents are saying and engage with the public by responding to their comments and questions. Facebook has become a major avenue for the agency in delivering customer service and answering constituent inquiries.

During the COVID-19 pandemic, the agency has been increasingly reliant on digital communication to engage with the public. MassWildlife staff has begun using livestream Facebook events to connect with constituents. In FY 2021, we hosted a variety of livestream video events, including Family Fishing Tips, Finding Bass in Mass, Fall Trout Fishing Tips, Get Started Birding, Where to Go Hunting, All About Owls, Learn to Ice Fish, and Spring Turkey Hunting Tips.

Instagram

MassWildlife initiated an Instagram account (@mass.wildlife) in September 2018. The number of followers has been steadily growing over time (2,800 in FY 2018; 9,600 in FY 2019; 15,200 in FY 2020, and 18,100 in FY 2021). Instagram is a widely used, fast-growing social media platform, especially among younger audiences. Instagram continues to introduce new features to the platform including

stories, carousels, and IGTV that MassWildlife has been able to use to engage with its constituents.

Newsletter

Nicole McSweeney and Emily Stolarski

Twelve issues of the electronic "MassWildlife Monthly" newsletter were published this fiscal year around the first of each month. Over the past year, the number of newsletter subscribers continued to grow; in July 2020, 81,271 received the newsletter, and by June 2021, that number had risen to 96,023. Sign-up tools like a check box to subscribe on the MassFishHunt online licensing system, links to subscribe on the MassWildlife website and social media, as well as signage at fairs and shows have increased the number of subscribers.

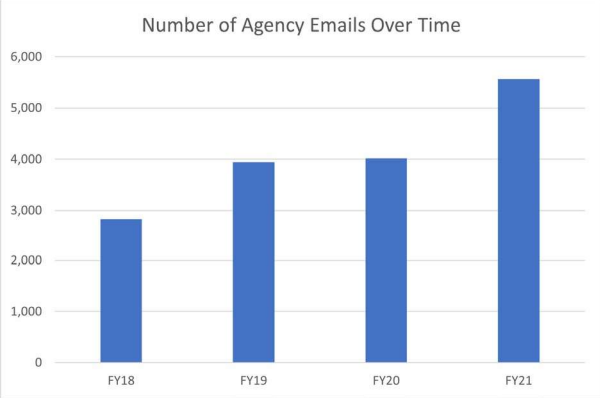
The newsletter is sent using Constant Contact, an email marketing service. Press releases to media and advisories alerting subscribers and license holders of new regulations, special events, public meetings, and hearings were also sent out through Constant Contact. On average, 32.3% of subscribers open the MassWildlife Monthly email, which is considered an "above industry average" open rate. (The average open rate across all industries using Constant Contact is 22.6%.) MassWildlife's average newsletter click rate was 7.8%, which is well above the average of 1.4% for Constant Contact users, indicating that MassWildlife is producing high quality, engaging content that subscribers want to read.

Agency Emails

Bridgett McAlice, Wildlife Program

The number of email messages to the agency rose again in FY 2021 (Figure 30). This year, a total of 5,569 agency email messages were received and managed (4,020 in FY 2020; 3,949 in FY 2019; 2,831 in FY 2018).

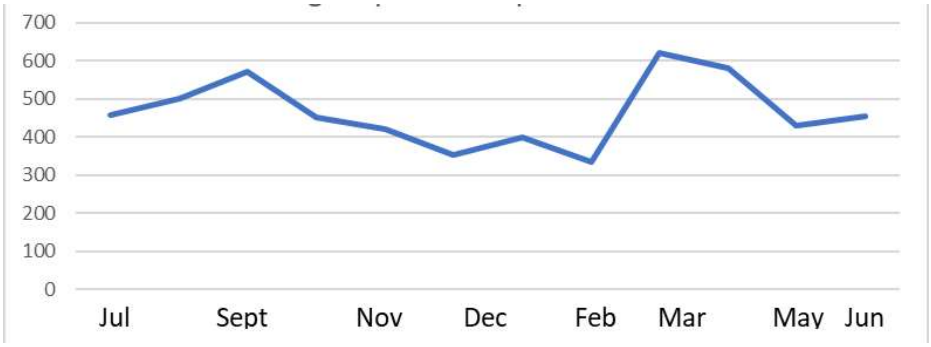
Figure 30. Number of emails received by MassWildlife in the last four fiscal years.



Email Trends

Historically, the number of email inquiries in the summer is stable and low, rising in the early fall and then declining in December and January. A steady rise in numbers in spring is usually related to fishing and young wildlife inquiries. This year, the sharp spike of inquiries in March 2021 (Figure 31) is primarily due to the license fee increase proposal published in the March *MassWildlife Monthly* e-newsletter. Inquiries about fishing license renewals and trout stocking were a distant second and third.

Figure 31. Numbers of agency emails received throughout the fiscal year, by month.



Marketing

Nicole McSweeney

Fishing and Hunting Promotions

MassWildlife works to recruit, retain, and reactivate hunters and anglers through innovative communication techniques. Targeted emails were used to retain and reactivate hunters and anglers throughout the year with license renewal reminders, and emails also delivered important information such as regulation changes, notices about education opportunities, and hunting and fishing tips. Social media also plays an important role in marketing for R3 through regular posts about hunting and fishing opportunities.

Digital Marketing for Fishing

Nicole McSweeney in collaboration with Emily Stolarski and Jody Simoes

Significant efforts to promote fishing through digital marketing were continued in FY 2021. In spring of FY 2021, MassWildlife received a competitive RBFF R3 Grant focused on retention of anglers who fished during 2020. Our challenge this year was to retain record numbers of anglers from 2020. We engaged these anglers with digital ads to keep fishing top of mind and encourage their continued participation with a mix of virtual resources and in-person classes.

- MassWildlife contracted with a local marketing firm, Tomo 360, to manage its spring/summer campaign. MassWildlife coordinated with Tomo 360 to implement a strategy for the campaign, select images, write ad copy, define target audiences, place ads, and evaluate performance.

- From April through August, MassWildlife utilized emails, social media (Facebook and Instagram), Google search, Google display, and YouTube ads targeted at anglers who fished in 2020 encouraging them to continue participating in 2021 and beyond. This "COVID cohort" angler group includes those who were new to fishing in 2020, those who reactivated in 2020, and those who simply renewed in 2020. Our engagement with these groups included simple license reminders, invitations to participate in learn to fish classes virtually and in-person, and ads promoting the benefits of fishing for relaxation, connection with nature, conservation, and time with family and friends. We also promoted resources like how to find fishing locations near home with our new fishing maps, fishing tips for different times of year, and more.

- In FY 2021, we continued to learn more about our customers and the types of content they engage with most, with particular focus on those anglers who participated in 2020. Part of our project this year involved the creation of new landing pages on our website to support our ads. For example, we ran spring trout stocking ads on social media which drove traffic to a special landing page featuring our trout stocking map which is updated daily, as well as tips on how to catch each of the 4 types of trout we stock. This has a long-term benefit that we now have some additional self-learning tools that can be used by anglers over time (including how to use digital maps to find local fishing spots and fall trout/bass fishing tips). We also learned more about how we could best utilize display ads on Google and YouTube for retargeting.

- In addition to driving sales, our ads increased interest in fishing. Social media ads resulted in 3.5 million impressions, reached 674,000 people, and generated 59,000 website clicks. Google search resulted in 168,000 impressions and 72,000 website clicks. Google display and YouTube ads resulted in 2.1 million impressions and 13,000 website clicks.

- We adjusted our fishing education course offerings this summer by selecting locations with high license sales growth in 2020, including urban areas like Lowell, Springfield, Pittsfield, and Worcester. Learn-to-fish courses were advertised to anglers who were new in 2020 and Becoming an Outdoors Woman fishing classes were promoted to female anglers who were new in 2020 through targeted email and social media. These advertisements were an effective way to attract participants in our target audience for retention. We used our new RBFF trailer to

improve the experience at these classes and help students build their skills. This was the first year we used online registration with email collection for these classes, which allows us to stay engaged with these participants over time.

NHESP Fundraising

State Income Tax Donation Promotion

An article about donations through Line 32A ("Endangered Species Conservation") of the state income tax return was included in the February edition of our monthly newsletter, which was sent to over 88,000 subscribers. The tax-form donation was also promoted on social media during the spring.

Donor Relations

To improve engagement with NHESP donors, we sent occasional emails to past donors through the year. For example, we sent an email around Thanksgiving to express our gratitude to donors and promote donations for Giving Tuesday. We also sent an email focused on bat conservation with a donation request around Halloween. A free copy of the special MESA issue of *Massachusetts Wildlife* magazine was sent to donors in October. An accompanying email was also sent at that time.

In addition to MassFishHunt donations, NHESP is now able to accept credit card donations online through the nCourt payment portal. The nCourt site was primarily built for accepting payments related to environmental review, but also has the functionality to accept online donations. To encourage donor loyalty, personalized emails were sent to donors after they made an online donation. This correspondence will help build relationships with donors with the goal of repeat donations. A MassWildlife branded thank you card was created to send personalized thank you messages when a mailing address is provided.

MESA 30 Promotion

CY 2020 marked the 30th anniversary of the implementation of the Massachusetts Endangered Species Act. Promotion of this occasion continued through the first part of FY 2021. Species spotlight articles were included in the monthly e-newsletter, and a special webpage that included information on how to donate and support the program were created. Media advisories about the anniversary were also sent to raise awareness of NHESP and make the public aware of donation opportunities.

Media Relations

Marion Larson

Current media protocol procedures allowing EEA agencies to interact directly with media have strengthened long-established media relationships and resulted in valuable connections with new media contacts. The protocol has also expanded the I&E Chief's ability respond to the media in a timely fashion and to proactively pitch stories to the news media.

For years, MassWildlife has utilized a media service to collect news coverage that mention the Division or other key words. The current media service primarily reports on print newspaper sources. In the past year the service has provided expanded coverage that includes reporting some online outlets and television. With the continuing decline of newspaper subscriptions and the increased consumption of digital media, the I&E Chief has begun investigating media reporting services which supply reports on conventional media outlets (print, radio, television) as well as digital and social media platforms. This will help the agency gain a better understanding of MassWildlife's presence in the broad media universe and inform future outreach communication strategies.

Media Outreach Efforts

Media outreach efforts to promote agency activities, and projects, and relevant wildlife topics included:

- Media Contact List –The media contact list stands at 664 as of the end of FY 2021, up from 606 in FY 2020. The new contacts were added through pro-active contact with media and organic media inquiries.

- Massachusetts Monthly e-newsletter Mailing - All media contacts receive this monthly mailing of articles and link to the agency's website events calendar.

- Media Advisories and collaborative press releases:
  - Endangered Orchid Rediscovered in Bristol County
  - Celebrating 30 Years of Endangered Species Legislation
  - Historic Loon Chick Hatch (with Biodiversity Research Institute)
  - Childs River Restoration Project (with Association to Preserve Cape Cod)
  - Peregrine Chick Banding on Gillis Bridge (with MassDOT)
  - Eagle Banding, multiple locations
  - Three-spine Stickleback Conservation (with Zoo New England)

Media Outreach Results

As in previous years, a variety of media outlets published stories utilizing content from MassWildlife's monthly e-newsletter and Media Advisories. Some media outreach results in inquiries to MassWildlife staff and a unique story is then printed or aired. Some outlets summarize MassWildlife's content in recurring outdoor segments or list events in a calendar section. Some print and digital outlets even reprint MassWildlife articles exactly as they were written. Damage to the media tracking spreadsheet prevents listing the exact tally of FY 2021 media utilization. Some of the most popular topics covered by the media as a result of MassWildlife outreach included license-fee-increase listening sessions and hearings, a historic loon hatch, deer hunting reminders and fall hunting announcements, what to do if you find young wildlife, ice fishing safety, spring trout stocking, fall hunting harvest data, habitat management grant, black bear information, MESA species spotlights, and prescribed fire. At least 30 MassWildlife events including angler education events and habitat site walks, were promoted by media outlets.

Media Inquiries

The majority of media inquiries (Table 44) originate from the press hearing from local readers, scanning local social media postings, reading the *MassWildlife Monthly* e-newsletter or accepting editorial assignments. In FY 2021, of the 256 media inquiries (from 89 different media outlets), 71 were in response to agency communication outreach efforts.

Table 44. Media inquiries by type in FY 2021.

Media Type	Number of Inquiries
Newspaper/magazine	169
Television	48
Radio	32
Digital/blog/podcast	4
News Services	3
Total	**256**

Coverage, Reach, and Value

Newspaper coverage information is derived primarily from the current news clip service vendor. When time permits, staff also conduct internet searches for media coverage that has not been reported by the media service vendor.

- Newspaper coverage mentioning MassWildlife spanned a statewide range of 126 different newspaper outlets, from small community papers to major regional media outlets.
- MassWildlife mentions: 791 (565 print, 226 online), averaging 66 articles per month.
- Impressions: 15,192,848 print, 68,036,887 online
- Article Value: $5,759,138
- Major newspaper outlet coverage highlights: 52 mentions in the Berkshire Eagle (44 print, 8 web), 35 mentions in the Worcester Telegram & Gazette (24 print, 11 web), and 55 mentions in the Boston Globe (23 web, 19 print, 13 Sunday edition).

Photography

Video

MassWildlife was not able to host a film intern this year to assist with video production due to COVID-19, so I&E staff were primarily responsible for creating and editing video content for the Division. Videos document field work, events, and research conducted by staff. These videos have been utilized on social media, on a display in the MassWildlife Field Headquarters lobby, and by the traditional news media. New videos created in FY 2021 included eagle banding, wildlife management areas, habitat management, salmon and trout stocking, and ice safety.

Photo Projects

Troy Gipps, Magazine Editor and Publications Manager has spent a portion of his time on photography for both magazine articles as well as other publications, web, and social media use. Without a full-time photographer, it continues to be on-going challenge to keep up with the demand for fresh images.

FY 2021 Photo Shoots

·American kestrel chicks (at two and three weeks after hatching in a nest box)
·Hinsdale Flats, pheasant hunting and deer sign
·Muzzleloader equipment to support NPR story on Primitive Firearms season
·Duck bait-trapping
·Duck banding
·Neighborhood housing shoot to support Black Bear article.
·Trout Fishing
·Hooded Merganser (nesting)
·American Toad
·Wildflowers in western/central Mass
·Stafford Hill WMA regrowth 1-year after mulching treatment
·Westfield River, Middle and West branches
·Little Brown Bats (maternity colony)
·MESA30+1 Art Installation, Curation250 Gallery & Store, Lowell, MA
·Modest Sphinx Moth, Mount Greylock
·Hunting equipment to support magazine article

Signage And Publications

Wildlife Management Area Signage

Emily Stolarski

With goals of improving visibility of MassWildlife properties, welcoming traditional and new visitors, standardizing signage among Districts, and differentiating Wildlife Management Areas (WMAs) from other state-owned properties like state parks and state forests, work to update property signs continued in FY 2021. At the close of the fiscal year, at least 63 property name signs for 41 properties were produced and many have been installed. A new branded WMA welcome sign was designed to take the place of the collection of small signs that are usually posted at the pedestrian entrances to MassWildlife properties. Five hundred 24 x 31-inch signs were printed in FY 2020 and Districts continued to replace old signage with these new welcome signs in FY 2021.

The next phase of the signage project was to design and install educational kiosk panels at WMAs with high visitation (Figures 32a and 32b). The

Figure 32a. New kiosk at Eugene D. Moran WMA.

Communications Coordinator worked with District Managers and the GIS Coordinator on this project; other staff with knowledge about specific WMAs were also consulted. For each sign, a map of the property was developed showing important features, including WMA boundaries, adjacent open space and roads, habitat types, long-term habitat management operations, parking areas, gates, fishing areas, and boat launches. Narratives were written to give visitors and overview of the property and information about fishing opportunities, hunting opportunities, and wildlife viewing opportunities.

Each kiosk contains a panel outlining WMA rules and regulations.

Kiosk signs were completed for the following WMAs: Birch Hill, Bolton Flats, Burrage Pond, Chalet, Crane Pond, Eugene Moran, Frances Crane, George Darey, Herman Covey, High Ridge, Hinsdale Flats, Martin Burns, Nissitissit River, Old Sandwich Game Farm, Southwick, Stafford Hill, and Wayne MacCallum. New WMA Kiosks were installed at the most popular properties. Property signs are installed along roadways and at WMA entrances.

Figure 32b. New kiosk at Burrage Pond WMA.

Fact Sheets and Related Publications

No new fact sheets were published during this time period.

Massachusetts Wildlife *Magazine*

Troy Gipps

MassWildlife's most visible publication is *Massachusetts Wildlife*, a 40-page, full-color, quarterly magazine with a currently growing base of approximately 20,000 subscribers and a standard publication printing of 25,000 copies, which provides surplus for handouts and promotions at programs, shows, and fairs. Editor and Publications Manager Troy Gipps and I&E Chief Marion Larson, along with other staff, produced four issues of *Massachusetts Wildlife* (Number 3, 2020 – Number 2, 2021) covering a wide variety of fisheries, wildlife, and outdoor-related subjects, including wildlife research, rare and endangered species, general nature interest, and how-to articles for the hunter, angler, and nature observer.

Continuing a long tradition of producing articles that will be useful as references on particular subjects for

many years to come, this year's feature articles included:

Issue Number 3, 2020, Special Issue: MESA 30th Anniversary

Editorial: Three Decades of MESA by Mark S. Tisa (Staff)
Looking Back, Moving Forward by Everose Schluter, Thomas French (Staff)
Listing a Species: Why and How? by Michael W. Nelson (Staff)
Peregrine Pride by David Paulson, Andrew Vitz (Staff)
Flexing Freshwater Mussels by Peter Hazelton (Staff)
Tight-Knit Grasslands by Karro Frost, Robert Wernerehl (Staff)
By the Numbers by Sarah Maier, Cailtyn Sawicki (Staff)
Landscape-Scale Conservation by Michael W. Nelson, Chris Buelow (Staff)
Wood Turtle Partnerships by Michael T. Jones (Staff)
Demystifying the Eastern Spadefoot by Jacob E. Kubel (Staff)
How You Can Help! (Heritage Fund Ad Text) (Staff)

Issue Number 4, 2020:

Ice Fishing for Beginners by Jim Lagacy (Staff)
A Falcon Named Feona by William F. Johnston, Jr.
Pheasant Quest: Trials, Tribulations, and Triumphs of a Dogless Hunter by Troy Gipps (Staff)

Issue Number 1, 2021:

Massachusetts is Bear Country by Jim Behnke
Eyes in the Wild by Sally Naser
Waking Up Your Walk by Greta Phinney
Heart of the Hunt by Emma Ellsworth

Issue Number 2, 2021:

Chaser Racers by Liz Olson
Endangered Species Art by Troy Gipps (Staff) and Sophy Tuttle (Artist)
The Resurgent Hoodie by H W Heusmann (Staff)
Becoming a Hunter on a Budget by Troy Gipps (Staff)

Magazine Subscription Promotion Efforts

MassWildlife contracts with a vendor (Infonet) for magazine subscription fulfillment and promotion. The beginning of the fiscal year showed 19,578 subscribers for the magazine; by June 30, 2021, there were 21,558 magazine subscribers. One-year subscriptions account for 64% of the total, 36% of subscriptions are for two or more years. In FY 2021, a total of 18,153 new, renewal, and nominee subscriptions were sold.

Magazine Promotion Efforts by Infonet

During FY 2021, 18,674 regular renewal mailings were sent out to 6,373 subscribers whose subscriptions were about to expire. The total cost of these mailings was $6,535 and they resulted in revenue of $23,518 from 2,418 renewals. In addition, 3,047 renewals came in from the Nominee Renewal Promotion mailing done in FY 2020, with revenue in FY 2021 of $20,107. There was no Nominee Renewal Promotion mailed in FY 2021.

Any person who sent in a 1-year paid subscription on their own (Not a "Bill Me" sign up) is mailed an acknowledgement, thanking them for the subscription. The subscriber is invited to "step up" to receive a 2-year subscription by paying the difference in cost ($6 for 1 year versus $10 for 2 years). In FY 2021, 6,604 cash acknowledgements were sent out at a cost of $2,311. There were 1,991 1-year subscribers who stepped up, resulting in revenue of $3,940.

A renewal gift subscription promotion mailing of 7,392 pieces to 2,450 donors who have given gifts, at a cost of $2,587 resulted in revenue of $26,046. A smaller promotional mailing at a cost of $2,564 went out to 7,327 subscribers who did not have a history of giving gift subscriptions. The results were 724 orders for $4,344 in revenue.

Other Magazine Outreach/Distribution Efforts

Magazine subscriptions are available for purchase through the MassFishHunt licensing system, an option that became available in FY18. A guest account, for those people who are not purchasing licenses offers subscribers the convenience of purchasing with a credit card. During FY 2021, 290 194 one-year subscriptions and 1,347 1,081 two-year subscriptions were sold through the MassFishHunt system, an increase of 96 (one-year) and 266 (two-year) from FY 2020. This represents 9% of the total number of subscriptions that were sold in FY 2021.

Magazines at Meetings, Conferences, Exhibits, Fairs, and Education Workshops

Copies of back issues of magazines are made available at a variety of events where MassWildlife may have a display table or present a session or other public event. Magazines are distributed at all Project WILD teacher workshops and wildlife education programs conducted by the Education Coordinator. The Hunter Education program began distributing magazines through the Hunter Education courses beginning in FY 2020, an effort that typically reaches about 5,000 students annually.

The Guide to Hunting, Freshwater Fishing, and Trapping

The 2021 Guide to Hunting, Freshwater Fishing and Trapping was again produced in cooperation with J. F. Griffin Publishing Co., as part of a multi-year contract with this publisher. The full-color, glossy-stock, 56-page booklet includes a digest presentation of the fishing- and hunting-related laws and regulations and other information of interest to sportsmen. The Publications Manager and I&E Chief contributed much of their respective time to the production of the Guide. This year the Publications Manager worked with the vendor to continuing using Adobe InCopy to edit the initial two passes in a collaborative manner with the vendor prior to the multiple passes of Adobe PDFs that are used for the remaining balance of the editing process. MassWildlife also obtained a complete copy of the Adobe InDesign file and all dependent files after the publication of the 2020 Guide. There were 140,000 copies printed, representing a 21.25% drop in copies from last year (177,800) due to leftovers at the end of the year, the result of COVID-19 pandemic demand reduction for printed copies of the Guide. This is the sixth consecutive year that Guide printing numbers were reduced.

Outreach Events

MassWildlife staff interacted with the public at a variety of outreach events during this fiscal year. Note that FY 2021 outreach events continued to be impacted by the COVID-19 pandemic; some in-person events were canceled, and many were moved to an online format. In addition to exhibits and events directly organized by MassWildlife, MassWildlife's I&E Section coordinated with other agency staff on outreach events by providing support with event promotion and registration; helping to staff the agency's display at events; and developing targeted display and presentation materials such as images or other graphics for use in presentations, posters, and handouts.

Exhibits, Events, and Displays

MassWildlife did not participate with displays or booths at any fairs or tradeshows in FY 2021 due to the COVID-19 pandemic. MassWildlife hosted its Freshwater Sportfishing Awards Ceremony virtually during the spring of 2021, to honor anglers who caught the largest freshwater fish during the 2020 calendar year. MassWildlife held its annual Earth Week Trout Stocking event at Jamaica Pond in April and EEA Secretary Theoharides attended; due to COVID-19, attendance was restricted.

Informational Public Presentations

MassWildlife staff gave informational presentations on a variety of topics in FY 2021, using both in-person and virtual formats, including: Meet and Greet with MassWildlife and the New England Backcountry Hunters and Anglers (virtual meeting hosted by NEBHA); black bears in Northampton (virtual presentation hosted by City of Northampton); Restoring Fire Influenced Landscaped in Worcester County (webinar hosted by Athol Bird and Nature Club); MassWildlife and MassDOT: A Model for Early Coordination and Enhanced Project Planning (webinar hosted by MassDOT); Carbon Storage, Climate Change, and Species Conservation Efforts by MassWildlife (webinar hosted by the CounterAct Climate Change Project); Learn about Moose, Bears, Roads, and Land Protection (webinar hosted by the Nature Conservancy); Wildlife Success Stories: Wood Duck (online learning session hosted by Mass Audubon); Bobcats in Massachusetts (webinar hosted by Harwich Conservation Trust); Eastern Box Turtle (webinar hosted by Harwich Conservation Trust); Wildlife Success Stories: Peregrine Falcon and American Kestrel (online learning session hosted by Mass Audubon); Rare Species Conservation Panel (hosted by Andover Conservation Commission); Bald Eagles and Moths at the Cape Cod Natural History Conference (online presentation hosted by Mass Audubon); Pollinator Presentation (hosted by Massachusetts Dept. of

Energy Resources Leading by Example Council Annual Meeting); Reptile Ecology (online presentation at the Wildlife Rehabilitators Association of Massachusetts Annual Meeting); White-tailed Deer and the Future of our Forests (virtual presentation hosted by the Massachusetts Land Trust Coalition and the Rhode Island Land Trust Council); Managing Wildlife in the Third Most Densely Populated State (online presentation hosted by Tufts University Environmental Studies Program); Managing Wildlife in the Third Most Densely Populated State (online presentation hosted by Clarks University); Fish Health, Cyanobacteria, and Nutrient Management (online presentation hosted by City of Worcester and Indian Lake Watershed Association); Biology of Fly Fishing (online presentation hosted by City of Worcester); Freshwater Mussel Restoration: Five Years after Millie Turner Dam Removal (webinar series hosted by Nashua River Watershed Association); Some Like it Hot, Trout Do Not (webinar series hosted by Nashua River Watershed Association); History of Peregrine Falcon Restoration Talk and The Art and Science of Banding Wild Falcons (two presentations as part of virtual fall conference hosted by UMass/Amherst); Peregrine Falcon Banding in Springfield (livestreamed in collaboration with Monarch Place); Public peregrine falcon and bald eagle bandings (several, statewide); Turtle Training with Eversource in Agawam; Blanding's Turtle Talk (virtual speaker series hosted by Harvard Conservation trust); and, Connecting Art and Science Talk about Endangered Species (virtual presentation hosted by Lowell Cultural Council).

Land and Habitat Events

MassWildlife staff led habitat site walks at Stafford Hill WMA in Cheshire; Montague Plains WMA in Montague; Muddy Brook WMA in Hardwick; Herman Covey WMA in Belchertown; Tully Mountain WMA in Orange; Quaboag WMA in Brookfield; and Southeast Pine Barrens WMA in Carver. MassWildlife staff also participated in a joint tour of Young Forest Habitat with the Franklin Land Trust at its Guyette Farm Conservation Area in Plainfield. A prescribed fire demonstration was jointly hosted by the Department of Fish and Game and MassWildlife at Birch Hill WMA, during which the agency's habitat management program was showcased for the Governor's Office and Secretary of Energy and Environmental Affairs.

Professional Meetings and Conferences

MassWildlife hosted and/or participated in many professional meetings, workshops, and conferences throughout the year. Examples include the Northeast Bat Working Group Meeting; Recreational Boating and Fishing Foundation State Marketing Workshop; Northeast Association of Fish and Wildlife Agencies (NEAFWA) Annual Meeting; NEAFWA R3 Committee meetings; North American Wildlife and Natural Resources Conference; Northeast Conservation Information and Education meetings; Mass.gov user group meetings; Massachusetts Virtual Digital Government Summit; DFG Wildlife Habitat Forestry and Ruffed Grouse Society/American Woodcock Society Partnership meetings; and the Council to Advance Hunting and Shooting Sports 2021 Virtual R3 Forum.

Wildlife Conservation Education Programs

Pam Landry

Due to the COVID-19 pandemic, in-person education programs were cancelled during FY 2021. Numbers in this report reflect virtual programs offered during the fiscal year.

Project WILD in Massachusetts

Project WILD is one of the most widely used wildlife-focused conservation and environmental education programs among educators of students in kindergarten through high school. Project WILD addresses the need for human beings to develop as responsible citizens of our planet and fosters responsible actions toward wildlife and related natural resources. Using balanced curriculum materials and professional training workshops, Project WILD accomplishes its goal of developing awareness, knowledge, skills, and commitment. In Massachusetts, trained volunteer facilitators who are educators offer workshops for other educators of all kinds throughout the state. Project WILD is sponsored by MassWildlife and the Association of Fish and Wildlife Agencies, with support from the Massachusetts Sportsmen's Council.

Project WILD and Aquatic WILD (K-12)

These workshops are targeted for educators working with children from grades K-12. The Project WILD activities are terrestrial based while the Aquatic WILD curriculum focuses on aquatic environments and topics. There are strong connections in these curricula to Science, Technology, Engineering, and Math (STEM). Twenty Project WILD facilitators attended the virtual facilitator gathering. Christine Schadler gave a presentation on The Real Eastern Coyote (No Alternative Facts!)

Growing Up WILD: Exploring Nature with Young Children

This early-childhood (ages 3-7 years) education program for educators, caregivers, teachers, and families builds on children's sense of wonder about nature and invites them to explore wildlife and the world around them through a wide range of activities and experiences. Growing Up WILD (GUW) is a tool for helping fish and wildlife agencies meet their conservation goals through recognizing children start developing attitudes towards wildlife and nature at an early age and providing knowledge and skills to early childhood educators so they may teach about nature. GUW provides suggestions for outdoor nature-based recreation, conservation suggestions for each activity, and activities that families can do together. This lays a foundation for acquiring increased scientific knowledge and problem-solving skills. There is a continued strong focus on connecting Growing Up WILD to STEM. In FY 2021, one Growing Up WILD workshop was offered online as part of a college course curriculum. No in-person workshops were offered.

The North American Conservation Education Strategy (CE Strategy)

An array of tools developed by state fish and wildlife agencies support conservation educators who offer fish and wildlife-based programs that guide students in grades K-12 on their way to becoming involved, responsible, conservation minded citizens. The CE Strategy delivers unified research-based Core Concepts and messages about fish and wildlife conservation, translated into K-12 academic standards to shape students' environmental literacy, stewardship, and outdoor skills. Resources included in the toolkit included: landscape investigation, schoolyard biodiversity, field investigation, fostering outdoor observation skills, using technology in field investigations, applying systems thinking, and much more. Material was distributed to educators when applicable or they could download resources at www.fishwildlife.org (focus area, conservation education, tool kit).

Junior Duck Stamp Program (JDS): Connecting Youth with Nature through Science and Art

JDS provides a curriculum for students, educators, home school, and non-formal groups designed to spark youth interest in habitat conservation through science, art, math, and technology, made available to student artists and educators upon request. In Massachusetts, the Junior Duck Stamp Program is sponsored by MassWildlife and U.S. Fish and Wildlife Service, with support from the Massachusetts Sportsmen's Council.

Students in grades K-12 from across the Commonwealth submitted 134 pieces of artwork to this "Conservation through the Arts" program. Entries were received from public, private, and home-schooled students; individuals; and private art studios. The judging took place this year in two segments. The first segment was in-person by agency staff and the second segment was virtual via Zoom with a panel of three professional wildlife artists.

An acrylic painting of American Black Ducks by Caleb Clemons, a homeschool student from Hanson, was selected as Best of Show and represented Massachusetts at the National Competition. The state awards ceremony was cancelled due to the pandemic. Massachusetts was also going to be the host for the National Competition at MassWildlife's Field Headquarters, but it was held virtually instead. The US Fish and Wildlife Service plans to return to Massachusetts next spring to hold the National FDS Competition. The statewide traveling exhibit, comprised of a combination of the top 100 pieces of art, was also cancelled for FY 2021.

General Wildlife Education Programs

General wildlife education programs presented by the Education Coordinator focus on groups of educators, students, and youth gatherings. In-person programs were cancelled for FY 2021.

Massachusetts Envirothon

MassWildlife's continued involvement in this natural resource program, which reaches over 500 urban and rural high school students representing over 50 communities annually, continues through the efforts of Education Coordinator Pam Landry. She hosts teacher and student workshops, serves on the education subcommittee of the steering committee, prepares the wildlife exam, provides wildlife-related information to the Current Issue question, and attends the competition. The Chief attended quarterly meetings of the Massachusetts Envirothon Council whose purpose is to provide support for the event operation in coordination with the Mass. Commission on Soil, Water and Related Resources. Significant modifications were necessary to transition the traditionally in-person Envirothon to a virtual event for 2021. Ten teams participated in this year's challenge.

Massachusetts Junior Conservation Camp

A Camp organizing-board vote amid COVID-19 concerns in early July 2020 and then subsequent state orders prohibiting overnight camp operations across the state in 2020 cancelled the August Conservation Camp two-week session at Scout Camp Moses in Russell. The I&E Chief called 65 camper's families after the holiday weekend and asked if they would like to keep their spot for August 2021. Most campers said yes. Most camp club sponsors agreed to hold camper slots for campers in the following year. This was a difficult scenario, but most camper families were understanding of the situation. Camp organizing board meetings were held via Zoom and in the spring of 2021 plans for holding camp in August 2021 moved forward. The format of Boat Safety changed to a hybrid model, with campers taking the course online prior to camp and the plans are for campers to participate in a water-based orientation in August. Normally the Boat Safety Class requires a fee, but the OLE Vendor agreed to waive the fee for this session and OLE agreed to offer more water skills at camp. Hunter Education held Zoom classes and for those campers without internet access were provided homework materials to complete before camp. An in-person field day was planned to be held for campers on site. As of the end of June 2021, it is presumed camp will be taking place and with adherence to any relevant state and local COVID-19 guidelines and protocols.

Northeast Wildlife Trackers Conference

The Northeast Wildlife Trackers are a group of enthusiasts who share a passion for collaborative exchanges on all aspects of wildlife tracking in the Northeastern United States. Their mission is to convene, network, motivate, and inspire wildlife trackers across the Northeast. As a representative on the conference planning committee, the Education Coordinator has been hosting the annual conference at DFW Field Headquarters for the past four years. The pandemic forced a transition from in-person to a virtual week-long conference that reached an international audience.

Teaching with Trout

Conducted by the Coldwater Fisheries Project Leader and the Fish Culturist at Roger Reed Hatchery, Teaching with Trout is a popular school-aged education program. See the Fisheries Report, page 29, for program details in FY 2021.

Hunting and Fishing Skills Programs

Hunting and Shooting Skills Programs

Astrid Huseby

National Archery in the Schools Program in Massachusetts

This program offers international-style target archery training with a nationally standardized education package in cooperation with state fish and wildlife agencies across the country. The National Archery in the Schools Program and the Archery Trade Association have partnered with MassWildlife and the Massachusetts Outdoor Heritage Foundation to promote student education and lifelong interest and participation in the sport of archery in Massachusetts.

The National Archery in the Schools Program (NASP) is a part of the in-school curriculum, generally a physical education class. The NASP curriculum is designed for students in grades 4-12, and includes social studies, mathematics, and physical education. This provides all students with an opportunity to try archery, including many who may not otherwise show an interest in the sport. MassWildlife provides a 1-day Basic Archery Instructor training for physical

education teachers within schools/districts that plan to participate in NASP. In addition, MassWildlife coordinates the ordering and delivery of program equipment for the schools. To receive training, schools must obtain the NASP equipment kit, at a cost of about $3,000. The kit includes 11 Matthew Genesis bows, 122 arrows, 5 targets, 1 arrow curtain, and 1 tool/repair kit.

In FY 2021, Basic Archery Instructor trainings and the loaner kit were suspended in March 2020 due to COVID-19. The loaner kit remained suspended until April 2021, and the Basic Archery Instructor trainings remained suspended until August 2021. Four schools borrowed the NASP loaner kit April – June 2021. While no trainings were held in this fiscal year, trainings have been scheduled for the next fiscal year. While many schools were not able to offer NASP during the 2020-2021 school year, 3,583 students across Massachusetts participated in NASP as part of their in-school curriculum.

Young Adult Pheasant Program

The Massachusetts Young Adult Pheasant Hunt Program was developed by MassWildlife to provide an opportunity for 12-17-year-old Hunter Education graduates to practice firearms safety, develop shooting skills, and participate in a special pheasant hunt with an experienced pheasant hunter in a friendly environment. The program is run by participating local sportsmen's clubs. This program is a comprehensive, three-part recreational program. Shooting instruction and practice take place during the summer or early fall; the pre-hunt workshop is held a week or two before the youth pheasant hunt; the actual hunt is scheduled by the individual clubs for any one of the six Saturdays prior to the mid-October start of the regular pheasant hunting season.

The Young Adult Pheasant Program was run at four different clubs across the state in FY 2021. A total of 46 youth participated in the event.

Youth Turkey Hunt Program

This program was developed by MassWildlife in cooperation with the Massachusetts Chapter of the National Wild Turkey Federation (NWTF) to provide an opportunity for 12-17-year-old Hunter Education graduates to practice firearms safety and turkey-hunting techniques, develop shooting skills, and participate in a special 1-day turkey hunt under the one-on-one guidance of an experienced turkey hunter. The Recruitment and Retention Specialist coordinates the Youth Turkey Hunt.

The program is offered by participating local sportsmen's clubs in partnership with local chapters of the NWTF. It is a comprehensive, three-part outdoor education program designed to give young hunters an opportunity to acquire some of the specialized skills associated with the activity. Hunter safety is emphasized to help build the confidence of the inexperienced hunters so that they will feel comfortable when in the field.

The Youth Turkey Hunt Program takes place in the spring. Shooting instruction, practice, and the pre-hunt workshop take place two or three weeks prior to the day of the hunt. The actual turkey hunt takes place on the Saturday prior to the last Monday in April.

The youth turkey program format was altered during FY 2021 due to COVID-19 which included an online seminar followed by either an in-person or online field day. To make the online class possible, an online field day webpage was created with MassWildlife and NWTF content including written content and videos. In total, 5 clubs held seminars and 105 participants went through the program.

Learn to Hunt Program

The Learn to Hunt program, which is geared to target new hunter education graduates who need more information before they were comfortable hunting for a particular species, held a combination of virtual and hybrid classes in FY 2021. Below is a summer of the learn to hunt classes that were offered:

- Deer Hunting 101 online course: 24 participants
- Scouting for Deer online course: 50+ participants
- Where to Hunt in Massachusetts Facebook Live course: 50+ participants
- Turkey Calling 101 online course: 104 participants registered for the calling class
- Turkey Hunting 101 Facebook Live course: During the live broadcast, we had a peak of 76 live viewers, and about 65 viewers stayed to

watch through the full hour. Because this video is now posted as a resource that audiences can watch at any time, it has received additional views since posting, including approximately 60 people who have watched the full-hour video.

- Turkey Hunting 101 hybrid course: Included a 2-hour Zoom class and a 3-hour field day.
    - 51 participants attended the Zoom class
    - 17 participants attended the in-person class

Becoming an Outdoors Woman Program

Becoming an Outdoorswoman (BOW) is a program designed for women ages 18 and older, providing basic outdoor skills sessions.

Two BOW events were held in FY 2021, the mentored deer program, which included two online classes, an in-person field day, and a mentored hunt, and a hybrid turkey seminar that included an online class followed by an in-person field day. 16 women participated in the deer program.

Angler Education Program

Jim Lagacy

The Angler Education Program is the main component of the Aquatic Resource Education Program. The other component is Aquatic Project WILD, overseen by the Wildlife Education Specialist. The Angler Education Program has several components designed to introduce people to fishing and the outdoors, including family fishing festivals, fishing clinics, fishing classes, and our own Fishing Tackle Loaner Program. Due to the COVID-19 pandemic our numbers for FY 2021 were extremely reduced as we did not conduct any in-person public programs from July 2020 through January 2021.

The Angler Education Program operates with the cooperation of trained volunteers. All instructors complete a volunteer application and undergo a background check through the Criminal Offender Record Information (CORI) system. Volunteers are given pertinent information about MassWildlife and the Angler Education Program, and then begin apprenticing at program events. Instructors are recruited by press releases, our many fishing programs, fairs, sportsmen's shows, positive publicity, and word of mouth. The volunteer corps is 97 volunteer instructors who were approximately 20% active during FY 2021.

Development of Virtual and Online Fishing Content

The COVID-19 pandemic forced us all to approach almost all elements of the program differently to find a way to deliver quality fishing educational programming to the public in a safe, effective manner. We developed and offered virtual programming utilizing platforms such as Zoom, Facebook Live, and WebEx. We offered 1- and 2-hour "learn to fish" programs throughout the year covering both beginner and advanced fishing themes. We will no doubt continue to offer these programs in some capacity post-pandemic as these appear to be useful tools we can employ in certain circumstances. We also improved our online learning content by filming a few short segments on basic fishing techniques, as well as a longer 90-minute Beginners Fishing tutorial. As with the virtual programming, we will continue to add to these in the coming years. In FY 2021, 31 virtual fishing programs were attended by approximately 1,061 viewers.

Family Fishing Festivals

Weekend family fishing events are set up as an introduction to fishing, where we make available rod-and-reel combinations, terminal tackle, and bait at no charge, and when the manpower allows, instruction in casting, fish identification, knot tying, baiting, cleaning, and filleting. For FY 2021, no family fishing festivals held due to the COVID-19 pandemic

Family Fishing Clinics

Fishing clinics, while short in duration, are a very popular program component. These clinics are typically co-sponsored by town recreation departments, sporting clubs, Boy or Girl Scouts groups, summer camps, and or other state or federal agencies. Clinics are generally two to three hours, involving a short lecture on fish, fishing, safety, and ethics, followed by casting instruction and a healthy dose of fishing. Fishing educational handouts are generally provided, and clinic participation is kept small enough to allow the instructors to work with participants one-on-one. No in-person fishing clinics were run from July 1st of 2020 thru January 31st of 2021 due to the COVID-19 Pandemic. We started offering in-person fishing clinics in February of this

year and on throughout the end of the fiscal year in June. These were kept on the smaller side and were run under COVID-19 guidelines, where face masks and social distancing were required, from February thru May, and then eased up a bit into June as guidance allowed. In FY 2021, 26 in-person outside fishing clinics were given February through June, with 557 participants.

Fishing Classes

In past years, a small handful of fishing classes were conducted (12 to 15), and typically cover specialty fishing skills like fly tying, adult-only "learn to fish" classes, and a few school-based fishing classes. However, due to the COVID-19 pandemic, we were unable to offer indoor, in-person programming. Instead, staff created and conducted two Adult Hybrid Fishing Classes, where the first two-hour session was virtual using Zoom, and the second two-hour session was outside in-person. MassWildlife had 9 attendees at the in-person sessions and 80 participants in two virtual Learn to Fish presentations.

Fishing Tackle Loaner Program

The Angler Education Program keeps and maintains fishing equipment onsite for loan to various groups throughout the state. Loaner equipment includes basic spin casting rods, spinning rods, saltwater rods, as well as fly rods and fly-tying equipment and even ice fishing gear. Equipment was loaned to various groups and agencies, including the DCR, the U.S. Army Corp of Engineers, the USFWS, various sportsmen's clubs, scout troops, church groups, and private citizens. Along with the fishing gear, the necessary terminal tackle and various fishing education program handouts are also provided. In FY 2021, 26 groups received 592 pieces of loaner equipment, and 41 rods were loaned to individuals in summer, for a total of 633 pieces of gear loaned.

Cooperative Programs

Trout-stocking programs are performed mostly in the spring (April and May) with various school groups around the state. For FY 2021, there were no trout stocking programs due to the COVID-19 pandemic.

Information and Education Staff

Marion E. Larson, Chief of Information and Education
Troy Gipps, Magazine Editor and Publications Manager
Astrid Huseby, R3 Coordinator
Jim Lagacy, Angler Education Coordinator
Pam Landry, Education Coordinator
Nicole McSweeney, Outreach and Marketing Manager
Caitlin Sawicki, Outreach Specialist (*partial year*)
Jody Simoes, Human Dimensions Project Leader
Emily Stolarski, Communications Coordinator

6 The Hunter Education Program

Susan Langlois, Hunter Education Program Administrator

It is the mission of the Massachusetts Hunter Education Program to protect the lives and safety of the public, promote the wise management and ethical use of our wildlife resource, and encourage a greater appreciation of the environment through education.

The Hunter Education Program is a public education effort providing instruction in the safe handling of firearms and other outdoor activities related to hunting and firearm use. The Massachusetts Hunter Education Program evolved from a survey conducted in 1954 indicating that 75% of Massachusetts hunting accidents officially involved minors. In that same year, the State Legislature enacted a law establishing a Hunter Education Program providing instruction in basic hunter education. The program is administered by the Massachusetts Division of Fisheries and Wildlife, and courses are taught by MassWildlife staff and certified volunteer instructors. Courses are open to everyone, and no one shall be denied access to the course because of age, sex, race, color, religion, or country origin. All courses are offered free of charge.

Courses

In FY 2021, one of the six disciplines was offered. We were able to schedule and present Basic Hunter Education, which is mandated for people to qualify for a first-ever hunting license. The Hunter Education program was greatly affected by the COVID-19 pandemic. To provide a pathway for new hunters during the ongoing health emergency, the Hunter Education program developed and offered a modified format for Basic Hunter Education courses that blends online learning with a half-day, socially distanced field day session. This revised instructional model was offered exclusively at the end of FY 2020 and in FY 2021. We also did not have access to our traditional classroom locations in FY 2021. Initial sessions were offered at one central location, at the MassWildlife Field Headquarters. We extended offerings to two more locations in FY 2021 that were managed by MassWildlife staff. A total of 49 courses were successfully offered. A total of 1, 613 students participated in the Hunter Education Program and participation levels are much lower than the five-year average of 4,055 students. The following is a summary of course offerings and statistics on student participation in FY 2021.

Basic Hunter Education

Starting January 1, 2007, anyone 18 years of age or older who wishes to hunt for any bird or mammal in the Commonwealth must successfully complete a basic hunter education course, unless such person has held a license to hunt before January 1, 2007. The basic hunter education course is a standardized curriculum that provides information on the safe handling and storage of hunting arms and ammunition, hunting laws and ethics, wildlife identification, wildlife management, care and handling of game, basic survival skills, and first aid. The Certificate of Completion issued to graduates is recognized in all U.S. states, Canada, and Mexico. Forty-nine courses were offered in FY 2021. A total of 1,613 students participated and 1,452 successfully completed the course. Students are asked to provide information on age and gender. Of those responding, 283 students were minors (under 18 years of age), and 256 of the respondents were female.

Trapper Education

The Trapper Education curriculum standards were revised in May 2018 by the IHEA in cooperation with the Association of Fish and Wildlife Agencies. Trapper Education is mandatory in Massachusetts for Problem Animal Control (PAC) agents and first-time trappers to apply for a trap registration certificate. This course includes both classroom work and field training and focuses on the best

management practices for trapping. Students learn the proper use of traps, the identification of furbearing animals and their habitats, trapping laws, ethical trapper behavior with an emphasis on the responsible treatment of animals and landowner relations. This course was suspended in FY 2021 due to the COVID-19 pandemic.

Bow Hunter Education

The Bowhunter education curriculum standards were revised in May 2017 by the IHEA in cooperation with the National Bowhunter Education Foundation. This course is designed for both the experienced and novice hunter. Course topics include the selection of equipment, safety, ethics, bow-hunting methods, and care and handling of game. Bowhunter Education is not required in Massachusetts and a Bowhunter Education certificate does not qualify a person to purchase a Massachusetts Hunting or Sporting license. A Massachusetts Bowhunter Education Certificate is accepted, however, in other jurisdictions that do mandate the successful completion of the course. This course was suspended in FY 2021 due to the COVID-19 pandemic.

Waterfowl Identification and Hunting

This course teaches the identification of migratory waterfowl. It emphasizes the importance of distinguishing waterfowl in flight and includes identifying fall and winter plumage patterns and the size, shape, and flight characteristics of the birds. This course also covers hunting safely from boats and blinds and waterfowl hunting techniques. This course was suspended in FY 2021 *due to the COVID-19 pandemic.*

Black Powder (Muzzleloader) Education

This course was suspended in 2016 for review and revision. It was revised and tested in FY2018. The course includes the identification and selection of hunting equipment, state laws and regulations regarding muzzleloader hunting and the safe handling of muzzleloaders. A live-fire segment has also been added. Two pilot courses were conducted in FY18. Adjustments will be made and additional pilot courses will be conducted. This course was not offered in FY 2021 due to the COVID-19 pandemic.

Map, Compass & Survival

This 1-day course includes both classroom work and field training. Topics include instruction on the use of a compass and topographical map for land navigation as well as wilderness survival. This course was suspended in FY 2021 due to the COVID-19 pandemic.

Shooting Range Development and Enhancement

It is MassWildlife's objective to provide access to the public to range facilities for hunter education and shooting sports purposes by assisting shooting club range development and improvement activities. MassWildlife seeks to amend participation in this funding opportunity by collaborating with third-party entities to increase shooting opportunities and offer advanced (skill-based) hunter education courses for the public across Massachusetts.

Hunter Education Program Staff

Susan Langlois, Program Administrator
Kim Basso, Administrative Assistant
Timothy Bradbury, Hunter Education Specialist
Steve Foster, Program Logistics
Jesse St. Andre, Hunter Education Specialist

7 The District Reports

Trina Moruzzi, Assistant Director of Operations
Patricia Huckery, Northeast Wildlife District Supervisor
Jason Zimmer, Southeast Wildlife District Supervisor
Todd Olanyk, Central Wildlife District Supervisor
Joseph Rogers, Connecticut Valley Wildlife District Supervisor
Andrew Madden, Western Wildlife District Supervisor

Overview

Trina Moruzzi

Most people who interact with MassWildlife do so through one of the agency's five Wildlife Districts. The District offices are this agency's field stations, administering wildlife lands, conducting on-site management, enhancing recreational opportunities, and addressing the wildlife issues pertinent to their regions. Offices remained closed, however operations within the districts have continued, with staff performing core district operations while still protecting their health and safety during the COVID-19 pandemic. The tremendous staff dedication to the agency has helped to maintain and carry out core district functions as well as serve the needs of the agency's constituents during this pandemic.

District personnel sell hunting, fishing, and trapping licenses; stamps; and selected permits as well as distribute the Guide to Massachusetts Hunting, Freshwater Fishing, and Trapping and other materials related to the sale of hunting, fishing, and trapping licenses to vendors throughout their District. These District functions changed with the COVID-19 pandemic; however, staff were still able to address constituent requests and questions relating to the district as well as ensure that constituents could obtain licenses online.

District Managers are the agency's point persons, spending many hours with civic and conservation groups, including sportsmen's clubs and county leagues, and responding to inquiries from interested citizens. They provide technical advice on wildlife matters, particularly on matters pertaining to the handling of nuisance animals. In this context, District staff do a lot of education and deal with a large number of bear complaints, deer damage complaints, questions about coyotes, and other issues dealing with the impact of wildlife on human activities, and vice versa. They also assist officers from the Office of Law Enforcement (OLE) to ensure public adherence to wildlife laws and regulations.

District staff participate in a wide variety of survey and monitoring programs initiated by MassWildlife's biological staff based at the Westborough Field Headquarters (FHQ); see the individual section reports for the status of these projects. Among the survey projects conducted by District staff were the black bear habitat study, assisting in a bear hair snare study, rare turtle surveys, white-tailed deer browse surveys and pellet counts, a bald eagle breeding survey, whip-poor-will surveys, New England cottontail surveys, and stream and lake surveys. District personnel also conduct census counts of wild turkey, woodcock, ruffed grouse, and bobwhite quail.

District staff members continued to enhance recreational opportunities throughout the state by stocking Brown Trout, Eastern Brook Trout, Rainbow Trout, Tiger Trout, and brood stock Salmon into waters scheduled to receive them during the COVID-19 pandemic. Prior to releasing trout, they monitor the water quality of the designated lakes and streams. These operations were also affected by the COVID-19 pandemic, but staff continued to carry out their operations to efficiently get the fish out of the hatcheries to stock throughout the state while still maintaining staff safety.

Districts also provide additional upland gamebird hunting opportunities by releasing ring-necked pheasants on WMAs and in open covers (i.e., suitable habitat on public land). Due to the COVID-19 pandemic, staff did not operate check stations for safety reasons and because MassWildlife offices remained closed after the COVID-19 outbreak.

Land stewardship is an important MassWildlife priority and has become a large part of District activities. District staff assist the wildlife land acquisition effort to prioritize lands to be acquired by locating titles, landowners, and boundaries, and making other arrangements necessary for the acquisition of lands for wildlife. Stewardship biologists are responsible for communicating with members of the public, abutters, landowners, and other stakeholders on stewardship activities, including monitoring lands under Conservation Restrictions (CR). They also deal with mitigation of encroachments by adjacent landowners on our WMAs. Staff have also been assisting the Habitat program by participating in prescribed burns as part of the Biodiversity Initiative on several WMAs throughout the state. They also participate in habitat restoration and management work on the WMAs in their region by cutting brush, mowing, trimming trails, assisting with forest cutting operations, planting shrubs, and maintaining roads and parking areas. They emplace gates, erect signs, and make other arrangements related to the protection and management of the agency's lands. They also build and maintain nesting boxes for wood ducks, eastern bluebirds, bats, and platforms for loons and ospreys, as well as establish cooperative agreements with farmers who raise crops on DFW land.

In addition to the activities that are common to all the Districts, there are projects that involve only some of them; these are detailed, when and where applicable, below.

Northeast Wildlife District

Patricia Huckery, District Supervisor

Administration

The Northeast District staff worked together to make a safe work environment during the COVID-19 pandemic. There were no serious staff injuries or illnesses or cases of COVID-19.

The Office of Fishing and Boating Access coordinated with the DEP to complete Title 5 test pits as part of upgrading the septic system serving the Wildlife Technicians' and Biologists' office building. Staff evaluated the Ayer office buildings for any needed maintenance and repairs, and found damaged sills, siding, and windows.

Wildlife Technicians refurbished an old mower deck, installed an air compressor in the shop and undercoated vehicles, along with all other regular tractor and equipment maintenance. Snow plowing and shoveling were regular winter exercises.

Zoom and Teams meetings and trainings were attended, including Board, Senior staff, District Manager, Stewardship, R3, Agency Relevancy, Lands Committee, The Wildlife Society, Coastal Waterbird Cooperator's, Conservation Commission, Wild and Scenic River Stewardship Committee, Mt. Watatic Advisory Committee meetings, as well as Great Marsh manager and regulatory groups. A highlight was the workshop on "How to Talk About Hunting." On-line LART training was attended. NAWCA monitoring meetings were held. The agency annual conference was attended by all through Zoom. Deer farm permitting standards were reviewed. Staff attended meetings of the iNaturalist relevancy group.

Staff prepared property boundary contracts, survey contracts, ILF long term management plans, habitat management plans, reviewed R3 and agency relevancy documents, and kiosk maps and accompanying narratives. NED staff assisted with document research and preparation for the Crane Ponds WMA federal taking review. Research pertaining to huntable lands was conducted in multiple towns.

Research into the NFWF National Coastal Resiliency grant was conducted. A Great Marsh contract for salt marsh assessment and preliminary restoration was drafted, reviewed, and supervised.

Martin Burns WMA target range permits were not issued in 2020 due to the pandemic, but the range

was reopened in April 2021. Over 500 permits were issued in the order they were received. There were no camping permits issued. Fishing and Hunting Guides were distributed as well as deer and turkey check materials.

Dam replacement commenced at Upper Flint Pond WMA with project oversight handled by the Office of Fishing and Boating Access engineers. A spring storm caused flooding of the work site which was managed by contract engineers and local emergency professionals.

Land acquisition projects in Townsend, Ashby, Shirley, Tyngsborough, Groton, and Dunstable, were reviewed. Land Agent Anne Gagnon completed two Land and Water Conservation grants for land acquisition parcels in Townsend and Ashby, while working throughout the year on a Forest Legacy grant.

Stewardship, Management, and Habitat Restoration

A boundary contract project was completed at Delaney WMA resulting in 20 encroachment violations ranging from lawn overages to a chicken coop. Surveys were completed at Squannacook River WMA and Nissitissit River WMA. The survey at Squannacook River WMA was conducted to settle an ownership question raised by an abutting neighbor. The survey confirmed MassWildlife ownership. The Nissitissit River WMA survey was conducted to mark ownership of a length of ROW. A handful of encroachments were found on the ROW including part of a barn.

The Squannacook WMA Barrens Restoration project advanced to the permitting phase through the joint effort of MassWildlife's Chalis Bird, Chris Buelow and Tom Wansleben. A Restoration Project Management Plan was finalized with the Habitat Program and Notice of Intents were prepared to submit to the Townsend and Shirley Conservation Commissions. Over 200 acres of predominately white pine will be restored to an oak-pine-barrens type habitat that can support nearly 50 wildlife and plant species listed in the MA State Wildlife Action Plan, including Whip-poor-will, Eastern Hog-nosed Snake, and multiple rare moth species.

Great Marsh restoration projects at William Forward WMA advanced through a MassWildlife contract for 175 acres of salt marsh assessment and preliminary restoration design. Contract results will be discussed at Great Marsh Coalition and managers meetings to support prioritization of future salt marsh restoration projects. A Great Marsh permitting discussion group was created to assess how regulations pertain to habitat restoration projects state-wide, especially within salt marshes. An application was submitted to EOEEA for a State Mitigation and Climate Adaptation Plan grant.

NED staff created access to westerly fields at Dunstable Brook WMA and released about 25 apple trees that were thickly covered in invasive bittersweet vine and encroached by multiflora rose. A patch of invasive swallowwort near the parking area was being treated with herbicide by NHESP's Dan Bove.

A portion of Martin Burns WMA was cut to maintain early successional habitat as well as improve upland game hunter access. Ashby, Salisbury Marsh, Dunstable Brook, and William Forward WMAs were mowed to maintain grassland habitat.

Repair of the Mid-State Trail through Mt. Watatic Sanctuary was delayed due to the pandemic. The deadline for using the Mass Trails Grant was pushed to 2022. A high use trail at Ashby WMA was rerouted.

In-Lieu Fee management plans were reviewed for the Parker River Connector project and the associated Conservation Restriction (CR) with Essex County Greenbelt Association (ECGA). A BDR contract was reviewed for the ECGA CR. An In-Lieu Fee program habitat restoration grant was pursued with required site visits to subject salt marshes at William Forward WMA.

Kiosk maps and text were completed for Martin Burns WMA, Nissitissit River WMA, and Crane Pond WMA, with drafts completed for Nissitissit River WMA and Squannacook River WMA.

Research and Conservation

Wildlife

Black Bear den research was conducted on two study bears. One bear did not have yearlings with her, while the other bear had two yearlings which were both ear-tagged. Black Bear research began

mid-April and continued through mid-July with one bait and trap running through early August. Unfortunately, no bears were captured or marked in the district this year. Staff assisted with the Bear Snare Project set-up and breakdown state-wide.

Bluebird boxes were installed at Dunstable Brook WMA, Squannacook River WMA, and the Ayer District Office. Kestrel boxes were installed at Dunstable Brook WMA and William Forward WMA. Wildlife Technician Josh Gahagan handled Salt Marsh Sparrow surveys conducted at William Forward WMA. Pre-restoration bird surveys were conducted June 2021 at Squannacook River WMA. Finally, a Woodcock survey was conducted in Haverhill where one individual was heard after five years of absence.

Wood duck boxes were accessible for part of the winter where the district crew checked, replaced, and added nesting boxes at 12 sites.

Nearly 250 Canada geese were captured and banded throughout Middlesex, Essex, Suffolk, and Norfolk counties. District staff assisted with winter banding of mallards and black ducks which were captured using a tub launcher and traps. Staff helped with waterfowl airboat surveys state-wide.

Deer pellet browse survey transects were downloaded to iPads for staff, and data analyzed. A deer necropsy was conducted, and arterial worms were found as the possible cause of death. Mortality and CWD samples were collected from a Moose in Shirley.

Fisheries

Fish survey equipment and shocking boat were checked and maintained in anticipation of stream and pond surveys. No ponds were surveyed. Drought conditions hampered stream surveys. Stream surveys were conducted in 24 streams within the following watersheds: Nashua (8), Merrimack (1), Ipswich (7), Shawsheen (6), and Weymouth (2).

Three fish kills were reported: 1) July 14, 20 young of the year Yellow Perch found at Sandy Pond/Ayer, 2) September 24, 20+ White Perch and Blue Gill found at Lake Cochituate/Natick, and 3) June 8, 21 sunfish, Whitehall Reservoir, spawn related.

Natural Heritage and Endangered Species

Five bat boxes were erected at Ashby WMA, Squannacook WMA, Dunstable Brook WMA, and at the old Ayer Game Farm. NED staff collaborated with NHESP's Jennifer Longsdorf and David Paulson for protection and conservation of maternal sites including a barn in Sherborn which is a historic tri-colored bat maternity site. A bat cave in Middlesex County was evaluated.

Spring Bald Eagle nest surveys were conducted at 22 nests. Of these, 5 new nests were identified, and 3 of which were active. A total of 13 active nests have been identified in NED. Seven eaglets were banded from 3 different nests. Three out of 7 eaglets died, 1 from a fledging injury, 1 rodenticide toxicosis, and 1 pending analysis. Staff assisted with Peregrine Falcon banding in Woburn.

A Blanding's Turtle conservation collaboration was initiated with NHESP, the Orianne Society, Zoo New England, private conservation organizations and the Conservation Commissions of Groton, Townsend, and Dunstable. The goal was to identify locations to create or enhance nesting habitats and to renew public outreach/education. This is a long-term project that may include annual maintenance and monitoring of nesting sites. Four nesting locations were created at Townsend Hill WMA and monitored with cameras to record presence/absence data. One Blanding's turtle female was identified using a nesting site.

Wildlife Technicians assisted NHESP with freshwater mussel surveys on the Nissitissit River as part of a long-term study.

Enhancement of Outdoor Recreation

Following COVID-19 safety protocols, staff stocked 1,000 12+ inch Rainbow Trout and 1,000 9+ inch Brook Trout in the fall, and 92,780 trout were stocked in the spring.

District staff stocked 4,976 pheasants across 20 sites. Limited Access Pheasant Hunts were managed at Martin Burns WMA which averaged 20 hunters per Saturday hunt. Hunters did not apply for Special Pheasant Stocking Permits at Martin Burns WMA. Waterfowl blinds were maintained at Delaney WMA where one bench was replaced. Staff managed the controlled waterfowl hunt at Delaney WMA.

Staff helped conduct two Family Fishing Clinics in Gardner and North Andover. Angler access to the Merrimack River was maintained at Salisbury Marsh WMA. Old wire fencing and posts were removed from the fields off Sweet Apple Tree Lane to facilitate mowing.

NED's Leslie Gabrilska helped with implementation of the outdoor training component for those seeking a Hunter Education certificate during the pandemic.

The District office deer check station was closed during the pandemic. Three hunters took part in the paraplegic hunt held at Fort Devens, where one doe was harvested.

Four clubs were issued field trial permits for Delaney WMA, as well as one mock fox hunt. A mock fox hunt was approved at Surrenden Farm WCE.

Outreach and Education

Most wildlife talks were curtailed during the pandemic. Help with wildlife questions shifted to handling calls and e-mails as thoroughly as possible without site visits, unless deemed necessary (with masks and social distance). Many people were sent to MassWildlife's website and Facebook site to view on-line videos, Living with Wildlife hand-outs, and hunter information.

Wildlife Biologist Bird gave three Black Bear presentations in Westford, MIT Observatory and Ashburnham Conservation Trust annual meeting.

The annual Carlisle Conservation Breakfast, usually held in February, was cancelled due to the pandemic.

Technical Assistance

District staff worked alongside Environmental Police Officers on several Large Animal Response Team (LART) calls. One notable situation occurred in Haverhill where a doe and fawn became trapped in a fenced area along the Merrimack River. The doe was immobilized but succumbed from the heat and stress – thankfully, her fawn was adopted by another doe.

There were numerous wildlife calls regarding general questions, sightings, and conflicts as more people were home during the pandemic seeing wildlife. A mysterious bird disease generated many calls, especially when chicks began to fledge. A Marblehead flock of turkeys caused trouble for one unlucky homeowner where they roosted in a tree and proceeded to leave their droppings on the lawn, porch, grill, house, and cars. NED assisted by finding the culprit with a bird feeding station and asked them to stop feeding. There were also aggressive turkeys in Wenham and Somerville.

Help was provided to a Screech Owl trapped in a building. Non-native Red-eared Sliders were collected and euthanized. District staff visited a site in Pepperell where a Black Bear killed some chickens and advised them on protective measures. Canada geese nested on a rooftop garden at a Brookline hospital where they decided to raise their young. Once the goslings started growing it became clear they would need help getting to the ground. A good Samaritan helped make that happen. This is only a sampling of the wildlife calls received at the Northeast District Office.

An outdoor testing area was set-up to assist people taking wildlife rehabilitator and animal control agent tests during good weather. Otherwise, NED's Clerk coordinated with Westborough staff to arrange suitable test-taking areas at Field Headquarters.

Southeast Wildlife District

Jason Zimmer, District Supervisor

Administration

There were no personnel changes in the Southeast District in FY 2021.

The COVID-19 pandemic was a central theme in agency operations over the course of the year. Safety protocols, as mandated by the Governor's office, CDC and various public health agencies and officials, were put into place and, while they significantly changed the ways that we completed many of our tasks, it did not affect our ability to meet our conservation mission. Undoubtedly, there were negative impacts on the time/cost efficiency of completing certain tasks, however there were also great strides made in efficiency in other areas. The

biggest impact on District operations due to the pandemic came in the form of limited staff interaction. District personnel work so closely together and operate almost as a family so, not unlike many people's personal relationships with friends outside work, it was difficult to handle the new work environment. Thankfully, once the vaccines were developed and widely administered, we were able to return to essentially normal operations towards the end of the year.

A second thing that was a dominant theme this in FY 2021 was the agency's effort to address a major funding crisis that jeopardized our ability to provide all of the services and programs that the public love and expect and are necessary to meet our mission. The District Supervisor was heavily involved in the process of evaluating the agency budget and creation of a proposed fee increase schedule, and then the public outreach effort associated with that fee schedule. While the proposed fee increases were met with a significant amount of concern from hunters and anglers, the agency's efforts to work with the public, and the administration, to develop a revised proposal that took into consideration public feedback and represented a compromise that still met our agency's funding needs, ultimately went to public hearing and was approved.

The Hyannis Ponds water issue that consumed so much agency time and effort over the past few years finally came to an end. Following the comprehensive USGS study of the area, the Town's consultant completed a review of all available options for Hyannis to obtain supplemental sources of clean water and ultimately decided not to pursue wells on the WMA. This was the best possible outcome, as the Town found viable sources of clean water for the community and the sensitive coastal plain pond habitats on the WMA and surrounding area would not be faced with the negative impacts that additional withdrawals in system would cause. Another somewhat related issue that began this FY was the agency's involvement in the developing concerns over PFAS (per- and polyfluoroalkyl substances) in the environment. The District Supervisor was involved in initial informational meetings with various State and Federal organizations to develop an understanding and play a role in decisions made regarding these substances in the environment. PFAS has been found to occur in fertilizers containing sewage sludge, which raises particular concerns relative to MassWildlife lands where agricultural leases/licenses have been in place.

The agency was approached by MassDOT and their consultants this FY regarding a proposed land swap abutting our Canoe River WMA that was intended to facilitate a large commercial/industrial development. District staff attended several meetings with DOT and their consultants and conducted a very thorough site visit to document conditions on the section of the WMA they were interested in and the portions of the DOT property that they wanted to swap. MassWildlife found a number of issues and concerns on the DOT parcel, including an abandoned car, several vehicle gas tanks, and significant areas of invasive plant species. Further, there were several areas identified on both the DOT land and MassWildlife land that appeared to possibly be functioning as vernal pool habitat. MassWildlife expressed our concerns and laid out the conditions that we believed could possibly meet the requirement so our land and water dispositions policy, but also Article 97. MassDOT or their consultant had not responded as of the end of FY 2021.

Several important land issues came up in FY 2021. District staff worked with other agency personnel to review an Army Corps of Engineers License Agreement covering groundwater contamination remediation activities at the Frances A. Crane WMA. One major issue was identified in the agreement pertaining to the appraisal and the District Supervisor worked with fiscal staff and legal to get it corrected so that the agency received proper compensation for the impacts on the WMA. Another similar issue at Crane involving soil remediation also started in FY 2021, with the district coordinating with the abutting Camp Edwards cleanup personnel to facilitate the remediation of old grenade courts (grenade testing ranges) partially on the WMA. Staff worked such that the project would be designed in a manner that complements our existing habitat management on the property. It was still in the planning phase at the end of the FY and is expected to be completed in FY 2022.

The district also worked with other agency staff and legal to complete additional revisions/updates to a license agreement with NSTAR to allow the reconstruction and relocation of a substation on the Camp Edwards WMA. This project also involved a land swap and NHESP MESA permitting, with our

agency receiving additional land in the area and habitat work to ensure a net benefit to rare species.

There was a major effort in the Town of Wareham, spearheaded by the NOTOS Group, a large private developer, to rezone a portion of the town abutting our Red Brook WMA into a hospitality, recreation, and entertainment district. The proposal appeared to have some support in the Town administration, but it was met with widespread opposition from many residents and environmental organizations. MassWildlife submitted formal comments in opposition to the proposal due to concerns for impacts on the WMA and, most importantly, groundwater which is so critical to the salter brook trout population in Red Brook. Thankfully, the rezoning proposal was soundly defeated at Town meeting by a vote of 843-141.

The District, once again, had to deal with issues surrounding homeless encampments on the Hyannis Ponds WMA. This year, we received word of a reestablished camp by a homeless couple that was involved in the last round of removals and cleanup, but this time in a different portion of the WMA. While we were working with local and state law enforcement and transitional officials to address the situation, we were notified that the male party died while on the WMA. Following that event, the female party entered a care facility, and the remains of the camp were removed from the WMA.

The District's few cranberry bog restoration projects all saw progress in FY 2021. The Red Brook project was scaled back in design but is still awaiting the identification of possible funding sources. The Dyer project RFR was worked on and was nearly complete by the end of the FY and is expected to go out to bid in early FY 2022.

District staff continued to work on the R3 and Relevancy projects, with the District Supervisor taking on a lead role on the Relevancy team. Several district staff are involved in a variety of the subgroups and projects in both efforts including the INaturalist project and creating more meaningful connections between hunters and non-hunters.

Two local hunting/bylaw issues came up in FY 2021, both on Cape Cod, with one in Provincetown and one in Brewster. District staff were actively engaged in both cases and worked to educate the Town officials and avoid unnecessary bylaws from being put into place. In the Provincetown case, the bylaw was modified/clarified so that it did not illegally attempt to restrict hunting in Shank Painter Pond. In the Brewster case, we completed numerous surveys to evaluate the deer density in Town and its impacts on the habitat and, in spite of the data, the Town followed through with disallowing hunting for deer in the Punkhorn Conservation Lands.

Dog issues continued to be a major topic in the District in FY 2021. With the passage of the new dog regulation last year, it was hoped that we would gain some control over dog issues and complaints on at least our high-profile problem areas; Burrage Pond WMA, Crane WMA and the Old Sandwich Game Farm in particular, however we continued to receive numerous complaints from all three WMAs. The signs we put up are routinely torn down or defaced, and our on the ground educational efforts seem to have little effect with many dog people seemingly completely ignoring the regulation. It is evident that we need to improve and/or increase enforcement of the regulation and the agency has engaged with OLE to work towards increased patrols and issuance of citations.

We had a break in at our Red Brook WMA house, with major damage being done to the front door. Fortunately, no other damage was done and nothing appeared to be taken from the house. District staff purchased a new security front door and replaced the damaged door. It is likely that the existing alarm system at the house helped to prevent any further damage or theft.

There was a significant wildfire at our Mashpee Pine Barrens WMA. Multiple MassWildlife district staff, town fire personnel and DCR Forest Fire control all responded. Fortunately, the fire was contained by the fire breaks that the district has been mowing/maintaining and the fire did not spread to other portions of the WMA or threaten any abutting neighborhoods. The fire was considered very suspicious, and an investigation is ongoing. This is a prime example of how our prescribed fire program works to not only improve wildlife habitat, but also how it can prevent catastrophic wildfires.

District staff attended several trainings in FY 2021 including all fire crew members successfully completing an online/virtual prescribed fire refresher course and work capacity test, the District Wildlife Biologist and Supervisor successfully

completed a LART refresher course, our three licensed herbicide applicators successfully completed their annual continuing education requirements, all staff completed annual ladder safety training and multiple staff completed annual refresher training and obtained required DOT physicals in order to maintain their hoisting licenses.

Stewardship, Management, and Habitat Restoration

The District Stewardship Biologist completed annual monitoring visits and reports on all District Wildlife Conservation Easements (WCE) that were his responsibility in FY 2021.

Boundary marking efforts continued in FY 2021, with both in-house and contracted boundary marking work being completed on many properties including the Southeast District HQ, Taunton River WMA, Atwood Reservoir WMA, Black Brook WMA, Burrage Pond WMA, Clapps Pond WMA, Cooks Pond WMA, Erwin Wilder WMA, Fisk Forestdale WMA, Frances A. Crane WMA, Halfway Pond WMA, Hartley Reservoir WMA, Haskell Swamp WMA, Hockomock Swamp WMA, Hog Ponds WMA, Mashpee Pine Barrens WMA, Mashpee River WMA, Plymouth Grassy Pond WMA, Red Brook WMA, Rocky Gutter WMA, Sly Pond WMA, South Triangle Pond WMA, Triangle Pond WMA and Copicut WMA.

Prescribed fires were completed at the Frances A. Crane WMA, Noquochoke WMA, Penikese Island Sanctuary, CCNS and Manuel Correllus SF. Staff assisted with a wildfire at the Tully Mountain WMA in the CT Valley District. Fire breaks were created or maintained at the Mashpee Pine Barrens WMA, Hyannis Ponds WMA, SE Pine Barrens WMA, Noquochoke WMA, Camp Cachalot WCE and Penikese Island Sanctuary.

Non-native and/or Invasive species were treated by our licensed herbicide applicators at Burrage Pond, Frances A. Crane and Erwin S. Wilder WMAs.

The Hartley Reservoir WMA main flume replacement project was completed in FY 2021 with the District purchasing and spreading loam on the top and sides of the dam, installing erosion control matting, spreading a native, local-ecotype seed mix on it and routinely using one of our slip-on fire tanks to water the area until the seed was established and the site stabilized in accordance with the Conservation Commission requirements.

Road issues were addressed in several areas this fiscal year. An illegal OHV roadway blocked at the former site of the Black Mallard Club at our Hockomock Swamp WMA. The entrance roadway at the Old Sandwich Game Farm WMA, which is a constant source of issues, was repaired by adding grave and grading the entire length of the roadway into the parking lot. A large tree that fell across one of the main roadway at the Erwin Wilder WMA was cut and removed. A private roadway that abuts our Rocky Gutter WMA, which we have equal rights to pass/repass on, was blocked by a new abutting landowner, which resulted in complaints to our agency. However, the district did not want people driving on the road anyway, as we have had major dumping issues in the past, so we met with the landowner and agreed to allow him to gate the roadway as long as we had a key for management purposes.

Routine road maintenance was conducted on every WMA in the district to maintain management access and pedestrian access for the general public. This effort also includes the mowing and maintenance of dikes on former cranberry bog farms owned by the agency such as Burrage Pond WMA, Mill Brook Bogs WMA, Red Brook WMA, etc.

The significant issue that arose last year along Drew Road in Plymouth abutting our Plymouth Town Forest WMA continued this FY, with people still illegally parking along the road to access the beach area on Great South Pond. However, due to last year's coordination with the local residents and Town of Plymouth Police and DNR, we were able to quickly get the situation under control.

Gates were installed at several properties including Frances A. Crane WMA, Hyannis Ponds WMA, Mashpee Pine Barrens WMA and Maple Springs WMA.

One significant encroachment was identified and addressed this year at the Burrage Pond WMA. The abutting landowner had cut a bunch of trees and installed posted signs on what we believed to be the WMA. Aaron Best met with the landowner and reviewed the situation and looked over deeds/plans with him. The agency then determined that we needed a survey to confirm the boundaries in the

field as there was no monumentation to go off. We contracted out the survey and had pins installed and then worked with the landowner to mark the new boundary line and replace all of the cut trees.

The district completed a major field reclamation project at the Noquochoke WMA, using the Terex machine to reclaim old fields that had grown beyond our capability to mow with our standard brush hogs due to lack of fire. The project will maintain early successional habitat for wildlife and improve hunting access and conditions for stocked pheasants. Fields were also mowed at the Old Sandwich Game Farm WMA.

District staff completed the required In Lieu of Fee property report for the new acquisition along the Taunton River.

A couple significant trail issues were addressed in FY 2021 including the review of a DCR trails grant for an accessible trail proposed by the Trustees of Reservations at Copicut Woods, a property we hold a CR on. District staff worked with Liz Newlands and DCR personnel to review the project and made significant modifications to the proposal to get it to where we felt it complied with the CR language and would not negatively impact hunting access and opportunity. The second trail issue was related to the proposal by DCR to mitigate for the loss of permitted dirt bike trails in the Fall River-Freetown State Forest when the Bioreserve deal was done. The District Supervisor attended several meetings on the topic and expressed various concerns about how the existing trail network has major maintenance issues, impacts on wetlands and rare species habitats and impacts on pheasant hunting in the Forest. That process is still ongoing. However, during that process and whether it was intended or not, MassWildlife became privy to another proposal in the works to create new dirt bike trails in the former Town of Lakeville property that abuts our Mill Brook Bogs WMA. The maps depicted for that proposal showed a dirt bike trail crossing the WMA, which certainly would not be allowed. Further, that area has a huge problem with illegal OHV use that negatively impacts out WMA. That will be a project to watch out for in the future.

The district completed an effort to map out all of the mountain bike trails and illegal mountain bike structures at the Frances A. Crane WMA using one of our staff that is an avid mountain biker. We will be progressing with an effort to educate the mountain bike community on the WMA regulations and what they can and cannot do on the property. All illegal structures are planned for removal.

The issue with illegal storage of boats and personal property on our Fox Island WMA came up again this year and we worked with the local Conservation Commission to install signage to address it. We are also planning for a formal property boundary survey for the area in FY 2022 so that we can better work with the Town and OLE to enforce the illegal storage.

A new license agreement to allow for cranberry bog operation and harvesting was entered into this FY with the Harju Cranberry Company. We had recently purchased one of their cranberry farms, a beautiful addition to the Rocky Gutter WMA that provides another exceptional public access point, but the acquisition was contingent upon their continued farming on the property for at least 5 years. We happily agreed, both due to the quality of the acquisition, but also because we know the Harju family well. They are a very conservation-minded family with a long history of sound property stewardship, plus we have learned through experience that having the farmers continue to have a presence on the land helps incredibly with management and keeping illegal OHVs and dumping to a minimum.

Research and Conservation

Wildlife

Southeast District staff completed multiple annual spring surveys including two ruffed grouse drumming surveys (Joint Base Cape Cod, Myles Standish State Forest), one nightjar survey (Mashpee/Falmouth), six breeding waterfowl plot surveys (Eastham, Barnstable, Chatham, Truro, Falmouth, Joint Base Cape Cod) and two woodcock peenting surveys (Rochester, Brewster).

District staff also conducted annual winter American black duck trapping, however this year's effort was scaled back and focused primarily on capturing three ducks to be part of a pilot satellite tagging survey being coordinated by the USFWS. Regardless, we successfully captured a total of 255 mallards and black ducks and provided the three ducks to be used in the study. Further, we completed both summer mallard banding using a tub launcher, capturing a

total of 54 ducks. Goose banding resumed in FY 2021 and we successfully banded a total of 200 geese from 19 different locations across the District. District staff also assisted Westborough biologists with air boating to band ducks at New Bedford Reservoir.

Nesting boxes for wood ducks and Eastern bluebirds were monitored, maintained, and replaced on DFW lands and other public and private lands. A total of 56 wood duck boxes were maintained at 17 different sites throughout southeastern MA.

Kestrel nesting boxes were installed, maintained or monitored at Burrage Pond WMA, Frances A. Crane WMA, Erwin Wilder WMA and Maple Springs WMA.

District staff cooperated with the USFWS and Buzzards Bay Coalition to assist with the completion of a common eider nesting survey on Cuttyhunk Island which is part of a new 5-year study.

Former cranberry bogs on Burrage Pond WMA, now managed as emergent wetlands, were regularly visited and strategically flooded at different depths throughout the year to continue to sustain and enhance wetland habitats and provide suitable conditions for migratory waterfowl. Regular and ongoing maintenance and repairs are needed to many water control structures on the property in order to retain our ability to properly manage habitat at the WMA.

Due to a variety of factors including staffing issues at the Roger Williams Zoo and an outbreak of tularemia in rabbits being held at the Bristol County Agricultural School, the ongoing New England Cottontail trapping effort was put on hold this FY. It is anticipated that the project will resume in FY 2022.

District staff assisted with several agricultural crop or livestock damage situations this year. Calls were received by farmers in multiple towns throughout the district, primarily associated with damage to crops by white-tailed deer, but occasional issues were also reported with other species such as coyotes, woodchucks, foxes and fishers, among other species. In most cases, a site visit is conducted to inspect and verify the damage and then District staff can provide the best possible technical advice to reduce the damage. Section 37 letters/info were issued to landowners/farmers in the towns of Dighton, Mattapoisett and Pembroke for deer damage and technical advice, including fencing, harassment, etc., was provided in many other cases.

Several serious coyote situations occurred this year involving unusually aggressive or habituated coyotes. The most serious situation involved a coyote that bit two children in Fall River. We worked closely with the Fall River Police, Animal Control and Massachusetts Environmental Police to attempt to trap and/or euthanize the animal but were not successful. A second situation was in Cohasset where one bold coyote had attacked and/or killed numerous dogs in one neighborhood. We worked with the Cohasset Police and OLE and permitted the residents to hire a coyote-certified PAC agent to attempt to remove the animal. The situation is ongoing. Towards the end of the fiscal year, a very bold/aggressive coyote appeared in Falmouth near the Shining Sea bike path and was chasing bikers and approaching people. The animal showed all the classic signs of being hand-fed by people and we have been working with the Falmouth DNR to attempt to remove the animal.

Beavers are clearly becoming more established in the southeast. In FY 2021 we dealt with a number of issues involving beavers flooding roadways or residential properties, blocking up or damaging water control structures and impacting an important herring run. District staff worked with David Wattles, MassWildlife's furbearer project leader, to provide residents and town officials with the proper laws/regulations and protocols to address the various beaver problems. Further, at our Burrage Pond WMA we had to trap and remove beavers in a couple areas where they were causing damage to water control structures and jeopardizing the integrity of the main dam. Also, at Burrage Pond, beavers were removed where they had built a dam across Stump Brook and were impacting the main dam on the Brook which is a critical part of the City of Brockton water supply system. Other beaver issues in the district were solved through a variety of means including regulated trapping, PAC, dam breach permits through the local Conservation Commission and providing contact information for companies that install "beaver deceiver" devices.

New bat boxes, constructed through a partnership between MassWildlife and MADOT, were installed at Red Brook, Frances A. Crane, Burrage Pond, Mill

Brook Bogs, Hartley Reservoir and the Old Sandwich Game Farm WMAs.

District staff investigates several odd deer mortality/illness situations in FY 2021. One was an ongoing situation from the island of Martha's Vineyard from last year where a number (>10) deer, almost all button bucks, were found either dead or in a semi-paralyzed state. We had a number of the deer tested last year, but the results were essentially inconclusive. When the District received a report of another sick deer this FY, we investigated, but in this case it appeared to be a natural death and luckily no additional reports came in, suggesting the issue from the previous year was an anomaly. Another deer mortality issue on Grape Island in Boston Harbor was also investigated cooperatively with the Northeast District. In this case, it appeared that a group of deer has swam onto the island and eventually depleted all of the suitable/preferred browse foods and then turned to less desirable foods in addition to not having any fresh water to drink. The deer were determined to have died from a combination of malnutrition and saline toxicity. A third deer illness was investigated in Mashpee and it was determined that the deer was suffering from a brain abscess.

Due to COVID-19, biological deer checking stations were not operated in FY 2021, however District staff still had to coordinate with any check stations that were open to be sure they had the supplies and support needed to operate effectively.

District staff again assisted with the deployment of bear hair snare traps that are part of an ongoing graduate student research project through the UMASS Cooperative Fish and Wildlife Research Unit. We constructed a total of 17 traps in the field in Central Massachusetts and then took them down at the conclusion of the field season.

One of the most exciting and significant wildlife stories in the District in FY 2021 was the dispersal of a 2–3-year-old male black bear into the region. The bear first entered the District sometime in May in the general area of Plainville/Attleborough, which for some reason seems to be a common dispersal corridor for bears into southeastern MA. The bear was observed almost daily and quickly became quite popular. However, once he made his way to the south shore area (Scituate, Cohasset, Duxbury, Marshfield, etc.), interest in the bear exploded and eventually found him with his own social media accounts. The positive aspect of this situation is that the vast majority of the people were enamored with the bear and were completely comfortable with the message of peacefully living with the bear in the area. The good thing was that the bear cooperated for the most part, aside from routinely raiding bird feeders. The district seemed to get out in front of the situation and had launched a widespread public education campaign, reaching out to every town in the district and contacting every police department to ensure that the proper messaging was being given to residents. Sadly, the bear was struck and killed by a vehicle in Marion MA in late June.

Towards the end of the FY, MassWildlife received reports from the USDA-APHIS Wildlife Services personnel that raccoon rabies had once again been found on Cape Cod after their oral rabies vaccination program had successfully pushed it off the Cape for the past 8 years. The situation was deemed suspicious due to the location of the case and information that was obtained by USDA. An investigation into the situation is ongoing.

Fisheries

The Southeast District Fisheries Biologist spent a considerable amount of time this year with technical assistance and oversight on stream restoration projects he has been involved with for over a decade. The Childs River restoration, conducted by the Falmouth Rod and Gun Club with assistance from the Division of Ecological Restoration and other partners, broke ground this year and was almost completed by the end of the fiscal year. This project, which involved the removal of a small pond at Carriage Shop Road and restoration of former cranberry bogs to improved stream and wildlife habitats, should improve wild Brook Trout habitat in the river. Brook Trout populations were reintroduced to this river by the district by transplantation of wild Brook Trout brood stock from the Quashnet River in 2008-2010.

Another stream restoration project which the Southeast District fisheries manager has spent considerable time on with technical assistance and oversight was on the Coonamessett River. This river was the second site for Brook Trout reintroductions in the district, with transplantations from the Mashpee River in 2013-2014. Stream restoration efforts in the lower Coonamessett River by the town of Falmouth have allowed colonization of the new

habitats by adult Brook Trout. This spring, young-of-year Brook Trout were noted in the restored areas for the first time, indicating spawning in or near these areas.

A failure of a culvert on Red Brook Road on the Mashpee/Falmouth line resulted in a fish kill and opened up an opportunity for restoration planning on a tributary to Waquoit Bay that formerly supported Brook Trout. The fisheries manager attended numerous zoom meetings with the towns and other stakeholders to discuss restoration opportunities for this system, a series of cranberry bogs flooded during development of residential areas near the Mashpee Pine Barrens WMA.

The dam and fish ladder at White Island Pond on the Red Brook WMA was routinely monitored and boards adjusted to allow fish passage by River herring and other species. Fish passage was maintained through Century Bog by vegetation management and other measures including monitoring the removal of a jeep that crashed into the herring channel in May of 2021. Progress was made on a dam management plan to address pond front property owner concerns about water levels while maintaining the downstream coldwater habitats of Red Brook and allowing diadromous fish passage. Borings were done on the dam in spring of 2021 to inform the dam safety plan.

The stream temperature monitoring network in the district was maintained and expanded to several new sites. Data was summarized and stored in a database and provided to other researchers and interested parties. Stream temperatures in the district using continuous temperature monitors started in 2000 and long-term records have been maintained at several sites that have proven useful to assess future impacts of stream restoration activities at the Childs River, Coonamesset River, Jones River and other sites. Technical assistance in summarizing stream temperature data on Red Brook was given to Trout Unlimited, and assistance was given on summarizing data on Mill Brook in West Tisbury, and the Childs River.

Technical assistance in fish collection was given to the U.S. Geological Survey in collecting fish from Ashumet Pond in Mashpee for PFAS analysis in August 2020. In Spring 2021, fish were collected from the Quashnet and Santuit Rivers for a Harvard University PhD study on PFAS buildup in fish tissue. The PFAS is believed to originate from firefighting foams used at Joint Base Cape Cod. Sampling assistance was provided for a follow up study by a Woods Hole researcher on mercury in Smallmouth Bass in Long Pond- Falmouth. In June 2021, sampling assistance was provided to Division of Marine Fisheries staff conducting baseline surveys on the Taunton River for an American Shad reintroduction project.

The Southeast District Fisheries Biologist served on the Coalition for Buzzards Bay's (CBB) Restoration advisory committee, SNEP Project End User Advisory Group (Cape Cod Water Quality), the Joint Base Cape Cod Cleanup team and attended meetings over Zoom or Teams. He also attended R3 planning team meetings. The Horseshoe Pond dam removal and site restoration was completed by the CBB this year on the Weweantic River WCE.

The Southeast District Fisheries Biologist was a coauthor on a paper published in the September 2020 issue of Copeia by a UMaine PhD student on the cold tolerance of the mosquitofish population in the Quashnet River.

A proposal to change zoning for large parcels near Route 25 in Wareham to allow dense development threatened the Red Brook WMA and its coldwater fisheries resources and generated a groundswell of concern and opposition. The proposal was soundly defeated at a special town Meeting in April of 2021.

Fish kills were investigated at Indian Brook Reservoir in Plymouth and Marys Pond in Rochester in summer 2020, both fish kills were determined to be from natural causes.

The annual spring and fall PIT tagging of wild Brook Trout continued this fiscal year at Red Brook, the Quashnet River and the Childs River, but without the usual large numbers of volunteers. During the surveys, the number of staff was reduced and wearing masks. PIT tagging also occurred at Third Herring Brook and a tributary. The largest number of Brook Trout captured and tagged in Third Herring Brook system occurred in Spring of 2021 at the location of the old Tack Factory Pond. This indicated the great improvement in Brook Trout habitat in the mainstem of Third Herring Brook after the dam removal. This was in spite of the extremely low water levels in fall of 2020 that led to the brook being a series of isolated pools in many locations. In

the Coonamessett River, Brook Trout were also tagged, and assistance was given in maintaining antennas managed by the Coonamessett River Trust for a River Herring study. Since PIT tagging of wild Brook Trout started in 2007 in the Southeast District, a total of 9,515 trout have been tagged (Quashnet River: 4,458; Red Brook: 3,441; Childs River 1,020; Coonamessett River: 423; Third Herring: 173).

Streams surveys, under the statewide protocols with total pickups of all species, were conducted at 19 locations during the summer of 2020 in the Southeast District, primarily at locations of dam removal sites in cooperation with the Division of Ecological Restoration. Temperature and dissolved oxygen profiles at nine selected trout ponds were conducted in summer of 2020.

Pond and stream surveys, using electro-fishing, gill netting, rod/reel survey and other techniques, were completed in a number of southeastern Massachusetts water bodies in FY 2020 in consultation with the Fisheries Section in Westborough including the Eel River, Town Brook, Coonamesset River, Quashnet River, an unnamed stream in Attleboro, an unnamed stream in Westport, Childs River, Third Herring Brook, Jones River, Ashumet Pond, Widgeon Pond and Hamblin Pond, among many others.

The District continued our excellent relationship with the Sandwich Fish Hatchery. We assisted with a variety of day-to-day projects, helping to unload feed truck deliveries, inventories of trout, relocation of trout to other raceways and assisting with fall trout spawning.

The District Fisheries Biologist continued our efforts to monitor stream temperature in many southeastern Massachusetts systems including Quashnet River, Mashpee River, Santuit River, Coonamesset River, Red Brook, Weir River, Indianhead River, Childs River, Jones River, Eel River, Wellingsley Brook, Town Brook, Marshfield Fairgrounds Brook, Beaver Dam Brook, Third Herring Brook, Phillips Brook, Furnace Brook, Pocasset River, Rattlesnake Brook, Iron Mine Brook, Marstons Mills River in order to better manage these systems, warn of dangers or issues, and provide a baseline set of data.

Pond profiles, collecting data on temperature and dissolved oxygen levels, were completed at Ashumet Pond, Cliff Pond, Falls Pond, Hamblin Pond, Herring Pond, Johns Pond, Little Pond, Long Pond – Brewster/Harwich, Long Pond – Plymouth, Long Pond- Yarmouth, Lovells Pond, Mashpee-Wakeby Pond, Mystic Lake, Peters Pond, Scargo Lake, Shubael Pond, Sheep Pond, Spectacle Pond – Sandwich and Whitings Pond.

An electrofishing demonstration and talk on Quashnet River fish and PIT tagging was given to Mashpee Wampanoag Tribal youth attending the Preserving Our Homeland summer camp.

As part of ongoing research and monitoring of wild salter brook trout populations, Passive Integrated Transponder (PIT) antennae were monitored and maintained at Red Brook, Quashnet River, Santuit River, Childs River, Coonamesset River and Third Herring Brook and additional surveys and tagging were completed.

Restoration of the lower bogs and a dam removal on the lower Coonamessett River was monitored and technical assistance was provided to the town of Falmouth. The southeast District Fisheries Manager has been involved in the Coonamessett River Restoration plans for over 20 years. He attended an event, along with the Commissioner of the Department of Fish and Game, among many others, to celebrate the project.

The Fisheries Biologist continued to be heavily involved in several other important restoration or dam removal projects in the district including the Jones River dam removal project, Red Brook WMA restoration project, Weweantic River restoration project and Childs River project.

The White Island Pond dam was monitored routinely by the Fisheries Biologist and fish passage provided through the fish ladder when appropriate. Restrictions to fish passage due to vegetation overgrowth of the herring channel was removed to allow fall outmigration of young-of-year river herring.

Natural Heritage and Endangered Species Program

The district cooperated with the Natural Heritage and Endangered Species Program (NHESP) staff on a variety of projects this fiscal year. The district continued their increased role in the shorebird projects this year as seasonal staff and volunteers

were not at their typical levels. Staff assisted with a variety of habitat projects on Bird, Ram and Penikese islands, as well as monitoring of nests/survival, etc. Further, staff completed annual shorebird surveys/monitoring at many sites in the district along the south coast, Cape Cod and the Elizabeth islands. Staff also responded and completed site visits to beaches to monitor or install fencing to protect piping plover nests.

Staff also assisted with locating the damaged tern project tent and transported it to the tent vendor in Southbridge MA to be evaluated for potential repair or replacement.

District staff assisted with a diamondback terrapin case in Wareham where a number of terrapins were captured accidentally and died in lobster/crab traps. Staff collected the terrapins and transported them to Westborough for further analysis.

A site visit was completed at the Tarpaulin Cove Sanctuary on Naushon Island to ensure the sanctuary regulations were being followed and to ensure compliance with the US Government requirements under the original land transfer.

Rare plant surveys were completed at several sites including a number of coastal plain ponds, as well as assisting with Agalinis surveys at Frances A. Crane WMA.

In spring 2021 SEWD monitored all of the known/active Bald Eagle nesting locations within Bristol, Plymouth and Barnstable counties, however due to COVID-19 restrictions, we only banded chicks at two nests in our District and assisted with a nest in the Central District. Below is a summary of Southeast District eagle nests (Table 45)

The District also participated in the annual Spring Bald Eagle Survey.

Table 45. Locations and results of eagle nesting in the Southeast District in FY 2021.

Town	Location of Nest	Results
Lakeville	Anuxanon Island	1 chick fledged
Plymouth	Halfway Pond	1 chick fledged
Plymouth	Billington Sea	2 chicks fledged
Plymouth	Big Sandy Pond	1 chick fledged
Middleboro	Pocksha Pond	Activity observed, no incubation
Carver	Sampson Pond	2 chicks fledged
Pembroke	Silver Lake	2 chicks fledged
Wareham	Tihonet Pond	2 chicks fledged
Barnstable	Mystic Lake	Incubation, no success observed
Martha's Vineyard	Unknown osprey pole	Activity observed, no success observed
Fall River	North Watuppa Reservoir	Incubation, no success observed
Marshfield	North River (middle island)	2 chicks fledged
Dighton	Bristol Agricultural High School	Incubation, no success observed
Taunton	Lake Sabbatia	2 chicks fledged

Enhancement of Outdoor Recreation

Despite difficulties in scheduling due to COVID-19 protocols, the Southeast District stocked its fall 2020 allocation of 13,000 trout into 24 ponds.

The Southeast District was able to get an early start on spring trout stocking in 2021 and stocked its spring allocation of 85,867 trout into 51 ponds and 13 streams. The reduction in number of streams stocked in the spring was continued this year. This change, started to streamline stocking because of COVID-19 issues in the spring of 2020, was continued to better utilize the district's trout allocation, to help protect our limited wild Brook Trout resources and put trout into areas with higher fishing pressure and access.

The staff provided birds for another safe and successful upland game bird hunting season, stocking 7,912 pheasants on six WMAs and over 12 open covers throughout the district. WMAs stocked with pheasant include Erwin Wilder, Frances A. Crane, Freetown State Forest, Marconi (CCNS), Myles Standish State Forest, Hockomock Swamp and Noquochoke. Open local covers include Sandy Neck Beach and Town Conservation Land off Popple Bottom Road in Barnstable, Crowes Pasture Conservation Area in Dennis, Scusset Beach State Park, South Cape Beach State Park, the Shawme Fish and Game Club grounds, the Falmouth Rod and Gun Club grounds, private agricultural land off River Street in Halifax and Middleboro, private agricultural land off Cedar Street and North Central Street in East Bridgewater, and two other portions of the CCNS, near the Provincetown Airport and the eastern edge of Griffin Island in Wellfleet. Also, Waskosim's Rock Reservation, Sepiessa Point Reservation, Manuel Correlus State Forest and Katama Farm are stocked on Martha's Vineyard and 8 locations are stocked on Nantucket.

In addition to Pheasants, staff also stocked 3,500 Bobwhite Quail, split evenly between the Frances A. Crane WMA and Myles Standish State Forest WMA. Eight-week-old pheasants were again delivered to the Samoset Rod and Gun Club and the Shawme Fish and Game Club as part of the DFW's Club Bird Program. The district also provided pheasants to the Carver Sportsmen's Club and the Falmouth Rod and Gun Club for use in the DFW's Young Adult Pheasant Hunt.

The district operated and managed safe and successful controlled-access hunting opportunities for white-tailed deer and wild turkey at Camp Edwards on Joint Base Cape Cod, working with base personnel to ensure proper COVID protocols. These efforts provided hundreds of sportsmen with the opportunity to hunt on roughly 9,500 acres of open territory on the base and resulted in the harvest of 60 deer and 23 turkeys. Further, the District worked closely with base personnel to offer MassWildlife's annual paraplegic deer hunt, with all participants seeing deer. The district also worked with base staff to again provide very successful youth deer and youth turkey hunting programs.

District staff also assisted The Trustees in planning and operating the first ever controlled deer hunt at the World's End Reservation. Staff helped The Trustees plan the hunt and connected its staff with a rod and gun club to host shooting proficiency tests for all permitted hunters. The hunt was conducted safely, with no incidents, and successfully removed a number of deer from the property, which is significantly overpopulated.

The District Manager issued permits for a total of 28 special winter game bird hunts, 5 at the Erwin Wilder WMA and 23 at the Frances A. Crane WMA. A total of 205 pheasant and 914 bobwhite quail were stocked during these hunts. Two field dog trials and three training days were reviewed and permitted by the District Manager at the Frances A. Crane WMA. Further, eight individual dog training permits for using captive-reared mallards were issued to interested sporting dog owners/trainers. Field mowing specifically to provide quality dog training opportunities was completed at the Frances A. Crane WMA and the Maple Street section of the Hockomock Swamp WMA.

Capital stewardship funding was again utilized to crate, maintain and improve recreational access to our lands this FY. Brand new parking lots were created at the Taunton River WMA on Cherry Street, Burrage Pond WMA on Elm Street, Sippican Headwaters WMA on Spruce Street, Black Brook WMA on Highland Street, Camp Cachalot WCE on SE Line Road, Halfway Pond WMA on both Mast Road and West Long Pond Road and the Mashpee Pine Barrens on Great Hay Road. Existing parking lots and/or access roads were maintained or improved at the Erwin Wilder WMA, Frances A. Crane WMA, Hyannis Ponds WMA, Noquochoke WMA, Black Brook WMA, West Meadows WMA, Dartmoor Farms WMA and the Old Sandwich Game Farm WMA. Further, the new Agawam Mill Pond Access was mowed and maintained.

The district contracted out several tree-removal projects to improve access or increase public safety at parking areas on our lands. A major hazard tree at the Tispaquin Pond boat tramp was removed, and tree clearing was conducted at the Taunton River WMA and Burrage Pond WMA to make way for the previously mentioned new parking lots. Tree clearing was completed by our stewardship biologist at the Black Brook WMA to facilitate the new parking lot that was created there.

District staff played a significant role in the new and improved signage project this year. Staff were

involved in the planning and design process, creation and editing of both the maps and associated text and the design and installation of the signs and new kiosks. This project gives a more uniform look to our property signage and the new kiosks will help improve the public's ability to recreate on our lands.

The District Manager worked closely with the DFG Commissioner and the City of Fall River on a long-standing effort to improve hunter access to parts of the Southeastern Massachusetts Bioreserve. Fortunately, we had success in establishing a pilot program with the Fall River Water Department to allow hunters access through several gates on the Watuppa WCE, which will greatly improve hunter access and, consequently, deer management on the property.

Distrct staff also cooperated with Westborough staff to create and edit both bear hunting tips and tactics and muzzleloader hunting tips and tactics sections for our agency website and newsletters.

Outreach and Education

District personnel continued to provide information and educate the general public, as well as a wide variety of other agencies and organizations, through publications and presentations and by attending meetings and events throughout the region. MassWildlife's annual Guide to Hunting, Fishing and Trapping was delivered to all license vendors, State Parks and a variety of other locations throughout the district.

Southeast District personnel prepared and staffed displays at the Marshfield Fair, Standish Sportsmen's Association Sportsman Show, the Boston Bowhunters Group annual BBQ event and several other environmental career days and youth events.

District staff gave presentations on a variety of topics this year including a fisher talk through the Harwich Conservation Trust and an eagle talk at the Cape Cod Museum of Natural History Annual Conference. Further, staff were heavily involved in several virtual outreach and education events including Learn to Hunt workshops and Deer Scouting tips done via Facebook live and an informational session on the agency done also done via Facebook live with the Backcountry Hunters and Anglers organization.

District staff assisted with multiple hunter education courses this year, teaching both in-person at Westborough courses and one at the Monument Beach Sportsman Club, as well as virtually through Zoom.

The District Manager served as an instructor as part of training for new Environmental Police Officers, providing information on deer hunting and assisting with role playing in staged hunting situations for officers.

The District Fisheries Biologist participated in the Earth Day Trout Stocking Event, stocking fish at Little and Long Ponds in Plymouth and giving a brief presentation on trout stocking and fisheries management to the public in attendance.

The Fisheries Biologist also attended regular meetings of the River Herring Network, Eastern Brook Trout Joint Venture and Sea Run Brook Trout.

The District Manager attended virtual and in-person monthly meetings of the Barnstable, Bristol, and Plymouth County leagues of sportsmen, providing them with information on MassWildlife activities and answering fish and wildlife questions.

Technical Assistance

District staff provided technical advice and support to many local Animal Control Officers, police departments, boards of health, and conservation commissions, as well as to the MEP on issues dealing with fish, wildlife, and their habitats. Many of these issues relate to the review of the potential impacts of proposed development projects on fish and wildlife. Others dealt with suburban wildlife and conflicts with humans and with other public health and safety concerns related to fish and wildlife, particularly nuisance or damage complaints and reports of sick or injured wildlife. The district responded to a variety of problem animal calls this fiscal year, predominantly dealing with coyotes and aggressive wild turkeys.

Once again, numerous nuisance and aggressive turkey complaints were reported during FY 2021 in the District, including in Attleboro, Mansfield, Mashpee, Falmouth, Barnstable, Fairhaven, Dartmouth and Marshfield.

Aggressive hawks also continued to be a routine issue in the Spring in the District. We conducted several site visits to meet with the affected homeowners and evaluate the situation (determine extent of aggressive behavior, hawk species, presence and age of young, and tree/nest characteristics). In all cases, we first and foremost educate the residents and try to promote living with the situation, at least until the young fledge, however in some instances it is necessary to remove the nest/young, as the level of aggression and injuries sustained is not tolerable. In cases where we remove the young, we work with Norm Smith (formerly with MassAudubon) to foster them into other known nests in the area.

The district had staff that served as the MassWildlife representative on a variety of management teams and efforts including the Santuit Pond Preserve Management Team, the Assawompset Pond Complex Management Team, the Lyman Reserve/Red Brook Management Team, the Buzzards Bay Restoration Committee, the Southeastern Massachusetts Bioreserve Management Team and the Mashpee National Wildlife Refuge Management Team. The Fisheries Biologist was actively involved in monitoring the Massachusetts Military Reserve (MMR) cleanup activities as a member of the Plume Containment Team.

Central Wildlife District

Todd Olanyk, District Supervisor

Administration

Central District staffing was stable through FY 2021. All current staff positions have been filled with the same personnel for a minimum of three to five years, with some of the team in place for more than a decade. This continuity of experience enhances the efficiency of district activities in that the entire group are aware of the annual cycle of work and require less direction.

The COVID-19 pandemic began effecting district/agency operations in March of 2020 during the peak of fish stocking season and continued to have a significant impact throughout FY 2021. Following state guidelines, the Central District office facility was closed to the public and remained so through June 2021. Staff also focused on limiting the number of personnel inside the office facility at any one time, and concentrated efforts on solo field work or field work that maintained social distancing of 6’ or greater to avoid transmission of the virus. Although stressful and difficult at times, the staff has persevered and there has been no illness or interruption in the completion of duties within the district.

The District Manager and the District Biologists provided input to the DFG Lands Committee on potential land acquisition projects, focusing on wildlife habitat and recreational opportunities. The District Stewardship Biologist and Wildlife Technicians monitored Conservation Easements throughout the District.

License agreements were issued by the district for agricultural leases on WMAs. The district currently manages 31 agreements. The Licensee at the High Ridge WMA opted to terminate their agreement (they were in year two of a five-year term). This property was not put back out to bid, and district staff will maintain the habitat for wildlife for the time being. These agreements benefit wildlife by maintaining open habitats, often in places that would otherwise not be actively managed due to staff, equipment, and time constraints.

Staff participated in professional development and training, including wildland fire training, and large animal response and safe capture training.

Stewardship, Management, and Habitat Restoration

Acreage was added to Moose Hill (55 acres) and Muddy Brook (32 acres) WMAs during FY 2021. The District Stewardship Biologist completed 29 WCE/WCR Monitoring visits ensuring compliance. We also reviewed one landowner cutting plan on WCE/WCR properties. Throughout the year maintenance work was performed on all WMAs. There was a large amount of trash removed from parking areas throughout the district. We concentrated on replacing or adding new signs at the

MacCallum WMA, High Ridge, Bolton Flats and Birch Hill WMAs, with many more planned for FY 2022.

Seven parking areas were improved with new gravel at the following WMAs: MacCallum, Bolton Flats, Natty Brook, Savage Hill, and High Ridge.

Over the summer of 2020, the timber cut at Norcross Hill WMA was completed, and the cut at Quaboag entered phase two; monitoring at that site is ongoing. The District Land Stewardship Biologist worked on boundary marking on parts of the Phillipston WMA where abutting property owners were conducting timber cuts, to proactively avoid encroachment problems.

Dam maintenance and cleaning is a continuous effort. Although there are many small dams that the agency has jurisdictional ownership of in the Central District, much of our time in FY 2021 was spent at Wine Brook, Williamsville Pond, Cusky Pond, and the Merrill Pond systems. As part of our ongoing effort to restore the Merrill ponds system, the dam at Putnam Pond was removed, and engineering work and permitting has begun for the dams at School House, and Adams ponds in that chain. We maintained the dam on Adams Pond by clearing brush and small woody growth. The engineering plan calls for repairing / replacing the spillway there, as well as improving access and parking.

District staff conducted habitat reclamation work on sections of Muddy Brook and Quacumquasit WMAs using a skid steer machine with a Fecon head to remove woody growth from overgrown fields and field edges. District staff also participated in prescribed fire treatments at Frances Crane, Birch Hill, Muddy Brook, Montague Plains, Herm Covey, and Leyden WMAs.

The District Stewardship Biologist worked with COOP farmers on active agricultural lease properties to ensure the farmers were following the requirements of their lease agreements. Five Agricultural License agreements were up for bid in FY 2021. These were put out to bid and new agreements were signed for the next five-year period. We also issued new snowmobile trail licenses on a short section of the Winnimussett WMA, and a large section of Birch Hill and Millers River WMA. Problems occurred on the Winnimussett WMA when riders disregarded signs and trail location and rode across parts of the WMA fields that were off limits. We will be working with the local club holding the license agreement to try to prevent this from happening again.

The Quacumquasit WMA/South Pond access parking area was impacted by a bridge replacement project for all FY 2021. That project was nearing completion by the end of the fiscal year, and the parking area for fishing boat access has been greatly enhanced by a larger, now paved, parking lot and new guardrail system. New updated signs will be placed there in FY 2022.

Research and Conservation

Wildlife

COVID-19 restrictions precluded much of our Bald Eagle nest climbing and chick banding activity for FY 2021, however, district staff were able to monitor 15 active bald eagle nests from the ground including new territories in Lunenburg and Harvard. One nest was climbed, and two chicks were banded at a nest site in West Brookfield.

Barrel traps were deployed at three research bear trapping sites in the district; one female with two cubs and one male were captured. The female was outfitted with a tracking collar bringing the total females in the Black Bear Study to ten within the Central District. We conducted five bear den site visits during the winter to assess the health of the bears and cubs they produced.

A total of 130 wood duck boxes were checked and maintained at 29 sites throughout the district. Six new boxes were erected. Efforts were hampered by poor ice conditions throughout the season. The district partnered with Assabet Valley Regional Technical High School to construct additional boxes.

We stocked 13,328 adult pheasants at 15 properties (13 WMA and 2 DCR). We also have seven sporting clubs and one jail location participating in the club bird program (two fewer clubs than last year, and one less jail raising program). These locations were delivered 4,074 pheasant chicks that were reared and subsequently released onto publicly huntable grounds in the district. Development pressure continues to reduce the available habitat where birds can be stocked and hunted. New house construction eliminated some locations from prior years, resulting in the concentration of stocked birds in fewer places.

In the early summer of 2021, we banded 150 Canada Geese at 14 sites. This number is comparable to our annual goose banding efforts from previous seasons.

Due to COVID-19 restrictions we did not staff any of the biological reporting stations for the first week of shotgun deer season this year. Harvest reporting was done primarily online through the MassFishHunt system. A total of seven private businesses chose to continue to operate the reporting station at their locations, and district personnel received the data from those locations.

We also assisted in waterfowl breeding plot surveys, Ruffed Grouse drumming surveys, and Woodcock surveys. The District Wildlife Biologist also conducted 12 miles of deer pellet count survey transects.

Fisheries

District staff surveyed 58 river and stream sites on the Millers, Nashua, Chicopee and Quinebaug drainages during the months of July, August, and September. The surveys were conducted using backpack electro shocking equipment, gathering information on fish identification, lengths, dissolved oxygen, pH, conductivity, and temperature.

District staff surveyed 2 waterbodies, Whitmanville Reservoir in Westminster and Ashburnham and Chauncy Lake in Westboro, using boat mounted electro shocking equipment to determine species, length, and weight.

District staff also surveyed 2 waterbodies during safe ice conditions using Ice Fishing Equipment and Minnow traps. Recording information on Identification, Length and Weight, the information is helpful on State WMAs and Conservation areas providing benchmark and comparison data to monitor the health and productivity of the location.

District staff assisted FHQ staff to conduct Lake Trout sampling on Quabbin and Wachusett reservoirs, setting gillnets for age and growth rates.

Trout were stocked with approved spring and fall allotment numbers. A total of 86 waterbodies received trout with 36 ponds, lakes, and reservoirs; 23 rivers; and 27 streams. The hatcheries in Belchertown, Sunderland, Montague, Palmer and Sandwich supplied the trout.

Central District did not conduct any public trout stocking events this year due to COVID-19 restrictions.

Central District staff conducted water-quality monitoring of the trout population at Goodrich Brook in Lancaster due to a proposed housing development upstream. Staff also continued oversight at Bartlett Pond in Lancaster to reintroduce wild eastern brook trout into the lower section of Wekepeke Brook to the Nashua River. We conducted follow up surveys on trout at Slack Brook in Leominster to repopulate in lower sections after a retaining wall collapse. We monitored and assessed water quality to sustain native brook trout at Coolidge Brook in Berlin and Northborough. At Old Mill Brook in Leominster, we conducted follow-up surveys on trout to repopulate in lower sections due to a past retention pond failure.

Outreach and Education

The District Manager attended the monthly meetings of the Worcester County League of Sportsmen providing highlights of district activities and interacting with meeting participants. Most of these meetings were conducted online via the Zoom platform due to COVID-19 restrictions. A monthly report of these activities was also generated and distributed to a mailing list of constituents maintained by the district office.

The Hunter and Angler Education Programs were drastically restricted due to the COVID-19 pandemic. Most of these courses are conducted by volunteer instructors, and due to the shutdown, none of the volunteers were able to conduct courses as they normally would have. In response to this, the Programs developed a COVID-19 safe protocol for delivering the curriculum to a limited number of students. The courses were conducted at a few locations by agency staff, and a few volunteers trained in the safety protocol. Central District staff participated in teaching and conducting several of these courses throughout the year.

District staff also aided the American Chestnut Foundation at the orchard located at the Westborough FHQ by improving drainage at the site of this ongoing project.

Connecticut Valley Wildlife District

Joseph Rogers, District Supervisor

Administration

The Connecticut Valley District Office continues to be fully staffed, as such we have had no new hires for the duration of this reporting period.

The District Manager served as local representative on the DFW Lands Committee again this year providing guidance and input on 9 new land acquisition projects. These acquisitions will serve to protect critical wildlife habitat and provide recreation opportunities for outdoorsmen and women throughout the district. This year over 2200 acres of new property were acquired to expand the Wildlife Management area and Wildlife Conservation Easements in the district. See the DFW Wildlife Lands section of this report for additional details on these, and other property acquisitions across the state.

Agricultural licensing agreements were issued on three Wildlife Management Areas (WMAs) in FY 2021. These agreements are allowed and maintained when they provide a benefit to wildlife by maintaining open space habitat in places that would otherwise not be actively managed due to staffing, equipment, and time constraints.

Working collaboratively with the Department of Conservation and Recreation (DCR), the Conn. Valley District staff sold 1,133 Quabbin one-day fishing Licenses, 132 of these were from credit card sales. The licenses were issued at the three boat launch areas on the Quabbin Reservoir and totaled $5,665 this fiscal year.

The Swift River primitive camping area remained closed for FY 2021 due to the COVID-19 pandemic.

There were no Field Trial permits or Special Pheasant Hunt permits issued for events in the Conn. Valley District this year.

Valley District staff participated in professional development and training throughout the year including prescribed fire certifications, pesticide applicator's license, Large Animal Response and Safe Capture training and attended workshops and conferences.

Stewardship, Management, and Habitat Restoration

Boundary marking of WMAs continues to be a priority throughout the district. This year in the Connecticut Valley District a total of 14.5 miles of WMA property boundary lines were marked. Including parcels at: Mount Toby WMA. Mount Esther WMA, Leyden WMA, Swift River WMA, Montague WMA, Wendall WMA, Herman Covey WMA, Lake Warner WMA and Forest Lake WMA. While agency staff did the majority of this work, contractors were used to complete the more complicated boundary tracks.

Annual monitoring visits and reports were conducted on 20 Wildlife Conservation Easements (WCE) throughout the district in FY 2020. Annual monitoring is a legal obligation under the terms of each easement and is also critical to protecting the conservation values of these properties. Landowners were contacted via letter and invited to participate. Participants who decided to come along for the site visits provided a good perspective on the land's history and current use, as well as a chance to build relationships with these landowners. A new Conservation Easement, the Walter C. Jones Working Forest WCE was purchased from W.C. Cowls and several site visits were conducted with staff. In collaboration with Cowls, an existing forestry landing was reconfigured to provide a more established parking area with improved base materials.

Under the agency's current Walking Trails Policy, proposed trails and maintenance of existing trails must undergo an in-depth application and approval process. The Valley District completed the trail license for the Tully Trail on the Tully Mountain WMA, Fish Brook WMA, and Tully Mountain WCE in agreement with the North Quabbin Trails Association. Work continues with the Appalachian Mountain Club (AMC), and Kestrel Land Trust to bring sections of the New England Trail, Robert Frost Trail, into compliance with this policy.

Use of WMAs continued to see a marked increase from previous years and several new issues stemming from the influx of new user groups to the

properties continues to be a challenge. Over two tons of dumped materials were removed from WMAs. Increased parking pressures on several WMAs (notably Green River WMA and Herm Covey WMA) has led to increased parking lot maintenance and ATV trespass issues. New boulders were installed at Palmer WMA in an effort to reduce ATV access. WMAs are also seeing increased pressure from abutters to address damages and risk of falling trees due to increased storm strength and frequency across the District. Three separate storm events led to several requests for fallen tree removals.

Parking areas and access points were improved by district staff at several of the WMAs throughout the district. Improvements to hunting access were completed at Leyden WMA, and Palmer WMA. Improvements and maintenance included widening existing parking areas, improving surfaces with gravel, boulder exclusions to limit illegal off-road access, installation of new gates, repair and/or maintenance of existing gates, and motorized vehicle trespass deterrence. All WMAs were posted with rules and regulations. Signs are posted at public access entrance points at 35 WMAs throughout the district.

Approximately 176 acres of fields were mowed at nine WMAs (63 acres at Southwick WMA, 19 acres at Southampton WMA, 18 acres at Herman Covey WMA, 6 acres at Poland Brook WMA, 28 acres at Leyden WMA, 1 acre Montague Plains WMA, 16 acres Satan Kingdom WMA, 18 acres Green River WMA, and 6 acres at Flagg Mt WMA).

A total of 160 acres of grasslands and shrublands were burned under prescribed fire plans at four WMAs (19 acres at Leyden WMA, 10 acres at Montague Plains WMA, 54 acres at Herman Covey WMA, and 77 acres at Southwick WMA). Four District staff were trained and recently certified as fire fighter type 2 and were able to assist with prescribed fires though out the state to improve wildlife habitat.

District staff spot treated 120 acres of herbicide on seven WMAs (16 acres at Leyden WMA, 1 acre at Montague Plains WMA, 17 acres at Satan Kingdom WMA, 27 acres at Herman Covey WMA, 18 acres at Green River WMA, 3 acres at Poland Brook WMA, and 31 acres Southwick WMA).

Also, staff converted 10 acres of fields to warm season grasses at Herman Covey WMA. Several firebreaks were mowed and/or maintained at Montague Plains WMA, Southwick WMA, Herm Covey, and Leyden WMA for prescribed fire management on those properties.

Research and Conservation

Wildlife

Valley District staff contributed to the statewide wildlife survey efforts by completing 8 Ruffed Grouse drumming survey routes and conducted Wild Turkey brood surveys. Staff also banded 67 Canada Geese at three sites. A total of 113 Wood Duck boxes were checked and maintained at 33 sites. Blue Bird and Kestrel nesting boxes were maintained at several WMAs as well.

Valley District staff monitored the survival and reproduction of 21 radio-collared female black bears during this reporting period. One collared female was shot during hunting season, and one slipped her collar during the reporting period. Attempts were made to capture 16 collared females in their dens to determine reproductive success and first-year cub survival, 11 of the females were successfully immobilized and handled in dens. It was determined that 11 females had newborn cubs, 5 had yearling cubs. Global Positioning System (GPS) collars were affixed to bears to monitor locations every 45 minutes. Bear traps were set in the spring and early summer to recapture a female bear with a GPS collar that malfunctioned and to add new females to sample size. In total this year six new bears were captured during trapping (5 males, 2 females). Only three check stations in the district were willing to check hunter harvested animals this year due COVID-19 and no biological deer check occurred. Game check had to be completed online or via a call-in check process. District personnel staffed phones to allow hunters to call in their harvest if they did not have computer access.

Valley District staff stocked 10,000 pheasants on 10 agency owned WMAs, 6 government town owned properties, and 10 privately owned hunter accessible properties prior to and during the 6-week long pheasant hunting season. The WMAs stocked by district staff this year included: Herm Covey WMA, Poland Brook WMA, Leyden WMA, Montague Plains WMA, Connecticut River WMA, Bennet Meadows

WMA, Pauchaug Brook WMA, Southampton WMA, Southwick WMA and Whately Great Swamp WMA. Tully Mountain WMA was also stocked this year by local clubs as part of the Club Bird Program. Towns stocked within the district included: Amherst, Belchertown, Brimfield, Conway, Deerfield, Hadley, Hatfield, Holland, Brimfield, Leverett, Leyden, Montague, Northfield, Northampton, Orange, South Hadley, Southampton, Southwick and Whately. A complete list of pheasant stocked properties within the district can be found on MassWildlife's website at: https://www.mass.gov/service-details/pheasant-stocking-connecticut-valley-district.

Also, District staff that were hoisting certified helped cleaned up and reopen Bitzer Hatchery after down trees from a micro burst storm blocked access though out the hatchery.

Fisheries

The fall 2020 trout stocking season proceeded in a more normal fashion than the spring 2020 stocking season. Pacing was not at an accelerated rate as it had been the previous spring. District staff stock 12,600 trout at 17,943 pounds, into 31 different waterbodies. All but 1,000 of these stocked trout were Rainbow Trout from the McLaughlin Hatchery in Belchertown. The remining 1,000 trout were Brown Trout from the Bitzer Hatchery in Montague, all of which were stocked into the Swift River. Fall stocking started on October 2, 2020, and was completed on October 16, 2020. District staff completed the season with 12 loads using one stocking truck.

The Spring 2021 stocking, for the Connecticut Valley District, ran from March 23 to May 27 (with additional loads on July 1 and 2, in FY 2022), to the Swift River. Spring season stocking totals reached 95,858 individual trout, weighing 89,290 pounds. In the spring season, the majority of fish stocked were Rainbow Trout, comprising 56% of all stocked fish. Brown Trout were 27%, Brook Trout 16%, and Tiger Trout 0.6% of the remaining stocked fish.

The District continued with previous year's fisheries projects, but with slight modifications due to the limitations associated with the COVID-19 pandemic. Alterations to field protocols were made to ensure safe conditions while still allowing for the continuation of data collection field work. These included the fourth year of the Connecticut River Juvenile Shad Project, a further expanded Swift River Rainbow Trout mark-recapture project, and the continuation of the Quabbin Reservoir Lake Trout netting project. Additionally, district staff worked closely with biologists from field headquarters for smaller scale sampling projects. Please note that the fiscal year reporting period splits the normal summer sampling season, sampling season is ongoing for these projects.

An expanded Swift River mark recapture project was initiated in March 2021 following postponement from the previous season. In 2021 all stocked fish were marked using Visible Implant Elastomer (VIE) tags, in previous years only summer and fall stocked Rainbow Trout were marked. In an effort to convey project goals, schedules, and eventually results, a public facing website was launched to warehouse information and provide a place to direct anglers and other members of the public encountered in the field (www.mass.gov/swift-trout). Release groups were differentiated with 5 different color elastomer marks immediately behind their left eyes: blue, red, orange, yellow, and green for March, April, May, July, and October, respectively. Additionally, an adipose fin clip was applied to all fish stocked in the fly-fishing-only, catch-and-release area above Route 9. At the time this report was written, staff had marked 4 out of the 5 planned release groups, and completed numerous recapture events for each, data collection and analysis are ongoing.

A fourth year for the Connecticut River juvenile American Shad assessment project, a cooperative project with the USFWS, was completed in the summer and fall of 2021. In 2020 field protocols were modified to minimize total staff on boats, and only utilized one netter rather than two to maximize physical distance. Despite these limitations, staff were able to complete a very successful sampling season: 14 sampling nights were completed, consisting of 65 individual runs, and 3,221 juvenile shad were sampled and assessed. Both the total runs and total shad sampled were higher than the previous sampling season. Catch rates are compared and used to estimate juvenile shad abundance in a variety of different temporal and geographic strata.

The Quabbin Lake Trout sampling continued in FY 2021 but was modified like other projects this sampling season due to the COVID-19 pandemic. Under normal circumstances a crew of five would be the standard for this project's current setup,

however this season a minimal crew of 3 was utilized to allow for maximum spacing on the sampling boat. Additionally, due to malfunctions with both PIT (Passive Integrated Transponder) tag scanners, no new PIT tags were applied this sampling season. In total 94 total Lake Trout were captured, assessed, and released at the Windsor Dam site (20 of which were recaptures from previous years). 63 Landlocked Atlantic Salmon were also captured, 61 of which were hatchery origin (adipose fin clip present).

In addition to the larger scale research projects outlined in the sections above, the district staff also completed numerous smaller scale electrofishing surveys. In total 41 backpack electrofishing surveys were completed on smaller wadable streams, often collaborating with staff from field headquarters and other districts. District staff also had the opportunity to assist with 5 mussel snorkeling surveys in 2 river systems this season.

As mentioned in previous sections of this report, this was the first season of a new mark-recapture project on the Swift River, a large trout-stocking research project. The marking of the fish was carried out by district staff in cooperation with the Coldwater Fisheries Project Leader. Equipment and materials for this project had been purchased and prepared for the Spring 2020 stocking season, but the pandemic necessitated a postponement until the Spring of 2021. Applying elastomer to fish took place immediately prior to stocking, district staff picked up each load of fish from the hatchery as any normal load and brought the fish back to the district office for marking. Due to the timeline, chemical sedation could not be used, so staff researched and constructed a new electronarcosis tank to immobilize the large trout for mark application. This tank, applies very low levels of electricity to sedate the fish momentarily so staff can safely handle and apply the VIE tags just behind their eye, once removed from the tank/electric field, there are no lingering effects to the individual fish, or the chemical concerns associated with MS222. Research and rationale for the electronarcosis equipment was found in “A Portable Electronarcosis System for Anesthetizing Salmonids and Other Fish” by Hudson et al. 2011 (J. Michael Hudson, Jeffrey R. Johnson and Boyd Kynard (2011) A Portable Electronarcosis System for Anesthetizing Salmonids and Other Fish, North American Journal of Fisheries Management, 31:2, 335-339), and proved to be quite effective for this application. The workflow associated with marking and stocking these trout necessitated a somewhat unique stocking approach, often splitting the loads over a 2-day period and involving all available stocking crews. Each stocking day created 3 unique batches of fish with differential marks that needed to be kept separate from one another and stocked in the correct geographic region on the river in line with the project scope. Staff often utilized 3 stocking trucks and worked in an assembly line fashion marking and then stocking groups of fish throughout the day. Several hundred fish could be safely marked and stocked efficiently within each stocking day with this current approach and equipment setup.

Natural Heritage and Endangered Species Program

The Valley District staff continues its efforts to monitor and band eagle census covering Hampshire, Hampden and Franklin counties. District staff identified and monitored 34 breeding Bald Eagle territories.

The district cooperated with NHESP staff on a variety of projects throughout the district this year. Valley District staff also assisted FHQ staff with four whip-poor-will surveys within the district.

Enhancement of Outdoor Recreation

Valley District staff continues to clear and maintain the 1.25 miles of access trails and four duck blinds for the annual Ludlow WMA controlled duck hunt.

Five sportsmen’s clubs within the Valley District participated in the Club Pheasant Program this year. District staff received and distributed 1,120 seven-week-old pheasants to these clubs in July. These birds will be released on properties open to public hunting during the regular hunting season for sportsmen and sportswomen to enjoy. Valley District staff administered the annual controlled waterfowl hunt at Ludlow WMA. Twelve hunters applied for this year’s raffle style permits and all those who applied were drawn to participate in the hunt.

Outreach and Education

Due to the ongoing COVID-19 pandemic, the 2021 season had no public stocking events and the Springfield Sportsmen’s Show was not held.

Technical Assistance

Our District offices are often our first line of contact to the general public. While the Valley District office remained closed to the public during most of the COVID-19 pandemic our phones remained open and staffed resulting in hundreds of calls requesting technical assistance regarding wildlife and fisheries concerns. Staff addressed the needs of callers ranging from hunting and fishing license sales, requests for information, aided with nuisance-animal complaints, assistance with injured wildlife and hunter harvest reports for hunters without access to computers.

Western Wildlife District

Andrew Madden, District Supervisor

Administration

Fiscal Year 2021 was one of the most challenging years for Western District personnel and operations. The COVID-19 pandemic limited staff ability to work or travel together which is an essential part of normal district function. This required constant changing of plans and strategies to accomplish the necessary work. The staff was adaptable and extremely effective under these difficult circumstances. The Western District staff reported for work in person throughout the FY with only a few exceptions, despite the elevated risk associated with in-person work, once again demonstrating great commitment to the agency, our constituents, and public service.

The Sistrict operated on reduced staffing again for FY 2021 with two Technician positions remaining vacant. The lack of adequate staffing has hurt our ability to provide the high level of service that the public and our constituents have come to expect. We were able to add Seasonal Wildlife Technician Jasper Gardner in April 2021 to help fill the gap.

It was another successful year for land protection in the Western District. The District Supervisor and the Stewardship Biologist assisted the Western District DFG Land Agent in protecting almost 1,200 acres across 12 towns in FY 2021. These efforts involved site visits, deed research, parcel evaluation and stewardship. Many of the FY 2021 projects were complicated and required substantial time investment but protect important habitats and provide great opportunity for hunting, fishing, and passive recreation.

Capital funding provided opportunity to improve security and energy efficiency at both the Dalton and Pittsfield headquarters buildings. New entry doors were installed at the Dalton building, replacing weak and energy inefficient entryways. A new alarm system was installed in each of the buildings at 400 Hubbard Ave, Pittsfield, securing equipment and buildings.

Large Animal Response Team (LART) cases in FY 2021 included an injured bear in Great Barrington (immobilized, assessed and released), an injured bear in North Adams (euthanized), a deer in a fenced solar farm (left to exit on its own), a weak yearling bear in Savoy (rehabilitated and released), a weak yearling bear in Dalton (assessed and left in place), a habituated fawn in Monterey (rehabilitated and released), an injured deer in Pittsfield (euthanized), a moose in Tyringham (directed out of sheep pasture), and two bear responses in Pittsfield (assessed and left in place).

The District Manager worked on issues related to snowmobile trails on Wildlife Management Areas. This included trail assessment and numerous meetings with Snowmobile Association of Massachusetts officials. The District Manager also spent considerable time communicating the need for increases in license fees by meeting with sporting clubs, county leagues, and individual constituents.

Stewardship, Management, and Habitat Restoration

The Stewardship Biologist is responsible for coordinating efforts on boundary marking, encroachments, access, Conservation Easement monitoring, and other land management activities. The Stewardship Biologist was the point of contact for contractors working on boundary marking and surveys. A total of twenty-five miles of boundaries were marked in FY 2021, in combined efforts between District staff and contractors. Property surveys were contracted and completed on 2 Western District WMAs (Tower Brook and Chalet).

These surveys were important in establishing boundary lines and determining clear ownership.

The Stewardship Biologist completed 33 monitoring visits to Conservation Easements. He reviewed multiple forest management plans, in conjunction with the Realty Section and Habitat Program, for operations on Conservation Easements.

Illegal use of ORVS on WMAs continues to be a major source of damage and has only increased with the COVID-19 pandemic. District staff continued to impede ORV use and work with the Environmental Police on enforcement.

New signage was installed at the Moran WMA, Swift River WMA, and Stafford Hill WMA. The newly designed welcome signs were installed at most parking areas in the district.

District staff maintained parking areas at 12 WMAs and 4 Public Access ramps. With stewardship funding, we were able to improve parking at Hop Brook WMA, Darey WMA, and Eugene Moran WMA. District staff installed a new gate at the Chalet WMA. Staff maintained water flow at the Eugene Moran WMA protecting the road and access for pheasant stocking and management.

Staff spent multiple days on annual maintenance the Three Mile Pond dam, including vegetation removal and maintenance of the outflow structure.

Research and Conservation

Wildlife

Annual surveys for Woodcock (3), Ruffed Grouse (7) and waterfowl indicated pair surveys (5) were conducted in the district. Staff also cleaned, constructed, and installed nesting boxes for Wood Ducks, Bluebirds and Kestrels.

Western District personnel implemented multiple habitat projects including brush mowing over 400 acres across 13 different WMAs and pruning apple trees and creating young forest habitat at Chalet WMA. Staff also coordinated with the Habitat Section on projects, including management plan review, site visits and logistical support.

The district deployed loon rafts at Cleveland Reservoir in Hinsdale and Ashley Reservoir in Pittsfield. The Cleveland raft was used successfully for the fourth consecutive year. One-hundred Canada Geese were banded throughout the district in June 2021.

The District had continued success with the bear trapping and collaring program, despite COVID-19 limitations from low staffing. Five new bears were tagged. Bear trapping requires substantial effort but has provided some very important local data which has been directly relevant in explaining and, in some cases, reducing bear conflicts in the region. District staff also helped put up 21 bear hair snare traps in coordination with the UMass Coop Unit research project. Winter den work went well with all necessary bears captured, collars serviced, and data collected.

The District Manager and Wildlife Biologist conducted numerous site visits related to bear activity. In most cases the issues were resolved with education and information. In two cases, bears had to be removed because of public safety threats, including a bear at the Tolland State Forest campground. The district worked with the Town of Stockbridge to develop a wildlife feeding ordinance which was implemented in Spring of 2021.

Fisheries

Due to the COVID-19 pandemic and limited staff, very few stream surveys conducted in the summer of 2020. A total of 7 fisheries surveys were conducted on 3 waterbodies in August and September 2020, with assistance from the Westboro Fisheries Section, Connecticut Valley District, Sunderland Hatchery, and UMass Amherst. Surveys on the West Branch Housatonic River and on the North Branch Hoosic River were conducted to monitor fish populations post-removal of the Tel-Electric and Briggsville Dams. An electrofishing raft survey on the Housatonic River in Great Barrington was performed to sample Northern Pike in the lower reaches of the river.

Due to reduced staff levels and COVID-19 safety requirements only 1 pond survey was conducted in 2020. Benedict Pond in Monterey was surveyed on June 17, 2020. Four waterbodies were surveyed in June 2021: Laurel Lake, Onota Lake, Pelham Lake, and Thousand Acre Swamp. Laurel Lake was surveyed as part of the 3-year fisheries survey schedule in response to the presence of Zebra

Mussels in the lake. All fish were identified and measured to the nearest millimeter and weighed before being returned to the water.

The District Fisheries Biologist and Technicians continued to monitor for the presence of *Didymosphenia geminata* (a.k.a Didymo) in the Green River and throughout the Westfield River system. One fish kill was investigated at Cheshire Reservoir.

The Fisheries Biologist assisted the Fisheries Section in adipose clipping of Brown Trout for stocking in the Deerfield River, as part of an ongoing assessment of wild Brown Trout.

One day was spent removing Water Chestnut from Three Mile Pond in Sheffield on July 7, 2020, to control the plant's spread to other parts of the waterbody. A crew of 6 Western District staffers assisted with the effort pulling plants by hand from kayaks and canoes. Overall coverage of the plant has significantly decreased in comparison to the previous 2 years, indicating annual pulling efforts are making a significant impact on Water Chestnut density in the pond. Monitoring and removal efforts will continue annually to control the plant's spread.

Natural Heritage and Endangered Species

District Biologists provided support in the form of local knowledge and biological input to the NHESP on environmental reviews and listed-species issues, particularly on issues of lake and pond management. Staff accompanied NHESP botanists on numerous site visits in the district.

District Staff participated in the Bald Eagle Nesting Survey. There are 9 confirmed active nests known in the Western District: Russell, Pittsfield, Lee, Monterey, Buckland, Great Barrington, Richmond, Williamstown, and Otis. The district banded eagle chicks at the nests in Richmond and Tekoa.

With a grant from MassDOT a fence was installed around a vertical mine shaft at the Maxwell Brook WMA. The project included extremely difficult logistics but was successful in alleviating a potential danger while allowing bat ingress and egress.

District Biologists and Wildlife Technicians partnered with NHESP to manage and enhance habitat for endangered bog turtles by conducting surveys, clearing vegetation, and maintaining water levels. The District Manager attended monthly meetings of the Berkshire Fens working group with The Nature Conservancy.

District staff assisted with peregrine banding at Tekoa WMA and continued efforts to curtail illegal climbing at the area.

District technicians and Biologists constructed and installed seven bat boxes on District WMAs in coordination with the NHESP program.

Enhancement of Outdoor Recreation

Enhancement of outdoor recreation is a core function of the district office. In addition to the usual efforts, district staff excelled in this category by reporting to work throughout the COVID-19 shutdown to distribute fish and support sportsmen and women.

Pheasants were stocked 3 days per week throughout the season. The Western District distributes 4,000 birds, released on nine WMAs: Stafford Hill (Cheshire), Eugene Moran (Windsor), George Darey Housatonic Valley (Lenox), Hop Brook (Lee), Knightville (Huntington), Hinsdale Flats (Hinsdale), Three Mile Pond (Sheffield), Flat Brook (West Stockbridge), and Peru (Peru) and 13 covers across the towns of Ashfield, Lee, Lenox, Williamstown, Hawley, Great Barrington, and Pittsfield. Overall, Pheasant stocking requires about 40 personnel days to complete each year. Pheasant chicks were provided to the Lee and Ashfield sportsmen's clubs in early FY 2021.

The Western District hosted two sites for paraplegic sportsmen to participate during the designated three-day hunt. District staff attended all hours of the hunt and, with the help of volunteers, ensured safe and successful hunting, while complying with Covid protocols.

Fall trout stocking commenced on September 30 and concluded on October 14, for a total of 9 stocking days. Sixteen waterbodies were stocked: 16 lakes and ponds and 2 rivers (Deerfield River and East Branch Westfield River). The total number of trout stocked in Western District waters in the fall was 14,652 fish, which came from Bitzer, McLaughlin and Sunderland hatcheries.

Spring Stocking commenced on March 26, 2021. A total of 98,303 fish were stocked during the spring season in 77 waterbodies: 23 lakes and ponds, 54 rivers and streams. Stocking practices returned close to normal, given the circumstances of the pandemic. Stocking concluded on June 1, 2021, for a total of 45 stocking days.

Outreach and Education

Outreach activities were among the most impacted by the COVID-19 restrictions. The usual shows, fairs, and school visits were unavailable. District field staff continued daily public interactions; the importance of those communications was magnified during the pandemic.

The District Manager attended monthly meetings and provided updates to the Berkshire County League of Sportsmen. He also presented a public lecture in Sheffield on living with black bears.

District biologists and technicians participated in several R3 working groups to promote hunting, fishing, and shooting activities.

Technical Assistance

For almost all of FY 2021, the district office was closed to the public. On most days, a staff member was assigned to answer the phone. On occasions where staff was unavailable, we recorded messages and returned calls, usually the same day. Throughout the pandemic and office closure we found creative ways to assist the public in attaining licenses and permits.

The District Fisheries Biologist served as an alternate to the Westfield River Wild and Scenic Committee and attended the Chester Municipal Vulnerability Workshop.

The Western District responded to numerous wildlife situations in FY 2021. We picked up multiple hawks and owls over the course of the year. We provided technical advice on living with bears daily in spring and early summer.

Wildlife District Staff

Field Headquarters

Trina Moruzzi, Assistant Director of Operations
James Pollock, Operations Specialist

Northeast Wildlife District

Patricia Huckery, District Supervisor
Chalis Bird, Wildlife Biologist
Travis Drudi, Stewardship Biologist
Leslie Gabrilska, Clerk
Anne Gagnon, Land Agent (DFG)
Joshua Gahagan, Wildlife Technician
Tim Mathews, Wildlife Technician
Derek McDermott, Wildlife Technician
John Sheedy, Fisheries Biologist

Southeast Wildlife District

Jason E. Zimmer, District Supervisor
Aaron Best, Stewardship Biologist
Jeff Breton, Wildlife Technician
Daniel Fortier, Wildlife Technician
John Garofoli, Wildlife Technician
Steve Hurley, Fisheries Biologist
Joan Pierce, Land Agent (DFG)
Debra Silva, Clerk
Steve Wright, Wildlife Biologist

Central Wildlife District

Todd Olanyk, District Supervisor
John Bonafini, Wildlife Technician
Mark Brideau, Fisheries Biologist
Scott Kemp, Stewardship Biologist
Ethan LaPlante, Wildlife Technician
Mike Morelly, Wildlife Biologist
Debra Manty, Clerk
Jessi Manty, Wildlife Technician
James McCarthy, Land Agent (DFG)
Ian Sypek, Wildlife Technician
Bruce Walker, Wildlife Technician

Connecticut Valley Wildlife District

Joseph Rogers, District Supervisor
Anne-Marie Bartus, Clerk
Christopher Connors, Wildlife Technician
David Fuller, Wildlife Biologist
Brian Keleher, Fisheries Biologist
Jennifer Jones, Stewardship Biologist
Christina Petersen, Land Agent (DFG)
Kevin Pelosky, Wildlife Technician
Shasta Slade, Wildlife Technician
Walter Tynan, Wildlife Technician

Western Wildlife District

Andrew Madden, District Supervisor
Ray Bressette, Wildlife Technician
Nathan Buckhout, Wildlife Biologist
Tammy Ciesla, Wildlife Technician (*partial year*)
Leanda Fontaine, Fisheries Biologist
Debra Lipa, Clerk
Peter Milanesi, Land Agent (DFG)
Jacob Morris-Siegel, Stewardship Biologist
Eli Pease, Wildlife Technician

8 Wildlife Lands: Stewardship and Acquisition

Trina Moruzzi, Assistant Director of Operations

Overview

The Wildlife Lands program worked diligently this past year during the COVID-19 pandemic to ensure acquisition, maintenance, and stewardship of the thousands of acres of wildlife lands acquired and managed by MassWildlife remain protected wildlife habitat. Despite the COVID-19 pandemic, realty and wildlife lands staff coordinated stewardship efforts with the 5 districts. Land stewardship in the form of habitat management, Conservation Restriction (CR) landowner relationships and CR monitoring, boundary marking, survey contracts, signage, and managing access continued to be carried out throughout the pandemic. As detailed below, Masswildlife's continued focus on strategic land acquisition and long-term stewardship underscores its commitment to protecting the best land for wildlife, biodiversity, and wildlife-dependent recreation in Massachusetts. The DFG/MassWildlife land acquisition teams look forward to another productive year of conserving land for habitat biodiversity as well as hunting, fishing, trapping, wildlife viewing and other nature-based recreations.

Stewardship Highlights

MassWildlife continues to be a leader in statewide stewardship efforts with six full-time staff members dedicated to overseeing the care of fee-owned properties and those held under a Conservation Restriction. Stewardship staff regularly monitors properties, works with landowners to review their land management plans, consults with abutters, and engages with other interested parties.

The Stewardship team continues to help the agency reach its goal of improving access and educating the public about MassWildlife lands. Stewardship staff routinely works on efforts to install signs, parking areas, and gates, and spends many hours in the field working in their own right and with contractors and District staff to mark the boundaries of MassWildlife properties.

Conservation Restriction (CR) Stewardship

CR monitoring continues to be a highlight of the achievements MassWildlife's Stewardship Biologists are able to accomplish, and the Stewardship team is able to meet its goal of visiting each property annually with few exceptions. Landowners have also become accustomed to working more closely with their local Stewardship Biologist to help ensure they are compliant with the terms and conditions of their CR. This past year the Stewardship team distributed the *MassWildlife Conservation Restriction Landowner Handbook* to each CR landowner (Figure 33). Funded by the Executive Office of Energy and Environmental Affairs, the handbook helps landowners understand their CR, provides guidance on their roles and responsibilities as landowners, and identifies MassWildlife's obligations as holders of the CR.

Figure 33. Cover of the MassWildlife Conservation Restriction Landowner Handbook.

Surveys

MassWildlife hired private survey contractors to help resolve a number of challenging boundary questions

that have arisen in the Districts. Land Agents, Stewardship Biologists, Realty staff and District Managers worked closely with these contractors, who prepared survey plans for seven different properties among the Districts.

Boundaries

MassWildlife hired experienced private contractors in FY 2021 for the purpose of confirming over 106 miles of property boundaries at 17 WMAs throughout the state. Some boundaries were easier to confirm than others. Field conditions (terrain, the presence of wetlands) and parcel configuration contributed to the ability to confirm boundaries. Boundaries on larger parcels with less intricate boundaries typically were easier to confirm and mark. District staff, with assistance from Realty staff from Field Headquarters provided contractors with maps and deeds together with basic orientation. The contractors performed a diverse set of tasks depending on district preference, including researching deeds, locating boundaries in the field, creating GPS track-logs, blazing and painting trees, and hanging MassWildlife signage.

Land and Conservation Restriction Acquisitions in FY 2021

The Department of Fish and Game (DFG) and MassWildlife work together to protect the Commonwealth's most important fish and wildlife habitat and to expand the public's access to land and inland waters for hunting, trapping, and fishing. To accomplish this dual mission, DFG/MassWildlife's Land Protection Program uses funding from the Environmental Bond and the Wildlands Fund to purchase land and conservation restrictions from willing landowners who seek to conserve their property. Some landowners donate their land or a CR on it to DFG/MassWildlife, which may result in an income tax deduction for the landowner.

Fiscal year 2021 was another successful year for protecting land across the Commonwealth, yielding a multitude of public benefits. Land agents in each of the five districts completed a total of 33 projects for land acquired in fee covering 1,547.3 acres for a total cost of $3,579,317 (Figure 34; Table 46). There was a total of seven projects for land acquired through a Wildlife Conservation Easement (WCE), totaling 2,969 acres for $5,025,000 (Table 47). Land acquired in fee and through a CR improves Massachusetts' climate-change resiliency by protecting forests that absorb carbon dioxide and wetlands that work to absorb floodwaters in extreme weather events, and by connecting large tracts of wildlife habitat to allow plants and animals the ability to adapt to changing weather conditions.

Figure 34. FY 2021 Acquisitions by Town and Acreage

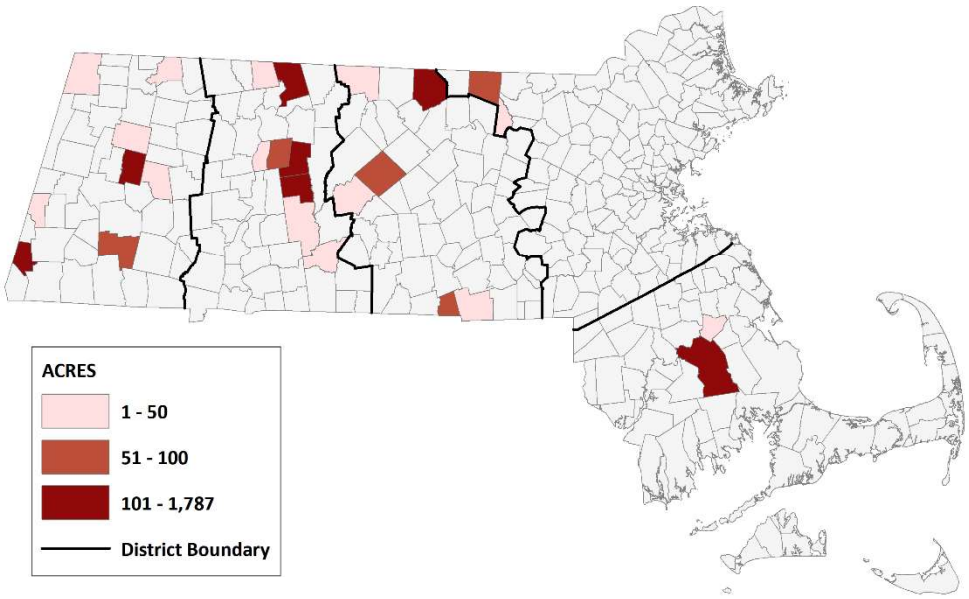


Table 46. FY 2021 summary of land acquired in fee.

Town	Property Name	District	Acreage
Middleborough	Copicut WMA	Southeast District	91.73
Halifax	Peterson Swamp WMA	Southeast District	7.67
Worthington;	Hiram H. Fox WMA	Western District	1
Windsor	Chalet WMA	Western District	13
Williamstown	Misery Mountain WMA	Western District	5.86
Otis	Long Mountain WMA	Western District	1.03
Otis	Long Mountain WMA	Western District	54.59
West Stockbridge	Maple Hill WMA	Western District	12.76
Peru	Peru WMA	Western District	130
Egremont	Jug End Fen WMA	Western District	103.62
West Stockbridge	Maple Hill WMA	Western District	31.38
Egremont	Jug End Fen WMA	Western District	9.59
Rowe	Maxwell Brook WMA	Western District	38.89
		Total Acreage	**1,547.3**

Table 47. FY 2021 summary of land acquired under a conservation restriction.

Town(s)	Property Name	District	Acres
Leverett, Shutesbury, Pelham	Walter Cowls Jones Working Forest WCE	Connecticut Valley District	2038.78
Dunstable	Unkety Brook WCE	Northeast District	72.18
Dunstabl	Unkety Brook WCE	Northeast District	65.6
Lanesborough	Widow White's Peak WCE	Western District	159
Great Barrington	Tom Ball Mountain WCE	Western District	360
West Stockbridge	Tom Ball Mountain WCE	Western District	265
Dalton, Hinsdale	Housatonic River East Branch WCE	Western District	9
		Total Acreage	**2,969.56**

Land Conservation Highlights

A total of nine land projects were completed in the Connecticut River Valley District this year resulting in 2,240.77 acres of land protected.

The largest and most notable acquisition within the district this year was a 2,038.78-acre Wildlife Conservation Easement (WCE) purchased on property owned by W.D. Cowles, Inc. The property, now named the Walter Cowls Jones Working Forest, stretches across the towns of Leverett, Shutesbury and Pelham. It will continue to be owned and managed by Cowls but will also be protected under a CR, preventing future development; requiring sustainable forestry practices; and ensuring future public access for hunting, fishing, hiking, and other wildlife-dependent forms of recreation. Visitors to the property will find a mixed deciduous forest including pockets of wetland complexes, early forest communities, and mature woodlands.

One additional 8.04-acre parcel of land was purchased along the northern shore of Forest Lake in Palmer, adding to the existing Forest Lake WMA and further protecting the access to the lake. This property is the only public fishing access to this popular fishing destination. Forest Lake ranks sixth out of the 53 lakes in the Connecticut Valley District for total submissions to the sportfishing program.

Several properties were added to the area in and around Satan's Kingdom WMA this year. The five properties totaled over 140 acres purchased throughout the towns of Bernardston and Northfield. These new acquisitions included an

expansive wetland complex and additional wooded uplands adding to the diversity within the Satan's Kingdom WMA complex.

The remaining acquisitions included a 28-acre parcel acquired on the southern end of the Palmer WMA, a 15-acre parcel next to Mt. Toby WMA, and a 10-acre parcel bordering Herman Covey WMA. All three of these acquisitions continue to add to existing properties owned by MassWildlife, assuring continued preservation of the state-owned lands in this District.

The Southeast District acquired the beginnings of the new Sippican Headwaters WMA in Middleboro. Two parcels were purchased totaling 335 acres. The property includes most of a 14-acre cranberry bog reservoir which can be used for carry-in kayaks and canoes and for shore fishing. Other features include about 15 acres of retired cranberry bogs and 300 acres of mature forest. The parking area is on the south side of Spruce Street, a short distance west of the RR tracks. A woods road connects the parking area to the interior of the property. The District also added some property to the Peterson Swamp WMA in Halifax for improved public access. The District will create a small public parking area on the property's frontage on the south side of Aldana Road.

In the Northeast District, two wildlife conservation easements (WCE) and five fee acquisitions were completed in FY 2021, conserving 205.25 additional acres at a cost of $282,185. The two WCEs protect rare species habitat in Dunstable. One was acquired as mitigation for a solar array and the adjacent WCE was purchased. Three more parcels were added to the Townsend Hill WMA, including a 29-acre gift as part of a cluster development. Two small gifts were added to the Mulpus Brook WMA in Shirley.

In addition, the North County Land Trust (NCLT) worked with MassWildlife to pre-acquire 203 acres, including the South Peak of Watatic in Ashby/Ashburnham to protect it from development. NCLT will transfer most of the property to MassWildlife in FY 2022. They will retain 14 acres at the end of Hardy Road and will gift a WCE over the land they retain.

The Western District completed 15 land protection projects that added to ten different WMAs and three WCEs and conserved close to 1,194 acres of land. Among the highlights was 625 acres of land protected in cooperation with Berkshire Natural Resources Council (BNRC) known as the Tom Ball Mountain WCE. This property contains both the ridgetop of Tom Ball Mountain and a substantial portion of Round Pond. The rare combination of steep hillside and waterfront provides excellent recreational opportunity while protecting important wildlife habitats. The Western District also added 130 acres of high-elevation, spruce-dominated forest abutting the Peru WMA, which buffers existing land and protects what is becoming a less common habitat type in Massachusetts. Perhaps the most publicly notable acquisition was the addition of Smiley Mill Pond to the Jug End Fen WMA. This 103-acre parcel includes the entirety of Smiley Mill Pond, which is home to numerous rare species and is a very important stopover point for migrating waterfowl. The conservation community was united in its desire to see this resource permanently protected, so MassWildlife's acquisition was very well received.

The Central District completed six fee acquisitions totaling 531.69 acres at a total acquisition cost of $789,000. One of the projects, the 15-acre Barnes acquisition at Muddy Brook WMA in Hardwick, came as a donation to DFG through the Massachusetts Conservation Land Tax Credit (CLTC) program.

The most significant land project completed in the Central District during FY 2021 was the 272-acre Monadnock Trust acquisition on Lake Wampanoag in Ashburnham. This acquisition created the brand-new Ashburnham Wildlife Management Area, which DFW hopes to expand upon in future years. The property boasts extensive frontage along the lake itself, known to host nesting loons, and has over 2,200 feet of frontage along the Whitman River, a coldwater fisheries resource. The Ashburnham WMA creates an open-space connection/wildlife corridor between DCR's Ashburnham State Forest to the north and Mass Audubon's Lake Wampanoag Wildlife Sanctuary to the south. Access to the WMA is most readily available from Kelton Street in Gardner, which turns into Old Gardner Road when you cross over the town line into Ashburnham.

The current total number of acres conserved by DFG/MassWildlife is 227,221 acres. The DFG/MassWildlife land acquisition team looks forward to another productive year of conserving land for habitat biodiversity as well as hunting, fishing, trapping, wildlife viewing and other nature-based recreation.

Wildlife Lands: Acquisition and Stewardship Staff

Trina Moruzzi, Assistant Director of Operations
Elizabeth Newlands, CR Stewardship Coordinator

Appendix C: Wildlife Lands Inventory

9 Federal Aid Program Administration

Lori Cookman, Fiscal Program Coordinator

Overview

The Federal Aid Coordinator implements MassWildlife's Federal Aid Program, including oversight of documentation, reporting, compliance with acts and regulations, and other requirements for the administration of federal grants. The position also serves as the liaison between the grantee and Federal agencies – including the grant administrator of the Legacy Region 5 office of the U.S. Fish and Wildlife Service (USFWS) for the U.S. Department of the Interior and the Natural Resources Conservation Service (NRCS) of the U.S. Department of Agriculture.

Federal Aid in Wildlife Restoration (Pittman-Robertson)

MassWildlife's Wildlife Restoration Act apportionment, $6,953,778, was an increase from last year's apportionment. These funds are available for wildlife restoration projects and hunter education. The following projects were reimbursed with these funds: hunter education, wildlife population trends and harvest surveys, waterfowl research and management, wildlife habitat management, wildlife outreach and communication, expanding hunter opportunities, land acquisition, and program coordination.

Federal Aid in Sport Fish Restoration (Dingell-Johnson and Wallop-Breaux)

MassWildlife's Sport Fish Restoration Act apportionment, $4,142,605, was an increase from last year's apportionment. These funds were divided as follows: The Department of Fish and Game's Office of Fishing and Boating Access (OFBA), which is responsible for constructing and maintaining motorboat access facilities, received $621,391 (15%); and the balance of $3,521,214 was equally divided between the Division of Marine Fisheries and MassWildlife ($1,760,607 each).

MassWildlife activities reimbursed under the Sport Fish Restoration Program include aquatic resources education, program coordination, hatchery operations, hatchery maintenance, fish distribution, and boat accommodations. The OFBA, in cooperation with MassWildlife, had six boat accommodation grants active in FY21.

State Wildlife Grant Program (SWG)

MassWildlife's State Wildlife Grant apportionment of $811,274 was an increase from the previous year. The SWG funds were applied to six projects. Activities reimbursed under those projects include fish community research, anadromous fish restoration, biodiversity impact review, biodiversity inventory and research, biodiversity conservation mapping and planning, habitat evaluation, regional conservation needs, program coordination, and in the development and implementation of the Massachusetts State Wildlife Action Plan.

MassWildlife served as the lead state and was awarded $402,545 through the FY 2016 national State Wildlife Grant Competitive program to fund the *Brook Floater Rangewide Conservation and Restoration Initiative*. MassWildlife is partnering with the states of Maine, New Hampshire, and Virginia. This cooperative project will continue into FY 2022.

Also in FY 2016, MassWildlife was awarded $101,000 through the national State Wildlife Grant competitive program to fund the *Northeast Blanding's Turtle Initiative*. MassWildlife is partnering with the states of New Hampshire, Maine, and Pennsylvania. This cooperative project expands upon a previous grant that was completed in FY 2016. Implementation of the Blanding's Turtle grant will continue into FY 2022.

MassWildlife was awarded $40,000.00 through the FY 2017 national State Wildlife Grant competitive program to fund the *Conservation and Management of the Spotted Turtle and Seasonal Wetland Habitats in the Eastern U.S.* MassWildlife is partnering with the states of Virginia, Connecticut, Maine, New

Hampshire, Pennsylvania, and Georgia, as well as the District of Columbia. This cooperative project was completed in FY 2021.

MassWildlife was awarded $161,673 through the FY 2019 national State Wildlife Grant competitive program to fund the *Implementation of the Bog Turtle Conservation Plan for the Northern Population, With Benefits to Associated Headwater Wetland Species of Greatest Conservation Need*. MassWildlife is partnering with Pennsylvania, Maryland, New Jersey, and Connecticut. This cooperative project expands upon a previous grant that was completed in FY 2019. Implementation of the new Bog Turtle grant began in FY 20 and will continue through FY 2025.

Also in FY 2019, MassWildlife was awarded $115,206 through the national State Wildlife Grant competitive program to fund the project entitled *Using Nanotag Technology to Identify Landscape-scale Habitat Use of Multiple Species of Greatest Conservation Need in New England*. MassWildlife is partnering with the states of New Hampshire, Maine, and Pennsylvania. Implementation of this grant began in FY 2021 and will continue through FY 2023.

MassWildlife was awarded $52,000 through the FY 2020 national State Wildlife Grant competitive program to fund the project entitled *Testing Salt Marsh Restoration Practices to Advance Saltmarsh Sparrow Conservation*. MassWildlife is partnering with the states of Connecticut, Maine, Maryland, Rhode Island, and Virginia. This project will continue into FY 2026

MassWildlife will serve as the lead state and was awarded $124,200 through the FY 2020 national State Wildlife Grant Competitive program to fund the *Regional Conservation for Wood Turtles and Related Emydine Turtles*. MassWildlife is partnering with the states of Connecticut, Maine, Maryland, New Hampshire, New Jersey, Pennsylvania, Rhode Island, and Virginia. This cooperative project will continue into FY 2023.

The Endangered Species Act (Section 6)

In FY 2021, MassWildlife received $62,417 in Section 6 funding from the USFWS. Funds will be used to reimburse the federally listed Plant Monitoring and Management project, the Dwarf Wedgemussel survey project, and Northern Red-bellied Cooter Adaptive Management.

Regional Conservation Partnership Program

During FY 2017, MassWildlife was awarded $286,520 in Natural Resources Conservation Service Funds through a cooperative agreement with the Wildlife Management Institute to provide technical assistance to private landowners interested in conducting habitat management on their property. Implementation of this cooperative agreement will continue into FY 2022.

During FY 2019, MassWildlife was awarded $150,000 in RCPP funds through a cooperative agreement with the Natural Resources Conservation Service Funds. The agreement will help to provide technical assistance to private landowners interested in conducting habitat management on their property. Implementation of this cooperative agreement will continue into FY 2024.

Miscellaneous Federal Grant Funds

In FY 2020, MassWildlife received $48,500 through a cooperative agreement with the USFWS to partially fund Frosted Elfin Habitat Enhancements at Montague Plains WMA. These funds will be used to reimburse habitat management activities that benefit Frosted Elfin as well as a wide array of other wildlife species – including birds, mammals, and other SGCNs. Implementation of this cooperative agreement will continue into FY 2022.

Also in FY 2020, MassWildlife received $20,000 through a cooperative agreement with the USFWS to partially fund Habitat Restoration for Roseate Terns on Penikese Island. These funds will be used to reimburse habitat enhancements to improve habitat suitability and expand nesting habitat to higher elevations that will be more resilient to sea level rise. Implementation of this cooperative agreement will continue into FY 2023.

Audits

One audit began in late FY 2020. The US Department of Interior, Office of the Inspector General (OIG) began an audit of Wildlife and Sport Fish Restoration grants received by MassWildlife during FY 2018 and FY 2019. The final OIG audit report is expected to be received early in FY 2022. These federal audits are conducted every five years.

Other Matters

Additional Federal Aid Coordinator's duties included responding to requests for information, public inquiries, MassWildlife inventory management, overview of project performance and financial reporting, project assistance (both field and office), field visits, and serving as the liaison between all Federal Aid personnel and MassWildlife.

Federal Aid Program Personnel

Kris McCarthy, Chief Fiscal Officer/Associate Director of Administration and Finance
Michael Sawyers, Federal Aid Coordinator (*partial year*)
Lori Cookman, Fiscal Program Coordinator
Debra Chamberlain, Assistant to the Federal Aid Coordinator
Debbie McGrath, Federal Aid Bookkeeper

10 The Personnel Report

Johanna Zabriskie, EEA Deputy Human Resources Director/Department of Fish and Game

July 1, 2020—June 30, 2021

New Hires: Employee

Name	Title	Action	Date
Rawlings, Jacob	Wildlife Technician II	New Hire	10/13/2020
Feehan, Martin	Game Biologist IV	New Hire	05/23/2021

Seasonal and Intern Hires

Name	Title	Action	Date
Garder, Jasper	Wildlife Technician I	Seasonal Hire	04/11/2021

New/Rehires: Contractors

Name	Title	Action	Date
Scanlon, John J.*	Scientist	Rehired-Post Retirement Contract Position	05/23/2021

*Retired on 01/16/2021 from full-time (EA V) position.

Terminations: Employee

Name	Title	Action	Date
Hazelton, Peter D.	Environmental Analyst V	Resignation	07/24/2020
Gibson, Gail L.	Accountant II	Retirement	08/31/2020
Harper, Lynn	Conservation Biologist IV	Retirement	10/30/2020
Stainbrook, David P.	Game Biologist IV	Resignation	11/20/2020
Ciesla, Tammy M.	Wildlife Technician III	Retirement	04/30/2021
Kennedy, Rick A.	EDP Systems Analyst III	Retirement	05/01/2021
Sawyers, Michael	Aquatic Biologist IV	Resignation	05/21/2021
Scanlon, John J.**	Environmental Analyst V	Retirement	01/16/2021

**Rehired in a post-retirement contract Scientist position on 05/23/2021.

Terminations: Contractors

Name	Title	Action	Date
Sawicki, Caitlin	Program Coordinator	Expired Contract	06/30/2021

Transfers

Name	Title	Action	Date
Freniere, Joshua	Wildlife Technician II	From DCR Urban Parks to Sunderland	10/11/2020

Promotions

Name	Title	Action	Date
Palmateer, Kurt	Aquatic Biologist IV	Promoted from Fish Culturist II	12/06/2020
Mattocks, Steven	Aquatic Biologist III	Promoted from Aquatic Biologist I	12/22/2020
Hawthorne, Brian	Environmental Analyst V	Promoted from Game Biologist III	02/17/2021

Reclassifications

Name	Professional Titles	Action	Effective Date
[None]			

11 The Financial Report

Kris McCarthy, Chief Fiscal Officer

Inland Fish and Game Fund Revenue

July 1, 2020—June 30, 2021

Departmental Revenues	**FY 2021**
Fishing, Hunting, and Trapping Licenses	$5,991,937
Archery Stamps	$188,784
Primitive Firearm Stamps	$195,826
Waterfowl Stamps	$58,827
Wildlands Stamps	$1,118,145
Trap Registrations	$ 2,765
Antlerless Deer Permits	$229,190
Bear Permits	$84,060
Turkey Permits	$140,845
Special Licenses, Tags and Posters	$37,355
Magazine Subscriptions	$124,273
Timber Sales, Other	$103,052
Fines and Penalties	$ -
Rents	$395,431
Prior Year Refunds	$ -
Donations	$52,652
Miscellaneous Income	$ 3,803
PAC	$31,401
NSF Charge/Debt. Collection	$320
Total	**$8,758,667**
Federal Aid Reimbursements	
Dingell-Johnson (Fisheries)	$720,610
Pittman-Robertson (Wildlife)	$6,055,295
Total	**$6,775,905**
Taxes	
Gasoline Tax Apportionment	$849,065
Other Financial Sources	
Reimbursement for Half-Price Licenses	$235,648
Investment Earnings	$ 2,117
Total	**$237,765**
Total Revenue	**$ 16,621,402**
Fund Equity as of June 30, 2021	**$ 10,010,110**

Fiscal Year 2021 License and Stamp Sales

Code	*Type of License*	*Cost*	*Quantity*	*Amount*
F1	Resident Citizen Fishing	22.50	131,033	$ 2,948,242.50
F2	Resident Citizen Minor Fishing	FREE	8,656	$-
F3	Resident Citizen Fishing (Age 65-69)	11.25	11,430	$128,587.50
F4	Resident Cit. Fishing (Over 70)	FREE	16,563	$-
F4	Resident Cit. Fishing (Disabled)	FREE	322	$-
F6	Non-Res. Citizen/Alien Fishing	32.50	14,622	$475,215.00
F7	Non-Res. Citizen/Alien Fishing (3 day)	18.50	3,322	$ 61,457.00
F8	Resident Fishing (3 day)	7.50	3,448	$ 25,860.00
F9	Non-Resident (Citizen) Minor Fishing	6.50	480	$3,120.00
F10	Quabbin 1-Day Fishing	5.00	1,538	$7,690.00
T1	Resident Citizen Trapping	30.50	691	$ 21,075.50
T2	Resident Citizen Minor Trapping	6.50	1	$ 6.50
T3	Resident Citizen Trapping (Age 65-69)	15.25	60	$ 915.00
H1	Resident Citizen Hunting	22.50	14,219	$319,927.50
H2	Resident Citizen Hunting (Age 65-69)	11.25	1,060	$ 11,925.00
H3	Resident Citizen Hunting (Paraplegics)	FREE	4	$ -
H4	Resident Alien Hunting	22.50	175	$3,937.50
H5	Non-Res. Cit./Alien Hunting (Big Game)	94.50	4,116	$388,962.00
H6	Non-Res. Cit./Alien Hunting (Sm. Game)	60.50	1,351	$ 81,735.50
H8	Resident (Citizen) Minor Hunting	6.50	1,332	$8,658.00
S1	Resident Citizen Sporting	40.00	35,314	$ 1,412,560.00
S2	Resident Citizen Sporting (Age 65-69)	20.00	4,711	$ 94,220.00
S3	Resident Citizen Sporting (Over 70)	FREE	12,565	$-
S4	Resident Sporting Paraplegic	FREE	39	$-
	Total License Sales (Gross)		**267,052**	**$ 5,994,094.50**
	Type of Stamp			
M1	Archery Stamps	5.10	37,018	$188,791.80
M2	Waterfowl Stamps	5.00	11,766	$ 58,830.00
M3	Primitive Firearm Stamps	5.10	38,399	$195,834.90
W1	Wildlands Stamps	5.00	199,650	$998,250.00
W2	Non-Resident Wildlands Stamps	5.00	23,979	$119,895.00
	Total Stamp Sales (Gross)		**310,812**	**$ 1,561,601.70**
	Previous Years' Stamp Sales			
M1	Archery Stamps		0	
M2	Waterfowl Stamps		0	
M3	Primitive Firearm Stamps		0	
	Total Stamp Sales (Gross)		**0**	**$ -**
	Fees Retained and Adjustments by Clerks			$ (90.64)
	Refunds			$ (2,086.30)
	Total			**$ (2,176.94)**
	Total License/Stamp Sales (Net)			***$ 7,553,519.26***

Inland Fish and Game Fund Expenditures

July 1, 2020—June 30, 2021

Administration:	***FY 2021***
Administration	$2,041,065
Information-Education	$1,132,974
ISA DCAMM Field Headquarters	$92,158
Total	**$3,266,197**
Fisheries and Wildlife Programs:	
Hatcheries	$2,486,456
Game Bird Program	$ 641,809
Seasonals	$370
Cooperative Units	$ 120,672
Fisheries and Wildlife Management	$5,779,242
Total	**$9,028,550**
Other Programs:	
Land Acquisitions	$1,378,421
Waterfowl Management Program	$47,064
Hunter Safety Program	$ 286,049
Total	**$1,711,534**
Other Assessments:	
Payroll Taxes	$ 188,863
GI and Other Fringe Benefits	$3,442,986
Total	**$3,631,849**
Total Expenditures*	***$17,638,129***

Natural Heritage and Endangered Species Fund

July 1, 2020—June 30, 2021

Revenues	***FY 2021***
Natural Heritage and Endangered Species Tax Checkoff Donations	$423,021
Sales	$5,025
NRCS/Wildlife Habitat Incentives Program (WHIP)	$ 35,664
Section 6	$ 87,425
State Wildlife Grant (SWG)	$288,247
RCPP	$ 20,330
Massachusetts Endangered Species Act Fees	$392,200
Contracts	$415,010
Direct Donations	$9,821
Interest	$ 189
Total Revenues	**$1,676,933**
Expenditures	
Natural Heritage and Endangered Species Program	$ 2,239,307
Housatonic Natural Resource Damage	$ 63,225
Total Expenditures	**$ 2,302,532**
Fund Equity as of June 30, 2021	***$2,144,406***

Other Expenditures

July 1, 2020—June 30, 2021

Capital Outlay Funds:	***FY 2021***
Land Protection: Habitat Management, CR Stewardship	$1,080,737
Staffing for Land and Infrastructure Programs	$506,100
Hatchery/District/Westborough Field Headquarters Repairs	$220,310
Habitat Grant Program	$266,059
Dam Safety and Repair	$1,327,045
Total Capital Expenditures	$3,400,251
Interdepartmental Service Agreements	
Massachusetts Highway Department (MassDOT)	$446,241
Massachusetts Department of Conservation and Recreation	$22,809
Executive Office of Energy and Environmental Affairs	$132,476
Total ISA	$601,527
Natural Heritage and Endangered Species Line Item:	$676,303
Other Trust Accounts	
Federal Duck Stamp (e-stamp)	$144,876

Administrative Staff

Kris McCarthy, Chief Fiscal Officer/Associate Director of Administration and Finance

Procurement and Payables

Mary Cavaliere, Program Coordinator
Yunus Khalifa, Program Coordinator
Kathleen Plett, Program Coordinator

Revenue

Gail L. Gibson, Accountant II (*partial year*)
Carl Liu, Customer Service/Accounts Payable
David Manzer, License Receiving Teller
Robert Oliver, License Revenue/Utility Payables Supervisor

Permits

Robert Arini, Fish and Wildlife Permit Specialist

Business Operations

Rick Kennedy, Business Analyst (*partial year*)
Robert Morley, Business Analyst

Clerical

Jill Durand
Colleen Hubbard

Appendix A The Fisheries Tables

Table 11. Number of trout produced at each of MassWildlife's five fish hatcheries in FY 2021 (fall 2020 and spring 2021).

Number of Fish							
	Size Category						Total Number of
Species	(inches)	Bitzer	McLaughlin	Palmer	Sandwich	Sunderland	Fish
Rainbow	6+					1,000	**1,000**
Trout	9+	2,525					**2,525**
	12+	21,800			29,579	53,302	**104,681**
	14+		200,399				**200,399**
	Sub-total	**24,325**	**200,399**	**-**	**29,579**	**54,302**	**308,605**
Brook	6+					33,200	**33,200**
Trout	9+			165			**165**
	12+	27,824			10,151	5,805	**43,780**
	14+			456			**456**
	18+				405		**405**
	Sub-total	**27,824**	**-**	**621**	**10,556**	**39,005**	**78,006**
Brown	6+	22,775				14,840	**37,615**
Trout	9+	4,000	24,840	410			**29,250**
	12+	21,593			10,972	19,600	**52,165**
	14+			482			**482**
	18+				584		**584**
	Sub-total	**48,368**	**24,840**	**892**	**11,556**	**34,440**	**120,096**
Tiger	14+				2,983		
Trout	**Sub-total**				**2,983**		**2,983**
Total		**100,517**	**225,239**	**1,513**	**54,674**	**127,747**	**509,690**

Table 12. Pounds of trout produced at MassWildlife's five fish hatcheries in FY 2021 (fall 2020 and spring 2021).

Weight of Fish in Pounds							
Species	Size Category (inches)	Bitzer	McLaughlin	Palmer	Sandwich	Sunderland	Total Weight of Fish
Rainbow	6+					370	**370**
Trout	9+	3,391					**3,391**
	12+				35,061	29,146	**64,207**
	14+		248,266				**248,266**
	Sub-total	**3,391**	**248,266**				**316,234**
Brook	6+					7,003	**7,003**
Trout	9+			117			**117**
	12+	20,586			10,683	5,021	**36,290**
	14+			970			**970**
	18+				978		**978**
	Sub-total	**20,586**		**1,087**	**11,661**	**12,024**	**45,358**
Brown	6+	5,367				4,210	**9,577**
Trout	9+		10,925	168			**11,093**
	12+	21,639			10,751	23,911	**56,301**
	14+			2,488			**2,488**
	18+				2,006		**2,006**
	Sub-total	**27,006**	**10,925**	**2,656**	**12,757**	**28,121**	**81,465**
Tiger	14+				3,079		**3,079**
Trout	**Sub-total**				**3,079**		**3,079**
Total		**50,983**	**259,191**	**3,743**	**24,418**	**40,145**	**446,136**

Table 13. Summary of landlocked salmon, Brook Trout eggs, Brown Trout eggs, and Tiger Trout eggs produced in FY 2021.

Hatchery	Species	Size Category (inches)	Number	Weight (Pounds)
Palmer	Landlocked salmon	8+ inches	10,016	2,211
	Landlocked salmon	Fall Fingerlings	3,280	141
	Brook Trout	eggs	747,902	N/A
	Brown Trout	eggs	472,112	N/A
Sandwich	Brook Trout	eggs	243,648	N/A
	Brown Trout	eggs	233,560	N/A
	Tiger Trout	eggs	200,400	N/A

Table 14. Results of fish health tests conducted at the MassWildlife's five fish hatcheries in FY 2021.
NEG signifies negative test results.

Hatchery	Species[2]	number	IPNV	VHSV	OMV	IHNV	RS	AS	YR	MC	Other[3]
Bitzer	BK (SA)	60	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	
	BT (SA)	60	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	
	RT (E/A)	60	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	
	BT (SA)	10						NEG	NEG		
McLaughlin	BT (SA)	60	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	
	RT (E/A)	60	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	
	RT (SH)	60	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	
	RT (E/A) (lot 1)	10						NEG	NEG		+CWD
	RT (E/A) (lot 2)	10						NEG	NEG		+CWD
	RT (E/A) (lot 3)	10						NEG	NEG		+CWD
	RT (E/A) (1,2,3)	10						NEG	NEG		+CWD
	RT (SH)	10						NEG	NEG		+CWD
	RT (SH)	10						NEG	NEG		+CWD
Palmer	LLS(GL)	60	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	
	BK (SA)	15	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	
	BK (SA)	144[4]	NEG	NEG	NEG	NEG					
	BT (SA)	15	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	
	BT (SA)	57[4]	NEG	NEG	NEG	NEG					
Sandwich	BK (SA)	60	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	
	BK (SA)	102[4]	NEG	NEG	NEG	NEG					
	BT (SA)	60	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	
	BT (SA)	101[4]	NEG	NEG	NEG	NEG					
	RT (E/A)	60	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	
	RT (SH)	60	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	
	TT	30	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	
Sunderland	BK (SA)	60	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	
	BT (SA)	60	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	
	RT (E/A)	60	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	
	RT (SH)	60	NEG	NEG	NEG	NEG	NEG	NEG	NEG	NEG	

[1]Fish were tested following the Northeast Fish Health Guidelines and the American Fisheries Society – Fish Health Section "Suggested Procedures for the Detection and Identification of Certain Finfish and Shellfish Pathogens".

IPNV – Pancreatic Necrosis Virus, VHSV – Viral Hemorrhagic Septicemia virus, OMV – *Oncorhynchus masou* virus, IHNV – Infectious Hematopoietic Necrosis virus, RS – *Renibacterium salmoninarum* AS – *Aeromonas salmonicida,,* YR – *Yersinia ruckeri*, MC – *Myxobolus cerebralis*

[2]Species codes: BK (SA) – Brook Trout (Sandwich Strain), BT (SA) – Brown Trout (Sandwich Strain), RT (E/A) – Rainbow Trout Erwin Arlee strain, RT (SH) – Rainbow Trout Shasta strain, LLS (GL) – landlocked salmon Maine Grand Lake strain, TT – Tiger Trout (Sandwich strain)

[3]Other included examinations and diagnostic tests performed on fish that showed symptoms of a specific disease or parasitic infection. NDT = no addition diagnostic testing necessary; CWD = Coldwater disease caused by the bacteria *Flavobacterium psychrophilum*.

[4]Female ovarian fluid samples.

Table 17. Daily anadromous fish passage at Holyoke 2020.

	American Shad		Blueback Herring		Sea Lamprey		Striped Bass		Gizzard Shad	
Date	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD
4/21	2	2	0	0	0	0	0	0	0	0
4/22	0	2	0	0	0	0	0	0	0	0
4/23	0	2	0	0	0	0	0	0	0	0
4/24	0	2	0	0	0	0	0	0	0	0
4/29	98	100	0	0	0	0	0	0	0	0
4/30	17	117	0	0	0	0	0	0	0	0
5/1	32	149	1	1	0	0	0	0	0	0
5/4	7,291	7440	1	2	1	1	0	0	1	1
5/5	1,928	9368	0	2	4	5	0	0	4	5
5/6	1,493	10861	0	2	0	5	0	0	1	6
5/7	1,022	11883	0	2	0	5	0	0	0	6
5/8	5,113	16996	9	11	6	11	1	1	7	13
5/9	1,138	18134	7	18	1	12	2	3	1	14
5/10	482	18616	3	21	2	14	0	3	0	14
5/11	2,094	20710	0	21	0	14	0	3	0	14
5/12	492	21202	0	21	0	14	0	3	1	15
5/13	565	21767	5	26	0	14	0	3	1	16
5/14	2504	24271	1	27	0	14	0	3	1	17
5/15	9,840	34111	32	59	17	31	0	3	2	19
5/16	8,998	43109	10	69	218	249	2	5	1	20
5/17	8,442	51551	0	69	153	402	1	6	1	21
5/18	28,162	79713	6	75	183	585	0	6	2	23
5/19	19,544	99257	13	88	44	629	1	7	2	25
5/20	30,221	129478	30	118	60	689	2	9	0	25
5/21	54,947	184425	37	155	1288	1977	1	10	4	29
5/22	35,243	219668	48	203	510	2487	0	10	1	30
5/23	27,128	246796	21	224	972	3459	1	11	0	30
5/24	15,487	262283	49	273	323	3782	0	11	2	32
5/25	12,114	274397	219	492	151	3933	2	13	3	35
5/26	10,838	285235	33	525	656	4589	4	17	1	36
5/27	7,192	292427	73	598	2381	6970	7	24	2	38
5/28	10,600	303027	38	636	2848	9818	8	32	1	39
5/29	12,834	315861	6	642	9892	19710	24	56	2	41
5/30	5,252	321113	0	642	6841	26551	26	82	2	43
5/31	7,437	328550	108	750	544	27095	23	105	3	46
6/1	3,228	331778	7	757	164	27259	21	126	3	49
6/2	3,073	334851	0	757	233	27492	15	141	0	49
6/3	5,064	339915	3	760	398	27890	19	160	1	50
6/4	3,027	342942	0	760	3868	31758	36	196	0	50
6/5	2,080	345022	0	760	867	32625	20	216	2	52
6/6	3,732	348754	1	761	691	33316	28	244	1	53
6/7	2,890	351644	0	761	82	33398	26	270	2	55
6/8	2,257	353901	0	761	22	33420	15	285	4	59
6/9	2,324	356225	0	761	201	33621	20	305	3	62
6/10	1,294	357519	0	761	23	33644	14	319	2	64
6/11	786	358305	0	761	37	33681	6	325	0	64
6/12	773	359078	1	762	13	33694	12	337	0	64
6/13	492	359570	0	762	10	33704	6	343	0	64

	American Shad		Blueback Herring		Sea Lamprey		Striped Bass		Gizzard Shad	
Date	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD
6/14	629	360199	0	762	7	33711	15	358	0	64
6/15	394	360593	0	762	10	33721	6	364	0	64
6/16	388	360981	0	762	4	33725	12	376	0	64
6/17	335	361316	1	763	7	33732	6	382	0	64
6/18	228	361544	0	763	2	33734	6	388	0	64
6/19	133	361677	0	763	0	33734	8	396	0	64
6/20	123	361800	0	763	4	33738	4	400	0	64
6/21	18	361818	0	763	0	33738	10	410	0	64
6/22	69	361887	0	763	0	33738	3	413	0	64
6/23	66	361953	0	763	0	33738	3	416	0	64
6/24	56	362009	0	763	0	33738	3	419	0	64
6/25	21	362030	0	763	1	33739	1	42	0	64
6/26	66	362096	0	763	0	33739	0	420	0	64
6/27	13	362109	0	763	0	33739	1	421	0	64
6/28	20	362129	0	763	0	33739	0	421	0	64
6/29	42	362171	0	763	0	33739	1	422	0	64
6/30	73	362244	0	763	0	33739	1	423	0	64

Table 18. Historical Anadromous Fish Passage at Holyoke.

Year	Atlantic Salmon	American Shad	Blueback Herring	Striped Bass	Shortnose Sturgeon	Gizzard Shad	Sea Lamprey
1975	1	114,132	1,600		5	0	23,000
1976	1	346,185	4,700		3	0	32,000
1977	1	196,311	33,000		0	0	52,000
1978	23	143,336	38,000		1	0	43,000
1979	19	254,894	40,000	103	3	0	31,000
1980	119	376,757	198,000	148	0	0	34,000
1981	316	376,639	419,733	510	4	0	53,549
1982	11	294,606	570,083	128	4	0	26,297
1983	23	527,508	442,313	226	4	0	29,252
1984	66	496,389	449,178	57	10	0	22,000
1985	285	481,589	632,255	369	6	0	40,308
1986	259	352,112	517,520	187	13	27	20,010
1987	207	276,837	358,607	521	3	94	22,553
1988	72	294,157	343,363	257	4	95	15,912
1989	80	353,880	286,325	900	4	294	15,364
1990	187	363,999	394,128	998	5	927	22,245
1991	152	523,046	411,108	169	0	490	40,854
1992	368	721,336	312,884	336	4	1,140	27,567
1993	167	340,351	108,214	191	6	327	22,820
1994	256	181,073	31,766	159	1	164	30,026

Year	Atlantic Salmon	American Shad	Blueback Herring	Striped Bass	Shortnose Sturgeon	Gizzard Shad	Sea Lamprey
1995	150	190,082	112,131	1,292	1	2,065	18,332
1996	202	273,695	55,040	529	16	1,078	44,914
1997	94	299,448	63,945	679	0	2,081	32,377
1998	197	311,704	11,170	492	11	1,087	98,690
1999	91	193,782	2,699	860	1	35,072	21,084
2000	76	228,390	9,588	474	0	37,737	24,045
2001	41	280,871	10,605	1,152	4	5,498	58,221
2002	43	377,402	1,950	1,086	0	3,018	78,906
2003	28	286,814	1,392	883	0	859	53,030
2004	45	191,555	151	256	0	279	59,461
2005	131	116,517	534	231	1	126	28,134
2006	118	154,772	21	144	1	127	17,620
2007	106	158,807	75	243	5	73	39,933
2008	81	153,149	84	617	3	127	57,049
2009	61	160,669	40	671	0	68	18,996
2010	41	164,439	76	298	0	371	39,782
2011	72	244,189	138	183	3	423	19,136
2012	29	490,431	39	336	5	337	14,089
2013	69	392,967	976	250	6	827	22,092
2014	27	370,506	647	69	3	410	22,136
2015	13	412,656	87	21	1	84	22,245
2016	3	385,930	137	638	94	598	35,249
2017	10	536,670	875	338	85	738	21,526
2018	2	273,979	1,061	262	91	69	10,187
2019	3	314,361	5,052	207	20	320	18,347
2020	0	362,244	763	423	18	64	33,739

Table 20: Date range, number of collections, total eels collected, and descriptive statistics for catch and catch-per-unit-of-effort; Holyoke 2020.

Trap	Date Range	N	Catch					CPUE (catch/hour)		
			Sum	Min	Max	Mean	SD	Max	Mean	SD
Tailrace Ramp	5/8-11/8	138	13,697	0	3,000	100.7	364.98	62.8	2.7	8.11
Stilling Basin Ramp	5/8-11/8	138	684	0	138	5.0	17.89	5.8	0.2	0.68
South Hadley Ramp	7/25-11/8	73	13,123	0	3,070	184.8	497.21	42.5	4.8	9.28
Spillway Ramp	6/17-8/16	46	1	0	1	0.0	0.18	0.0	0.0	0.01
Total	**5/8-11/08**	**395**	**27,505**							

Table 21. 2020 Daily Fish Passage through the Turners Falls Fish Passage Complex.

Site:	Cabot		Spillway		Gatehouse	
Species:	American Shad	Sea Lamprey	American Shad	Sea Lamprey	American Shad	Sea Lamprey
Date						
30-Apr	0	0	0	0	0	0
1-May	0	0	0	0	0	0
2-May	0	0	0	0	0	0
3-May	0	0	0	0	0	0
4-May	0	0	0	0	0	0
5-May	0	0	0	0	0	0
6-May	0	0	2	0	1	0
7-May	0	0	4	0	3	0
8-May	17	0	34	0	30	0
9-May	8	0	21	0	16	0
10-May	6	0	1	0	13	0
11-May	18	0	0	0	2	0
12-May	18	0	1	0	8	0
13-May	3	0	0	0	12	0
14-May	5	0	1	0	7	0
15-May	67	0	0	0	9	0
16-May	154	0	28	0	99	0
17-May	1076	0	97	0	576	0
18-May	728	0	182	2	503	0
19-May	368	0	663	0	929	0
20-May	612	0	315	5	660	0
21-May	651	0	597	41	809	6
22-May	1560	0	896	46	879	4
23-May	3713	1	1725	143	2636	29
24-May	1655	13	1775	392	3087	127
25-May	3002	10	2364	390	2474	170
26-May	1757	12	897	364	783	108
27-May	2481	528	1448	503	3469	211
28-May	2285	838	2054	635	3824	423
29-May	1994	1172	1392	1393	2771	1027
30-May	1767	1334	1140	988	2790	1024
31-May	1665	3019	934	1355	1302	1552
1-Jun	1343	2555	466	1490	454	1134
2-Jun	1262	526	625	773	2426	1599
3-Jun	968	249	941	879	1125	1484
4-Jun	1123	483	714	832	1384	1344
5-Jun	1351	813	889	724	2004	1196
6-Jun	693	905	464	742	1194	1175
7-Jun	531	256	240	397	1220	880
8-Jun	274	124	14	486	454	1736
9-Jun	480	73	305	629	593	1627
10-Jun	261	38	254	186	441	348

Site:	Cabot		Spillway		Gatehouse	
Species:	American Shad	Sea Lamprey	American Shad	Sea Lamprey	American Shad	Sea Lamprey
Date						
11-Jun	265	26	155	117	283	128
12-Jun	159	6	130	72	295	68
13-Jun	119	5	94	37	243	39
14-Jun	128	1	101	25	148	27
15-Jun	80	2	80	9	158	9
16-Jun	80	3	84	7	163	25
17-Jun	24	-3	118	5	199	15
18-Jun	19	0	115	2	155	5
19-Jun	36	-1	114	6	114	1
20-Jun	13	0	107	5	123	-2
21-Jun	8	0	89	0	58	1
22-Jun	11	3	70	2	77	2
23-Jun	9	-2	67	2	68	0
24-Jun	10	0	51	-1	51	1
25-Jun	2	0	42	1	46	0
26-Jun	1	1	43	2	25	1
27-Jun	5	0	21	0	15	0
28-Jun	-1	0	21	0	17	0
29-Jun	.	.	21	1	14	1
30-Jun	3	1	11	0	9	0
1-Jul	1	0	5	0	4	0
2-Jul	0	0	0	2	0	0
Total	**34868**	**12991**	**23022**	**13689**	**41252**	**17525**

Table 22. Historical anadromous fish passage through the Turners Falls project.

Year	Location	American Shad	Blueback Herring	Striped Bass	Sea Lamprey
1980	Cabot	687	0	11	187
	Spillway	5	0	0	0
	Gatehouse	298	0	1	66
1981	Cabot	224	0	0	1622
	Spillway[2]				
	Gatehouse	200	0	0	935
1982	Cabot				
	Spillway[2]				
	Gatehouse	11	4	0	210
1983	Cabot	26697	106	6	859
	Spillway	263	1	1	649
	Gatehouse	12705	28	7	703
1984	Cabot	1831	4	0	334
	Spillway	4563	12	0	851
	Gatehouse	4333	21	0	683
1985	Cabot	31000	1726	0	3198
	Spillway	843	243	0	3185
	Gatehouse	3855	301	0	1809
1986	Cabot	22144	7091	0	1424
	Spillway	5857	6248	0	2230

Year	Location	American Shad	Blueback Herring	Striped Bass	Sea Lamprey
	Gatehouse	17858	9578	0	1961
1987	Cabot	33114	2866	0	1324
	Spillway	3679	2841	0	2921
	Gatehouse	18959	5091	0	2590
1988	Cabot	28546	349	0	335
	Spillway	3354	865	0	1912
	Gatehouse	15787	1079	0	1175
1989	Cabot	14403	199	0	578
	Spillway	1494	279	0	947
	Gatehouse	9511	510	1	868
1990	Cabot	31056	711	0	1304
	Spillway	5898	768	0	1013
	Gatehouse	27908	1585	0	1301
1991	Cabot	87168	6433	1	2089
	Spillway	6282	2718	0	3026
	Gatehouse	54656	7522	3	4090
1992	Cabot	94046	1765	1	1836
	Spillway	11760	884	0	3275
	Gatehouse	60089	2157	2	2170
1993	Cabot	21045	243	0	711
	Spillway	898	90	0	2082
	Gatehouse	10221	278	0	1637
1994	Cabot[2]				
	Spillway	1507	17	0	1740
	Gatehouse	3729	97	0	1702
1995	Cabot	33938	4234	0	1417
	Spillway	543	31	0	1372
	Gatehouse	18369	2957	0	1813
1996	Cabot[2]				
	Spillway	2293	13	0	2651
	Gatehouse	16192	515	0	4556
1997	Cabot	22518	231	0	2374
	Spillway	3473	15	0	2219
	Gatehouse	9216	128	0	2265
1998	Cabot	14947	2	0	8707
	Spillway	4721	0	0	8642
	Gatehouse	10527	4	0	7579
1999	Cabot	11501	5	0	2014
	Spillway	4215	0	8	1449
	Gatehouse	6751	2	0	916
2000	Cabot	12289	0	0	1455
	Spillway	2240	0	0	1962
	Gatehouse	2590	0	0	1350
2001	Cabot	20933	0	0	3678
	Spillway	2344	0	0	5280
	Gatehouse	1540	0	0	2144
2002	Cabot	7922	0	0	14709
	Spillway	5372	0	0	12367
	Gatehouse	2870	0	0	10160
2003	Not monitored				

Year	Location	American Shad	Blueback Herring	Striped Bass	Sea Lamprey
2004	Cabot	6489	0	0	13352
	Spillway	2024	0	0	5821
	Gatehouse	2235	0	0	8418
2005	Cabot	5404	2	7	
	Spillway	1626	0	7	
	Gatehouse	1581	2	2	
2006	Cabot	11530	0	Unknown	5377
	Spillway	2577	0	Unknown	5133
	Gatehouse	1810	0	Unknown	3005
2007[3]	Cabot	11130	0	0	11061
	Spillway	1793	0	0	5555
	Gatehouse	2248	0	0	15438
2008	Cabot	15809	0	0	NC
	Spillway	627	0	0	NC
	Gatehouse	3995	0	0	NC
2009	Cabot	13360	NC	NC	NC
	Spillway	928	NC	NC	NC
	Gatehouse	3947	NC	NC	8296
2010	Cabot	30232	NC	NC	NC
	Spillway[4]	2735	NC	NC	NC
	Gatehouse	16768	NC	NC	6352
2011	Cabot	27077	NC	NC	NC
	Spillway	1966	NC	NC	NC
	Gatehouse	16798	NC	NC	2032
2012[6]	Cabot	51901	NC	NC	NC
	Spillway	10608	NC	NC	NC
	Gatehouse	26727	NC	NC	4503
2013[6]	Cabot	46886	NC	NC	NC
	Spillway	10571	NC	NC	NC
	Gatehouse	35494	NC	NC	6016
2014[6]	Cabot	40666	NC	NC	NC
	Spillway	24262	NC	NC	NC
	Gatehouse	39914	NC	NC	5553
2015[6]	Cabot	47588	NC	NC	NC
	Spillway	41836	NC	NC	NC
	Gatehouse	58078	NC	NC	8436
2016	Cabot	34709	NC	NC	NC
	Spillway	19399	NC	NC	NC
	Gatehouse	54760	NC	NC	15128
2017	Cabot	43269	NC	NC	NC
	Spillway	16741	NC	NC	NC
	Gatehouse	48727	NC	NC	9223
2018	Cabot	24031	NC	NC	NC
	Spillway	32593	NC	NC	NC
	Gatehouse	43146	NC	NC	1010
2019	Cabot	21804	3	NC	1151
	Spillway	13150	4	NC	7918
	Gatehouse	22649	1	NC	3700
2020	Cabot	34868	0	NC	12991
	Spillway	23022	3	NC	13689

Year	Location	American Shad	Blueback Herring	Striped Bass	Sea Lamprey
	Gatehouse	41252	3	NC	17525
[1]1990 was the first year that gizzard shad was recorded					
[2]Not monitored					
[3]Partial counts because of digital system start-up problems					
[4]Count is a minimum; a power outage/video system failure					
[5]Two salmon were observed at neither Cabot nor spillway, probably because of power outage at both locations or video system failures at spillway					
[6]High turbidity reduced visibility at times, resulting in counts lower than actual passage					
NC = not counted					

Table 23. Temporal characteristics of American shad passage at the Holyoke and Turners Falls fish passage facilities, 2020.

Passage Facility	Cumulative percentage of total American shad passage				
	25%	50%	75%	90%	Day of Highest Daily Passage
Holyoke Fishlift					
Day*	29	31	35	41	
Date	5/19	5/21	5/25	5/31	5/21
Spillway Fishladder (Turners Falls)					
Day*	35	39	44	49	36
Date	5/24	5/28	6/2	6/7	5/25
Gatehouse Fishladder (Turners Falls)					
Day*	36	39	45	49	39
Date	5/25	5/28	6/3	6/7	5/28
Cabot Fishladder (Turners Falls)					
Day*	34	38	43	47	34
Date	5/23	5/27	6/1	6/5	5/23

*Day one is April 20, the first day shad were lifted at the Holyoke fish passage facility.

Table 24. Daily American shad passage at the West Springfield fishway, Westfield River 2020.

Date	Daily	Year to Date
5/12/20	5	5
5/13/20	7	12
5/14/20	30	42
5/15/20	966	1008
5/16/20	454	1462
5/17/20	1143	2605
5/18/20	241	2846
5/19/20	54	2900
5/20/20	162	3062
5/21/20	179	3241
5/22/20	179	3420
5/23/20	254	3674
5/24/20	106	3780
5/25/20	112	3892
5/26/20	25	3917
5/27/20	150	4067
5/28/20	226	4293
5/29/20	172	4465
5/30/20	127	4592
5/31/20	60	4652
6/1/20	32	4684
6/2/20	9	4693
6/3/20	15	4708
6/4/20	45	4753
6/5/20	117	4870
6/6/20	131	5001
6/7/20	112	5113
6/8/20	30	5143
6/9/20	38	5181
6/10/20	68	5249
6/11/20	49	5298
6/12/20	58	5356
6/13/20	14	5370
6/14/20	15	5385
6/15/20	13	5398
6/16/20	13	5411
6/17/20	21	5432
6/18/20	17	5449
6/19/20	4	5453

6/20/20	38	5491
6/21/20	28	5519
6/22/20	16	5535
6/23/20	14	5549
6/24/20	8	5557
6/25/20	5	5562
6/26/20	5	5567

Table 25. Temporal characteristics of American shad passage at the West Springfield fish passage facility, 2020, showing cumulative percentage of total American shad passage.

	25%	50%	75%	90%	Day of Highest Daily Passage
Day*	5	7	17	27	6
Date	5/16	5/18	5/28	6/7	5/17

*Day one is May 12, the first day of shad passage at the West Springfield fish passage facility.

Table 26. Historical yearly passage totals, Westfield River fish passage facility, West Springfield, 1992-2020.

Date	American Shad	Blueback Herring	Sea Lamprey	Striped Bass	Atlantic Salmon	Gizzard Shad	White Sucker	Small-mouth	Brown Trout	Rainbow Trout	Brook Trout	Tiger Trout
*1992					2							
*1993					10							
*1994					7							
*1995					6							
1996	1,413	1	4,699	0	19	0	4,699	110	12	91	7	0
1997	1,012	-	2,255	0	37	0	2,255	64	77	8	12	0
1998	2,292	2	1,756	5	47	1	5,515	149	210	18	42	44
1999	2,668	-	643	0	17	1	1,227	109	162	3	23	103
2000	3,558	-	2,040	0	11	122	3,158	207	77	9	9	44
2001	4,720	2	2,345	2	8	0	3,735	129	116	18	8	34
2002	2,762	4	3,638	2	5	1	2,242	146	160	9	14	90
2003	1,957	5	404	0	6	0	1,832	155	90	2	4	29
2004	913	1	1,171	0	12	0	2,789	148	77	8	6	75
2005	1,237	0	818	0	27	0	1,161	201	58	29	5	28
2006	1,534	0	1,276	1	34	0	3,447	188	39	10	7	69
2007	4,497	0	1,797	0	21	0	2,280	133	44	11	15	21
2008	3,212	0	1,220	0	30	0	1,757	246	34	0	11	6
2009	1,395	0	538	0	2	0	1,865	260	21	15	5	7
2010	3,444	4	447	0	3	0	954	185	24	2	11	21
2011	5,029	0	1,590	0	9	0	1,544	496	24	10	5	38
2012	10,373	3	392	0	6	176	1,529	326	50	6	13	34
2013	4,938	0	729	0	11	0	1,241	620	37	3	11	56

Date	American Shad	Blueback Herring	Sea Lamprey	Striped Bass	Atlantic Salmon	Gizzard Shad	White Sucker	Small-mouth	Brown Trout	Rainbow Trout	Brook Trout	Tiger Trout
2014	4,787	4	1,127	0	2	0	1,663	290	65	15	33	59
2015	3383	0	218	0	3	0	2065	341	54	4	34	19
2016	6003	0	456	1	1	0	1023	601	49	11	35	13
2017	6004	5	262	1	5	5	2176	613	26	11	36	18
2018	5762	4	138	0	0	0	2201	363	21	16	10	3
2019	4166	5	484	0	0	0	1822	285	21	27	15	32
2020	5567	-	-	-	-	-	-	-	-	-	-	-

*In 1992-1995, adult salmon were netted at the base of the dam.

Table 27. 2020 Anadromous Fish Passage at Essex Dam, Lawrence.

	American Shad		River Herring		Sea Lamprey		Atlantic Salmon		Striped Bass	
Date	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD
15-Apr	-	-	-	-	-	-	-	-	-	-
16-Apr	-	-	-	-	-	-	-	-	-	-
17-Apr	-	-	-	-	-	-	-	-	-	-
18-Apr	-	-	-	-	-	-	-	-	-	-
19-Apr	-	-	-	-	-	-	-	-	-	-
20-Apr	-	-	-	-	-	-	-	-	-	-
21-Apr	-	-	-	-	-	-	-	-	-	-
22-Apr	75	75	-	-	-	-	-	-	-	-
23-Apr	24	99	-	-	-	-	-	-	-	-
24-Apr	25	124	-	-	-	-	-	-	-	-
25-Apr	-	124	-	-	-	-	-	-	-	-
26-Apr	13	137	-	-	-	-	-	-	-	-
27-Apr	-	137	-	-	-	-	-	-	-	-
28-Apr	4	141	-	-	-	-	-	-	-	-
29-Apr	17	158	-	-	-	-	-	-	-	-
30-Apr	127	285	-	-	-	-	-	-	-	-
1-May	248	533	-	-	-	-	-	-	-	-
2-May	274	807	-	-	-	-	-	-	-	-
3-May	-	807	-	-	-	-	-	-	-	-
4-May	560	1,367	-	-	-	-	-	-	-	-
5-May	185	1,552	30	30	-	-	-	-	-	-
6-May	1,896	3,448	22	52	-	-	-	-	-	-
7-May	915	4,363	9	61	1	1	-	-	-	-
8-May	489	4,852	1	62	2	3	-	-	-	-
9-May	834	5,686	-	62	2	5	-	-	-	-
10-May	19	5,705	1	63	-	5	-	-	-	-
11-May	11	5,716	1	64	-	5	-	-	-	-
12-May	98	5,814	28	92	-	5	-	-	-	-
13-May	-	5,814	-	92	-	5	-	-	-	-
14-May	-	5,814	28	120	-	5	-	-	-	-

	American Shad		River Herring		Sea Lamprey		Atlantic Salmon		Striped Bass	
Date	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD
15-May	54	5,868	262	382	32	37	-	-	-	-
16-May	229	6,097	612	994	322	359	-	-	-	-
17-May	20,050	26,147	581	1,575	90	449	-	-	-	-
18-May	8,547	34,694	591	2,166	86	535	-	-	1	1
19-May	501	35,195	570	2,736	30	565	-	-	3	4
20-May	8,552	43,747	681	3,417	69	634	-	-	-	4
21-May	8,969	52,716	313	3,730	152	786	-	-	-	4
22-May	3,609	56,325	678	4,408	183	969	-	-	-	4
23-May	73	56,398	1,400	5,808	654	1,623	-	-	1	5
24-May	4,641	61,039	854	6,662	125	1,748	-	-	-	5
25-May	483	61,522	1,139	7,801	303	2,051	-	-	2	7
26-May	137	61,659	3,916	11,717	748	2,799	1	1	-	7
27-May	344	62,003	4,974	16,691	2,441	5,240	-	1	-	7
28-May	20,712	82,715	1,627	18,318	1,120	6,360	1	2	1	8
29-May	875	83,590	2,729	21,047	776	7,136	-	2	8	16
30-May	1,811	85,401	5,597	26,644	640	7,776	1	3	-	16
31-May	23	85,424	3,604	30,248	708	8,484	-	3	-	16
1-Jun	1	85,425	2,291	32,539	275	8,759	-	3	1	17
2-Jun	3	85,428	2,599	35,138	199	8,958	-	3	-	17
3-Jun	-	85,428	1,461	36,599	124	9,082	-	3	2	19
4-Jun	-	85,428	3,025	39,624	271	9,353	-	3	-	19
5-Jun	337	85,765	1,338	40,962	91	9,444	1	4	10	29
6-Jun	-	85,765	1,135	42,097	116	9,560	-	4	-	29
7-Jun	-	85,765	83	42,180	25	9,585	-	4	23	52
8-Jun	-	85,765	2,156	44,336	37	9,622	-	4	8	60
9-Jun	-	85,765	1,692	46,028	18	9,640	-	4	-	60
10-Jun	-	85,765	786	46,814	16	9,656	-	4	-	60
11-Jun	7	85,772	988	47,802	36	9,692	-	4	-	60
12-Jun	594	86,366	2,463	50,265	24	9,716	-	4	-	60
13-Jun	1,004	87,370	525	50,790	5	9,721	-	4	-	60
14-Jun	-	87,370	144	50,934	2	9,723	-	4	1	61
15-Jun	416	87,786	667	51,601	-	9,723	-	4	-	61
16-Jun	(263)	87,523	89	51,690	1	9,724	-	4	-	61
17-Jun	(292)	87,231	271	51,961	1	9,725	-	4	-	61
18-Jun	-	87,231	121	52,082	8	9,733	-	4	-	61
19-Jun	-	87,231	65	52,147	-	9,733	-	4	-	61
20-Jun	-	87,231	28	52,175	-	9,733	-	4	-	61
21-Jun	-	87,231	17	52,192	-	9,733	-	4	1	62
22-Jun	-	87,231	22	52,214	-	9,733	-	4	-	62
23-Jun	-	87,231	11	52,225	-	9,733	-	4	-	62
24-Jun	-	87,231	6	52,231	-	9,733	-	4	-	62
25-Jun	-	87,231	8	52,239	-	9,733	-	4	-	62

	American Shad		River Herring		Sea Lamprey		Atlantic Salmon		Striped Bass	
Date	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD
26-Jun	-	87,231	-	52,239	-	9,733	-	4	-	62
27-Jun	(81)	87,150	-	52,239	-	9,733	-	4	-	62
28-Jun	-	87,150	-	52,239	-	9,733	-	4	-	62
29-Jun	-	87,150	-	52,239	-	9,733	-	4	-	62
30-Jun	-	87,150	-	52,239	-	9,733	-	4	-	62
1-Jul	-	87,150	-	52,239	-	9,733	-	4	-	62

Table 28. Historical Anadromous Fish Passage at Essex Dam, Lawrence.

Year	Atlantic Salmon	American Shad	River Herring	Striped Bass	Sea Lamprey	Gizzard Shad
1982	16*	0	0	0	0	
1983	88	5,500	4,800	50	2,800	
1984	104	5,500	1,800	40	2,000	
1985	212	13,000	23,000	110	18,000	
1986	98	18,000	16,000	64	13,000	
1987	129 (6)**	17,000	77,000	133	18,000	
1988	65	12,000	360,000	86	8,900	
1989	85	7,900	379,000	262	12,000	
1990	243	6,000	250,000	377	8,300	
1991	331	16,000	380,000	632	10,000	
1992	197	21,000	102,000	424	18,000	
1993	61	8,600	14,000	169	11,000	
1994	17 (4)***	4,300	89,000	426	5,000	23
1995	34	14,000	33,000	1,800	4,000	224
1996	69	11,000	51	584	3,600	6
1997	67	22,000	362	2,200	8,600	180
1998	123	28,000	1,400	1,400	4,000	58
1999	191	57,000	7,900	843	9,700	208
2000	85	69,000	19,000	1,100	11,000	3,100
2001	84	75,000	1,600	511	3,700	57
2002	56	55,000	526	1,900	8,100	158
2003	120	53,000	11,000	979	2,200	50
2004	131	45,000	15,000	806	6,700	17
2005	31	6,500	98	257	848	1
2006	49	574	1,105	-	-	0
2007	73	16,000	1,200	56	1,400	1
2008	123	25,000	108	42	4,900	12
2009	78	23,000	1,500	46	2,000	0
2010	85	10,000	518	59	3,400	6
2011	402	14,000	740	0	2,600	2
2012	137	21,000	9,000	139	2,100	11
2013	22	37,000	17,000	103	548	11
2014	41	35,000	34,000	129	4,900	29
2015	13	89,000	129,000	248	5,000	25
2016	6	68,000	417,000	1,600	5,200	112
2017	5	63,000	92,000	2,100	2,100	0

2018	10	29,060	449,356	5,619	470	16
2019	14	17,003	116,963	280	9,367	0
2020	4	52,239	87,150	62	9,733	0

*Lifts for seven weeks in fall only.
**In addition to the 129 salmon captured, 6 salmon escaped the fish trap.
***17 salmon captured, 2 salmon escaped, and 2 were illegally taken by angling.

Table 29. Fish passage at the Pawtucket Dam fishlift, Lowell, in 2020.

	American Shad		River Herring		Sea Lamprey	
Lift Date	Daily	YTD	Daily	YTD	Daily	YTD
1-May	-	-	-	-	-	-
2-May	-	-	-	-	-	-
3-May	-	-	-	-	-	-
4-May	-	-	-	-	-	-
5-May	-	-	-	-	-	-
6-May	-	-	-	-	-	-
7-May	-	-	-	-	-	-
8-May	-	-	-	-	-	-
9-May	-	-	-	-	-	-
10-May	-	-	30	30	-	-
11-May	-	-	3	33	-	-
12-May	-	-	-	33	-	-
13-May	-	-	-	33	-	-
14-May	-	-	25	58	-	-
15-May	-	-	-	58	-	-
16-May	1	1	216	274	-	-
17-May	1	2	66	340	2	2
18-May	5	7	8,456	8,796	5	7
19-May	5	12	1,026	9,822	4	11
20-May	8	20	1,467	11,289	2	13
21-May	2	22	2,138	13,427	1	14
22-May	7	29	3,199	16,626	-	14
23-May	133	162	2,369	18,995	7	21
24-May	74	236	702	19,697	21	42
25-May	181	417	2,153	21,850	7	49
26-May	164	581	696	22,546	10	59
27-May	375	956	643	23,189	53	112
28-May	537	1,493	562	23,751	140	252
29-May	585	2,078	3,766	27,517	215	467
30-May	538	2,616	1,064	28,581	202	669
31-May	321	2,937	1,642	30,223	89	758
1-Jun	485	3,422	1,245	31,468	34	792
2-Jun	298	3,720	1,913	33,381	17	809
3-Jun	396	4,116	1,143	34,524	10	819

4-Jun	211	4,327	2,419	36,943	37	856
5-Jun	649	4,976	211	37,154	24	880
6-Jun	444	5,420	940	38,094	38	918
7-Jun	356	5,776	430	38,524	9	927
8-Jun	198	5,974	484	39,008	12	939
9-Jun	426	6,400	866	39,874	10	949
10-Jun	370	6,770	604	40,478	10	959
11-Jun	242	7,012	-	40,478	39	998
12-Jun	221	7,233	-	40,478	11	1,009
13-Jun	168	7,401	-	40,478	4	1,013
14-Jun	51	7,452	-	40,478	-	1,013
15-Jun	-	7,452	-	40,478	-	1,013
16-Jun	66	7,518	-	40,478	1	1,014
17-Jun	31	7,549	-	40,478	-	1,014
18-Jun	67	7,616	-	40,478	-	1,014
19-Jun	25	7,641	-	40,478	-	1,014
20-Jun	-	7,641	-	40,478	-	1,014
21-Jun	8	7,649	-	40,478	-	1,014
22-Jun	1	7,650	-	40,478	-	1,014
23-Jun	-	7,650	-	40,478	-	1,014
24-Jun	-	7,650	(79)	40,399	-	1,014
25-Jun	-	7,650	(64)	40,335	-	1,014
26-Jun	-	7,650	(85)	40,250	-	1,014
27-Jun	-	7,650	(51)	40,199	-	1,014
28-Jun	1	7,651	(29)	40,170	-	1,014
29-Jun	-	7,651	(45)	40,125	-	1,014
30-Jun	-	7,651	-	40,125	-	1,014
1-Jul	-	7,651	-	40,125	-	1,014

Table 30. Historical fish passage at the Pawtucket fishway and ladder, Lowell.
(0-999 fish are reported to the nearest individual; 1,000-9,999 to the nearest 100; 10,000-99,999 to the nearest 1,000; and 100,000 or greater to the nearest 10,000).

Year	American Shad	River Herring	Sea Lamprey	Striped Bass
1986*	1,600	570	910	0
1987	3,900	31,000	1,900	2
1988	1,300	32,000		
1989	922	37,000	1,900	1
1990**	443	9,900	169	4
1991				
1992***	6,600	34,000	200	0
1993	1,700	4,300	1,500	0
1994	383	34,000	340	0

Year	American Shad	River Herring	Sea Lamprey	Striped Bass
1995	5,300	12,000	920	18
1996	1,300	292	395	4
1997	4,400	20	2,000	26
1998	4,200	13	545	5
1999	16,000	2,900	3,700	17
2000	13,000	673	2,300	66
2001	7,700	58	606	16
2002	5,300	0	2,000	32
2003	6,600	194	822	51
2004	11,000	7,500	2,200	129
2005	716	201	185	7
2006	0	27	9	0
2007	1,700	0	127	2
2008	4,200			
2009	2,800	139	260	2
2010	479	43	507	
2011	1,200	256	272	5
2012	1,800	1,800	166	1
2013	13,500	9,800	70	3
2014	3,500	24,000	691	
2015	21,000	32,000	208	
2016	11,000	290,000	227	
2017	5,100	5,600	333	
2018	14,046	311,867	2,407	4
2019	2,201	43,871	1,113	
2020	8,360	181,979		

*Testing period; facility not fully functional.
**Lifts began 5/5; however, counts did not begin until 5/30.
***Fishlift out of operation 6/2-18.

Appendix B The Wildlife Tables

Table 31. FY 2021 biological monitoring sites.

Site Name	Town	Type of Monitoring	Acres
Southwick WMA	Southwick	Grassland bird nesting territories	250
Frances Crane WMA	Falmouth	Grassland bird nesting territories	360
Bird Island	Marion	UAS photography, Colonial Waterbird Survey	5
Kettle Island	Manchester	UAS photography, Colonial Waterbird Survey	15
Kampoosa Fen WMA	Stockbridge/Great Barrington	UAS photography, Western Fen Phragmites Inventory	200
Agawam Lake WMA	Stockbridge/Great Barrington	UAS photography, Western Fen Phragmites Inventory	250
Fairfield Brook WMA	Richmond	UAS photography, Western Fen Phragmites Inventory	75
Hop Brook WMA	Lee/Tyringham	UAS photography, Western Fen Phragmites Inventory	400
Muddy Brook WMA/WCE	Hardwick	UAS photography, Habitat restoration documentation	1,300
Montague Plains WMA	Montague	UAS photography, Prescribed Fire	900
		Total	**3,755**

Table 32. FY 2021 habitat management and prescribed fire planning sites.

Site Name	Town	Plan Type	Acres
Ashfield-Hawley WMA	Ashfield and Hawley	Habitat Site Plan	285
Bolton Flats WMA	Bolton	Wildfire Response Abstract	978
Camp Cachalot WCE – S	Plymouth and Wareham	Prescribed Burn Unit Plan – Moderate Complexity	217
Farmington River WMA	Becket and Otis	Habitat Site Plan	400
Frances A. Crane WMA	Falmouth	Wildfire Response Abstract	2,466
Frances A. Crane WMA – N	Falmouth	Prescribed Burn Unit Plan – Low Complexity	12
Frances A. Crane WMA – S	Falmouth	Prescribed Burn Unit Plan – Low Complexity	20
Herm Covey WMA East Gr	Belchertown	Prescribed Burn Unit Plan – Low Complexity	18
Leyden WMA	Leyden	Wildfire Response Abstract	759
Manuel F. Correllus SF, Willow Tree Bottom	West Tisbury	Phase 1 Restoration Concept	235
Maple Springs WMA	Carver and Wareham	Prescribed Burn Unit Plan – Moderate Complexity	441
Maple Springs WMA	Carver and Wareham	Wildfire Response Abstract	576
Mashpee Pine Barrens	Mashpee	Wildfire Response Abstract	289
Montague Plains WMA	Montague	Wildfire Response Abstract	1,575
Montague Plains WMA - SP1/BR	Montague	Prescribed Burn Unit Plan – Moderate Complexity	69
Montague Plains WMA – SP5/E	Montague	Prescribed Burn Unit Plan – Moderate Complexity	113

Scarborough Brook Conservation Area	Belchertown	Prescribed Fire Unit Plan – Low Complexity	70
SE Pine Barrens WMA/South	Plymouth	Prescribed Burn Unit Plan – Moderate Complexity	350
Southwick WMA	Southwick	Wildfire Response Abstract	265
William Forward WMA	Newbury	Saltmarsh assessment and preliminary restoration design	175
Total Acres			9,313

Table 33a. FY 2021 summary of habitat management sites, by practice.

Habitat Practice	Acres
Fire Breaks/Fuel Reduction	76
Invasive Control	1,021
Mow/Mulch	529
Prescribed Fire	568
Tree Cutting	730
Total	**2,924**

Table 33b. FY 2021 fire break/fuel reduction management sites.

Site Name	Town	Habitat Type, Vegetation, or Fuels	Acres
Hyannis Ponds WMA	Barnstable	Woodlands	14
Mashpee Pine Barrens WMA	Mashpee	Woodlands	30
Montague Plains WMA	Montague	Pitch Pine Oak Woodland	22
Muddy Brook WCE	Hardwick	Woodlands	10

Table 33c. FY 2021 invasive plant control sites.

Site Name	Town	Habitat Type, Vegetation, or Fuels	Acres
Ashfield-Hawley WMA	Ashfield and Hawley	Young Forest	1
Birch Hill WMA	Winchendon	Heathland	125
Bird Island	Marion	Coastal Dunes, Beaches, and Small Islands	0.3
Bolton Flats WMA	Bolton	Sandplain Grassland	50
Bullock Ledge WMA	Williamstown	Ridgetop	0.2
Burrage Pond WMA	Hanson	Forested Wetlands, Marshes and Wet Meadow	16
Cooks Pond WMA	Plymouth	Oak-Pine Forest	6
Dunstable Brook WMA	Dunstable	Woodlands	7
East Mountain WMA	Holyoke	Woodlands	11
Erwin S. Wilder WMA	Taunton	Woodlands	12
Fairfield Brook WMA	Richmond	Peatlands, Open and Forested	14
Frances A. Crane WMA	Falmouth	Pitch Pine Oak Woodland	237

Frances A. Crane WMA	Falmouth	Pitch Pine Oak Woodland	100
Green River WMA	Leyden	Northeast Central Oak-Pine Forest	21
Groton Town Forest WCE	Groton	Northeast Central Oak-Pine Forest	1
Herman Covey WMA	Belchertown	Northeast Central Oak-Pine Forest	3
Hop Brook	Lee	Peatlands, Open and Forested	26
Hyannis Ponds WMA	Barnstable	Woodlands	0.2
Leyden WMA	Leyden	Ridgetop Heathland/Oak Woodland	68
Montague Plains WMA	Montague	Pitch Pine Oak Woodland	3
Muddy Brook WMA	Hardwick	Woodlands	41
Norcross Hill WMA	Templeton	Young Forest	10
Poland Brook	Conway	Grassland	3
Quaboag WMA	Brookfield	Grassland	23
Rainbow Beach WMA	Northampton	Floodplain Forest	30
Rainbow Beach WMA	Northampton	Floodplain Forest	91
Ram Island	Mattapoisett	Coastal Dunes, Beaches, and Small Islands	0.4
Red Brook WMA	Plymouth	Woodlands	3
Satan's Kingdom WMA	Bernardston	Northeast Northern Hardwood and Conifer Forest	17
Southwick WMA	Southwick	Sandplain Grassland	62
Squannacook WMA	Townsend	Oak Woodland Barrens	2
Stafford Hill WMA	Cheshire	Marshes and Wet Meadows	26
Tully Mountain WMA	Orange	Young Forest	10
Winimusset WMA	New Braintree	Grassland	0.7

Table 33d. FY 2021 mow/mulch management sites.

Site Name	Town	Habitat Type	Acres
Frances A. Crane WMA	Falmouth	Pitch Pine Oak Woodland	170
Montague Plains WMA	Montague	Pitch Pine Oak Woodland	184
Myles Standish Complex	Plymouth	Pitch Pine Oak Woodland	175

Table 33e. Prescribed fires completed by MassWildlife in FY 2021.

Prescribed Fire Date	Site Name	Vegetation/Fuels	Acres
03/10/21	Frances A. Crane WMA	Pitch Pine Oak Woodland	10
03/22/21	Frances A. Crane WMA	Grassland	45
04/06/21	Penikese Island Sanctuary	Grassland	68
04/08/21	Birch Hill WMA	Heathland	10
04/19/21	Frances A. Crane WMA	Grassland	92
05/06/21	Southwick WMA	Grassland/Shrubland	36
05/07/21	Noquochoke WMA	Grassland/Shrubland	36
05/13/21	Frances A. Crane WMA	Pitch Pine Oak Woodland	22
05/14/21	Leyden WMA	Ridgetop Heathland/Oak Woodland	24
05/18/21	Muddy Brook WMA	Shrubland	02
05/19/21	Herm Covey WMA	Grassland	27
05/27/21	Herm Covey WMA	Grassland	26

05/28/21	Birch Hill WMA	Grassland/Heath	24
06/02/21	Muddy Brook WMA	Oak Woodland/Shrubland	65
06/10/21	Southwick WMA	Oak Woodland/Shrubland/Grassland	63
06/17/21	Montague Plains WMA	Pitch Pine Oak Woodland	08
06/23/21	Frances A. Crane WMA	Pitch Pine Oak Woodland	10

Table 33f. FY 2021 Tree Cutting

Site Name	Town	Habitat Type	Acres
Ashfield-Hawley WMA	Ashfield and Hawley	Young Forest	78
Fox Den WMA	Middlefield and Worthington	Young Forest, Marshes and Wet Meadows	74
Frances A. Crane WMA	Falmouth	Pitch Pine Oak Woodland	16
Mashpee Pine Barrens WMA	Mashpee	Woodlands	30
Myles Standish Complex	Plymouth	Pitch Pine Oak Woodland	532

Table 34. FY 2021 WCE/WMA Compliance Monitoring

WCE/WMA Name	Activity	Town	Acres
Housatonic River WMA	Deed research	Lenox	150
Knightville WCE	Owner timber harvest review	Huntington	239
Lily Pond WMA	Abutter timber harvest license agreement	Goshen	1
Poland Brook WMA	Abutter invasive control assistance	Conway	5
Swift River WCE	Owner habitat review	Plainfield and Cummington	26
Windsor Brook WCE	Owner timber harvest review	Windsor	33
		Total	**454**

Table 35. FY 2021 DCR Harvest Proposal Reviews.

Property	Parcel	Town	Acres
Chester-Blandford SF	Old House Lot	Blandford	106
Mt. Washington SF	Intemann Lot/Cattle Barn Lot	Mt. Washington	362
Northfield SF	Birnam Road	Northfield	165
Otter River SF	Beaman Pond Lot 2.0	Baldwinville and Winchendon	174
Lawton SF	Willis Road North	Athol	122
Lawton SF	Willis Road South	Athol	109
Myles Standish SF	Charge Pond Campground	Plymouth	175
		Total	**1,213**

Table 36. 2020 Airboat nightlighting results

Location	Date	MALL	ABDU	X	WODU	AGWT	BWTE	MISC	Total	P.B.[1]
Great Meadows	8/7	21			69	1			91	2
Quaboag River.	8/10	1			17				18	
Otter River	8/11	17			47				64	1
Lackey Pond	8/12	7			52				59	12

New Bedford Res	8/13	6			18				24	2
Nashua River	8/18*	38			42				80	2
Chicopee River	9/7				30				30	1
West Meadows	9/14	5			34		2	2[2]	43	
Lackey Pond	9/18	8			89	2	1	1[3]	101	23
Totals	**9 trips**	**103**			**398**	**3**	**3**	**3**	**510**	**43**

[1] Previously banded

[2] 1 sora, 1 northern pintail x mallard

[3] sora

Table 37. Historical furbearer harvest 1992/1993 to 2020/2021.

Hunting/Trapping Season	River Otter [a,d]	Mink [a,d]	Muskrat [a,d]	Beaver [a,d]	Gray Fox [a,c]	Red Fox [a,c]	Weasel [a,c]	Skunk [a,c]	Opossum [a,c]	Raccoon [a,c]	Coyote [a,c]	Bobcat [a,c]	Fisher [a,d]
1992/1993	149	591	9,474	1,086	19	118	0	31	66	2,150	95	10	111
1993/1994	151	593	9,595	1,017	10	92	0	31	54	1,438	92	16	120
1994/1995	165	559	11,341	2,083	19	78	4	52	87	1,471	107	12	158
1995/1996	171	502	7,873	1,135	36	83	15	41	54	640	153	14	226
1996/1997	147	441	7,062	623	20	65	1	11	44	998	166	9	278
1997/1998	13	49	712	98	43	31	5	99	113	559	86	8	340
1998/1999	15	49	1,017	114	54	27	2	64	75	368	97	8	395
1999/2000	11	63	747	312	26	17	1	67	32	123	84	15	220
2000/2001	16	59	667	558	37	27	0	55	24	300	95	14	124
2001/2002	38	49	917	1,172	50	36	0	60	52	399	91	18	197
2002/2003	25	39	649	495	43	24	0	85	27	717	85	23	303
2003/2004	72	25	1,419	717	49	40	0	110	54	720	176	47	215
2004/2005	97	34	1,063	564	37	42	4	111	53	403	191	51	339
2005/2006	119	30	543	791	38	33	7	119	37	178	188	45	342
2006/2007	97	36	679	730	45	46	1	8	25	234	242	38	582
2007/2008	72	40	976	848	33	48	3	25	79	344	530	53	486
2008/2009	64	49	709	702	45	31	0	23	38	239	513	63	521
2009/2010	78	34	1,066	509	46	53	1	15	30	186	599	53	262
2010/2011	79	35	947	548	49	55	6	12	74	237	489	67	321
2011/2012	88	38	1,174	828	38	42	9	15	43	287	449	81	214
2012/2013	156	51	967	711	57	47			3	77	470	103	415
2013/2014	166	60	110	969	65	65	8	8	28	55	420	103	459
2014/2015	102	30	61	562	56	58	1	12	32	26	468	81	398
2015/2016	57	12	518	727	24	27	0	21	16	71	532	79	286
2016/2017	101	8	34	534	56	70	0	15	10	46	486	100	280
2017/2018	62	22	115	667	45	81	1	30	18	59	522	87	244
2018/2019	35	18	32	567	32	126	2	23	20	97	759	109	109
2019/2020	22	17	89	672	30	103	0	39	36	101	626	118	152
2020/2021	30	11	99	594	33	65	2	19	30	82	574	94	118
Past 5 Year Average	50	15.2	73.8	606.8	43.2	89	1	25.2	22.8	77	593.4	101.6	180.6

a - number of animals reported at official check stations or via online check system
b - number of animals reported from voluntary trapper survey
c - both hunting and trapping seasons
d - trapping season only

Table 38. The 2019 white-tailed deer harvest by season and sex/age class in Massachusetts, including Quabbin harvest.

Season	Adult Male	Female	Button Buck	Total	Percent Harvest
Paraplegic/Youth	51	64	16	131	1%
Archery	4,415	1,855	394	6,664	45%
Shotgun	2,791	1,871	462	5,124	35%
Primitive	1,246	1,322	270	2,838	19%
State	**8,503**	**5,112**	**1,142**	**14,757**	**100%**

Table 39. The 2020 white-tailed deer harvest by deer sex/age and the number of antlerless deer permits allocated and issued, by WMZ, for Massachusetts (Quabbin excluded).

WMZ	Adult Male	Female	Button Buck	Total	Goal of Deer Management	2020 Allocation	2020 Issued
1	261	77	14	352	Stabilize	600	
2	463	67	11	541	Stabilize	300	
3	415	141	22	578	Stabilize	1,600	
4N	461	132	18	611	Stabilize	600	
4S	318	43	6	367	Stabilize	500	
5	535	186	31	752	Stabilize	1,500	
6	166	54	9	229	Increase/Stabilize	300	
7	412	250	45	707	Stabilize	2,400	
8	546	248	40	834	Increase/Stabilize	2,600	
9	810	528	110	1,448	Reduce/Stabilize	5,500	
10	1,421	1,184	271	2,876	Reduce*	12,000	
11	1,853	1,272	320	3,445	Reduce	13,000	
12	216	76	14	306	Stabilize	1,000	
13	342	440	140	922	Reduce*	2,700	
14	284	414	91	789	Reduce*	2,700	
Statewide	**7,752**	**5,156**	**983**	**14,757**		**47,300**	**44,783**

* Antlerless deer permits are functionally unlimited in Zones 10, 13, and 14

Appendix C The Wildlife Lands

Central District	*50,717.16*
Ashburnham WMA	272.00
Bare Hill Pond Access	1.45
Benjamin Hill WCE	87.50
Bennett WMA	281.20
Birch Hill WMA	4,560.55
Blackstone / West River Access	28.00
Bolton Flats WMA	1,319.88
Breakneck Brook WCE	526.00
Breakneck Brook WCR	176.00
Breakneck Brook WMA	707.00
Burnshirt River WCE	100.00
Carter Pond WCE	300.50
Chockalog Swamp WMA	52.50
Clinton Bluff WMA	42.00
Coy Hill WMA	1,137.50
Cusky Pond Access	23.00
E. Kent Swift WMA	157.00
Fish Brook WCE	75.00
Fish Brook WMA	142.50
Fitchburg Watershed WCE	1,875.00
Five Mile River Access	178.52
Five Mile River WCR	17.27
Four Chimneys WMA	200.00
Glen Echo Lake Access	1.00
High Ridge WMA	2,240.87
Hitchcock Mountain WCE	110.50
Hitchcock Mountain WCR	499.50
Hitchcock Mountain WMA	268.41
Lackey Pond WMA	174.54
Lawrence Brook WCE	462.60
Lawrence Brook WMA	295.50
Leadmine Mountain WCE	826.37
Leadmine Pond Access	0.05
Leadmine WMA	826.00
Long Pond WCE	8.85
Long Pond WMA	5.60
Martha Deering WMA	232.58
McKinstry Brook WCE	31.00
McKinstry Brook WCR	26.00
McKinstry Brook WMA	291.30
Merrill Pond WMA	1,037.06
Millers River WCE	194.22
Millers River WMA	3,814.76
Mine Brook WMA	1,165.60
Moose Brook Access	20.13
Moose Brook WCE	125.00
Moose Brook WMA	849.20
Moose Hill WMA	695.60
Moosehorn Pond Access	9.00
Mossy Pond Access	17.00
Mount Watatic Sanctuary	228.00
Mt. Pisgah WCE	19.12
Mt. Pisgah WMA	88.80
Muddy Brook WCE	575.69
Muddy Brook WMA	1,888.92
Natty Brook Access	95.17
Newton Reservoir WCE	622.00
Nineteenth Hill WCE	623.75
Nineteenth Hill WMA	293.60
Norcross Hill WMA	464.93
North Pond Access	0.18
Oakham WMA	911.20
Phillipston WMA	3,224.03
Popple Camp WMA	1,459.91
Potter Hill WCE	90.80
Poutwater Pond WMA	391.74
Prince River WMA	838.95
Quaboag WMA	1,822.53
Quacumquasit WMA	179.82
Quag Pond Bog Access	31.00
Quinapoxet River Access	32.00
Quinsigamond Marsh Access	59.00
Quinsigamond River Access	18.60
Quisset WCE	247.00
Quisset WMA	424.69
Raccoon Hill WCR	22.00
Raccoon Hill WMA	646.16
Richardson WMA	467.22
Savage Hill WCE	234.00
Savage Hill WMA	930.96
Scripture Hill WMA	121.00
Secret Lake WCE	311.30
Sevenmile River Access	77.00
Slater Woods WCE	73.90
South Meadow Pond Access	0.25
Sputtermill Pond Access	58.50

Stone Bridge WMA	505.17
Stuart Pond WCE	28.70
Sucker Brook WMA	102.60
Susan B. Minns Sanctuary	139.91
Taft Hill WCE	394.60
Thayer Pond WMA	131.00
Tully River Access	1.00
Ware River Access - Barre	40.00
Ware River WMA	185.36
Wayne F. MacCallum WMA	894.58
Webster Lake Access	1.70
Wekepeke WCE	564.00
West Hill WMA	350.00
Whitmanville WCE	118.10
Whortleberry Hill WMA	334.36
Williamsville Pond WCR	5.64
Winchendon Springs WMA	854.06
Winimusset WCE	100.00
Winimusset WMA	670.17
Wolf Swamp WMA	1,233.88
Connecticut Valley District	***32,748.49***
Amethyst Brook WCE	36.90
Bachelor Brook WMA	93.70
Bennett Meadows WMA	201.00
Bitzer Fish Hatchery	74.54
Brewer Brook WMA	456.69
Brushy Mountain WCE	78.00
Brushy Mountain WMA	181.38
Catamount WMA	413.00
Chestnut Hill WCE	175.40
Connecticut River Access	94.80
Darwin Scott WMA	27.30
Deerfield River Access	23.00
East Mountain WMA	604.45
Facing Rock WCE	190.00
Facing Rock WMA	1,388.89
Flagg Mountain WCE	345.00
Flagg Mountain WMA	223.69
Forest Lake Access	34.80
Great Swamp WCE	0.94
Great Swamp WMA	724.85
Green River WMA (Valley District)	558.85
Herman Covey WMA	1,505.94
Honey Pot WCE	52.74
Honey Pot WMA	178.42
Lake Lorraine Access	0.26
Lake Quinsigamond Access	6.49
Lake Rohunta Access	2.49

Lake Rohunta WCE	59.00
Lake Warner WMA	98.00
Leyden WMA	759.00
Little Alum Pond Access	0.50
Little Tully Mountain WCE	461.38
Ludlow Reservoir WCE	1,750.00
Mill River Access	14.15
Millers River Access	60.50
Montague Plains WMA	1,983.59
Montague WMA	2,074.45
Mt. Esther WMA	328.95
Mt. Toby WMA	739.10
Mt. Tom WMA	79.90
Orange WCE	877.97
Orange WMA	388.50
Packard Pond Access	0.54
Palmer WMA	1,541.49
Pauchaug Brook WMA	161.30
Paul C. Jones Working Forest WCE	3,486.00
Poland Brook WMA	707.53
Rainbow Beach WMA	45.90
Reed Fish Hatchery	316.00
Satan's Kingdom WCE	123.50
Satan's Kingdom WMA	2,403.77
Sawmill River Access	52.00
Shattuck Brook WMA	178.80
Southampton WMA	170.60
Southwick WCE	61.31
Southwick WMA	348.28
Sunderland Fish Hatchery	45.59
Sunderland Islands WMA	15.00
Tully Brook Access	154.88
Tully Mountain WCE	692.87
Tully Mountain WMA	704.00
Wales WMA	207.15
Walter Cowls Jones Working Forest WCE	2,038.78
Ware River Access	39.00
Warwick WMA	379.00
Wendell WCR	2.39
Wendell WMA	591.19
Westfield River Access	79.40
Westfield WMA	234.03
Whately WMA	388.59
Wilbraham Nature and Cultural Center	143.09
Williamsburg WMA	88.00
Northeast District	***19,136.65***
Ashby WMA	946.76
Ayer Game Farm	90.72

Baddacook Pond Access	0.16
Boxborough Station WMA	124.10
Carr Island Sanctuary	110.50
Castle Neck River WMA	54.67
Concord River Access	0.25
Concord River WCE	18.90
Cow Pond Brook WCE	127.00
Crane Pond WMA	2,623.21
Devilâ€™s Den WCE	28.00
Dunstable Brook WMA	177.35
Eagle Island WMA	5.00
Elbow Meadow WMA	210.33
Fessenden Hill WMA	21.00
Flagg Swamp WMA	54.00
Flint Pond Access	89.18
Gov. Thos. Dudley Park	4.50
Great Marsh North WCE	426.13
Great Marsh North WMA	459.12
Great Meadows WCE	16.00
Great Swamp Brook WCE	106.00
Groton Town Forest WCE	513.00
Hauk Swamp WMA	61.00
Henry Cabot Lodge Bird Sanctuary (Egg Rock)	2.00
Hunting Hills WCE	84.59
Hunting Hills WMA	430.02
Ipswich River Access	1.79
Ipswich River Access, Peabody	22.23
J. C. Phillips Sanctuary	390.98
King Phillip Woods	87.20
Knops Pond Access	0.60
Lake Attitash Access	6.03
Long Sought For Pond Access	1.00
Martin H. Burns WCE	113.44
Martin H. Burns WMA	1,576.70
Mascuppic Lake Access	0.25
Meadow Pond WCE	81.90
Milk Island Sanctuary	29.00
Mill Creek WCR	59.00
Mount Watatic Reservation	280.00
Mulpus Brook WMA	498.40
Nashua River Access - Dunstable	15.00
Nashua River Access - Groton	10.10
Nashua River Access - Pepperell	11.20
Nashua River Access - Shirley	31.20
Nissitissit River WMA	428.06
Northeast District HQ	15.70
Pantry Brook WMA	449.95
Pepperell Springs WCE	255.00
Ram Island Sanctuary (North)	20.00
Salisbury Salt Marsh WMA	865.87
Squannacook River WCE	348.51
Squannacook River WCR	68.00
Squannacook River WMA	1,893.69
Sucker Brook WCE	12.00
Sudbury River Access	51.86
Surrenden Farm West WCE	169.70
Throne Hill WCE	177.50
Townsend Hill WMA	724.30
Trapfall Brook WMA	45.38
Unkety Brook WCE	137.78
Unkety Brook WMA	826.14
Upper Parker River WMA	208.89
Weymouth Back River Access	16.50
Whittier WMA	42.00
William Forward WCE	274.75
William Forward WMA	1,957.56
Wright Ponds WCE	148.00
Southeast District	***57,447.09***
Acushnet River WCE	30.20
Agawam Mill Pond Access	1.40
Agawam Mill Pond Access WCE	0.50
Agawam River WCE	3.98
Angeline Brook WCE	100.70
Assawompsett Pond Complex WCE	3,065.00
Atwood Reservoir WMA	511.07
Bakers Pond Access	1.75
Barnstable Harbor Access	2.78
Bearse Pond WMA	5.80
Bettys Neck WCE	329.22
Big Sandy Pond Access	0.20
Billingsgate Island Sanctuary	12.00
Billington Sea WCE	69.74
Bird Island Sanctuary	3.10
Black Brook WMA	411.32
Blueberry Pond WMA	1.50
Brandt Island Cove WCE	109.52
Brayton Point WMA	2.20
Bread and Cheese Brook WCE	5.52
Burrage Pond WMA	1,842.17
Camp Cachalot WCE	789.00
Camp Edwards WMA	15,013.16
Canoe River WMA	116.60
Chase Garden Creek WMA	56.40
Childs River Access	0.25
Clapps Pond WMA	68.35
Cook Pond Access	3.00
Cooks Pond WMA	69.18

Copicut WCE	486.22
Copicut WMA	3,992.56
Dartmoor Farm WMA	473.00
Dennis Grassy Pond WMA	7.24
Dogfish Bar Beach Access	2.40
Eastham Salt Marsh WMA	7.44
English Salt Marsh WMA	288.50
Erwin S. Wilder WMA	540.95
Fisk Forestdale WMA	235.00
Fox Island WMA	71.10
Frances A. Crane WMA	2,302.31
Gosnold WMA	3.45
Great Herring Pond Access	1.06
Halfway Pond WCE	28.00
Halfway Pond WMA	122.64
Hartley Reservoir WMA	70.00
Haskell Swamp WMA	3,111.22
Head Of The Plains WMA	2.00
Hockomock Swamp WMA	4,552.54
Hog Ponds WMA	24.50
Hyannis Ponds WMA	365.00
Johns Pond Access	0.52
Katama Plains WMA	18.57
Lake Nippenicket WCE	8.35
Lobster Hatchery	14.80
Maple Springs WCE	156.25
Maple Springs WCR	466.24
Maple Springs WMA	774.57
Marconi WMA	1,211.00
Mashpee Pine Barrens WMA	198.35
Mashpee River WMA	55.80
Mashpee-Wakeby Pond Access	25.00
Mattapoisett River WMA	163.00
Meetinghouse Swamp WMA	123.00
Miacomet Heath WMA	3.83
Mill Brook Bogs WMA	584.52
Muddy Pond WMA	72.00
Nemasket River Access	0.46
Noquochoke WMA	204.50
North Attleborough WMA	36.46
Old Sandwich Game Farm WMA	93.13
Olivers Pond WMA	12.00
Penikese Island Sanctuary	60.00
Peterson Swamp WMA	264.99
Pickerel Cove WCE	78.30
Pickerel Cove WMA	15.90
Pilgrim Springs WCE	17.05
Plymouth Grassy Pond WCR	33.90
Plymouth Grassy Pond WMA	25.50
Plymouth Pine Hill WCE	240.70
Plymouth Town Forest WCE	296.00
Poor Meadow Brook WCE	101.00
Poor Meadow Brook WMA	161.61
Popponesset Beach Access	1.50
Provincetown Corridor WMA	122.00
Purchade Brook WMA	106.00
Quashnet River WCE	14.10
Quashnet River WMA	51.54
Quashnet Woods State Reservation and WMA	360.00
Ram Island Sanctuary (South)	2.00
Red Brook WMA	683.20
Robbins Pond Access	1.00
Rocky Gutter WMA	3,318.56
Sandwich Fish Hatchery	69.76
Sandwich Hollows WMA	224.20
Santuit Pond WCE	293.00
Scorton Creek Access	5.48
SE Massachusetts Bioreserve	5.94
SE Pine Barrens WMA	436.84
Shubael Pond Access	0.35
Sippican Headwaters WMA	336.73
Sippican Woods WCE	390.14
Sly Pond WMA	192.00
Snipatuit Pond Access	0.50
South Shore Marshes WMA	22.40
South Triangle Pond WCE	47.50
South Triangle Pond WMA	10.26
South Watuppa Pond Access	5.26
Southeast District HQ	29.80
Spectacle Pond Access	0.50
Stump Brook Reservoir WCE	174.00
Tarpaulin Cove Sanctuary	4.50
Taunton River WCE	290.07
Taunton River WCR	4.00
Taunton River WMA	684.72
Tispaquin Pond Access	6.00
Triangle Pond WMA	81.90
Wasque Point WMA	99.50
Watuppa Reservation WCE	4,300.00
West Meadows WMA	231.72
Weweantic River WCE	10.08
Western District	***67,171.99***
Abbott Brook WCE	1,782.00
Abbott Brook WMA	18.00
Agawam Lake WMA	785.75
Alford Spring WCE	889.82
Allen Mountain WCE	208.00

Ashfield Hawley WMA	284.00
Barton's Ledge WMA	88.60
Boulders WCE	642.53
Bullock Ledge WMA	15.50
Chalet WMA	7,804.33
Cold Brook WCE	405.00
Cole Meadow WCE	101.00
Cummington WMA	288.97
Day Mountain WMA	387.54
Deerfield River Access - Charlemont	0.62
Dolomite Ledges WMA	389.87
E. Howe Forbush Sanctuary	365.50
Eugene D. Moran WMA	1,870.43
Fairfield Brook WMA	164.90
Farmington River WMA	1,901.10
Fisk Meadows WMA	638.17
Flag Rock WCE	41.38
Flat Brook WMA	273.15
Fox Den WMA	5,686.95
George L. Darey Housatonic Valley WMA	812.93
Grace A. Robson Sanctuary	62.00
Green River WMA (Western District)	489.12
Hawks Brook WCE	23.19
Hawks Brook WMA	509.83
Hinsdale Flats WMA	1,924.97
Hiram H. Fox WMA	3,755.19
Hoosic River Access	5.90
Hop Brook WMA	527.53
Housatonic River Access	17.00
Housatonic River East Branch WCE	123.83
Housatonic River East Branch WMA	27.50
Hubbard Brook WMA	195.93
John J. Kelly WMA	342.00
Jug End Fen WCE	81.57
Jug End Fen WMA	246.64
Jug End State Reservation and WMA	1,169.80
Jug End WCE	262.48
Kampoosa Fen WMA	72.00
Knightville Dam WMA	0.00
Knightville WCE	676.00
Konkapot River Access	8.80
Lilly Pond WMA	395.70
Long Mountain WMA	1,014.46
Maple Hill WMA	687.99
Maxwell Brook WMA	168.19
Meadow Brook WCE	126.04
Meadow Brook WMA	50.00
Misery Mountain WMA	1,341.90
Mt. Darby WCE	319.29
Mt. Plantain WCE	1,337.44
North Egremont WCE	21.50
North Egremont WMA	25.96
North River West Branch WCE	250.20
Oak Hill WMA	712.30
Peru WMA	5,143.47
Powell Brook WMA	404.58
Ram Hill WMA	468.83
Richmond Fen WMA	22.90
Rockhouse Mountain WCE	78.00
Savoy WMA	1,985.37
Scout Pond WCE	175.90
Shales Brook WCE	5.60
Shales Brook WMA	234.00
Shaw Brook WMA	153.33
Silver Brook WCE	162.00
Stafford Hill WMA	904.60
Stage Brook WCE	581.00
Stage Brook WMA	148.30
Steadman Pond WCE	1,178.71
Swift River WMA	867.46
Tekoa Mountain WMA	1,383.30
Thorpe Brook WCE	266.20
Three Mile Pond WMA	1,141.82
Tom Ball Mountain WCE	625.00
Tower Brook WMA	579.61
Tracy Pond WMA	323.12
Umpachene River WCE	239.00
Upper Westfield River WMA	328.72
Walnut Hill WMA	988.70
Western District - Old HQ	2.35
Westfield River Access - Chester	3.50
Westfield Watershed WCE	2,300.00
Widow White's Peak WCE	244.00
Williams River WMA	60.50
Windsor Brook WCE	3,284.43
Windsor Brook WCR	69.40
Grand Total	***227,221.38***