2020 Annual Report

Massachusetts Division of Fisheries & Wildlife

Annual Report 2020

Massachusetts Division of Fisheries & Wildlife

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An agency of the Department of Fish & Game

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Front Cover:

MassWildlife Fisheries Biologist Rebecca Quiñones and Nashua River Watershed Association (NRWA) Water Programs Director, Martha Morgan installing a temperature datalogger in a coldwater tributary to the Nashua River. This is part of a larger state and regional partnership effort to identify important coldwater patches (refugia) where fish can retreat during the warmer months. Photo by Kathryn Nelson/NRWA

Back Cover:

MassWildlife staff and volunteers judge the 2019 Junior Duck Stamp Program competition at the Field Headquarters in Westborough. Photo by Troy Gipps/MassWildlife

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The Board Reports

Joseph S. Larson, Ph.D.
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, and sets policy and regulations pertinent to wildlife in the Commonwealth.

The Board has a tradition of holding monthly meetings at locations around the state when possible, but this year, for a variety of reasons, this was largely not feasible. In particular, the COVID-19 pandemic that began in early 2020 forced Governor Baker in mid-March to order the closure of state offices and prohibit gatherings of more than 20 persons. These and other necessary containment efforts prompted the Governor to suspend portions of the state's Open Meeting laws, enabling municipal and state boards, including the Fisheries and Wildlife Board, to hold public meetings via open conference calls and virtual meeting video platforms, with the public listening in. The Board also held a required public hearing on proposed regulatory changes virtually in April.

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. The Board also invites brief reports or comments from the Commissioner of the Department of Fish and Game and from a representative of the Massachusetts Environmental Police in the agenda of its monthly business meeting. 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.

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

MassWildlife staff began in the previous fiscal year a lengthy and comprehensive review of the regulations as they applied to coyote-hunting contests sponsored by private entities in the Commonwealth in response to public concerns. MassWildlife staff brought an outline of proposed regulations and a detailed discussion of the issues associated with furbearer hunting and contests to the Board at its first meeting of the new fiscal year, and the Board voted to charge staff with developing regulations and taking those regulations to a public hearing. After publishing and distributing the proposed regulations in September, staff continued to collect public feedback, including by conducting two formal hearings in October, one in Lenox and the other in Westborough, and letters and emails from the public were also reviewed and factored into the staff's analysis. Staff brought its final recommendations to the Board at the December meeting (see below for details). The Board commended the staff on a long, thorough, and inclusive process when the matter was resolved.

The COVID-19 pandemic, mentioned earlier, brought unique challenges to state government and all citizens in the last quarter of the fiscal year, beginning in mid-March. MassWildlife managers and their staff had to quickly make sweeping changes to daily operations 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, all while responding to public inquiries, accomplishing spring trout stocking, carrying out seasonal surveys and other duties, and generally continuing to do the conservation work to which MassWildlife employees have devoted their careers. I am pleased and proud to report that MassWildlife's staff responded immediately and in the best cooperative spirit to meet the challenges, and the entire Board joins me in thanking and congratulating the managers and staff on a job very well done. At the end of the fiscal year the pandemic is still ongoing and most of the Governor's orders, including against medium to large gatherings and requiring face coverings and social distancing, are still in force.

Administrative Matters

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

Adopted Regulations and Other Votes of the Board

MESA List Changes: Public Hearing, Comment Review, and Vote

A public hearing was held on August 28, 2019, proposing changes to the Massachusetts Endangered Species Act (MESA) list of species. Dr. Michael Nelson presented the proposals for each of the changes, the reasons for the proposals, and the staff's recommendations for each (Figure 1).

In summary:

Figure 1.

	Remove from List	Add to List	Change Status: SC ↔ T ↔ E
Vertebrates	0	3	3
Invertebrates	3	3	0
Plants	2	3	0
Total	5	9	3

At the September meeting, Assistant Director for the Natural Heritage and Endangered Species Program Eve Schlüter presented the staff analysis of comments received on the recommended changes to the MESA List that were the subject of the August public hearing and a written comment period for 2 weeks thereafter.

Dr. Schlüter began by reminding the Board members of the steps in the process of developing recommendations for the MESA List and of the broad categories of proposed changes. The Assistant Director then reviewed the public comments received, stating that there were five in all, and provided the evidence and analysis that NHESP staff used to evaluate the species in question and the suggested changes in the two comments that disagreed with the staff's recommendations. The Board voted to adopt the changes as recommended. Please refer to page 73 in the Natural Heritage and Endangered Species Program Section of this Annual Report for the details of the proposals and the final updated list.

Regulations to Prohibit Contests for the Capture, Take, or Waste of Certain Predator or Furbearing Animals; to Prohibit the "Waste" of Certain Game Animals; and to Amend the Harvest Reporting Requirements for Fox and Coyote: Public Hearings, Comment Review, and Vote

As was briefly referred to above, two public hearings were held in October to solicit oral public comments on regulations recommended by staff to address public concern over coyote-hunting contests conducted by private entities in the past several years. In addition to gathering input from diverse stakeholders to formulate its recommendations, including during much of the previous fiscal year, MassWildlife wildlife professionals also considered the best available science and consulted with wildlife biologists from other fish and wildlife agencies around the country.

Board members and staff listened to oral comments from a wide range of constituents during the two hearings and staff collected written comments before, during, and after the hearings. The analysis performed by staff of all comments after the close of the public comment period produced small changes to the regulations as originally proposed. Staff presented its final recommendations to the Board at the December meeting and the Board voted to amend and adopt the regulations as amended and recommended by staff.

2020-2021 Migratory Game Bird Season Regulations: Public Hearing, Comment Review, and Vote

In March, the Board heard the staff's proposals for the 2020-2021 Migratory Game Bird hunting seasons, which as always were based on the federal frameworks for migratory bird hunting and the input and preferences of Massachusetts bird hunters. In April, the staff held the public hearing; and, 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 the final regulations, see the Waterfowl sub-report in the Wildlife Section of this Annual Report on page 59).

2019 Annual Deer Review and 2020 Antlerless Deer Permit Allocation Recommendations

Deer and Moose Project Leader David Stainbrook presented the annual Deer Review to the Board at its May meeting. He also presented the staff recommendation for the 2020 Antlerless Deer Permit (ADP) allocations, which were unchanged from the previous year and were approved by the Board. Please refer to page 62 in the Wildlife Section of this Annual Report for the details of the review and of the ADP allocations for 2020.

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

August meeting

Land Protection Review of FY 2019 Acquisitions (Chief of Wildlife Lands Elizabeth Wroblicka)

June meeting

Habitat Management Program (Habitat Program Leader John Scanlon)

Other Presentations on Topics of Interest to the Board

November meeting

Using iNaturalist for MassWildlife Projects (Land Protection Specialist for the Natural Heritage and Endangered Species Program Lynn Harper)

January meeting

Update: Hunting and Fishing Access on USFWS Refuges (Michael Huguenin)

Massachusetts Fisheries and Wildlife Board
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

Fisheries

Todd A. Richards
Assistant Director, Fisheries

Overview

Fisheries Program activities for FY 2020, like all programs, were certainly impacted by the onset of the Coronavirus pandemic beginning in March 2020. This section summary, however, highlights the work accomplished and the progress made on several fisheries and agency-wide projects and products. Recreational fishing was one of the few activities that meets social distancing requirements, put more constituents out on the water, and provided a safe experience for so many people in the Commonwealth. This continues to highlight the importance of recreational fishing to the agency and the economy of Massachusetts.

While our I&E staff are still analyzing the data, it certainly appears that more people went fishing this spring and summer than in any year in recent history. The fisheries section responded to this spike in use in several ways. First, the Hatchery staff, with tremendous support from District and Westborough staff, responded by stocking fish at an unprecedented rate without incident. Trout were stocked into Massachusetts waters when the region was shutting down due to Coronavirus and provided a much-needed escape for many people who were not otherwise leaving their houses. Second, our efforts to ramp up R3 efforts, in collaboration with I&E staff resulted in the dramatic improvement of our on-line fishing map products to help put people in touch with their preferred fishing experience.

The fisheries staff also completed a very productive field season at the end of 2019, adjusted quickly to the new work at home situation in March, and redirected field efforts for the spring of 2020 to accomplish the most pressing field needs while following social distancing and PPE requirements. In some cases, where field work was not possible, staff redirected their efforts further to focus on several projects that integrated efforts and expertise across the agency and Department. These projects included a revised process for prioritizing land acquisition, investment in the next Biomap project with increased emphasis on aquatic biodiversity, and formal involvement in R3 and Relevancy efforts. Our input to these efforts relies on a fisheries database that is extensive, current, and versatile enough to apply to many situations.

Despite the loss of two positions in fisheries, we were able to continue to support agency Climate Change efforts, continue progress on a Wild Trout Management Plan, support research efforts in the Cooperative Fish and Wildlife Research Unit, and be responsive to public inquiries and associated field efforts.

Several staffing changes occurred during this year as well. Long-time biologist Richard Hartley retired after an extended leave. Richard coordinated fisheries Environmental review, the Sportfish Awards program, fish kill investigations, and participated in all the other fisheries projects. His innovations in the Sportfish Awards program led to the establishment of Youth Programs and the Catch and Release categories. All these programs led to a dramatic increase in participation.

Ken Simmons, Jim Hahn and John Williams, retired this fiscal year. These three employees held more than 100 years of hatchery experience managing the hatchery system. These employees oversaw changes at the hatchery during their tenure that lead to dramatic improvements in the quality of the fish we rear and the consistency with which we can provide them to the sportsmen and women of the Commonwealth.

Large Rivers and Climate Change Project: Rebecca Quiñones, PhD.

Big River analysis (in collaboration with Steven Mattocks)

Target Fish Community (TFC) and dissimilarity analyses (as in Kashiwagi and Richards 2009) were updated to describe the current ecological condition of major rivers in Massachusetts. Each river's fish assemblage was compared to the assemblage of refence rivers with similar characteristics. Enough data was collected in recent years to facilitate the evaluation of 10 major rivers (Figure 1). Fish assemblages were divided by species composition, habitat use (i.e., fluvial specialist, fluvial dependent, macrohabitat generalist), and pollution tolerance (i.e., intolerant, moderately tolerant, tolerant) before comparisons were made. Conditions in major rivers were subsequently categorized as good, fair or poor. Please refer to Kashiwagi and Richards (2009) for specifics on TFC calculations and definitions.

In keeping with the 2009 results, only one major river (Westfield River) ranked in good condition (Table 1). Conditions in the Hoosic (fair), Quinebaug (fair), Blackstone (poor), Ipswich (poor) and Shawsheen Rivers (poor) also remained unchanged. However, three rivers changed categories between the two time periods (1998-2005 vs. 2006-2018). Conditions in the West Branch Farmington and Housatonic Rivers seemed to worsen (fair to poor) but conditions in the Charles River seemed improved (poor to fair).

Figure 1. Evaluations of ecological condition of 10 major rivers (outlined in blue) were updated in FY20.

This year's evaluation differed from the 2009 effort by incorporating data on rivers not previously evaluated, and additional statistical analyses including:

- non-metric multidimensional scaling (NMDS) to visualize the data (Figure 3),
- permutational Multivariate Analysis of Variance (PERMANOVA) to test for significant differences between groups, and
- pairwise comparisons ($\alpha = 0.05$) to identify which groups differed from one another (Table 2).

Table 1. Condition of Massachusetts major rivers (2006–2018)

GOOD	FAIR	POOR	NEED FURTHER EVALUATION
Westfield	Charles	Blackstone	Chicopee
	Deerfield	French	Concord
	Hoosic	Housatonic	Mystic
	Quinebaug	Ipswich	Nashua
		Millers	Neponset
		Shawsheen	Taunton
		WB Farmington	

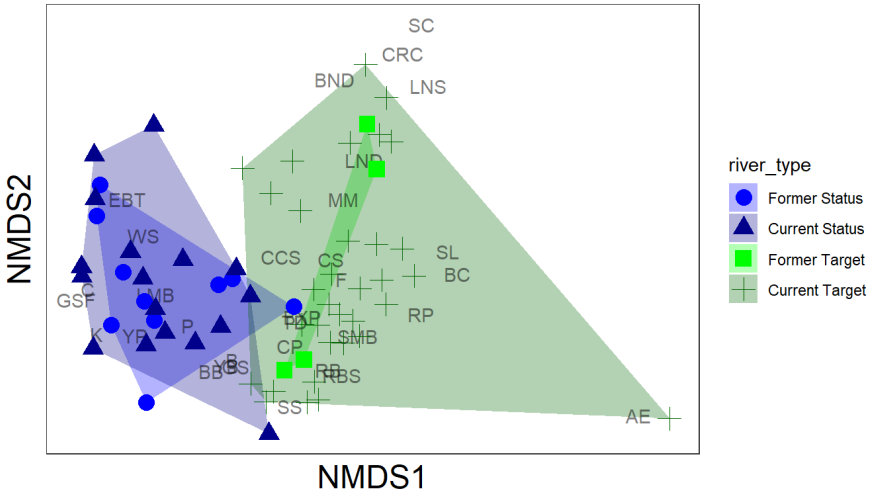
Conditions in the Deerfield (fair), West Branch Farmington (poor), Millers (poor) and French (poor) were evaluated with TFC methods for the first time. Sufficient data was also collected in the Nashua, Concord, Mystic, Chicopee and Neponset Rivers but these will need further evaluation because fish were collected through boat surveys not via backpack or barge electrofishing. Project results were presented at the 2020 Southern New England Chapter of the American Fisheries Society's conference in January.

MassWildlife also partnered with New Hampshire Department of Environmental Services (Andrew Chapman, Wayne Ives) to survey multiple sites in the Cold and Isinglass Rivers in New Hampshire. Both rivers are used to calculate TFC's for rivers in Massachusetts. This data will be used to evaluate whether reference conditions themselves have changed over time.

<u>Aquatic Biodiversity (in collaboration with Jason Stolarski and Todd Richards)</u>

In order to update the aquatic component of BioMap2, MassWildlife reevaluated fisheries resources across the state. Although much is known about the distribution of individual fish species, the information has not yet been con-

Figure 2. Example of non-metric multidimensional analysis completed for major rivers. Here, the species (letter abbreviations) composition of two time preriods, former (1998-2005) vs. current (2006-2018), is compared for the Blackstone River (blue polygons) and its reference rivers (green polygon). The little overlap between blue and green polygons suggests that fish assemblages in the Blackstone River are significantly different from the Target Fish Community in reference rivers. Divergence between the two assemblages appears to have occurred prior to 1998 as depicted by the high overlap of blue polygons.



solidated into a more holistic analysis of biodiversity. Fish species richness was calculated by stream order, a proxy for stream size, and major basin in order to understand patterns of biodiversity. Fish assemblages in Massachusetts rivers and streams differ by stream size and longitude. Assemblages also reflect the basic hydrology of habitats so data were also broken up into fishes within rivers and streams (lotic habitats) vs. lakes and ponds (lentic habitats). Consequently, a conscious effort was made to calculate richness within lotic habitats at the stream order and major basin scales and for lentic habitats at the major basin scale. Preliminary maps depict number of total species, and number of species within four habitat use categories: fluvial specialist, fluvial dependent, macrohabitat generalist, and pond dependent (J. Stolarski, MassWildlife, unpublished data). The first three categories describe preferred habitat use of fish within lotic habitats while the last describes specialized habitat use within lakes and ponds. Pond Dependent was first described as a category in FY 2020 as fish species that need lentic habitat in order to complete at least one life history stage (e.g., Brown Bullhead, Pumpkinseed). Future work will include survey data collected during boat surveys and calculated ratios of observed : expected composition as a metric to describe changes in fish community.

<u>Sportfishing Awards Program (with assistance from Debra Chamberlain)</u>

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. Anglers with the largest fish of 21 species in each category are recognized with a gold pin, 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. MassWildlife received 1519 entries in 2019. Unfortunately, the ceremony scheduled to recognize 2019 anglers had to be cancelled due to state mandates that prohibited large gatherings due to the spread of COVID-19. Several new state records were set in 2019, all in the Catch & Release Category (Table 3).

Table 2. Crosswalk of comparisons to evaluate large ("big") rivers n Massachusetts.

Ecological condition of major rivers was evaluated by species composition, habitat use, and pollution tolerance. Pairwise comparisons were completed for each pair of matching letters.

Waterbody	Time period	
	Former (data from 1998-2005)	Current (data from 2006-2018)
Major River	A C E	A D F
Reference Streams	B C F	B D E

Table 3. New state records from the 2019 Sportfishing Awards Program.

Species	Size (inches)	Location
Bowfin	31	Taunton River
Crappie	18.25	Lashaway Lake
Rainbow Trout	25.5	Jamaica Pond
Smallmouth Bass	22.75	Quabbin Reservoir

Other work duties:

MassWildlife continued to collaborate with other agencies on several efforts, including the role of Secretary for the In-stream Flow Council, and reviewer of grants funded by the Culvert Replacement Municipal Assistance Grant Program (led by the MA Dept. of Ecological Restoration) and Massachusetts Environmental Trust.

Climate adaptation:

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 2016 State Hazard Mitigation and Climate Adaption Plan (SHMCAP) in which MassWildlife identified 11 Priority Actions to increase climate resiliency agencywide. Progress on MassWildlife Priority Actions was provided in November 2019 (Table 4).

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 standards and guidelines used to evaluate the climate change resiliency of projects requesting capital funding. The standards and guidelines are under development with expected completion in FY21. In November 2019, MassWildlife submitted a proposal for capital funding to update BioMap2, a Priority Action in the SHMCAP. Updates to BioMap2 continue to be apriority for the Executive Office of Energy and Environmental Affairs.

Collaboration with Northeast Climate Adaptation Science Center (NECASC)

In FY 2020, MassWildlife contributed to two publications in Frontiers in Ecology and the Environment. The first (Morelli et al. 2020) summarized how concepts in the science of climate change refugia have been evolving. The second (Ebersole et al. 2020) used MassWildlife's work on coldwater climate change refugia as an example of how these areas can be used to advance climate adaptive work. A synopsis of the coldwater climate change refugia work can be found in the 2019 annual report. Further work is now being conducted to validate sites acting as potential climate change refugia, by documenting both temperature profiles and presence of coldwater fish species. To validate water temperatures, Onset Hobo Water Temp Pro v2 loggers were placed at 9 sites in the Manhan River watershed, 9 sites in the Squannacook River watershed, 7 sites in the Blackstone River watershed, and 8 sites in the Ammonoosuc watershed in New Hampshire. Loggers were placed in June 2019 (FY19) with collaborating citizen scientists associated with the Connecticut River Conservancy, Squan-A-Tissit Trout Unlimited, Blackstone River Watershed Association, and New Hampshire Fish and Game Department (Dianne Timmins). Loggers were checked monthly during summer months to ensure correct placement. Water temperature (degrees C) was also collected with a calibrated thermometer at that time. Standard (100 m) electrofishing surveys were conducted at each of the sites in summer 2019 to validate the presence of coldwater fish species.

Most sites in the Squannacook and upper Blackstone River watershed appeared good candidates for climate change refugia with temperatures consistently <20 degrees C and Eastern Brook Trout presence. However, one site (lower Locke Brook) went dry and others became sufficiently shallow as to potentially displace trout during low flow periods. In contrast, most sites in the Manhan River watershed (e.g. Bassett Brook) and lower Blackstone River watershed reached temperatures > 22 degrees C, likely too warm for Brook Trout for at least part of the summer. All temperature data was QA/QC'd and uploaded into the ecosheds.org temperature database in winter 2019. Loggers in the Manhan River watershed were removed in October 2019 because almost all were buried by sand at some point during the field season. Loggers buried in sediment can yield data that inaccurately reflect conditions in the water column. All suspect data were removed from the data prior to uploading into the database. Loggers in the Squannacook and Blackstone River watershed remained onsite. Loggers in the Ammonoosuc watershed also remain onsite and provide important information on the potential of coldwater climate change refugia at the regional scale.

Structured Decision Making Workshop

In February 2020, the fisheries section collaborated with NECASC, UMass-Amherst and other partners in the development and implementation of one of three Structured Decision Making (SDM) Workshops hosted at our Westborough office. The goal of SDM workshops is to break down complex problems in order to inform management decisions. The Department of Environmental Protection was the Decision Maker in this scenario. The problem was whether

(and how) habitat restoration could be used to mitigate for potential adverse impacts on coldwater streams from water withdrawals. After much discussion over the course of the week, the group recommended a fee-based system of penalties when permitees used more water than they were allocated. Banked fees could then be used to fund restoration projects identified by a steering committee that would include stakeholders, including MassWildlife. Logistics of such a program still need to be flushed out (e.g., DEP's authority to manage funds).

NECASC grants

In FY 2020, MassWildlife completed three grant proposals for Research Awards through the NECASC. Each of the three proposals focused on ecosystems where the intersection of climate change and management decisions needed further investigation. The proposals outlined projects that studied the impacts of sea level rise on coastal pond communities, groundwater withdrawal on coldwater streams, and effects of draw-downs on lake ecology, including incidence of cyanobacterial blooms. Funding was granted for the lake drawdown study in March 2020. This research will be led by Drs. Jason Carmignani and Jason Stolarski of MassWildlife in collaboration with Dr. Allison Roy, U.S. Geological Service.

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 beginning to update the 2015 Climate Adaptation Strategy. A related product is the development of a "connectivity toolkit" to provide managers tools used in project development that can facilitate species migration. 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.

Table 4. Excerpt from MassWildlife's report to the Resilient Massachusetts Action Team detailing progress made on Priority Actions identified in the State Hazard Mitigation and Climate Adaptation Plan (2016). *progress since December 2019

Action:	Action Description:	STATUS	PROGRESS NOTES
MassWildlife: Evaluation of climate change impacts on common species.	MassWildlife is largely funded through the purchase of fishing and hunting licenses. Common species (e.g., yellow perch, pumpkinseed, chain pickerel, wild turkey, deer, bear,) provide recreational opportunities to the broadest number of anglers and hunters and yet little work has focused on understanding how these species will respond to climate change in Massachusetts. Climate change is likely to shift habitats that support common species as well as angler and hunter behavior. Understanding the direct and indirect effects of climate change on common species and angler/hunter behavior will allow the Division to foresee how management strategies may need adjustment to provide recreational opportunities to Commonwealth citizens into the future.	Not Started	
MassWildlife: Updates to BioMap2.	In 2010, the MassWildlife's Natural Heritage and Endangered Species Program completed a rigorous analysis of the status and location of rare species and natural communities in collaboration with The Nature Conservancy. The resulting document, BioMap2, identified areas where conservation efforts should be focused in order to protect plant and wildlife biodiversity in Massachusetts. For example, the document has been used to identify where land acquisition is likely to benefit the protection of rare species. Since completion of the document newer and finer-scaled climate change predictions have become available. Incorporation of the newer predictions as well as more recent species and habitat data can help the Division prioritize and tailor effective management actions.	Not Started	*discussions have begun between MassWildlife and The Nature Conservancy to outline responsibilities, timelines, and products.
MassWildlife: Work with MassDOT to incorporate habitat and coldwater fisheries considerations into MassDOT climate vulnerability assessments, adaptation projects, and community planning tools.	Ongoing efforts by MassDOT (e.g. Deerfield River Watershed Climate Change Vulnerability Assessment Pilot Project) are identifying road stream/wetland crossings that are vulnerable to climate change, storm damage and flooding. Information from this assessment will be incorporated into an existing GIS-based project planning tool used by MassDOT staff and shared with municipalities and regional planning authorities. Building on the existing "Linking Landscapes" MassWildlife/MassDOT partnership—a nationally recognized model for State Wildlife/Transportation Agency coordination, the proposed project will: • Expand the pilot MassDOT Road Infrastructure Vulnerability Assessment statewide. Identify the important habitat areas that would benefit from improved stream and wetland crossing structures and that intersect with the most vulnerable road infrastructure (e.g. Rare Species key sites, coldwater Fisheries priority areas, Natural Communities). • Conduct a comprehensive assessment that builds on existing models to (SHEDS-ICE) to map stream reaches in Massachusetts that are likely to remain cold water refugia under different climate scenarios and timescales (2030-2100).	In Development	MassWildlife has been in discussions with MassDOT to begin this process. Both agencies participate in the North Atlantic Aquatic Connectivity Collaborative which meets several times a year and provides a platform for these discussions. *potential coldwater climate change refugia have been identified and mapped

	• Incorporate project results into an existing GIS-based project planning tool used by MassDOT staff and shared with municipalities and regional planning authorities. In addition to identifying vulnerable road infrastructure that intersect habitat features of statewide and regional significance the planning tool will make specific project design recommendations, and highlight available technical assistance and funding opportunities.		
MassWildlife: Evaluation of shifts in habitats and species distributions.	Species habitats and distributions are expected to shift with changing environmental conditions, resulting in changes to the function and structure of ecosystems. The Division of Fisheries and Wildlife will need to understand the rate and extent of changes to ecosystems over different timescales in order to effectively manage resources. The Division is already considering these shifts in management decisions. For instance, emphasis has fallen away from purchasing areas that will likely be lost to sea level rise (e.g., salt marshes). However, comprehensive spatially-explicit analysis (where, how) of impacts to ecosystems and vulnerable species and habitats has not been completed.	Not Started	
MassWildlife: In partnership with CZM, improve management of beach nourishment projects and other shoreline protection strategies and incorporate habitat considerations into coastal storm disaster response habitat and infrastructure on barrier beaches.	The proposed project will strengthen technical expertise in management of beach nourishment projects and other strategies (e.g. dune revegetation) to simultaneously enhance wildlife habitat and protect shoreline infrastructure, ensuring key habitat considerations are made in coastal storm disaster response.	Not Started	
MassWildlife: Study impact of climate change on fish hatcheries held by MassWildlife.	The Division owns and manages five fish hatcheries, Bitzer Hatchery (Montague), Sunderland Hatchery (Sunderland), McLaughlin Hatchery (Belchertown), Roger Reed Hatchery (Palmer), and Sandwich Hatchery (Sandwich). All hatcheries breed and raise trout that are stocked in lakes and streams statewide. Sea level rise, extreme weather, heat and changes in precipitation may all affect these resources and a study will be conducted to assess vulnerabilities and impacts and to determine next steps.	Completed	HDR completed the study as part of a greater evaluation of the hatcheries. The resulting report is currently under review. An estimated $40m are needed to implement actions that make the five hatcheries resilient to climate change.
MassWildlife: Identification of areas with high native aquatic biodiversity to help prioritize aquatic adaptation actions as the climate changes.	The Division of Fisheries and Wildlife is responsible for the conservation of freshwater fishes and wildlife throughout Massachusetts. Efforts (i.e. BioMap2) have been made to rigorously analyze and map rare species and natural community data in terrestrial ecosystems. These efforts identified lands critical for protecting and maintaining wildlife and plant biodiversity in Massachusetts. However, similar efforts have not been completed for the river and streams providing habitat to aquatic species (e.g., fishes, freshwater mussels) managed by MassWildlife. Identification of water bodies with high native aquatic biodiversity would provide critical information necessary for effective management and conservation of aquatic species in the state.	Not Started	
MassWildlife: Mapping and control of invasive plant species.	Climate change is expected to increase the spread of non-native invasive species by increasing growth rates and providing weather-related disturbances that favor the life cycles of these species. Invasive plants are one of the greatest threats to the integrity of natural communities by decreasing the survival of many native species. As a result, the Division engages in efforts to identify the most problematic species and to manage them when and where possible. Comprehensive identification and mapping of the extent of invasive plants has not been completed on Division-owned and managed lands statewide. This information is necessary to determine the habitat quality and restoration potential of lands, as well as treatment methods for controlling or eradicating invasive species. Additionally, monitoring helps with early detection and eradication efforts to control for newly introduced invaders who may be able to spread north under climate change. Once invasive plants are mapped, treatment options for eradication or control can be determined and implemented. Because of the robust nature of most invasive species, treatment to eradicate or significantly control any one existing population can take 5-8 years.	Not Started	
MassWildlife: Identification of cold water climate refugia and transitional waters for protections of CFRs.	Coldwater streams are among the most vulnerable habitats to climate change. Changes in precipitation and air temperatures will alter hydrology to the detriment of many cold water streams. Some cold water streams are expected to diminish in size, permanently transition to warmer habitats, and/or go dry. However, certain watershed characteristics can buffer climate change impacts. 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 as conditions change. Such areas may act as cold water refugia, providing long-term habitat to ecologically and economically important species such as brook trout (Salvelinus fontinalis). The efficacy of conservation strategies to protect cold water streams and the cold water-adapted species that rely on them will	In progress	MassWildlife has worked with USGS and the Northeast Climate Adaptation Science Center to map the locations of coldwater refuges under warming scenarios of 2, 4, and 6°C increases in July temperatures. Modeled results are currently being validated on the ground. The efficacy of the network of refuges to support the persistence of coldwater species will need further investigation. *model validation continues

	depend largely on understanding the potential persistence and transition of habitats. We build on existing models (SHEDS-ICE) to map stream reaches in Massachusetts that are likely to remain cold water refugia, or transition to cool- or warm water habitats, under different climate scenarios and timescales (2030-2100). Although existing mapping tools incorporate some watershed characteristics (e.g., aspect, impervious surfaces), none directly include flow management, including lake-level management and groundwater inputs, the effects of which have been shown to shape fish assemblages in Massachusetts streams. Management decisions that benefit directly from this research include prioritization of dam removal, instream flow protection, riparian vegetation management and location and timing of trout stocking.		
MassWildlife: Dam removals at the Merrill Ponds Wildlife Management Area.	MassWildlife owns two dams in the Merrill Ponds Wildlife Management Area (WMA), Welsh Pond Dam and Putnam Pond Dam, that have undersized outlet structures that are prone to clogging with debris. Work is needed to remove two additional dams and rehabilitate a third dam that provides significant recreational benefits. Each project will continue to improve the resiliency of the agency's resources by improving the hydraulic capacity of the roadway stream crossings, reducing solar heating of Singletary Brook.	In Progress	Welsh Pond dam was removed in summer 2019. The Putnam Pond dam will go to bid in fall 2019 and is scheduled for removal in summer 2020. Plans are in place to remove Schoolhouse Pond and Arnold Pond dams and rehabilitate Adams Pond dam. Funds will be solicited for rehabilitation of Upper Flint Pond dam in summer 2020. Commissioner Amidon has requested MassWildlife prepare a report on recommended actions for the other 28 dams owned by MassWildlife.
MassWildlife: Great Marsh Pilot Ditch Remediation Project.	At more than 10,000 acres, Great Marsh is the largest and most ecologically significant Salt Marsh in New England. In addition to providing habitat for a great diversity of fish and bird species, the Great Marsh supports a large population of Salt Marsh Sparrows a species threatened with global extinction due to rising seas. Among its many ecosystem services the marsh buffers land and infrastructure against waves, storm surges, and coastal erosion. Although salt marshes are at great risk of being destroyed by sea level rise, pilot studies are demonstrating that, with human intervention, salt marshes can accrete material and increase in elevation, increasing the ability to adapt to sea level change. Because of the significance of the marsh, cost-effective experimental pilot projects are warranted to assess the feasibility of larger-scale interventions in the future. Marsh ditching during the past century has led to partial drying and lowering of the marsh bed. In cooperation with The Trustees of Reservations (TTOR), researchers at University of New Hampshire, and other partners, we propose to fill select ditches on MassWildlife and TTOR properties with organic material and measure the effects on marsh elevation and rates of sediment trapping. Preliminary indications are that this technique may prevent further subsidence, reduce the rate of marsh loss, and possibly even gradually elevate the marsh bed through sediment trapping. The ditch remediation pilot is only the first step. Through this project we will build a coalition of partners committed to additional adaptive management, including the possibility of experimenting with thin layer deposition—another technique that is more difficult to implement and permit, but also holds the promise of gradually raising the marsh elevation, while preserving marsh grasses and other marsh life. Planning for this second phase would occur during the 5 year implementation timeline for the project.	In Development	The Trustees of Reservations and MADER have taken the lead in developing plans and designs to begin restoration of areas in the Great Marsh. MassWildlife is taking the lead in bringing stakeholders together to develop and implement management actions to increase the nest success of the salt marsh sparrow.

Coldwater Fisheries Project, Adam Kautza, PhD.

As coldwater fisheries project leader I am tasked with developing applied research and monitoring projects aimed at conservation, protection, and sound management of our coldwater fisheries resources. I work closely with many individuals from our field headquarters office, our district wildlife offices, and other outside organizations and agencies to accomplish this work. Recently, we've been focusing on some of our more popular and productive coldwater streams, the Swift River in central Massachusetts and the Deerfield River out in western Massachusetts, to learn more about their trout fisheries and how to better manage them. We've also continued our other main priorities which are 1) learning more about our vast array of wild trout resources in small- to medium-sized streams across the state, and 2) developing a comprehensive wild trout management plan. In addition to my fisheries research and monitoring activities I also chair the Rivers and Streams Technical Committee, which is made up of biologists and managers from around the region who work in wild trout management. This committee is a forum for sharing ideas and strategies for wild trout management and is a good avenue for additional input while we develop our own wild trout management plan. Outreach is another essential part of my role with MassWildlife and I continue to present the virtues of our coldwater fisheries and the findings from our ongoing projects to various groups such as Trout Unlimited and local conservation organizations. And finally, I have taken over as co-coordinator for the Teaching with Trout program. Some additional details on individual projects are outlined below.

Swift River –

Teaming with Connecticut Valley District Fisheries Biologist

Brian Keleher, we have made investigating the coldwater fishery in the Swift River a top priority. We began comprehensive electrofishing surveys of the Swift River in 2017 to develop a baseline over several years in which to monitor changes in coldwater fish populations moving forward and to begin answering important questions regarding the status of the fishery.

In 2019, we surveyed 8 study reaches, from the impoundment downstream of the Cold Spring Road Bridge to the very upstream source of the tailwater near the Y-Pool and Windsor Dam, covering just over 3000 meters of river. We found 492 Brook Trout across all size classes from abundant young-of-the-year to a few truly large individuals 16+ inches (this was down from 1616 in 2018 and 1110 in 2017 across similar length of river and nearly the same study reaches). On average we found only 770 Brook Trout/mile throughout the tailwater section of the Swift River. This was substantially lower than 2017 (2300/mile) and 2018 (1900/mile) but we have not come to conclusions as to whether or not this is a trend or simply that this amount of annual variation is the norm in the Swift River. We haven't included the data for the 2020 surveys here in this report but it seems like Brook Trout abundance has rebounded from the low numbers seen last year.

We found 54 Rainbow Trout in our 2019 comprehensive surveys, slightly more than in the previous two years (40 and 41 in 2017 and 2018, respectively). Again, as in previous years, most of these fish were found in the upper 1/3 of the tailwater and consisted of recently stocked fish with only the rare larger holdover fish. We again surveyed a relatively high number of Brown Trout in our 2019 surveys, 31 (only 12 in 2017 followed by 35 in 2018).

In summary, the Swift River supports an abundant population of wild Brook Trout of all age classes, although the abundance of wild Brook Trout in 2019 was down slightly from the previous two years of surveys. The Swift also supports larger individuals than can be found in any other stream in Massachusetts, except maybe some of our sea-run Brook Trout streams in the Southeast and Cape Cod. The Swift has the ability to hold over stocked hatchery Rainbow Trout to some extent (mostly short-term) and Brown Trout (potentially for several years) in some reaches – the rainbows mostly in the upper section and the browns further downstream. Both stocked species have the potential to reach large size if they survive. Rainbow Trout over 20 inches and Brown Trout, in particular, over 30 inches and approaching 20 pounds.

Future work on the Swift will be designed to continue surveying the trout population to monitor changes in abundance and size structure over time, assess ages of larger fish to better understand growth rates, and to track the movement and mortality of stocked Rainbow Trout and Brown Trout in order to customize angling regulations and stocking density, timing, etc. We had planned to expand upon our 2018 pilot study (i.e., fin clips and caudal fin punch to track movement and mortality post-stocking) using a more sophisticated and comprehensive elastomer tagging program but COVID-19 halted this particular project until 2021 at the earliest.

Wild Trout Management Plan and Wild Trout Stream Surveys –

Beginning about January 2017, I started discussions with my supervisor and other colleagues regarding the development of a wild trout management plan, with data to be collected and a long-term plan put into place over the next several years. A draft version of the Massachusetts Wild Trout Management Plan was completed and distributed to fisheries staff for review in May of 2020. Revisions are ongoing and a finalized comprehensive plan should be ready during the next fiscal year 2020-2021.

One piece of the management plan was to classify all wild trout streams based on trout abundance. Additionally, the highest class in this classification system included additional criteria for what would be considered the best wild trout fisheries in Massachusetts. We identified 112 (of approximately 1250 total coldwater fishery resources) streams that met minimum criteria for trout relative abundance and size structure to be included in the list of potential Class A+ wild trout fisheries. In our selection process we wanted to narrow down the rather large number of coldwater fisheries into a condensed group of what we could consider, potentially, the best wild trout streams in terms of trout abundance, size structure, as well as angling access. We limited our selection of the top wild trout streams to those that, from previous surveys, showed evidence of harboring 1) naturally-reproducing populations of Brook Trout, Brown Trout, or both, 2) trout densities (number/mile) at or greater than the 75th percentile for all coldwater fisheries statewide (708/mile for Brook Trout; 129/mile for Brown Trout), and 3) presence of multiple age-classes of trout, preferably with a relatively high density of 150+mm individuals for Brook Trout (75th percentile 70/mile) and 200+mm individuals for Brown Trout (75th percentile 18/mile). Streams or stream sections were further omitted if they were too small to be considered viable angling destinations (channel width less than about 4 meters) or had no public access. These streams will be intensively surveyed to form a more complete and quantitative picture of their potential as high-quality wild trout fisheries. Management goals, regulations, and ideas to market these fisheries will be based on the data collected in our upcoming surveys set to be completed in the next 2-3 years.

Surveys of what are considered our highest quality wild trout streams began in 2017, continued in 2018, and 2019. In 2019 we surveyed 31 reaches on 16 streams. Only 6 of the 16 potential Class A+ streams met the criteria outlined for inclusion. As of the end of the 2019-2020 fiscal year we have surveyed 67 potential Class A+ wild trout streams from the original group, 32 have been confirmed and 35 have been dropped from the final list.

Deerfield River Wild Brown Trout –

Partly as a result of the FERC dam relicensing process and partly from a keen interest by the Deerfield Chapter of Trout Unlimited to partner with MassWildlife, we put together a study plan to investigate the Brown Trout fishery and, more specifically, to answer questions about Brown Trout recruitment and the contribution of wild Brown Trout to the fishery in the Deerfield River below Fife Brook Dam. In May 2019 we began a comprehensive mark-recapture survey to assess abundance, size structure, growth, and the contribution of wild Brown Trout to the fishery. This work was continued into the current fiscal year and will go to at least 2022.

One of the many important aspects of the Deerfield River project is the opportunity for collaboration and partnership with outside organizations. We will be working closely with Deerfield River Chapter of Trout Unlimited, Greater Boston Chapter of Trout Unlimited, and the Massachusetts-Rhode Island Council of Trout Unlimited. Trout Unlimited has become an important partner in funding part of this research – specifically they've donated a raft, funds to outfit the raft for electrofishing, and tags to individually mark Brown Trout for a mark-recapture study. Other partners have contributed as well, including Regal Engineering in Orange, MA who have donated time and supplies to modify the donated raft frame to make it suitable for electrofishing. Without the raft and associated equipment we would not have the ability to effectively survey larger high-gradient rivers like the Deerfield and as such would not be able to answer important questions regarding the status of coldwater fishes in these types of river systems.

Initial surveys in May 2019 yielded a low number of Brown Trout. Subsequent surveys were more successful in collecting and tagging Brown Trout in the Deerfield River. Over the next two survey periods we collected 128 Brown Trout and tagged 102 (untagged fish were too small to be safely tagged). Eight of these fish were recaptures from previous surveys. Only 24 of the 135 Brown Trout captured across all 2019 surveys had adipose clips indicating that the vast majority of Brown Trout in the upper river are likely wild fish. Overall, preliminary results suggest that the Deerfield River Brown Trout fishery consists of relatively low densities (approximately 500-800 Brown Trout/mile) of mostly larger adult individuals. Why this is the case will hopefully become clear as we collect more information. We are not able to confidently assess rates of mortality, recruitment, and growth from only one year of data.

We also worked closely with Deerfield River Trout Unlimited and a web application developer with Trout Unlimited National to put together an online survey form for Deerfield River anglers to voluntarily record their effort, catch, marked (adipose-clipped) and/or tagged Brown Trout caught, and location of catches. From when the survey went live in early April through to the end of the 2019 season (late October) we received 97 responses from anglers. Anglers who responded to the survey spent 347 hours fishing (mean trip length = approximately 3.6 hours; ranging from 0.5 to 12 hours) and caught 290 Rainbow Trout (0.83/hour), 100 Brown Trout (0.29/hour), and 23 Brook Trout (0.07/hr). Fishing was largely in the upper 5 miles of the study area (above Zoar Gap) and almost half of the recorded effort was concentrated in the very upper section of the Deerfield in the 1-2 miles below Fife Brook Dam. June-August (June in particular) received the greatest amount of angling effort. The angler survey is still up and running online but we have not analyzed the responses for 2020 to this point.

Additional collaborative work was done with USGS researchers and Deerfield River Trout Unlimited volunteers to fit 30 adult Brown Trout with radio-transmitter tags. The whereabouts of these fish have tracked on a weekly basis starting from October 2019 by volunteers. This project is ongoing so results are still pending.

Northeast Fisheries Administrators Association (NEFAA) Rivers and Streams Technical Committee –

I am tasked with chairing the NEFAA Rivers and Streams Technical Committee. This committee had been set up to focus on improving communication to better share ideas, methods, and management strategies and plans among agencies who all deal with similar issues pertaining to managing wild trout resources in flowing waters.

As committee chair I again helped organize a "Wild Trout Management Symposium" for the 2020 Northeast Fish and Wildlife Conference. We received abstracts for thirteen presentations, enough to fill up almost a full day session at the conference. Unfortunately this year's conference was cancelled because of the COVID-19. Talks were to be given by agency staff from throughout the region (including several committee members and colleagues) as well as by researchers in academia and federal agencies.

As a committee we've also began working on other tasks aimed at compiling and sharing information pertinent to agency protocols and rationale about stocking hatchery trout over wild trout, the use of triploid trout in hatchery programs, the presence and effects of gill lice in wild Brook Trout, and the progress of various agency wild trout management plans, among other items.

Outreach –

I've continued to do multiple presentations to angling and conservation groups throughout Massachusetts outlining the status of coldwater fisheries in the state and discussing the work we are doing to study and manage these resources. The groups I speak to include the state Fish and Wildlife Board, Trout Unlimited, fly fishing organizations, watershed associations, etc. Unfortunately the bulk of these were cancelled due to COVID-19 although I was able to do a handful of them over the winter before the shutdown.

Teaching with Trout –

This was my first year co-chairing the Teaching-with-Trout

program (along with Dan Marchant). We put together and hosted an in-person orientation for approximately 25-30 first time and returning teachers participating in the program. Most of the responsibilities consisted of organizing the teachers who were to be involved and answering questions about the program. 2019-2020 was the largest group of participants to date with 62 schools participating. Participating schools were located in all parts of Massachusetts. By all accounts the program went smoothly for everyone involved until COVID-19 hit and the teachers were forced to take care of and release the trout themselves, denying students the opportunity.

Fisheries Watershed Project, Jason Stolarski, PhD.

Lake and Pond Sampling:

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 relative to stream habitats. To fill data gaps, but also to update pond summaries with current fisheries data the fisheries section has begun to focus on conducting lake and pond samples in 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 1m 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 mm. 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 CPUE 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 2019 fiscal year, the fisheries section has conducted fisheries surveys on 19 waterbodies throughout the commonwealth (Table 5).

Table 5. Fisheries Surveys, Fiscal Year 2019

Waterbody Name	Palis	Date Sampled	Town
Chauncy Lake	82017	7/8/19	Westborough
Demond Pond	36051	7/10/19	Rutland
Whitehall Pond	36173	7/10/19	Rutland
Long Pond	36082	8/1/19	Rutland
Holland Pond	41022	7/18/19	Holland
George Lake	41016	8/19/19	Wales
Sherman Pond	41046	9/20/19	Brimfield
Harbor Pond	81054	7/24/19	Townsend
Baldpate Pond	91001	7/25/19	Georgetown,Boxford
Rock Pond	91012	8/1/19	Georgetown
Pleasant Pond	92049	8/27/19	Hamilton,Wenham
Saltonstall Lake	84059	8/28/19	Haverhill
Horn Pond	71019	9/5/19	Woburn
Sluice Pond	93071	9/6/19	Lynn
Mirimichi Lake	62118	9/10/19	Foxborough,Plainville,Plainville
Highland Lake	72047	9/19/19	Norfolk
Ashumet Pond	96004	8/7/19	Mashpee,Falmouth
Upper Spectacle Pond	31044	9/18/19	Otis,Sandisfield
Becker Pond	21008	10/15/19	Mount Washington

Lake Trout Sampling:

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.

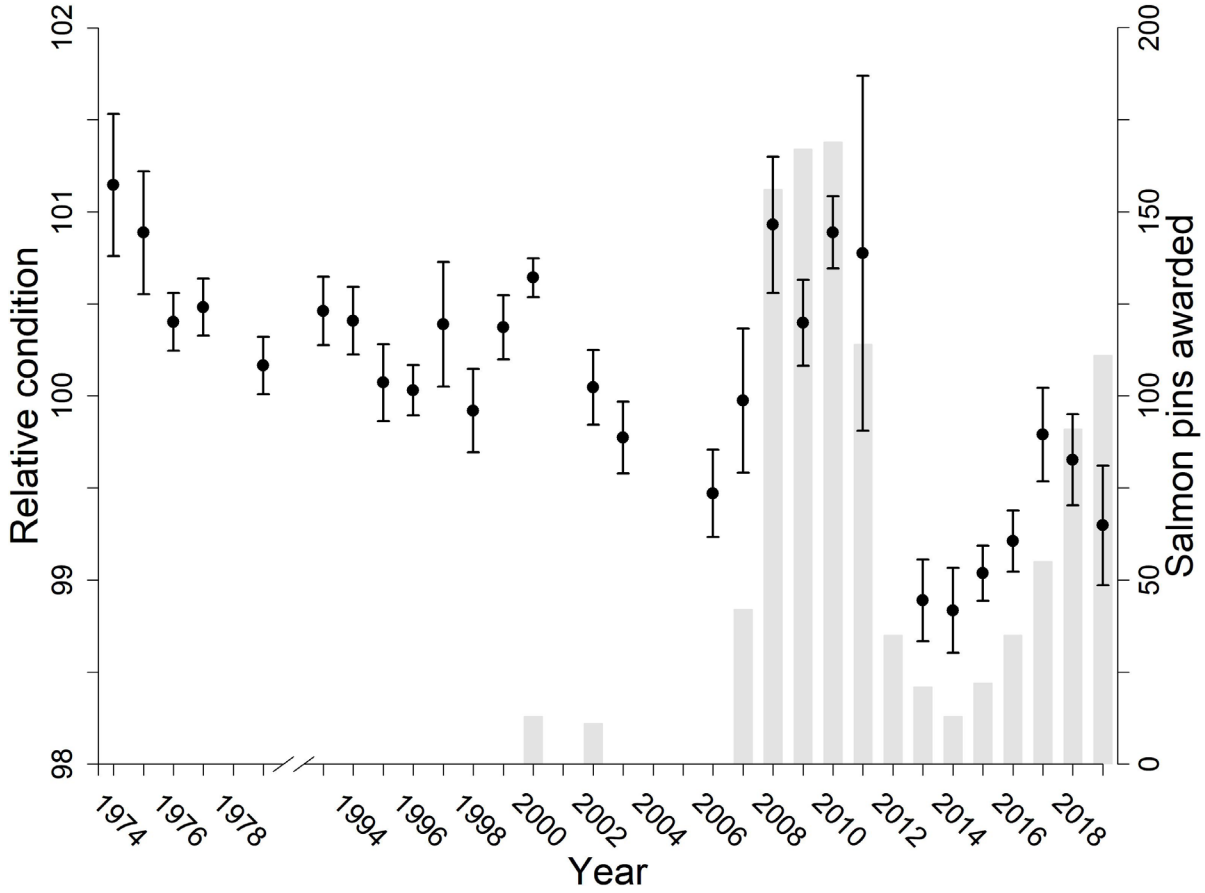
In FY 2020, a total of 331 Lake Trout were captured; 169 within Quabbin Reservoir and 162 within Wachusett Reservoir (Table 6). Within Quabbin Reservoir, 23 of the 169 fish were recaptures which displayed a modal recapture interval of 4 years and a maximum of 13 years. Among the 228 fish recaptured in Quabbin since 2006, the annual growth rate expressed as a percentage of body length is 1.4% which equates to approximately 7.8mm per year. Within Wachusett Reservoir, 6 of the 162 Lake trout were recaptures which displayed a modal recapture interval of 1 year and a maximum of 5 years which spans the length of the tagging program in Wachusett Reservoir. Among the 29 fish recaptured in Wachusett since 2015, the annual growth rate expressed as a percentage of body length is 1.6% which equates to approximately 9.3 mm per year. However, these statistics must be interpreted with caution due to the limited number of recaptured fish encountered since the inception of the project within Wachusett Reservoir. As more recaptures are encountered in successive years this estimate is likely to change.

Between 2014 and 2017 Lake Trout relative condition rose steadily within Quabbin Reservoir. However, 2019 marks the second consecutive year of modest declines in this metric and the first decline in mean length at capture in 3 years. Over the long-term these metrics have declined from historic highs in the 1970's but within decades oscillate fairly regularly (Figs 3 and 4). 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 by 10 fold between 2009 and 2011 which corresponds to a dramatic

Table 6. Lake Trout Sampling, Fiscal Year 2019

	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
Total	**2359**	**178**	**2537**	**487**	**23**	**510**

Figure 3. Lake Trout relative condition, Quabbin Reservoir



swing in Lake Trout relative condition during that time. Similar patterns observed in the number of land locked 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 2018 while length at catch remained stable (Figs 5 and 6). Unlike 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. Sampling crews have yet to find spawning areas that produce consistent numbers of fish each night in Wachusett Reservoir. In 2019, a new spawning area was located and resulted in greater catch relative to prior years. Efforts to locate additional spawning habitat will continue in the future.

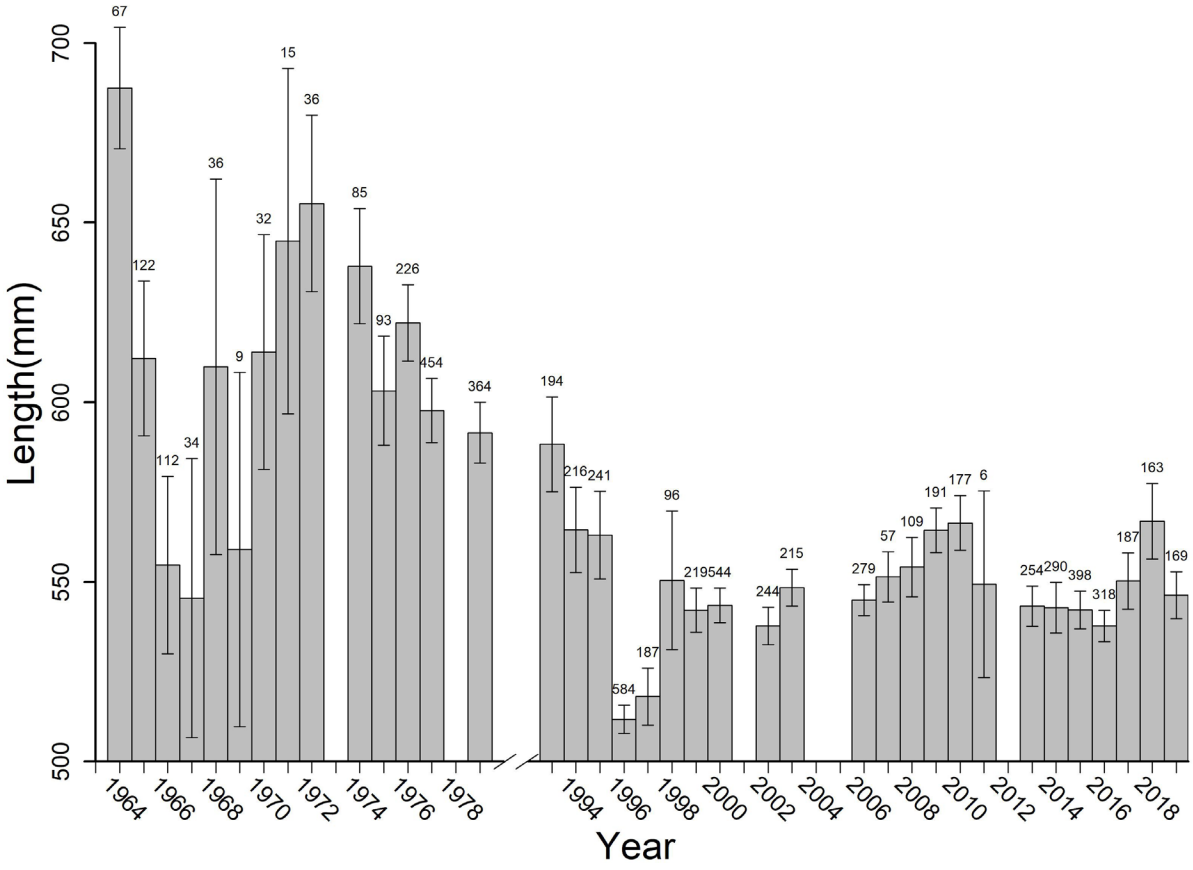
Quabbin Salmon Marking:

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 in (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 section 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 accidental 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 pandemic.

Fisheries Database:

This year roughly 40 historic stream and lake surveys spanning from 1940 to the latter 1980's were added to the fisheries database. These samples were either contained in old

Figure 4. Lake Trout mean length at catch, Quabbin Reservoir

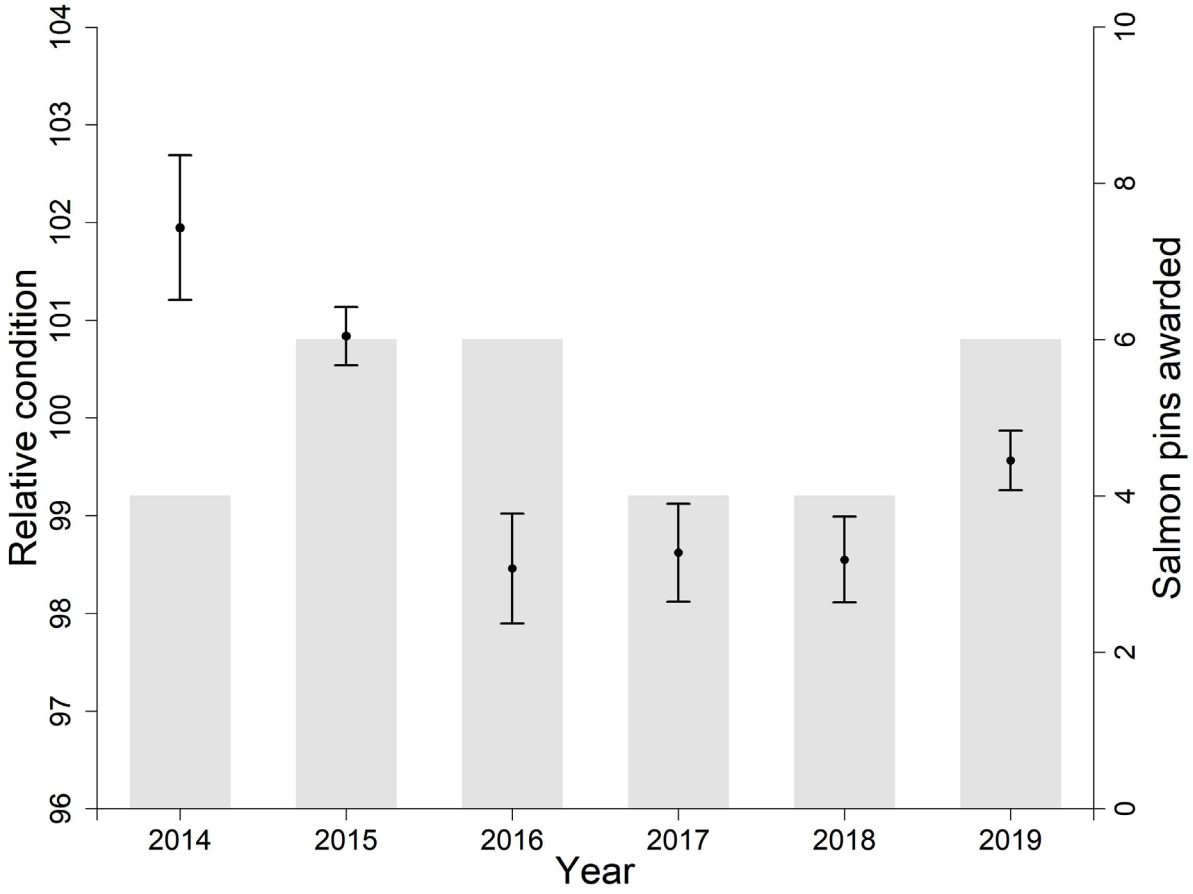


basin reports or were stored in lake and pond paper files that were discovered. Prior to their inclusion into the database, these records existed only on paper. As such, this information was not searchable or considered when assessing the fisheries resources of a particular lake or stream. These efforts now permit biologists to review data collected over a roughly 80 year time span when assessing the ecological character of a waterbody. Furthermore, biologists are able to compare the fish community of a particular lake or stream over long time periods. Since our efforts to digitize and catalog all our historic 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 computer.

Fisheries GIS Layers:

As modern fisheries surveys are conducted and historic 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; Appendix B 2018). 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 subsetting these master layers using simple queries in ArcGIS.

Figure 5. Lake Trout relative condition, Wachusett Reservoir, 2014 – 2019



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 redelinate all of the lake and pond shorelines in 2017, efforts are ongoing to continue to update shorlines 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, subwatersheds have been delineated for all samples conducted between 2000 and 2019 which equates to more than 7000 unique polygons.

Fish kill response:

MassWildlife responded to 30 fish kills in FY 2020 which is slightly below the 10 year average of 33 (Fig 7). 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. A large fish kill was reported on the North River in Shelburne and Colrain on September 1, 2019 and consisted of multiple species, size classes of fish, invertebrates, and amphibians. The event coincided spatially and temporally with a reported sulfuric acid spill at the Barnhardt Manufacturing Company located at 247 Main Rd, Colrain MA. Following investigations by Masswildlife and others, an estimated 271,158 fish were killed and included the state protected species Longnose Sucker. The matter is currently under litigation.

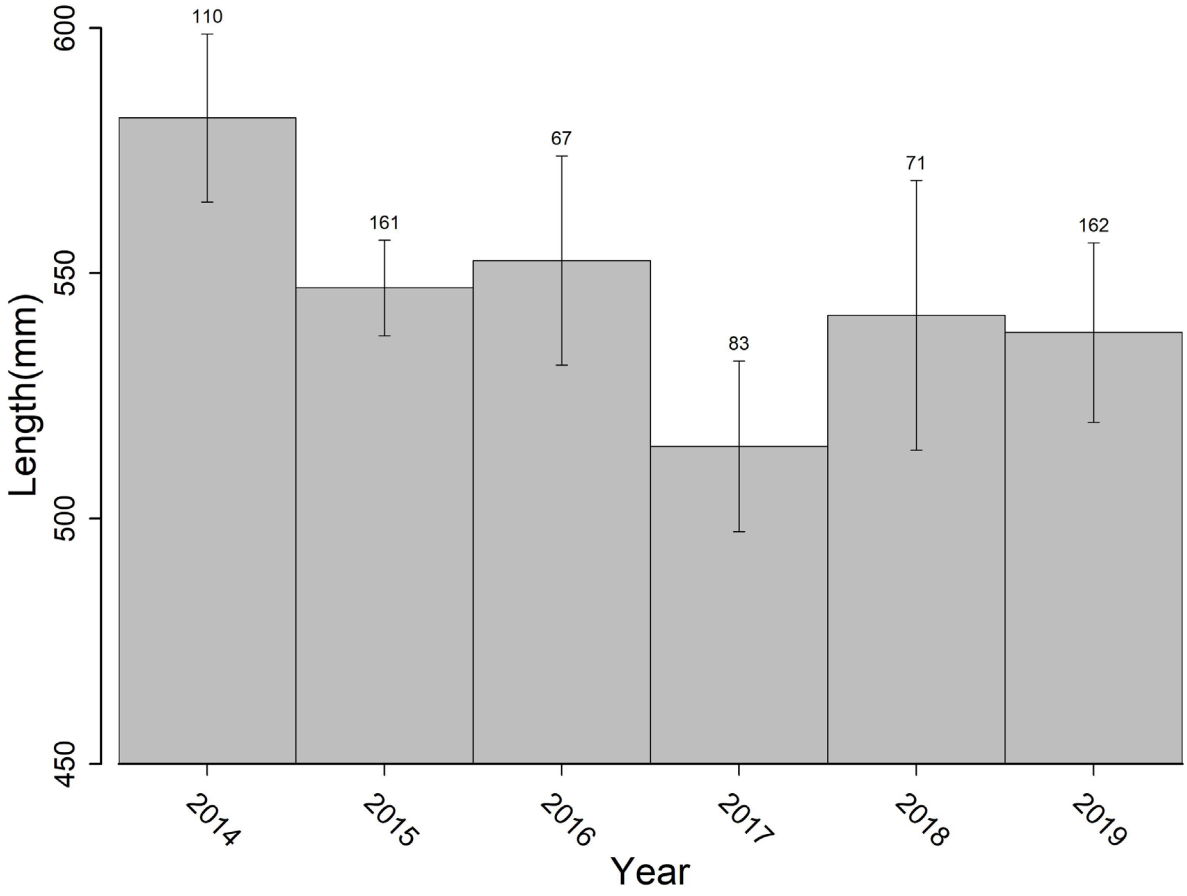
Smaller projects

Stream and lake biodiversity
Produced custom exports and analysis of fisheries and other databases to support onging efforts to catalog biodiversity in streams and lakes throughout the state

Fisheries recreation map
Produced custom exports and analysis of fisheries and other databases to support onging efforts to create an online tool to help anglers find information on fishing locations

Fisheries seasonal technicians

Figure 6. Lake Trout mean length at catch, Wachusett Reservoir, 2014 – 2019



Efforts to hire 6 seasonal fisheries technicians were ongoing in FY 2020. However, uncertainty regarding working conditions during the pandemic necessitated that the technicians not be brought on.

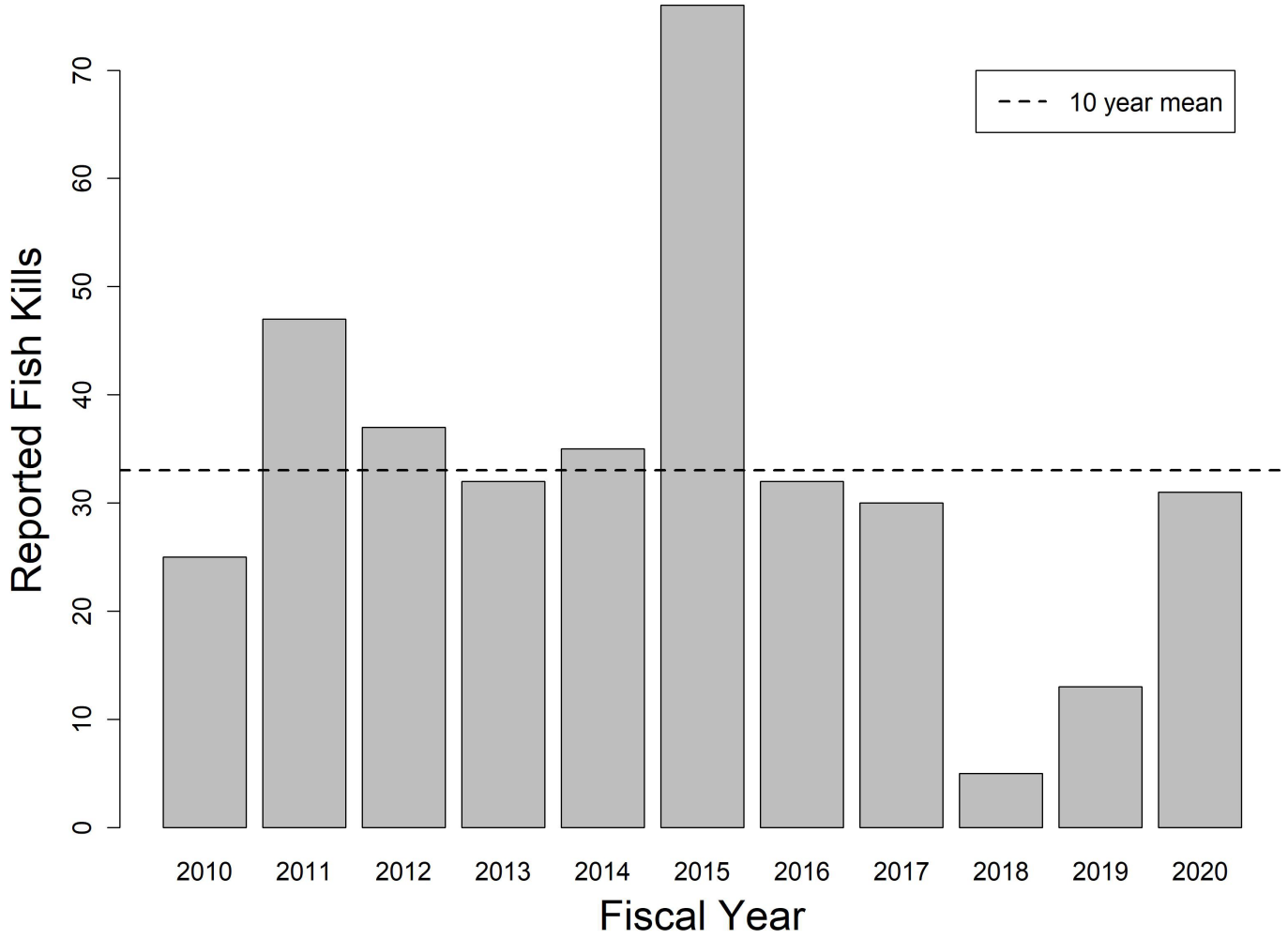
References:

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. 145pp

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

Figure 7. Reported Fish Kills



Anadromous Fish Investigations - Caleb Slater, Ph.D.

1. General

In FY 2020, MassWildlife hired three 6-month seasonal workers to conduct the Index Site Fish Population assessment work in Connecticut River tributaries and staff the West Springfield fishway on the Westfield River. This work includes stream samples at 50 sites on 40 streams that have been sampled annually as part of the Atlantic Salmon restoration program for the last 20 years-consequentially making these sites the longest continuously sampled streams in the Commonwealth. This electrofishing crew is also used to fill data gaps by sampling previously un-sampled streams or re-sampling historic (> 20 years old) sites and to aide other Project Leaders or District Biologists by conducting surveys as requested or by combining with other crews for large sites or boat or barge shocking. An additional three seasonal workers were hired for 3-months to staff the Essex fishway on the Merrimack River in Lawrence, MA. Holyoke Gas & Electric, as directed by the conditions of their FERC hydroelectric license, hired seasonal employees to staff the Holyoke fishway and Firstlight Power monitored fish passage at the Turners Falls fishways. The Project Leader supervised these activities.

The U.S. Fish and Wildlife Service withdrew its support and resources from the Connecticut River Atlantic Salmon restoration program in 2013. No Atlantic salmon fry have been produced at the Roger Reed State Fish Hatchery in Palmer, and no Atlantic salmon fry have been stocked since 2013. As a result the number of Atlantic salmon fry collected during index site sampling has declined to near zero over the last several years.

During FY 2020, the Project Leader was actively involved in Federal Energy Regulatory Commission (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 Bear Swamp Pumped storage facility on the Deerfield River
- Application for relicensing of the Fife Brook project on the Deerfield River
- Application for relicensing of the Riverdale Project on the Blackstone River
- Application for relicensing of the Tupperware Project on the Blackstone River

The Project Leader worked with the Massachusetts Department of Energy Resources, commenting on the applications of numerous hydroelectric projects seeking to qualify for "Low Impact Hydroelectric Certification" and/or "Green Energy" credits in Massachusetts.

- Red Bridge Project, Chicopee River
- Indian Orchard Project, Chicopee River
- Woronoco project, Westfield River

During FY 2020 the Project Leader assisted in the Bathymetry project by helping complete maps and writeups for ponds where depth data had been collected in FY19 or FY18 and vertical recording Temperature/Dissolved Oxygen profiles in several ponds.

In FY 2020 the project leader participated in MassWildlife's controlled burn program by attending the annual fireline refresher course but was unable to participate in any burns due to the cancelation of most prescribed burn activities in Spring 2020 due to the COVID-19 pandemic.

In FY 2020 the project leader was responsible for fisheries environmental review which involved review of MADOT projects, NPDES permits, NOIs from local Con Coms, MEAP projects and coordination of comments with the NH&ES section.

In FY 2020 the Project leader continued to serve as the Fisheries representative to MassWildlife's land acquisition program, attending two rounds of parcel meetings and ranking parcels for purchase priority.

In FY 2020 the project leader continued in the role of coordinator for all activities related to repair and removal of dams on MassWildlife lands. MassWildlife has identified 35 dams on its properties, including 10 rated as Significant Hazard by the MA office of Dam Safety. The estimated cost to properly repair/remove and operate these dams is $12.4 Million. $1.5 million was allocated for dam repair/removal projects in FY 2020.

FY 2020 accomplishments included:

-Completed removal of Welsh Pond Dam in Sutton, including the work of the contractor and Tighe & Bond's construction-phase services.

-Completed design, permitting, and undertook removal Putnam Pond Dam in Sutton, also including the work of the contractor and Tighe & Bond's construction-phase services.

-Completed installation of dry hydrant for town fire protection in Adams Pond in Sutton.

-Continued supporting for the upcoming Upper Flint Pond Dam project in Tynsgbobo, including, coordination on water levels, meeting attendance, design completion, permitting support, and retention of a title attorney to prepare a Certification of Title for Cory Lambert's property, secured required easement over Lambert property.

-Tighe & Bond performed Phase I inspections for numerous dams (a few reports are pending but those that are are about 90% complete):

- Gauco Pond Dam
- Thayer Pond Dam
- Burrage Pond – Lower Reservoir Dam
- Cusky Pond Dam
- Nye Pond Dam
- Patril Hollow Pond Dam
- Threemile Pond Dam
- Town Farm Pond Dam
- Upper Flint Pond Dam
- Welsh Pond Dam (to verify post dam removal conditions for permit close-out)
- White Island Pond Dam
- Williamsville Pond Dam

-Tighe & Bond performed regulatory follow-up inspections as required by DCR:

- Adams Pond Dam
- Nye Pond Dam
- Putnam Pond Dam (prior to removal)
- Schoolhouse Pond Dam (2)
- Upper Flint Pond Dam
- White Island Pond Dam

-Tighe & Bond performed inspections of non-jurisdictional dams to review status and condition:

- Farm Pond Dam (Oakham)
- Lantinen Farm Pond Dam
- Lizak Pond Dam
- Mashpee River Dam
- Plazas Pond Dam
- State Fish Hatchery Upper and Lower Dams (Palmer)
- Thousand Acre Reservoir Dam

-Tighe & Bond prepared Emergency Action Plans for Significant-hazard dams:

- Adams Pond Dam

- Burnshirt River Dam
- Cusky Pond Dam
- Lackey Pond Dam
- Nye Pond Dam
- Schoolhouse Pond Dam
- Threemile Pond Dam
- Town Farm Pond Dam
- Upper Flint Pond Dam
- White Island Pond Dam

-Performed an invasive species survey for Adams Pond Dam to aid in future wetlands permit close-out

-Discussed Welsh and Putnam Pond Dam removal with FEMA to satisfy Army Corps permit condition

-Performed a title search for Farm Pond Dam (Gardner) (underway, nearing completion)

-Submitted dam safety permit close-out reports for several older projects

-Developed repair recommendations for Fish Hatchery Upper Dam – Palmer, including survey, an H&H, structural evaluation, and development of pipeline replacement recommendations (including test pits). (underway, nearing completion)

-Performed geotechnical evaluation for Adams Pond Dam to develop embankment geometry for when the dam is rehabilitated (underway – report drafted, nearing completion)

-Met with NHESP and stakeholders to discuss plans for Nye Pond Dam in Sandwich.

In FY 2020 the project leader continued in the role of coordinator for permits issued for fisheries related activities such as scientific collection, baitfish dealers, and aquaculture facilities. Activities included coordination with the permit off ice in Boston, correspondence with permit applicants and commercial fish farms and several aquaculture facility site inspections.

2. Connecticut River

The Project Leader actively participated in the Connecticut River Atlantic Salmon Commission (CRASC) and continued as the chair of the CRASC Technical Committee. Many telephone, electronic, and written requests for information were also answered by the Project Leader. The FERC Relicensing of 5 hydroelectric projects on the Connecticut River (Northfield Mt, Turners Falls, Vernon, Bellow Falls, and Wilder) continued this year. This is a 5 year process that will require close attention.

Because 2020 fish passage operations are currently ongoing, this report summarizes the 2019 calendar year fish passage activities.

2.1 Holyoke

The City of Holyoke (Holyoke Gas and Electric Co. HG&E) bought the Holyoke Hydroelectric project from Northeast Utilities in 2002. The Project Leader has been involved in ongoing negations with the new owner to settle the outstanding issues and finalize the FERC license for the project (awarded in 2001). Holyoke Gas and Electric Co., as directed by the conditions of their new FERC hydroelectric license, hired seasonal employees for the Holyoke fishway in spring 2013. The Project Leader supervised their activities.

The Holyoke fish passage facility operated for 62 days during in the spring season passing a total of 338,290 anadromous fish (Figure 8, Table 7). Twenty Shortnose Sturgeon were lifted during 2019. The number of days that passage was greater than 1% of the seasonal total was considerably less than 62. 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, 89% of 314,361 in 20 days; Blueback Herring, 95% of 5,052 in 8 days; Sea Lamprey, 96% of 18,347 in 24 days; Striped Bass, 89% of 207 in 23 days; Gizzard Shad, 91% of 320 in 17 days (Table 14).

2.1.1 Atlantic Salmon

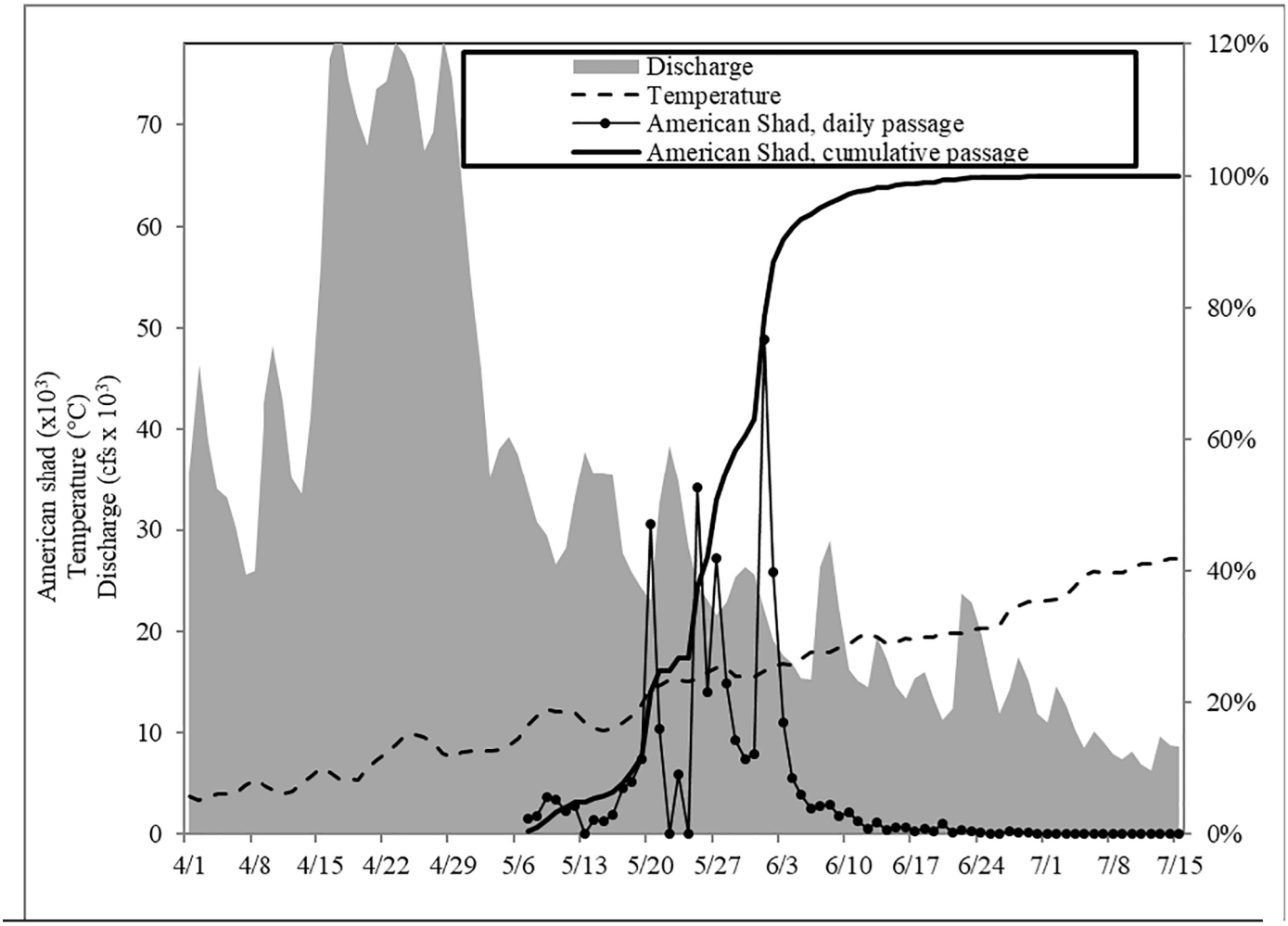
Three Atlantic Salmon were counted during the spring fish passage season at the Holyoke fishlift (Table 14). 2019 passage was 0.8% of the record passage of 1992 27% of the previous five year mean, and 9% of the previous ten year mean (Table 16). All salmon were released and allowed to continue their upstream migration. No salmon were radiotagged in 2019.

2.1.2 American Shad

314,361 American shad were passed upstream. This was 44% of the record high passage of 1992. 2019 passage was 79% of the previous five year mean, and 92% of the previous ten year mean (Table 15). The total number of shad lifted in 2019 was 316,829, including shad transferred to trucks for transport (2,401) and sacrificed for biological sampling and agency studies (67). Examining the cumulative percent of shad passed at Holyoke, 50% of fish passed this project on the 21st day of passage, May 27 (Table 16). A total of 1,102 American shad were sampled for biolgical data on 48 days from 9 May through 30 June. Fork length, weight, sex, and scale samples were collected from all individuals. This represents 0.4% of the total American shad passed for the year and between 0.1% and 15% (mean 2%) of the daily shad passage at the facility. The weighted percentage of the run sampled (the total number of fish passed on days of sampling expressed as a percentage of the entire run) was 98%. The weighted sex ratio of American Shad lifted at the Holyoke facility in 2019 was 66% males and 34% females.

2,401 shad were trapped and trucked for various restoration efforts (Table 17). 388 shad were trucked to the USFWS Nashua National Fish Hatchery for spawning where

Figure 8. Daily and cumulative (percent of season total) American Shad passage with daily average water temperature and river discharge at the Holyoke Fishlift 2019.183



3,423,816 fry were produced. 2,829,219 fry were released into the Lamprey River, NH, 271,155 fry were released into the Merrimack River, NH and 323,442 fry were released into the Nashua River, NH. 350 surviving post spawned shad were released into the Nashua River in NH.

2.1.3 Shortnose Sturgeon

Only 20 Shortnose Sturgeon were captured in 2019, marking the lowest total since 2015. Sixteen of the 20 fish captured were unmarked

2.1.4 American Eel

Eel ramps were deployed in the tailrace fish lift entrance and upper stilling basin on May 8. High flows and necessary dam apron repairs kept the South Hadley eel ramp from being installed until July 25. The spillway ramp (installed until the South Hadley ramp was operational) ran from June 17 and until August 16. The South Hadley eel ramp operated until November 8. Juvenile eel collections totaled 27,505 in 2019, a notable increase from 2018, and ranked 4th highest since 2003 when specific eel collection and upstream passage efforts began. The South Hadley ramp contributed 47.7% of the annual total collections and 52.3% were collected from the ramps in the Holyoke fish lift structures, 49.8% from the tailrace fish lift entrance ramp, 2.5% from the stilling basin ramp, and 0% from the spillway ramp.

The 2019 season was characterized by relatively high river flows in May and early June, but relatively low flows in August and September. The majority (75.3%) of eels were collected on just 12 dates in October, each contributing 2% or more of the annual total. (Table 18).

2.1.4 Other Anadromous Fish Species

Blueback Herring passage in 2019 (5,052) was 900% of the previous five-year mean and 1239% of the previous ten year mean (Table 8).

Sea Lamprey passage in 2016 (18,347) was 19% of the record passage of in 1998 and was 82% of the previous five-year mean and 81% of the previous ten year mean (Table 8).

Gizzard Shad passage in 2016 was 320. This was 84% of the previous five-year mean and 82% of the previous ten year mean (Table 8).

Table 7. Daily anadromous fish passage at Holyoke 2019.

	American Shad		Blueback Herring		Sea Lamprey		Striped Bass		Atlantic Salmon		Gizzard Shad		Shortnose Sturgeon	
Date	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD
4/1 – 5/5: no lift operations - temperature < flows > 40,000 cfs; poor visibility														
5/6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/7	1,479	1,479	1	1	0	0	0	0	0	0	1	1	0	0
5/8	1,727	3,206	6	7	2	2	0	0	0	0	7	8	0	0
5/9	3,652	6,858	8	15	5	7	0	0	0	0	9	17	0	0
5/10	3,421	10,279	2	17	2	9	0	0	0	0	20	37	0	0
5/11	2,307	12,586	79	96	2	11	1	1	0	0	17	54	0	0
5/12	2,791	15,377	12	108	0	11	0	1	0	0	26	80	0	0
5/13: no lift operations – high flows/poor visibility														
5/14	1,450	16,827	39	147	1	12	1	2	0	0	19	99	0	0
5/15	1,265	18,092	2	149	0	12	0	2	0	0	17	116	0	0
5/16	1,895	19,987	15	164	0	12	0	2	0	0	12	128	0	0
5/17	4,524	24,511	25	189	1	13	0	2	0	0	17	145	0	0
5/18	5,103	29,614	33	222	3	16	0	2	0	0	7	152	0	0
5/19	7,415	37,029	113	335	34	50	0	2	0	0	6	158	0	0
5/20	30,514	67,543	94	429	360	410	1	3	0	0	69	227	0	0
5/21	10,348	77,891	582	1,011	251	661	1	4	0	0	26	253	0	0
5/22: no lift operations – high flows/poor visibility														
5/23	5,845	83,736	48	1,059	30	691	0	4	0	0	17	270	0	0
5/24: no lift operations – high flows/poor visibility														
5/25	34,132	117,868	181	1,240	192	883	0	4	0	0	11	281	0	0
5/26	14,007	131,875	3,408	4,648	599	1,482	3	7	0	0	7	288	0	0
5/27	27,230	159,105	228	4,876	84	1,566	2	9	0	0	3	291	0	0
5/28	14,874	173,979	106	4,982	264	1,830	1	10	0	0	0	291	0	0
5/29	9,285	183,264	10	4,992	15	1,845	2	12	0	0	1	292	0	0
5/30	7,386	190,650	9	5,001	17	1,862	1	13	0	0	1	293	0	0
5/31	7,845	198,495	8	5,009	60	1,922	1	14	0	0	1	294	0	0
6/1	48,870	247,365	3	5,012	281	2,203	9	23	0	0	1	295	0	0
6/2	25,772	273,137	3	5,015	643	2,846	10	33	0	0	1	296	0	0
6/3	11,027	284,164	0	5,015	891	3,737	8	41	0	0	1	297	0	0
6/4	5,467	289,631	0	5,015	981	4,718	12	53	0	0	1	298	0	0
6/5	3,856	293,487	0	5,015	1,000	5,718	1	54	2	2	2	300	0	0
6/6	2,568	296,055	0	5,015	1,433	7,151	5	59	0	2	2	302	0	0
6/7	2,767	298,822	2	5,017	953	8,104	4	63	1	3	1	303	0	0
6/8	2,853	301,675	1	5,018	457	8,561	2	65	0	3	5	308	0	0
6/9	1,774	303,449	32	5,050	932	9,493	10	75	0	3	2	310	0	0
6/10	2,102	305,551	1	5,051	1,553	11,046	20	95	0	3	3	313	0	0
6/11	1,263	306,814	1	5,052	1,678	12,724	13	108	0	3	1	314	0	0
6/12	531	307,345	0	5,052	2,037	14,761	17	125	0	3	1	315	1	1
6/13	1,167	308,512	0	5,052	294	15,055	8	133	0	3	0	315	1	2
6/14	397	308,909	0	5,052	52	15,107	12	145	0	3	0	315	0	2
6/15	704	309,613	0	5,052	961	16,068	6	151	0	3	0	315	0	2
6/16	608	310,221	0	5,052	323	16,391	10	161	0	3	0	315	0	2
6/17	261	310,482	0	5,052	307	16,698	10	171	0	3	0	315	0	2
6/18	496	310,978	0	5,052	108	16,806	1	172	0	3	0	315	1	3
6/19	327	311,305	0	5,052	281	17,087	4	176	0	3	0	315	0	3
6/20	1,001	312,306	0	5,052	363	17,450	3	179	0	3	0	315	0	3

Date	American Shad		Blueback Herring		Sea Lamprey		Striped Bass		Atlantic Salmon		Gizzard Shad		Shortnose Sturgeon	
	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD	Daily	YTD
6/21	219	312,525	0	5,052	524	17,974	7	186	0	3	1	316	0	3
6/22	414	312,939	0	5,052	97	18,071	3	189	0	3	0	316	0	3
6/23	311	313,250	0	5,052	177	18,248	5	194	0	3	2	318	0	3
6/24	112	313,362	0	5,052	31	18,279	1	195	0	3	0	318	0	3
6/25-6/26: no lift operations - dewatered to make modifications for sturgeon passage														
6/27	244	313,606	0	5,052	24	18,303	0	195	0	3	1	319	0	3
6/28	111	313,717	0	5,052	31	18,334	3	198	0	3	0	319	0	3
6/29	152	313,869	0	5,052	5	18,339	0	198	0	3	1	320	0	3
6/30	89	313,958	0	5,052	5	18,344	2	200	0	3	0	320	0	3
7/1	82	314,040	0	5,052	1	18,345	0	200	0	3	0	320	1	4
7/2	56	314,096	0	5,052	1	18,346	0	200	0	3	0	320	1	5
7/3	48	314,144	0	5,052	0	18,346	2	202	0	3	0	320	1	6
7/4	18	314,162	0	5,052	0	18,346	0	202	0	3	0	320	1	7
7/5	31	314,193	0	5,052	0	18,346	2	204	0	3	0	320	0	7
7/6 - 7/7: no lift operations - summer schedule / no weekend operations														
7/8	46	314,239	0	5,052	1	18,347	3	207	0	3	0	320	2	9
7/9	9	314,248	0	5,052	0	18,347	0	207	0	3	0	320	0	9
7/10	17	314,265	0	5,052	0	18,347	0	207	0	3	0	320	2	11
7/11	70	314,335	0	5,052	0	18,347	0	207	0	3	0	320	0	11
7/12	18	314,353	0	5,052	0	18,347	0	207	0	3	0	320	0	11
7/13 - 7/14: no lift operations - summer schedule / no weekend operations														
7/15	8	314,361	0	5,052	0	18,347	0	207	0	3	0	320	1	12

2.1.5 Resident Fish

A total of 1,508 fish representing 18 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 Smallmouth Bass (41% of resident fish count), White Sucker (27%), and Channel Catfish (9%).

2.2 Turners Falls

The fish ladders at Turners Falls were operated for a total of 63 days from May 6 through July 8, 2019. Operational problems were reviewed as needed on an ongoing basis by agency personnel (Massachusetts Division of Fisheries and Wildlife, and United States Fish and Wildlife Service), and by the dam owner (Firstlight Power).

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.

2.2.1 American Shad

The number of shad passing the Gatehouse fish ladder in 2019 (22,649) was 38% of the maximum passage of 1992 (Table 12 and 13), 46% of the previous 5 year mean and 66% of the previous 10 year mean.

The number of shad passing the Spillway fish ladder in 2019 (13,150) was 31% of the maximum passage of 2015 (Table 12 and 13), 49% of the previous 5 year mean and 81% of the previous 10 year mean.

The number of shad passing the Cabot fish ladder in 2019 (21,804) was 23% of the maximum passage of 1992 (Table 12 and 13), 57% of the previous 5 year mean and 61% of the previous 10 year mean.

Examining the cumulative percent of shad passed at Gatehouse, 50% of fish passed this ladder on the 25th day of the migration 31 May, 2019 (Table 14).

Examining the cumulative percent of shad passed at Spillway, 50% of fish passed this ladder on the 27th day of the migration, 2 June, 2019 (Table 14).

Examining the cumulative percent of shad passed at Cabot, 50% of fish passed this ladder on the 23rd day of the migration, 29 May, 2019 (Table 14).

Table 8. Anadromous fish passage recorded at the Holyoke fishlift, Connecticut River, Massachusetts 1955-2019

Year	American Shad	Blueback Herring	Atlantic Salmon	Striped Bass	Sea Lamprey	Gizzard Shad	Year	American Shad	Blueback Herring	Atlantic Salmon	Striped Bass	Sea Lamprey	Gizzard Shad
1955	4,900	-	-	-	-	-	1987	280,000	360,000	208	521	23,000	94
1956	7,700	-	-	-	-	-	1988	290,000	340,000	72	256	16,000	95
1957	8,800	16	1	-	-	-	1989	350,000	290,000	80	923	15,000	294
1958	5,700	29	1	-	2	-	1990	360,000	390,000	188	1,000	22,000	956
1959	15,000	20	-	-	73	-	1991	520,000	410,000	152	1,200	41,000	486
1960	15,000	796	2	-	17	-	1992	720,000	310,000	368	327	28,000	1,100
1961	23,000	1,200	-	-	42	-	1993	340,000	100,000	167	194	23,000	341
1962	21,000	19	-	-	209	-	1994	181,000	32,000	256	159	30,000	165
1963	31,000	32	-	-	64	-	1995	190,000	110,000	150	1,300	18,000	2,000
1964	35,000	13	-	-	537	-	1996	276,000	55,000	202	537	45,000	1,100
1965	34,000	53	-	-	26	-	1997	299,000	64,000	94	679	32,000	2,100
1966	16,000	54	-	-	2	-	1998	316,000	11,000	196	492	97,000	1,100
1967	19,000	356	-	-	46	-	1999	194,000	2,700	91	859	20,000	35,000
1968	25,000	-	-	-	-	-	2000	225,000	11,000	50	489	21,000	38,000
1969	45,000	10,000	-	-	-	-	2001	273,000	11,000	25	1,200	49,000	5,500
1970	66,000	1,900	-	-	-	-	2002	375,000	2,000	34	1,100	74,000	3,100
1971	53,000	302	-	-	-	-	2003	287,000	2,700	28	881	53,000	859
1972	26,000	188	-	-	-	-	2004	191,000	145	34	259	59,000	287
1973	25,000	302	-	-	-	-	2005	117,000	534	131	233	28,000	132
1974	53,000	504	-	-	-	-	2006	155,000	21	118	144	18,000	127
1975	110,000	1,600	-	-	23,000	-	2007	159,000	75	106	243	40,000	75
1976	350,000	4,700	-	-	32,000	-	2008	153,000	84	80	617	57,000	127
1977	200,000	33,000	2	-	52,000	-	2009	161,000	40	61	668	19,000	68
1978	140,000	38,000	23	-	43,000	-	2010	164,000	76	41	298	40,000	371
1979	260,000	40,000	19	103	31,000	-	2011	244,000	138	72	138	19,000	423
1980	380,000	200,000	126	148	34,000	-	2012	495,000	39	29	336	14,000	337
1981	380,000	420,000	319	510	53,000	-	2013	393,000	976	69	250	22,000	827
1982	290,000	590,000	11	231	26,000	-	2014	373,000	976	27	69	22,000	410
1983	530,000	450,000	25	346	29,000	-	2015	413,000	87	13	21	22,000	84
1984	500,000	480,000	66	110	22,000	-	2016	386,000	137	3	638	35,000	598
1985	480,000	630,000	285	369	40,000	-	2017	537,000	875	10	338	22,000	738
1986	350,000	520,000	260	187	20,000	27	2018	273,979	1,061	2	262	10,187	69
							2019	314,361	5,052	3	207	18,347	320

Only 7.2% of the shad lifted at Holyoke (314,361) passed the Gatehouse observation window, well below the restoration goal of 50%.

2.2.2 Other Anadromous Fish Species

One Atlantic Salmon was recorded passing the gatehouse fishway in 2019. 3,700 Sea Lamprey passed the gatehouse fishway in 2019. This represents 24% of the maximum passage of 2007 and 47% of the previous 5 year mean and 56% of the previous 10 year mean (Table 12 and 13).

3. Westfield River

In 2019 a fish ladder was operated at the A&D Hydroelectric dam in West Springfield, MA. The fishway and associated downstream bypass facilities were constructed in the fall of 1995.

Five species of anadromous fish and six species of resident fish were identified and enumerated during the spring/summer fish passage season (Table 15).

50% of the American shad passage had occurred by the 21st day of the run, May 21 (Table 17).

3.1 Anadromous fish

The West Springfield fish passage facility operated for 90 days in the spring of 2019. The number of days that passage was greater than 1% of the seasonal total was considerably less than 90. 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, 92% of 4,166 in 19 days; sea lamprey, 93% of 484 in 26 days

A total of 4,166 American Shad; 0 Atlantic salmon; 484 Sea Lamprey; 0 Striped Bass; 8 Blueback Herring; and 0 Gizzard Shad were passed upstream in spring/summer 2019 (Table 7). The 2019 shad passage was 40% of the record high of 10,373 in 2012 (Table 18).

3.2 Non-anadromous fish

White sucker, brook trout, brown trout, rainbow trout, tiger trout, and smallmouth bass were documented passing upstream through the West Springfield fish passage facility in 2019 (Table 15).

4. Merrimack River

4.1 Essex Dam

The Essex Dam fish elevator operated for 85 days between 19 April and 12 July. For the fall season the fishway was operated from 15 September through 1 November. 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.

4.1.1 Atlantic salmon:

14 adult Atlantic Salmon were lifted at the Essex fishlift during spring 2019. This was 3% of the record passage of 2011 (402). Salmon returns were 93% of the previous 5 year mean, and 18% of the previous 10 year mean (Table 10 and 11). No salmon were captured in the fall.

4.1.2 American Shad:

The total number of shad lifted in 2019 (17,003) was 19% of the record passage (89,421) of 2015 (Table 8). 2019 shad passage was 30% of the previous five year mean and 44% of the previous ten year mean (Table 18 and 19). 180 shad were sampled for biological data collection on 13 days between May 20 and July 1. The sample was 38% female. The age frequency of the sample is shown in Table 20.

4.1.3 River Herring:

Table 9. Temporal characteristics of American shad passage at Holyoke, 2019

Cumulative Percentage of Total American Shad Passage					
	25%	50%	75%	90%	Highest Day
Holyoke Fishlift:					
Day*	17	21	26	28	26
Date	5/23	5/27	6/1	6/3	6/1

* Day one is 7 May, the first day shad were lifted at the Holyoke fish passage facility.

Table 10. Population age structure of American shad sampled at the Holyoke fishlift 2019. (from CTDEEP)

AGE	3	4	5	6	7
% male	2.7	33.1	41	20.5	2.7
% female		7.1	29.6	51.5	11.8
Total %	1.8	24.4	37	31	5.8

Table 11.

Date Range, Number of Collections, Total Eels Collected, and Descriptive Statistics for Catch and Catch-Per-Unit-of-Effort Holyoke 2019.

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**							

The total number of herring lifted in 2019 (116,963) was 26% of the record passage (449,356) of 2018 (Table 8). 2019 herring passage was 52% of the previous five year mean and 102% of the previous ten year mean (Table 18 and 19).

4.1.4 Other Anadromous Fish:

Total number of Sea Lamprey, Striped Bass, and Gizzard Shad passing through the Lawrence fishlift were 9,337, 280 and 0 respectively (Table 18).

4.1.5 American Eel

An estimated 122,600 elvers were passed in the lift hopper or the eelways at the dam. 89 yellow eels were observed passing upstream at the counting window.

4.2 Pawtucket Dam

Operation of the Pawtucket Dam fish elevator began April 22 and concluded on July 12. 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 Enel 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 April 22 and concluded on July 15 per agreement with ENEL and the Merrimack Technical Committee. The SalmonSoft video system was used to record fish passage. Videos were reviewed with Windows Media player or VLC software.

4.2.1 River Herring:

The estimated total number of River Herring passed at the Lowell lift in 2019 was 28,294. 15,577 river herring were counted passing the ladder. Therefore, we estimate the Lowell Project as a whole passed about 43,871 River Herring in 2019 (Table 21).

4.2.2 American Shad:

The estimated total number of American Shad passed at the Lowell lift in 2019 was 1,681. 520 American Shad were counted passing the ladder. Therefore, we estimate the Lowell Project as a whole passed about 2,201 American Shad in 2018 (Table 21).

4.2.3 Other Anadromous fish:

608 Sea Lamprey were counted passing the ladder. We estimate the Lowell Project as a whole passed about 1,113 Sea Lamprey in 2019 (Table 21).

Table 16 lists the annual runs of anadromous fish counted at the facility from 1986, the first year of operation, through 2019.

Assorted riverine species have been noted but not counted.

5. Index Site Samples

Many, but not all the former salmon index survey sites were successfully sampled in 2019.

Table 12. 2019 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						
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	0	0	0	0
7-May	0	0	0	0	0	0
8-May	0	0	0	0	0	0
9-May	0	0	0	0	0	0
10-May	2	0	0	0	1	0
11-May	1	0	0	0	0	0
12-May	0	0	0	0	0	0
13-May	0	0	0	0	0	0
14-May	0	0	0	0	0	0
15-May	0	0	0	0	0	0
16-May	0	0	0	0	0	0
17-May	1	0	74	0	16	0
18-May	0	0	24	0	39	0
19-May	159	0	143	0	155	0
20-May	494	0	237	0	587	0
21-May	324	1	55	0	415	0
22-May	51	1	47	-1	135	0
23-May	24	0	27	1	20	0
24-May	269	1	1759	16	1,058	-1
25-May	1,141	0	580	16	1,045	8
26-May	1,235	-1	212	15	562	1
27-May	2,213	10	325	18	1,764	6
28-May	3,691	37	494	58	1,214	15
29-May	1,711	5	1175	12	3,177	4
30-May	1,098	4	239	9	960	1
31-May	884	5	459	7	717	3

Site	Cabot		Spillway		Gatehouse	
Species	American Shad	Sea Lamprey	American Shad	Sea Lamprey	American Shad	Sea Lamprey
Date						
26-May	1,235	-1	212	15	562	1
27-May	2,213	10	325	18	1,764	6
28-May	3,691	37	494	58	1,214	15
29-May	1,711	5	1175	12	3,177	4
30-May	1,098	4	239	9	960	1
31-May	884	5	459	7	717	3
1-Jun	1,016	4	691	55	1,207	12
2-Jun	1,118	9	1496	81	1,779	17
3-Jun	973	33	342	112	659	35
4-Jun	531	43	116	46	644	20
5-Jun	536	52	166	93	534	33
6-Jun	645	64	192	164	224	40
7-Jun	355	108	89	148	137	70
8-Jun	298	109	39	162	420	94
9-Jun	462	134	477	459	430	236
10-Jun	553	102	647	559	1,109	391
11-Jun	408	50	538	395	800	180
12-Jun	200	57	180	594	408	229
13-Jun	369	40	782	658	697	236
14-Jun	192	77	398	562	427	232
15-Jun	80	28	97	372	131	135
16-Jun	97	16	80	226	92	122
17-Jun	51	29	45	303	58	120
18-Jun	113	21	154	534	166	191
19-Jun	55	23	112	326	96	184
20-Jun	65	6	95	534	122	294
21-Jun	51	13	44	245	49	122
22-Jun	57	5	42	58	76	77
23-Jun	20	4	23	130	24	76
24-Jun	68	1	97	158	67	70
25-Jun	34	4	201	160	293	108
26-Jun	0	0	43	99	37	79
27-Jun	9	1	16	146	6	61
28-Jun	26	5	21	81	13	66
29-Jun	47	24	45	138	31	58
30-Jun	10	19	18	79	24	35
1-Jul	33	2	1	36	5	25
2-Jul	26	3	2	28	5	11
3-Jul	4	0	4	9	4	3
4-Jul	0	0	1	12	6	2
5-Jul	0	0	4	4	1	-2
6-Jul	4	2	2	1	2	1
7-Jul	0	0	0	0	1	0
8-Jul	0	0	0	0	0	0
Total	21,804	1,151	13,150	7,918	22,649	3,700

Table 13. Historic 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
	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	Cabot2				
	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				
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

[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 failures.

[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 14. Temporal characteristics of American shad passage at the Holyoke and Turners Falls fish passage facilities, 2019

Passage Facility	Cumulative Percentage of Total American Shad Passage 25%	50%	75%	90%	Day of Highest Daily Passage
Holyoke Fishlift:					
Day*	17	21	26	28	26
Date	5/23	5/27	6/1	6/3	6/1
Spillway Fishladder (Turners Falls):					
Day*	21	27	35	39	18
Date	5/27	6/2	6/10	6/14	5/24
Gatehouse Fishladder (Turners Falls):					
Day*	21	25	32	38	23
Date	5/27	5/31	6/7	6/13	5/29
Cabot Fishladder (Turners Falls):					
Day*	21	23	28	35	22
Date	5/27	5/29	6/3	6/10	5/28

* Day one is 7 May the first day shad were lifted at the Holyoke fish passage facility.

Table 15. **Daily Fish Counts - West Springfield Fish Ladder 2019**

Date	American Shad	Sea Lamprey	Blueback Herring	White Sucker	Small-mouth	Brown Trout	Rainbow Trout	Brook Trout	Tiger Trout	Max. H2O Temp. (C°)
1-Apr										
2-Apr	0	0	0	0	0	0	0	0	0	
3-Apr	0	0	0	0	0	0	0	0	0	
4-Apr	0	0	0	0	0	0	0	0	0	
5-Apr	0	0	0	0	0	0	0	0	0	
6-Apr	0	0	0	0	0	0	0	0	0	
7-Apr	0	0	0	0	0	0	0	0	0	6.5
8-Apr	0	0	0	0	0	0	1	0	0	7
9-Apr	0	0	0	0	0	0	0	0	0	5.5
10-Apr	0	0	0	0	0	0	0	0	0	4.5
11-Apr	0	0	0	1	0	0	1	0	0	4.5
12-Apr	0	0	0	0	0	0	0	0	0	5
13-Apr	0	0	0	0	0	0	1	0	0	7
14-Apr	0	0	0	40	0	0	1	0	0	8
15-Apr	0	0	0	80	0	0	2	0	0	9.5
16-Apr	0	0	0	7	0	0	1	0	0	8
17-Apr	0	0	0	0	0	0	2	0	0	9
18-Apr	0	0	0	0	0	0	1	0	0	8
19-Apr	0	0	0	0	0	0	0	0	0	8.5
20-Apr	0	0	0	23	0	0	0	0	0	10
21-Apr	0	0	0	0	0	0	0	0	0	11
22-Apr	0	0	0	52	0	0	0	0	0	10.5
23-Apr	0	0	0	26	0	0	1	0	0	11.5
24-Apr	0	0	0	207	0	0	2	0	0	13.5
25-Apr	0	0	0	58	1	0	1	0	0	12
26-Apr	9	0	0	7	1	0	0	0	0	11.5
27-Apr	0	0	0	0	0	0	0	0	0	9
28-Apr	0	0	0	0	0	0	0	0	0	8
29-Apr	0	0	0	0	0	0	0	0	0	8
30-Apr	0	0	0	0	0	0	0	0	0	9
1-May	0	0	0	0	0	0	0	0	0	8.5
2-May	7	0	0	0	0	0	0	0	0	9
3-May	6	0	0	0	0	0	0	0	1	9
4-May	0	0	0	1	0	0	1	0	0	9.5
5-May	0	0	0	3	0	0	1	0	1	10
6-May	0	0	0	0	0	0	1	0	0	11
7-May	64	0	0	379	9	0	2	0	1	13.5
8-May	51	0	0	474	26	0	1	0	1	14.5
9-May	126	0	0	50	8	0	0	0	2	14
10-May	174	11	0	7	2	0	0	0	0	12
11-May	17	0	0	1	0	0	0	0	1	13
12-May	427	13	1	3	1	0	0	0	1	12
13-May	1	0	0	0	0	1	0	0	1	8.5
14-May	0	0	0	0	0	0	0	0	0	9
15-May	2	0	0	0	0	0	0	0	2	10
16-May	4	0	0	0	0	0	0	0	0	10.6
17-May	26	1	1	1	1	1	0	0	0	11.5
18-May	12	0	2	0	0	0	0	0	0	12

Date	American Shad	Sea Lamprey	Blueback Herring	White Sucker	Small-mouth	Brown Trout	Rainbow Trout	Brook Trout	Tiger Trout	Max. H2O Temp. (C°)
19-May	146	1	0	37	25	0	2	0	0	14
20-May	964	5	0	275	26	2	0	2	2	17
21-May	271	37	1	40	15	0	0	0	3	17
22-May	62	17	0	3	4	0	0	1	3	15.5
23-May	538	1	0	8	19	1	0	1	0	15
24-May	100	39	0	3	6	2	1	2	0	15.5
25-May	51	34	0	1	6	0	0	0	3	15.5
26-May	199	5	0	0	7	0	0	0	2	16.5
27-May	190	6	0	7	31	1	0	0	0	18.8
28-May	181	13	0	6	22	1	0	0	3	18
29-May	3	1	0	0	0	0	0	0	0	14.5
30-May	0	0	0	0	0	0	0	0	0	14
31-May	22	1	0	1	6	1	0	0	0	16.3
1-Jun	157	8	0	4	16	0	0	0	0	17
2-Jun	47	6	0	0	11	0	0	0	0	17.5
3-Jun	49	2	0	0	8	0	1	1	1	18.5
4-Jun	13	0	0	0	3	0	0	1	1	17.5
5-Jun	16	1	0	4	2	0	0	0	0	18
6-Jun	23	3	0	0	3	1	0	1	0	19.3
7-Jun	46	4	0	1	5	2	0	0	0	20
8-Jun	21	10	0	2	4	0	0	0	0	20
9-Jun	19	3	0	0	5	0	1	0	0	20.5
10-Jun	30	2	0	2	1	0	0	1	0	20.5
11-Jun	10	5	0	0	0	3	1	2	1	19.5
12-Jun	2	4	0	1	0	0	0	0	0	19
13-Jun	7	4	0	0	4	0	0	1	1	18.8
14-Jun	0	0	3	0	0	0	0	0	1	16.3
15-Jun	0	1	0	0	0	0	0	0	0	17.5
16-Jun	1	2	0	2	0	1	0	0	0	18
17-Jun	2	11	0	0	1	0	0	0	0	18.5
18-Jun	18	25	0	0	1	0	0	0	0	18
19-Jun	9	15	0	0	0	0	0	0	0	18.8
20-Jun	7	16	0	0	0	0	0	0	0	18.8
21-Jun	5	24	0	0	0	0	0	0	0	18.8
22-Jun	1	12	0	0	0	0	0	0	0	18.8
23-Jun	0	1	0	0	0	0	0	0	0	19
24-Jun	4	35	0	0	0	1	0	1	0	21.8
25-Jun	11	39	0	0	0	0	0	0	0	20.3
26-Jun	2	8	0	1	0	0	0	1	0	20.3
27-Jun	2	33	0	3	1	2	1	0	0	21.5
28-Jun	3	18	0	2	1	0	0	0	0	23
29-Jun	4	5	0	0	2	1	0	0	0	23.3
30-Jun	4	2	0	0	1	0	2	0	0	22.5
	4,166	**484**	**8**	**1,822**	**285**	**21**	**27**	**15**	**32**	

Table 16. **Historic yearly passage totals, Westfield River fish passage facility, West Springfield, Massachusetts, 1992-2019.**

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
2014	4,787	4	1,127	0	2	0	1,663	290	65	15	33	59
2015	3,383	0	218	0	3	0	2,065	341	54	4	34	19
2016	6,003	0	456	1	1	0	1,023	601	49	11	35	13
2017	6,004	5	262	1	5	0	2,176	613	26	11	36	18
2018	5,762	4	138	0	0	0	2,201	363	9	16	10	3
2019	4,166	5	484	0	0	0	1,822	285	21	27	15	32

*1992-1995 Adult salmon were netted at the base of the dam.

Table 17.

Cumulative Percentage of Total American Shad Passage
West Springfield Fish Ladder 2019

Percent Passage	25%	50%	75%	90%	Day of Highest Daily Passage
Day*	24	26	31	37	25
Date	5/19	5/21	5/26	6/1	5/20

*Day one is April 26, the first day of shad passage.

Table 18. 2019 Anadromous Fish Passage at Essex Dam, Lawrence, MA

	American Shad	River Herring	Sea Lamprey	Atlantic Salmon	Striped Bass
19-Apr	0	0	0	0	0
20-Apr	0	0	0	0	0
21-Apr	0	6	0	0	0
22-Apr	0	0	0	0	0
23-Apr	0	0	0	0	0
24-Apr	0	0	0	0	0
25-Apr	0	0	0	0	0
26-Apr	0	0	0	0	0
27-Apr	0	0	0	0	0
28-Apr	0	0	0	0	0
29-Apr	0	0	0	0	0
30-Apr	0	0	0	0	0
1-May	0	0	0	0	0
2-May	0	0	0	0	0
3-May	0	911	0	0	0
4-May	0	15	0	0	0
5-May	0	0	0	0	0
6-May	0	22	0	0	0
7-May	0	82	0	0	0
8-May	7	1021	2	0	0
9-May	0	0	0	0	0
10-May	0	18	0	1	0
11-May	16	357	0	0	1
12-May	10	885	1	0	0
13-May	1	258	1	0	0
14-May	0	443	1	0	0
15-May	0	100	0	0	1
16-May	1	1	0	0	2
17-May	0	26	0	0	0
18-May	0	80	0	0	3

	American Shad	River Herring	Sea Lamprey	Atlantic Salmon	Striped Bass
19-May	34	52	6	1	1
20-May	443	301	120	0	4
21-May	552	493	135	0	6
22-May	186	41932	63	0	21
23-May	125	2440	4	0	4
24-May	225	6976	137	0	3
25-May	676	5190	40	0	3
26-May	675	6772	74	0	4
27-May	608	192	538	0	8
28-May	265	25	263	0	2
29-May	650	48	16	0	12
30-May	196	8	11	0	17
31-May	140	0	11	0	5
1-Jun	133	1	44	1	3
2-Jun	320	3	147	0	9
3-Jun	520	8	75	0	3
4-Jun	97	6	32	0	14
5-Jun	118	4	275	1	1
6-Jun	1350	7	971	0	16
7-Jun	1426	12	1070	0	9
8-Jun	1252	7	386	1	1
9-Jun	0	0	0	0	0
10-Jun	1301	4	712	2	7

Photo by Troy Gipps/MassWildlife

Table 19. Historic Anadromous Fish Passage at Essex Dam, Lawrence, MA

Year	Atlantic Salmon	American Shad	River Herring	Striped Bass	Sea Lamprey	Gizzard Shad
1982	16	0	0	0	0	
Lifts for seven weeks in fall only						
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	4,300	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**	**16,963**	**68,711**	**277**	**9,335**	**0**

* 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 20. Age Frequency of American Shad Sampled At the Essex Fish Lift 2019

Age	n
3	3
4	46
5	72
6	28
7	17
Grand Total	180

Table 21. Fish passage at the Pawtucket Dam Fishlift, Lowell, MA in 2019.

Date	Herring			Shad			Lamprey		
	Lift	Ladder	total	Lift	Ladder	total	Lift	Ladder	total
22-Apr	0	0	0	0	0	0	0	0	0
23-Apr	0	0	0	0	0	0	0	0	0
24-Apr	0	0	0	0	0	0	0	0	0
25-Apr	0	0	0	0	0	0	0	0	0
26-Apr	0	0	0	0	0	0	0	0	0
27-Apr	0	0	0	0	0	0	0	0	0
28-Apr	0	0	0	0	0	0	0	0	0
29-Apr	0	0	0	0	0	0	0	0	0
30-Apr	0	0	0	0	0	0	0	0	0
1-May	0	0	0	0	0	0	0	0	0
2-May	0	0	0	0	0	0	0	0	0
3-May	0	0	0	0	0	0	0	0	0
4-May	0	0	0	0	0	0	0	0	0
5-May	0	0	0	0	0	0	0	0	0
6-May	0	0	0	0	0	0	0	0	0
7-May	0	0	0	0	0	0	0	0	0
8-May	0	0	0	0	0	0	0	0	0
9-May	5	0	5	0	0	0	0	0	0
10-May	0	0	0	0	0	0	0	0	0
11-May	0	42	42	0	0	0	0	0	0
12-May	0	0	0	0	0	0	0	0	0
13-May	9	0	9	0	0	0	0	0	0
14-May	0	0	0	0	0	0	0	0	0
15-May	0	0	0	0	0	0	0	0	0
16-May	0	1	1	0	0	0	0	0	0
17-May	0	0	0	0	0	0	0	0	0
18-May	0	0	0	0	0	0	0	0	0
19-May	0	0	0	0	0	0	0	0	0
20-May	0	0	0	0	0	0	0	0	0
21-May	5	0	5	0	0	0	0	0	0
22-May	0	0	0	0	0	0	2	0	2
23-May	86	0	86	0	0	0	0	0	0
24-May	2041	6833	8874	0	12	12	3	0	3

Date	Herring			Shad			Lamprey		
	Lift	Ladder	total	Lift	Ladder	total	Lift	Ladder	total
25-May	0	3542	3542	0	9	9	0	0	0
26-May	0	2215	2215	0	16	16	0	0	0
27-May	0	2379	2379	0	41	41	0	8	8
28-May	0	438	438	0	11	11	0	22	22
29-May	41	90	131	31	6	37	5	3	8
30-May	0	17	17	0	0	0	0	0	0
31-May	0	0	0	0	0	0	0	1	1
1-Jun	20	1	21	8	50	58	3	0	3
2-Jun	540	2	542	20	14	34	5	0	5
3-Jun	456	3	459	0	7	7	3	0	3
4-Jun	-25	1	-24	10	14	24	9	0	9
5-Jun	34	4	38	6	21	27	5	45	50
6-Jun	24	4	28	7	17	24	36	111	147
7-Jun	-166	2	-164	1	80	81	17	110	127
8-Jun	-61	0	-61	0	22	22	26	78	104
9-Jun	74	2	76	-1	110	109	18	16	34
10-Jun	1597	0	1597	5	23	28	6	19	25
11-Jun	1424	0	1424	340	6	346	49	36	85
12-Jun	4255	0	4255	38	5	43	48	37	85
13-Jun	286	0	286	125	18	143	82	30	112
14-Jun	4070	0	4070	82	4	86	7	9	16
15-Jun	1663	0	1663	25	6	31	28	27	55
16-Jun	485	0	485	38	3	41	35	10	45
17-Jun	645	0	645	52	10	62	20	11	31
18-Jun	522	0	522	88	0	88	54	15	69
19-Jun	1055	0	1055	32	0	32	6	5	11
20-Jun	997	0	997	37	0	37	16	5	21
21-Jun	1052	0	1052	138	0	138	3	1	4
22-Jun	658	0	658	120	0	120	2	0	2
23-Jun	395	0	395	3	7	10	2	0	2
24-Jun	793	0	793	139	1	140	2	6	8
25-Jun	167	0	167	30	0	30	1	0	1
26-Jun	912	0	912	84	0	84	1	1	2
27-Jun	3130	0	3130	46	2	48	0	1	1
28-Jun	30	0	30	21	0	21	0	0	0
29-Jun	-2	0	-2	37	0	37	0	0	0
30-Jun	126	0	126	33	0	33	0	0	0
1-Jul	-18	1	-17	4	1	5	1	0	1
2-Jul	-16	0	-16	0	0	0	0	0	0
3-Jul	366	0	366	7	2	9	0	0	0
4-Jul	92	0	92	2	0	2	0	0	0
5-Jul	363	0	363	-1	0	-1	0	0	0
6-Jul	-56	0	-56	14	0	14	0	0	0
7-Jul	217	0	217	23	0	23	0	0	0
8-Jul	0	0	0	4	0	4	0	0	0

Date	Herring			Shad			Lamprey		
	Lift	Ladder	total	Lift	Ladder	total	Lift	Ladder	total
9-Jul	3	0	3	15	0	15	0	1	1
10-Jul	0	0	0	15	2	17	10	0	10
11-Jul	0	0	0	2	0	2	0	0	0
12-Jul	0	0	0	1	0	1	0	0	0
13-Jul		0	0		0	0		0	0
14-Jul		0	0		0	0		0	0
15-Jul		0	0		0	0		0	0
	28,294	15,577	43,871	1,681	520	2,201	505	608	1,113

Table 22. Historic fish passage at the Pawtucket fishway and ladder, Lowell, MA. (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: 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
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	

Year	American Shad	River Herring	Sea Lamprey	Striped Bass
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	

* 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.

Hatchery/Trout Program Report, Kenneth Simmons, PhD. (retired) and Caleb Slater, PhD.

1. Trout Production and Stocking

The total number and pounds of each size category for each species of trout produced and stocked by the Division's five hatcheries in FY2020 are listed in Tables 25 and 26, respectively. Overall, a total of 510,889 Brook Trout, Brown Trout, Rainbow Trout and Tiger Trout with a combined weight of 445,768 pounds were stocked, which met the Division's annual trout production goal of 400,000 fish and was 99% of the 450,000 pound goal. Failure to meet the total pound production goal is related to the uncertainties around work restrictions due to the COVID-19 pandemic this spring. Not knowing if the hatcheries would be able to continue to operate, we accelerated the spring stocking schedule. This resulted in the loss of up to one month of growth and some of the fish stocked were slightly smaller usual. Most of these smaller than usual fish were Brown Trout and Brook Trout and the loss of growth did not affect the proportion of 12+ fish stocked.

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 Department of Environmental Protection and the Federal Environmental Protection Agency. 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 FY2020 as well; 78% (399,570 fish) of the fish met or exceeded this goal, including 297,123 Rainbow Trout, 52,372 Brook Trout, 47,404 Brown Trout and 2,671 Tiger Trout.

The Division has both a fall and spring trout stocking season. During the FY 2020 fall season, which ran from late September through mid-October 2019, 99 ponds and lakes, and 7 rivers and streams in 94 cities and towns across the 5 Wildlife Districts were stocked. A total of 61,612 trout comprised of 57,112 14+ Rainbow Trout and 4,500 9+ Brown Trout with a combined weight of 70,349 pounds were stocked. 93 percent of the fish stocked during the fall were in the 12+ or larger size category.

Photo by Troy Gipps/MassWildlife

In the spring stocking season, which ran from March through early June 2020, a total of 449,277 trout with a combined weight of 375,419 pounds were stocked in 73 lakes and ponds and 174 rivers and streams in 224 cities and towns. Overall, 76% of the fish that were stocked met or exceeded the 12+ size category. A total of 248,761 Rainbow Trout stocked of which 240,011 (76%) were in the 12+ category or larger and 188,274 (42%) were 14+ and weighed an average of 1.15 pounds each. Many of the rainbows were over 16 inches long and weighed more than a pound and a half apiece. A total of 85,274 Brook Trout were stocked in spring FY2020, of which 52,372 (61%) were in the 12+ size category or larger. More than 500 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 47,694 pounds. A total of 112,571 Brown Trout between 6 inches and 18+ inches with a total weight of 67,763 pounds were also stocked. Forty two percent (47,404 fish) of the Brown Trout were at least 2 ½ years old and 12 inches or larger with an average weight of 1 pound apiece. Almost 700 of these Brown Trout were longer than 18 inches and weighed an average of 4.5 pounds apiece. Sandwich Hatchery produced 2,670 Tiger Trout which averaged 14+ inches and weighed an average of 0.95 pounds apiece (Tables 23 and 24). 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 551,898 fertilized Brown Trout eggs and 702,366 fertilized Brook Trout eggs in FY2020. Sandwich Hatchery produced a total of 252,720 fertilized Brown Trout eggs, 254,240 fertilized Brook Trout eggs and 242,892 fertilized Tiger Trout eggs (Table 24).

2. Landlocked Salmon Production and Stocking

The Roger Reed Hatchery produced a total of 16,778 landlocked Atlantic Salmon in FY2020 (Table 25). 6,079 of these salmon that weighed a total of 318 pounds were transferred in September 2109 to the New Jersey Division of Fish and Wildlife Hackettstown Hatchery in exchange for Northern Pike fry and fingerlings. The remaining 10,699 salmon which averaged 8.7 inches and weighed a total of 2,272 pounds were stocked in Quabbin Reservoir in May 2020.

3. Northern Pike Stocking

In September 2019, approximately 2,000 Northern Pike yearlings between 8 and 12 inches long were stocked in the Cheshire Reservoir system (Chershire and Berkshire, MA) and North Pond Quaboag (Brookfield, MA). The usual April stocking of Northern Pike fry did not take place in 2020 due to COVID-19 travel restrictions. The Northern Pike were obtained from the New Jersey Division of Fish and Wildlife's Charles Hayford State Fish Hatchery in Hackettstown, NJ.

4. Fish Health Monitoring

The Division has maintained an active fish health monitoring program for its five hatcheries since the 1980s. Since that time, the Division'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). The Division is an active participant in the NEFHC. The fish are screened for fish pathogens that the NEFHC committee 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 2020 are in Table 25. No NEFHC listed pathogens were diagnosed in FY 2020. Cold water disease *(Flavobacterium psychrophilum)* was diagnosed in the Erwin/Arlee strain of Rainbow Trout at McLaughlin Hatchery (Table 4). Cold water disease is a ubiquitous pathogen of trout throughout much of the United States, but it is not listed by the NEFCH (FEFCH 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).

5. Capital Improvement Projects

The Division was awarded $250,000 in capital funding in FY2019 for a comprehensive study to identify the infrastructure improvements and costs needed at its five hatcheries in order to improve efficiency and maintain overall coldwater fish production goal at its current level through the next 50 years.

HDR, Inc., a broad based, international consulting firm with a Fisheries Division that specializes in hatchery studies of this type was awarded the contract for the study. HDR has conducted similar hatchery studies throughout North America. The final report was completed in FY2020.

Deliverables of the study include recommendations to improve, enhance and maximize efficiency of all MassWildlife hatchery facilities for the following:

- broodstock maintenance
- egg production, incubation and hatching
- fish rearing
- biosecurity and protection of fish from predators
- fish waste management and compliance with discharge permits
- water use, wells, water pumps and piping systems, flow monitoring
- emergency alarms
- energy efficiency and generation with a goal of LEED certification; shall include, but not be limited to analyses of hydropower, geothermal, solar and wind
- backup emergency power generation
- minimization of worker risk for occupational injury

Table 23. Pounds of trout produced at the Division's five fish hatcheries in FY2020 (fall 2019 and spring 2020).

		Weight of Fish in Pounds					
Species	Size Category (inches)	Bitzer	McLaughlin	Palmer	Sandwich	Sunderland	Total Weight of Fish
Rainbow	6+						-
Trout	9+	4,064					**4,064**
	12+		2,344		12,652	23,557	**38,553**
	14+	24,383	226,777		22,611	9,030	**282,801**
	Sub-total	**28,447**	**229,121**	**-**	**35,263**	**32,587**	**325,418**
Brook	6+					7,412	**7,412**
Trout	9+						-
	12+	23,958			10,664	2,983	**37,605**
	14+						-
	18+				1,335		**1,335**
	Sub-total	**23,958**	**-**	**-**	**11,999**	**10,395**	**46,352**
Brown	6+	4,766				5,987	**10,753**
Trout	9+	2,367	8,300				**10,667**
	12+	15,830			9,714	18,733	**44,277**
	14+						-
	18+				2,474		**2,474**
	Sub-total	**22,963**	**8,300**	**-**	**12,188**	**24,720**	**68,171**
Tiger	9+						-
Trout	14+				2,526		2,526
	Sub-total	**-**	**-**	**-**	**2,526**	**-**	**2,526**
Total		**75,368**	**237,421**	**-**	**61,976**	**67,702**	**442,467**

- tourism enhancement and educational outreach for visitors.

The potential impacts from climate change and recommended means to mitigate them are also included for each hatchery.

Other hatchery capital projects conducted in FY2020 included: Sandwich Hatchery- $25,683.50 replacement of deteriorated concrete headboxes on the I-J and K-L series of raceways and replacement of the collapsed water line from the hatch house to Pool F.

Palmer Hatchery- $22,988.00 replacement of the I-beam supports of the reservoir pumps and reservoir pump service. Also at Roger Reed, a study was performed by Tighe & Bond investigating the potential repair/replacement of the hatchery reservoir dam and reservoir water supply pipeline. This project was funded through the $1.5M in capital funds directed for DFW dam repair and removal.

6. Hatchery Program Personnel

John Williams, long time Bitzer Hatchery Manager, retired in August after 36 years with the agency. Bitzer Hatchery Assistant Manager Holly Hubert was promoted to Hatchery Manager in September.

Jim Hahn, long time McLaughlin Hatchery Manager, retired in June after more than 38 years of service. The McLaughlin Hatcher Manager position is currently vacant.

Brian Guerin, Assistant Manager at Sunderland Hatchery transferred to the vacant Assistant Manager position at Bitzer in October. Kevin Magowan was hired to fill the vacant Assistant Manager position at Roger Reed Hatchery in November.

Richard Pecorelli, technician at Sunderland Hatchery re-

Table 24. Summary of landlocked salmon, brook trout eggs, brown trout eggs and tiger trout eggs produced in FY2020.

Hatchery	Species	Size Category (inches)	Number	Weight (Pounds)
Palmer	Landlocked salmon	8+ inches	10,699	2,272
	Landlocked salmon	Fall Fingerlings	6,079	318
Palmer	Brook Trout	eggs	702,366	N/A
	Brown Trout	eggs	551,898	N/A
Sandwich	Brook Trout	eggs	254,240	N/A
	Brown Trout	eggs	551,898	N/A
	Tiger Trout	eggs	242,892	N/A

Photo by Troy Gipps/MassWildlife

Table 25. Results of fish health tests conducted at the Divison's five fish hatheries in FY2020.

Hatchery	Species[2]	Number of Fish Tested	IPNV	VHSV	OMV	IHNV	RS	AS	YR	MC	Other[3]
Bitzer	BK (SA)	60	negative	negative	negative	negative	negative	negative	negative	negative	
	BT (SA)	60	negative	negative	negative	negative	negative	negative	negative	negative	
	RT (E/A)	60	negative	negative	negative	negative	negative	negative	negative	negative	
	RT (E/A)	10						negative	negative		
McLaughlin	BT (SA)	60	negative	negative	negative	negative	negative	negative	negative	negative	
	RT (E/A)	60	negative	negative	negative	negative	negative	negative	negative	negative	
	RT (SH)	60	negative	negative	negative	negative	negative	negative	negative	negative	
	RT (E/A)	10						negative	negative		+CWD
	RT (E/A)	10						negative	negative		+CWD
	BK (SA)	10						negative	negative		
Palmer	LLS(GL)	60	negative	negative	negative	negative	negative	negative	negative	negative	
	BK (SA)	15	negative	negative	negative	negative	negative	negative	negative	negative	
	BK (SA)	101[4]	negative	negative	negative	negative					
	BT (SA)	15	negative	negative	negative	negative	negative	negative	negative	negative	
	BT (SA)	124[4]	negative	negative	negative	negative					
Sandwich	BK (SA)	60	negative	negative	negative	negative	negative	negative	negative	negative	
	BK (SA)	80[4]	negative	negative	negative	negative					
	BT (SA)	60	negative	negative	negative	negative	negative	negative	negative	negative	
	BT (SA)	100[4]	negative	negative	negative	negative					
	RT (E/A)	60	negative	negative	negative	negative	negative	negative	negative	negative	
	RT (SH)	60	negative	negative	negative	negative	negative	negative	negative	negative	
	TT	30	negative	negative	negative	negative	negative	negative	negative	negative	
Sunderland	BK (SA)	60	negative	negative	negative	negative	negative	negative	negative	negative	
	BT (SA)	60	negative	negative	negative	negative	negative	negative	negative	negative	
	RT (E/A)	60	negative	negative	negative	negative	negative	negative	negative	negative	
	RT (SH)	60	negative	negative	negative	negative	negative	negative	negative	negative	

[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.

signed in September. Tim Nye, technician at Sunderland Hatchery was promoted to fill the vacant Assistant Manager position there in February. Andrew Blajda, Technician at McLaughlin transferred to Sunderland in June. Consequently, there are technician positions vacant at both Sunderland and McLaughlin Hatcheries. Both positions have been advertised and interviews will be scheduled as soon as possible.

Elizaveta Hosage was hired as a 6-month seasonal at Sunderland in March, she resigned at the end of June.

Dr. Ken Simmons, fisheries biologist and Hatchery Supervisor retired after more than 30 years as a devoted MassWIldlife employee. His position was subsequently backfilled with Dr. Caleb Slater.

References

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

Fisheries Operations Project – Steven Mattocks, Fisheries Biologist

1. Biological sampling for fish community assessment

The annual fisheries stream sampling protocol, priorities, and fish identification meeting was held on June 4th, 2020, and was attended by district fisheries biologists and technicians across the state. Stream sampling priorities, sampling protocols, and fish identification were major themes of the meeting. Stream survey protocols were discussed, and fish identification exercises were conducted with the district biologists and technicians as an annual refresher of survey techniques and fish identification features. Priority sampling lists were supplied to district staff at the annual meeting as well as the updated fisheries database, fisheries GIS layers, and voucher collection specimen needs.

Stream and lake sampling priorities were generated by field headquarters fisheries staff prior to the annual meeting, and before the start of the sampling season. Survey locations were prioritized based on criteria formed by fisheries staff (e.g. gaps in current fisheries data, streams with historical surveys, potential rare and endangered species occurrences, and potential locations for naturally reproducing coldwater fish). In addition, surveys were prioritized to fulfill data requests submitted by internal and external sources. Stream survey priorities were reviewed by fisheries biologists and any notes or changes to the lists were made prior to the annual meeting. Logistical challenges that occurred during sampling coordination and prioritization among field headquarters staff were also addressed. Weekly communication with field headquarters project leaders and regular correspondence with district staff was integral in maximizing sampling and overall operation efficiency.

In FY 2020, we continued the juvenile American Shad productivity assessment in the Connecticut River. In coordination Masswildlife Valley District (Belchertown) and USFWS, random nighttime boat electrofishing runs were sampled in 3 dam sections within the Connecticut River: Holyoke, Turner's, and Vernon. Masswildlife was responsible for surveying the Holyoke dam section while USFWS surveyed the Turners and Vernon dam section. This work was presented as a poster at the Southern New England Chapter of the American Fisheries Society (https://www.fws.gov/r5crc/pdf/Mattocks_SNEC_winter_2020_shad_poster.pdf).

In addition, the Taunton River was also assessed by boat electrofishing as part of an assessment to potentially stock it with native but depleted American Shad. The Fisheries Operations Biologist and the River and Stream Project Leader worked with DMF (Sara Turner) to survey the river in July, August, and October. Several juvenile shad were found indicating potential suitable habitat.

2. Data entry and QAQC

Massachusetts Division of Fisheries and Wildlife staff conducted 316 surveys throughout the state during FY 2020. Stream surveys were conducted in all districts throughout Massachusetts which were intended to fill data gaps. Some surveys were conducted on streams and rivers that had previously been sampled, while other surveys occurred on streams with historical surveys or even no previous data. Additional CFR's were added which documented the reproduction of coldwater fish. The continued surveying of Massachusetts waters allows for monitoring changes in fish assemblages over time and space.

Surveys were completed in every major watershed within the state. Species summaries were produced, which include the minimum, maximum, and average lengths of each species captured, as well as the total number of fish captured. This information captures the size (length and weight) structure and infers age of fishes sampled in FY 2020. Surveys were conducted using a variety of gear including Backpack Electrofishing (n=247), Boat Electrofishing (n=43), Gillnet (14), Minnow Trap (n=1), Seine (n=3), and Water Quality (n=4). There were 4 site visits with no surveys due to low water.

All fisheries survey data collected by district and field headquarters staff were entered into the fisheries survey and inventory database. Data was then checked for quality and accuracy using pivot tables in Microsoft Excel, R scripts and table outputs using R Studio, as well as graphical displays (box plots, scatterplots). Errors in data were corrected before updating GIS layers.

Watershed voucher collections were updated with fish collected by Masswildlife staff during fish surveys. Fish that were missing from voucher jars were added (if surveyed and vouchered), and a new voucher request list was generated and provided to district staff.

3. Data summaries and requests

Multiple data requests were received during FY 2020. After data needs were outlined by individuals or organizations making the requests, data were partitioned using Excel or R Studio. Data release agreements were provided by the Operations Biologist prior to submitting data from the fisheries survey and inventory database. Many requests were made by individuals seeking information on fishing locations. Sampling requests by state, federal, and non-government agencies were also frequent.

Future sampling requests were also annotated and coordinated by the Operations Biologist. If the sampling request fit within the Masswildlife fisheries sampling goals and priorities, requested locations were added to priority sampling lists for either district staff or field headquarters biologists.

4. Other management assignments and activities

The Operations Biologist participated in a backpack demonstration for Framingham State University. Communication with federal (Climate Science Center, USFWS, USGS) and state (DER, DCR, DOT, DMF, and DEP) agencies was important for collaborative efforts regarding research and management of inland resources.

To update and maintain field equipment for fisheries sampling, new gear was budgeted for, and ordered. Major gear purchases and upgrades during FY 2020 include gillnets, boat electrofishing upgrades, boat safety equipment, and a myriad of other items integral to fisheries surveys. Outboard motors and small engines (generators) were winterized and maintained.

Scientific Collection Permit renewal applications were logged in coordination with Bob Arini. Operations Biologist also logged fisheries data collected by scientific collection permit holders.

4a. Target Fish Community and NMDS analysis- Data Organization and Prep

To assist the River and Stream Project Leader (Rebecca Quinones) in updating the large river target fish community assessment, the Fisheries Operations Biologist worked with Rebecca to filter, prep, QA/QC, and analyze fisheries data as part of this long-term project. The goal of this project was to compare current fish assemblages with previous fish assemblages on large rivers, and to compare “assessment rivers” with “target rivers”. For a more complete description of this project, see the River and Stream Project Leader Report.

Broadly, this project is an update to the target fish community assessment completed in 1998. Data were sorted into “old” (1998-2005) and “new” (2006-2019) time periods. We removed stocked fish and seasonally present anadromous fish. Temperature (cold, cool, warm, warm brackish) and pollution tolerance (tolerant, moderately tolerant, intolerant) were used to assess species status in the context of NMDS analysis, as well as habitat use classification (fluvial dependent, fluvial specialist, macrohabitat generalist).

For the NMDS analysis, we used the ‘metaMDS’ function in the *vegan* package. We used distance matrices with a Bray Curtis dissimilarity function and a shepards test for goodness of fit. Generally, we followed R code and guidelines from http://rpubs.com/CPEL/NMDS. We used the package ‘ggplot2’ to visually assess differences in fish assemblages between current and former assessment and target rivers. This analysis is generally preliminary and will likely be continued in FY 2021 in coordination with the River and Stream Project Leader.

Fisheries Staff

Westborough Field Headquarters Staff

Todd A. Richards, Assistant Director, Fisheries
Adam Kautza, Ph.D., Coldwater Fishery Resource Project Leader
Steven Mattocks, Field Operations Biologist
Rebecca Quiñones, Ph.D., Stream and River Project Leader
Ken Simmons, Hatchery Supervisor (partial year)
Caleb Slater, Anadromous Project Leader (partial year), Hatchery Supervisor (partial year)
Jason Stolarski, Ph.D., Watershed Project Leader
David Szczebak, Fisheries GIS Project Leader
Joseph Asta-Ferrero, Seasonal Employee
Eli Lagacy, Seasonal Employee
Nicole Harmon, Seasonal Employee
Campbell Morgan, Seasonal Employee
Kyle Grasso, Seasonal Employee

McLaughlin Hatchery Staff

Jim Hahn, Manager
Kurt Palmateer, Assistant Manager
John Sousa, Assistant Manager
Jennifer Ayre, Bacteriologist
Mark Coughlin, Wildlife Technician
Jeremy Davis, Wildlife Technician
Megan Cruz, Wildlife, Technician
Christopher Marsden, Wildlife Technician
Vacant, Wildlife Technician

Montague (Bitzer) Hatchery Staff

Holly Hubert, Manager
Brian Guerin, Assistant Manager
Chester Hall IV, Wildlife Technician
Joe Kendall, Wildlife Technician

Roger Reed Hatchery Staff

Daniel Marchant, Manager
Kevin Magowan, Assistant Manager
Cameron Young , Wildlife Technician

Sandwich Hatchery Staff

Adam Davies, Manager
Greg McSharry, Assistant Manager
Conor McMorrow, Wildlife Technician
Michael Clark, Wildlife Technician

Sunderland Hatchery Staff

Charles Bell, Manager
Timothy Nye, Assistant Manager
Andrew Ostrowski, Wildlife Technician
Andrew Blajda, Wildlife Technician
Heather Sadler, Wildlife Technician
Vacant, Wildlife Technician

Wildlife

Michael Huguenin
Assistant Director, Wildlife Research

Overview

The Wildlife Section is responsible for the conservation, management, and research of wildlife and game populations within the Commonwealth of Massachusetts and consists of 1 Assistant Director, 1 Habitat Program Leader, 7 Game Biologists, 6 Habitat Biologists, 1 Population Ecologist/GIS Specialist, 1 Ornithologist, and 2 vacancies. In general, the Wildlife Section strives to maintain healthy wildlife populations to enhance wildlife-based recreation, to reduce negative interactions between people and wildlife, and to forward MassWildlife's mission of wildlife conservation and management. We accomplish this goal by conducting research, implementing management strategies (including habitat management), and by developing and maintaining regulations. Specifically, the Game Biologists (4 Project Leaders and 3 Wildlife Biologists) in the Wildlife Section develop and implement research projects and collect and analyze data on dozens of species (including but not limited to black bears, white-tailed deer, wild turkey, waterfowl, cottontail rabbit, furbearers, woodcock, ruffed grouse, and moose). Game Biologists also spend a large portion of their time informing and educating the public as it relates to human-wildlife interactions, wildlife rehabilitation, and hunting and trapping. Additionally, the Habitat Biologists develop and implement habitat management plans to maintain and enhance biodiversity of both game and nongame species on state Wildlife Management Areas (WMA).

The Wildlife Section manages wildlife and wildlife habitat by developing science-based regulatory, policy and programmatic recommendations, which are ultimately approved by the Fisheries and Wildlife Board. Specifically, the Wildlife Section implements habitat management for a diverse suite of species through cutting, mowing, burning, invasive plant species control, etc. Also, the Wildlife Section is responsible for managing deer, moose, black bear, furbearer species, wild turkey, upland game, waterfowl, and other migratory bird populations. Management recommendations and strategies are based on research designed to understand wildlife population dynamics while considering biological and social variables. The Wildlife Section oversees the hunting and trapping seasons and allocates and issues permits for antlerless deer, wild turkey, and black bear. Further, the Wildlife Section issues permits for and oversees commercial game preserves, Problem Animal Control (PAC) agents, falconry, crossbows, commercial deer farms, and other propagators' facilities. The statewide pheasant stocking program is also coordinated through the Wildlife Section in addition to a 3-day paraplegic hunt for deer.

In addition to the above-mentioned responsibilities, staff time and resources are consumed by coordinating and managing the agency's Large Animal Response Team (LART); responding to reports of human-wildlife conflicts, media inquiries, and public records requests; and representing the agency on wildlife conservation and management issues in public forums and in partnership with local, state, federal, and private organizations. Staff provides technical assistance on habitat assessments for proposed management on Massachusetts Department of Conservation and Recreation (DCR) and other public and private forestlands, serves as the wildlife representative on the agency's land acquisition committee, and directs and coordinates with the University of Massachusetts and the USGS Cooperative Fish and Wildlife Research Unit on scientific wildlife research projects within the Commonwealth. Project leaders and managers serve as the state representatives on the Northeast Association of Fish and Wildlife Agencies' various technical committees and the Northeast Association of Wildlife Administrators, respectively.

Habitat Program
John Scanlon, Habitat Program Supervisor

The Habitat Program is a component of the MassWildlfie Biodiversity Initiative, which in part seeks to maintain and restore the native diversity of birds and mammals through active land management. The Habitat Program facilitates applied management across a range of upland and wetland sites on both public and private lands to conserve birds, mammals, and other wildlife identified as species of conservation concern in the Massachusetts State Wildlife Action Plan (SWAP). Upland sites include grasslands, shrublands, and forestlands. Wetland sites include marshlands, shrub swamps, and forested swamps. Applied management practices include invasive plant control, mowing, mulching, harrowing, seeding, prescribed burning, and tree-clearing.

Habitat Program staff contracts and administers 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 Pro-

gram staff assists the MassWildlife Realty Program and District offices with both monitoring of more than 150 Wildlife Conservation Easements (WCEs) on over 50,000 acres of private lands and with the acquisition of new lands across the Commonwealth.

Private Lands Habitat Biologists within the Habitat Program work under contract with the United States Department of Agriculture's Natural Resource Conservation Service (NRCS) to conduct public outreach and apply habitat management for rare and declining species on cooperating private lands through programs such as Working Lands for Wildlife, Northeast Turtles, and the Young Forest Regional Conservation Partnership Program (RCPP). Habitat Program Biologists also assists with reviewing and prioritizing applications for funding under the annual MassWildlife Habitat Management Grant Program.

The Habitat Program's objectives are to:

1) 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, young forest, and late-seral-stage forest habitats) on WMA and WCE lands throughout Massachusetts.

2) Provide technical assistance to other public and private landowners and conservation organizations on management of grassland, marshland, shrubland, and young forest habitats. Public and private landowners and conservation organizations include, but are not limited to, the U.S. Army Corp of Engineers (USACE), the DCR state forest and state watershed lands, town conservation lands, and private conservation lands (e.g., land trust properties).

The Habitat Program applies landscape composition goals for WMAs approved by the Massachusetts Fisheries and Wildlife Board that include 20-25% early-successional 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 ≥150 years old. Habitat Program staff actively participates in the MassWildlife prescribed fire crew to conduct prescribe burns on fire-associated habitats in compliance with the MassWildlife Prescribed Fire Policy. Habitat Program staff also conducts small scale invasive plant control efforts on WMAs in compliance with all local, state, and federal permitting requirements.

In addition, Habitat Program staff contracts and administers commercial tree clearing, mowing, mulching, stumping, harrowing, seeding, and invasive plant control contracts to restore and enhance grassland and shrubland habitats on WMAs through existing statewide contracts and procurement procedures in compliance with all local, state, and federal permitting requirements. Habitat Program staff also contracts and administers commercial wood product harvesting operations designed to create young forest habitat through a public, competitive bidding process in compliance with all local, state, and federal permitting requirements.

Project Accomplishments

Project Administration

Habitat Program staff conducted biological monitoring, management planning, and applied active management practices at more than a dozen sites in FY 2020 to help achieve landscape composition goals for a spatial and temporal diversity of successional habitats at the landscape level (Tables 1-3). Staff assisted with preparation and/or updating of habitat site plans and prescribed burning plans for these WMAs, created and administered habitat management contracts with private vendors at these sites, and planned or contracted biological monitoring at these sites. Habitat Program staff also maintained GIS databases of management and monitoring information for these sites.

Biological Monitoring

Regular monitoring is essential for practicing adaptive natural resource management and typically includes one or more of the following: 1) 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; 2) identification and location of invasive plants for subsequent control efforts; 3) identification and location of rare plants in order to design appropriate mitigation during harvesting activities; 4) photo documentation of pre- and post-harvest conditions; and/or 5) wildlife sampling to determine habitat use (e.g., breeding bird surveys, butterfly/moth surveys).

During FY 2020, Habitat Program staff conducted monitoring of vegetation on managed portions of seven sites, and contracted pollinator monitoring at one site totaling over 450 acres (Table 1).

Habitat Management Planning

Habitat Site Plans were developed for four properties totaling 665 acres, and companion Fire Management and/or Prescribed Burn Unit Plans were developed at five properties totaling 180 acres (Table 2) in FY 2020. 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. Lastly, 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.

Table 1. FY2020 Biological Monitoring Sites

Site Name	Town	Type of Monitoring	Acres
Frances Crane WMA	Falmouth	Vegetation Survey	73
Herman Covey WMA	Belchertown	Vegetation Survey	80
Montague Plains WMA	Montague	Pollinator Survey	100
Montague Plains WMA	Montague	Vegetation Survey	40
Muddy Brook WMA	Hardwick	Vegetation Survey	5
Tully Mountain WMA	Orange	Vegetation Survey	5
Southwick WMA	Southwick	Vegetation Survey	10
William Forward WMA	Newbury	Vegetation Survey	141
Total			**454**

Table 2. FY2020 Habitat Management & Prescribed Fire Planning Sites

Site Name	Town	Plan Type	Acres
Fox Den WMA	Middlefield/Worthington	Habitat Site Plan	175
Herman Covey WMA	Belchertown	Prescribed Burn Unit Plan	25
Herman Covey WMA	Belchertown	Habitat Site Plan	190
Hyannis Ponds WMA	Hyannis	Prescribed Burn Unit Plan	25
Katama Plains WMA	Edgartown	Prescribed Burn Unit Plan	10
Myles Standish Complex	Plymouth & Carver	Prescribed Burn Unit Plan	100
Quaboag WMA	West Brookfield	Habitat Site Plan	175
Southwick WMA	Southwick	Habitat Site Plan	125
Southwick WMA	Southwick	Prescribed Burn Unit Plan	20
Total			**845**

Table 3. FY2020 Habitat Management Sites

Site Name	Town	Habitat Type	Practice	Acres
Fox Den WMA	Middlefield	Young Forest	Mow/Mulch	20
Frances Crane WMA	Falmouth	Pitch Pine/ Oak Woodland	Mow/Mulch	100
Frances Crane WMA	Falmouth	Sandplain Grassland	Prescribed Burn	43
Herman Covey WMA	Belchertown	Sandplain Grassland	Invasive Control	73
Herman Covey WMA	Belchertown	Oak Woodland	Tree Clearing	110
Montague Plains WMA	Montague	Pitch Pine/ Scrub Oak Woodland	Invasive Control	40
Muddy Brook WMA	Hardwick	Oak Woodland	Invasive Control	5
Myles Standish Complex	Carver	Pitch Pine/ Scrub Oak Woodland	Mow/Mulch	318
Norcross Hill WMA	Templeton	Young Forest	Tree Clearing	283
Quaboag WMA	W. Brookfield	Young Forest	Tree Clearing	180
Southwick WMA	Southwick	Sandplain Grassland	Harrow/Seed	10
Stafford Hill WMA	Cheshire	Young Forest	Mow/Mulch	55
Tully Mountain WMA	Orange	Young Forest	Invasive Control	5
Tully Mountain WMA	Orange	Young Forest	Tree Clearing	75
William Forward WMA	Newbury	Coastal Shrubland	Invasive Control	141
Total				**1,488**

Habitat Management Practices

Nearly 1,500 acres were treated with one or more management practices across 13 different sites by Habitat Program staff and contractors in FY 2020 (Table 3). Specific practices for individual sites are described below.

Fox Den WMA: Aspen regeneration was completed on 20 acres using large mulching equipment to establish a second age class of aspen within a previous 60-acre aspen regeneration tree clearing operation that was completed a dozen years ago.

Frances Crane WMA: Mulching of oak tree sprouts occurred on 100 acres to reduce fuel loads for prescribed burning. In addition, 43 acres of existing sandplain grassland were maintained with prescribed burning.

Herm Covey WMA: Invasive plant control occurred on 73 acres of existing grasslands, and a wood products sale to establish open oak woodland habitat occurred on 110 acres of full-canopy mixed white pine/oak forest.

Montague Plains WMA: Herbiciding of invasive plants and oak stump sprouts was completed on 40 acres of pitch pine/scrub oak barrens to reduce fuel loads for prescribed burning.

Muddy Brook WMA: Invasive plant control and control of red maple stump sprouts occurred on 5 acres of open oak woodlands adjacent to herb/shrub wetlands to enhance connectivity between these open habitat types.

Myles Standish Complex: This ecologically unique area includes portions of the Myles Standish State Forest/WMA, Camp Cachalot Conservation Easement, and Southeast Pine Barrens WMA, which is undergoing restoration for pine barrens habitat. A total of 318 acres was treated with a combination of tree mulching/mowing and fuel break mowing to reduce fuel loads for future prescribed burning.

Norcross Hill WMA: A wood product harvesting operation occurred on 282 acres of mature white pine/oak forest to regenerate young forest habitat and promote a dense understory of lowbush blueberry, huckleberry, and other native shrubs.

Quaboag WMA: A total of 180 acres of wood product harvesting occurred to establish young forest habitat within mature white pine/oak forest.

Southwick WMA: Harrowing and seeding of native warm-season grasses occurred on 10 acres to expand previously reclaimed grassland.

Stafford Hill WMA: Aspen regeneration was completed on 55 acres using large mulching equipment to establish a new age class of aspen within the WMA.

Tully Mountain WMA: Five acres of invasive plant control occurred as part of a 75-acre wood products sale to establish young-forest habitat. Mature white pine/oak forest was cut to regenerate a mixed stand of oak and northern hardwood, with inclusions of Eastern hemlock and white pine.

William Forward WMA: Invasive plant control occurred on 141 acres of coastal shrubland/woodland on the Kent's Island portion of the WMA as part of a North American Wetlands Conservation Act (NAWCA) grant to restore habitat for native waterfowl and songbirds.

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 1,450 acres (Table 4). Habitat Program staff advocated for felling of low-quality stems to provide some coarse woody debris and additional sunlight for oak regeneration, inclusion of less-than-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

Private Lands Habitat Biologists contracting with NRCS conducted outreach and facilitated management planning and implementation on numerous ownerships (Table 5). 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 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

Table 4. FY2020 WCE/WMA Compliance Monitoring

WCE Name	Activity	Town	Acres
Flag Mountain WCE	Forest Management & Cutting Plans	Buckland	64
Hitchcock Mountain WCE	Forest Cutting Plan Review & Implementation	E. Brookfield	70
Mt. Pisgah WCE	Forest Management Planning	Northborough	20
Newton Reservoir WCE	Forest Cutting Plan Review & Implementation	Athol	30
Orange WCE	Forest Cutting Plan Review	Orange	28
Westfield Watershed WCE	Forest Stewardship Planning	Montgomery	1200
Tully Mountain WCE	Invasive Species Control Planning	Orange	50
Total			**1462**

agencies benefit.

Under cooperative agreements, MassWildlife provides NRCS with the services of two Habitat Biologists who are responsible for preparing site-specific habitat management recommendations for NRCS staff to develop conservation plans benefitting SWAP Species. One of the Habitat Biologists works under the NRCS Northeast Regional Young Forest Regional Conservation Partnership Program (RCPP). The other Habitat Biologist is responsible for serving as the liaison between NRCS and MassWildlife on the Conservation Strategy for the New England Cottontail and has an active role in implementing the NRCS Northeast Turtle Project. This Habitat Biologist also serves as the MassWildlife representative on the NRCS State Technical Committee, participating in meetings to provide input on funding programs and communicate MassWildlife's interests in restoring and managing critical habitats to help conserve the diversity of wildlife and plant communities in the Commonwealth.

Applications submitted for funding through the NRCS Environmental Quality Incentive Program include management that will maintain grassland habitat, create young forest habitat, and enhance upland forest habitat in areas that include Priority Habitat for state-listed species. In addition, this Habitat Biologist assisted in preparing materials for three potential funding applications that will involve wetland habitat restoration and management through the NRCS Wetland Reserve Easement Program. These projects will involve restoration and protection of habitat for federally and state-listed turtle species.

The Habitat Biologist continues to coordinate with members of the New England Cottontail Conservation Initiative; actively promoting habitat management and engaging in habitat management and outreach work group activities. During FY 2020, three site visits were conducted to develop NRCS funding applications for New England Cottontail habitat management. In addition, the Habitat Biologist contributed to the development of Wildlife in Your Young Forest, a 24-page brochure listing some of the wildlife that may be seen in a forest as it grows back following a management action, such as a timber harvest, and the "Faces of Conservation" article on habitat management benefitting New England Cottontail appearing in the Massachusetts Wildlife magazine.

Outreach activities promoting NRCS funding programs were also conducted by the Habitat Biologist in FY 2020. One included a DCR Sherborn Town Forest event in September 2019 with approximately 150 attendees. A Zoom presentation titled "Wildlife Friendly Forestry" was conducted in May 2020 under partnership with the New England Forestry Foundation and the Massachusetts Audubon Society for land stewards in the Granville area, which is part of the Southern Berkshire New England Cottontail focal area. There were approximately 30 attendees.

Table 5. FY2020 Private Lands Outreach & Technical Assistance

Type of Effort	No. Landowners	No. Acres
On-Line Outreach	180	NA
Personal Outreach	30	6,300
Technical Assistance	14	153

Habitat Program staff also provid-

Table 6. FY2020 DCR Harvest Proposal Reviews.

Property	Parcel	Town	Acres
Balance Rock Lot v2	Balance Rock State Park, Northern Berkshires	Lanesborough	246
Cold River Lot	Florida State Forest Northern Berkshires	Florida	107
ESF_Red Pine HQ_Proposal_D1	Erving State Forest Eastern CT Valley	Erving	11
Goodale_Chipman (Draft)	Marlborough-Sudbury State Forest	Hudson & Marlboro	113
Horse Valley - Proposal 12-02-19	Huntington State Forest Central Berkshires	Huntington	174
Hubbard River East - Proposal 01-02-19	Granville State Forest South Berkshires	Granville	330
Total			**1,018**

ed technical assistance to DCR by reviewing seven proposed harvesting operations totaling 1,018 acres on state forest lands across Massachusetts in FY 2020 (Table 6). MassWildlife Habitat Program staff advocated for inclusion of less-than-2-hectare young forest openings, and for consideration of barrens restoration efforts where appropriate.

Upland Game Program
Dave Scarpitti, Wild Turkey and Upland Game Biologist

Wild Turkey

Hunter participation

Hunting participation for wild turkey was quite varied during the 2019-2020 fiscal year. In the fall of 2019, 4,421 fall-only turkey permits (turkey permits purchased after the spring season closed), which was comparable to recent years. However, the 2020 spring season saw a record number of turkey permits issued, with approximately 23,182 permits sold representing the highest total ever by about 10%. The extremely high permit issuance was likely attributed to widespread COVID-19 closures that afforded hunters more opportunity to spend time afield.

Fall 2019 Harvest

The 12-day fall wild turkey hunting season occurred October 21–November 2, 2019. Fall season length was expanded from a 6-day to a 12-day season statewide and expanded into WMZs 10-12 in 2012. A total of 116 wild turkeys were harvested, which is the lowest fall harvest since 2011 (82) and 2009 (58). Fall season harvest is substantially more variable, probably as a result of variable brood success the preceding summer. There were 58 male and 58 female (50.0%) wild turkeys harvested during the 2019 fall hunting season. The proportion of females harvested in 2019 was comparable to most fall seasons where slightly less than 50% of the birds harvested are female. However, sex identification of juvenile turkeys in the fall can be challenging, possibly leading to some bias from hunters that report female harvests when in fact they have harvested a juvenile male.

Archery hunters (including crossbow under special permit) continued to contribute a significant portion of the harvest, accounting for approximately 38% of the total fall harvest; spring-season archery hunters typically account for 7%-8% of the total harvest. 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. A large portion of this archery harvest can likely be attributed to archery deer hunters who are opportunistically harvesting turkeys. 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. New regulations for the 2020 fall season will expand archery hunting opportunity for wild turkeys during the entire archery deer hunting season.

Spring 2020 Harvest

The 4-week spring wild turkey hunting season occurred April 27–May 23, 2020. A record total of 3,237 wild turkeys were harvested during the regular spring season, only in 2017 had more than 3,000 turkeys been harvested during the spring season. This outstanding spring harvest represents an 18% increase from 2019 (2,740 turkeys harvested). However, as previously mentioned, the number of turkey permits sold prior to and during the spring season was extremely high as well; the overall hunter success rate in 2019 (17.9%) was similar to that observed in 2020 (17.7%). New regulations this 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 of previous years.

Bearded hens perennially account for less than 1% of the total spring wild turkey harvest; 9 hens were reported during

the spring season. Approximately 5.2 adult turkeys (83.3%) were harvested per juvenile male turkey (18.8%). The ratio of adult males to immature males was the highest recorded in the past 15 years. As we saw a lower-than-normal 2019 fall season harvest, it is likely that the very high adult-to-immature ratio is due to hunter preference that was additionally exacerbated by poor juvenile recruitment, resulting in fewer jakes on the ground available for hunting harvest in 2020.

In spring 2020, harvest was highest in Worcester (835), Franklin (423), and Berkshire (322) counties. Suffolk County (4 towns) is nominally within the open zone but is heavily urbanized and many areas are closed to hunting and/or 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 8.4% harvested turkeys with archery equipment in 2020; 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, hunting opportunities remain excellent across the state, as the relatively high turkey population statewide continues to offer quality hunting experiences.

2020 Spring Youth Turkey Hunt

The annual mentored youth wild turkey hunt was held on April 25, 2020, on the Saturday immediately preceding the opening date of the spring hunting season. 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. Unfortunately, due to COVID-19 restrictions, no youth seminars were held in 2020, so only youths who had previously completed a seminar were permitted to participate on youth day. Youths aged 12-14 are given a special 1-day turkey tag. 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 245 youths received permits for the youth turkey hunt day. Youths harvested a total of 61 turkeys (15 immature, 50 adult) on youth day, representing a success rate of approximately 26.5%. Youth success rates are typically greater than regular spring season hunter success.

Ruffed Grouse

In order to assess the statewide/regional abundance of Ruffed Grouse, a springtime survey to detect their conspicuous drumming sounds is conducted each year by MassWildlife staff. In 2020, 17 drumming survey routes were surveyed across the state. Numerous "constant zero" routes (routes where no grouse had been recorded in 5 consecutive years) were not surveyed. All routes were surveyed between April 15–May 5. All but one (Route #3, Ashfield) constant zero routes occurred in either the Northeast, Southeast, or Central wildlife districts. 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 2020, the ANDS was down to 0.06. The ANDS per route in the Western District in 2020 declined to 0.14, compared to 0.16 in 2019. ANDS decreased for the fourth straight year in the Connecticut Valley District. Several constant zero routes were surveyed in the Northeast and Southeast districts; however, no grouse were heard on any of those routes.

The ANDS per route for subjective routes completed statewide in 2020 was 0.17, which is the second-lowest recorded since 2013 (0.16). Over the past 2 years, grouse continue to be detected on subjective routes in the Southeast District and the Northeast District (Route 49, Ashby). 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 appears to be declining slightly since 2014-2015; however, up until 2020, the abundance of drumming grouse on subjective routes has been stable over that time period. This presumably indicates that habitat conditions favorable for ruffed grouse are still declining in general statewide, whereas locally grouse abundance may be relatively high where suitable habitat is present. Other factors such as West Nile Virus, which grouse are quite vulnerable to in some parts of their range, may also be affecting grouse abundance during years with high West Nile Virus prevalence.

American Woodcock

Woodcock singing ground surveys are conducted April 20–May 10 each year. Routes are all 3.6 miles long and consist of 10 stops that are surveyed for 2 minutes each. 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, 14 were active in 2020. The average number of woodcock heard peenting per route (including constant zero routes) in 2020 was 1.19, slightly below 2018-2019 (1.22-1.26).

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.

New England Cottontail/Eastern Cottontail

Pellet Surveys and Trapping

Fecal pellet samples were collected from wild cottontail rabbits at 28 sites across areas of Barnstable, Plymouth, and Berkshire counties. Approximately 376 samples were collected. All plots were surveyed from early January through April 2020. Plots were surveyed 1-2 times with 0-20 samples collected per plot. Results of the 2020 winter sampling period are still pending. Overwhelmingly, most samples were collected from sites on Cape Cod, with an abundance of samples also prioritized within the Berkshire County survey area.

Of the 474 samples collected during the winter of 2019, 357 were from eastern cottontail, 101 were from New England cottontail, 4 were from snowshoe hare, and 12 were not able to be processed. Samples collected in 2018 resulted in no New England cottontail detections in Berkshire County, and only 1 plot of 5 had New England cottontail in Plymouth County. Cape Cod survey plots contained the majority of the New England cottontail pellet samples.

Live trapping of rabbits occurred at several properties on Cape Cod during January-February of 2020. Six (6) adult New England cottontail were trapped and successfully transported to Roger Williams Park Zoo for inclusion in regional captive breeding efforts to enhance and augment imperiled cottontail populations in Maine, New Hampshire, and Rhode Island. Additional trapping was conducted to facilitate the stocking of New England cottontail on Noman's Island National Wildlife Refuge. Over several weeks, 11 New England cottontail rabbits were trapped on Cape Cod and released onto Noman's NWR in May of 2020. The status of the stocked rabbits is currently unknown due to staff and logistical constraints for the USFWS Refuge.

Waterfowl Program
H W Heusmann, Waterfowl Program Leader

Division personnel conducted nest-box checks on 50 study sites used to monitor wood duck populations across the state. The winter of 2018-19 was relatively mild and wood ducks and hooded mergansers began nesting earlier than normal. Unlike the last three years, there was no cold snap the first week of April, which subjects pre-incubated eggs to addling, and nest success was good.

Wood duck nesting attempts increased substantially with 285 nest starts, compared to 237 nest starts last year and 274 in 2017 but well below the 297 in 2014 and 321 in 2013. There were 218.hatches compared to 201 hatches last year. Wood duck box use was especially low in the western third of the state, with only a single wood duck nest in the Western District study sites and none at Connecticut Valley study sites. Hooded mergansers, a species that had increased substantially over the past two decades, had 103 nest starts compared to 108 last year and 112 nest attempts in 2017. The 85 hatches were comparable to the 84 hatches last year and 88 hatches the year before that. Overall box use was 81%, up substantially from 69% last year and 74% in 2017.

Massachusetts participates in the Atlantic Flyway Resident-goose Banding Program. The Atlantic Canada Goose Resident Population Management Plan only requires Massachusetts to band 550 geese, but we band 800 for the federal database. Geese are captured by roundups during the summer molt, mid-June to mid-July. A total of 800 Canada Geese were banded at 75 sites in 63 cities and towns in Massachusetts. The state total included 408 goslings and 392 adults. Crews also captured an additional 179 previously banded geese.

For the 2019 airboat season we again made a strong attempt to reach the elusive goal of banding 1,000 birds by nightlighting, an accomplishment achieved only 5 times in 48 years of airboating. We scheduled 19 nights of boating on 16 sites but were unable to make a final trip to Chicopee River when a cooperator became ill. We ended up banding 917 birds by airboat nightlighting and captured 44 previously banded ducks. We were able to band at the Ipswich River Sanctuary in Topsfield, which was last boated in 2015. In a strong effort to band resident mallards, we used a tub net launcher borrowed from USDA APHIS-WS during 27 attempts at 24 sites where ducks were being fed and captured 348 mallards from some of 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. For the preseason banding period we banded a total of 1,273 birds. Among birds banded, there were 685 Wood Ducks, 533 Mallards,

5 Black Ducks, 8 mallard x black duck hybrids, 27 Green Winged Teal, 6 Blue Winged Teal,1 Northern Shoveler, 1 Hooded Merganser, and 6 Sora.

During the period of September 3-20, 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 18—February 15, 2020, Massachusetts held a late, resident Canada Goose season in the Central Zone while the season ran January 27–February 15 in the North Coastal Zone with a five-bird daily bag in each zone.

Postseason banding of wintering Black Ducks continued but emphasis was also shifted to banding wintering Mallards as part of an experiment to determine if two-season Black Duck banding efforts can improve the precision for Black Duck and Mallards survival rates. Also of interest was the increase in the Black Duck bag limit from 1 to 2 after 35 years, along with a reduction in the Mallard bag from 4 to 2. Black Ducks were banded at 11 sites and Mallards at 26. Some sites overlapped. The winter of 2019-20 began with a December blizzard but then turned warmer than normal. A brief cold snap in January was followed by a record warm weekend with temperatures exceeding 70 degrees in Boston. Colder temperatures returned in the second half of January but overall it was the third-warmest on record. February followed suit. Trapping was carried out in January and February 2020 by bait traps and tub net launcher. Totals of 249 American Black Ducks, 6 black-plumaged hybrids, 1 intermediate type, 4 Mallard-plumaged hybrids, and 418 Mallards were banded. In addition, there were 85 previously banded birds captured.

Eight states participated in the 2020 Northeastern states' waterfowl breeding survey, which is based on sampling randomly selected 1-kilometer-square plots in a breeding pair survey for waterfowl during April and May. A total of 884 plots were surveyed. Connecticut, New Jersey, and Maryland were unable to participate due to COVID-19 restrictions. The population estimate for Mallards was 280,5454 pairs +52,932. The estimate for Black Ducks was 16,482 pairs +6,940; Wood Ducks, 204,095 pairs +39,498; and Canada Geese, 364,885 pairs +60,036.

Massachusetts' survey was incomplete as we were unable to check some offshore plots due to being unable to social distance in the Cessna 172 we would normally use to fly the plots. We were able to check by canoe one of the 7 plots normally flown. Data from this survey is used to set hunting season regulations tailored to the Atlantic Flyway.

We continued to band Eiders nesting on coastal islands with the assistance of a volunteer boat operator. We banded 116 hens and one adult male on five islands off Cape Ann, two islands in Boston Harbor, and one island in Buzzards Bay, encompassing the main nesting range of Eiders in Massachusetts. An additional 21 previously banded eiders were also recaptured. This is a record number of Eiders banded in Massachusetts.

This year we conducted an intensive waterfowl hunter survey. Similar large-scale surveys were conducted in 1974, 1986, 1997, and 2008. The major question on the survey this year concerned whether hunters wanted to keep the present system of 3 zones (Berkshire, Central, Coastal), in which each could be divided into 2 segments, or adopt a new option of 2 zones (Inland, Coastal), in which each could be divided into 3 segments. Six thousand Massachusetts state stamp buyers with known email addresses were contacted and asked to participate in an online survey. We received 2,055 responses, 87.5% of whom had bought stamps for waterfowl hunting purposes and had done so in at least 1 of the last 3 years. Overall, 32.4% preferred the new option, 29% the current system, and 38.6% had no preference; 12.3% of hunters hunted in the Berkshire zone, 52.7% in the Central zone, and 45.4% in the Coastal zone. Berkshire and Central zone hunters preferred hunting in October with declining interest as the year progressed, Coastal zone hunters' interest in hunting increased as the calendar year progressed, declining only in the second half of January. In addition, the survey indicated participation in the Youth Day hunts was low, with less than 2% of adult hunters mentoring a youth during the 2019 season. Only 1% of hunters were in the 15-19 age bracket and 12.6% in the 20-29 age bracket, with the bulk of hunters (36.8%) in the 50-64 age brackets. Support for 2 additional days of hunting for active military or veterans was high (84%) but when to hold those days was mixed. Only 16% of waterfowlers always hunted with a dog while 51% never did.

Massachusetts issues individual egg-addling permits for resident Canada goose control under a federal program begun in March 2007. In 2019, we issued 59 such permits, all were returned. The permittees reported addling 1,225 eggs in 327 nests, while USDA/APHIS Wildlife Services addled 648 eggs in 131 nests under their statewide permit.

This year, the project leader attended the summer meeting of the Atlantic Flyway Council technical and council meeting in Jekyll Island, Georgia, September 15-20, and the winter meeting of the Technical Section held in Portsmouth, New Hampshire, February 24-27, as well as participating in two conference calls with the Canada goose committee on September 3, 2019, and February 2, 2020. The project leader is a member on the Mallard, Black Duck, and Canada goose committees as well as the voting representative for Massachusetts.

Black Bear Program
Dave Wattles, Black Bear Program Leader

Black Bear Distribution and Harvest Investigations

A near record total of 15,036 bear-hunting permits were issued for the 2019 hunting season. A total of 207 bears were taken during the 48-day season, including 142 during the 17-day September segment, 31 during the 18-day November segment, and 34 during the 12-day deer shotgun season segment. One hundred and nineteen males, 89 females and 2 of unknown sex were taken in Berkshire (82), Franklin (45), Hampden (33), Hampshire (29), Worcester (17), and Middlesex (1) counties. Seventy eight percent of bears were reported through the online system in 2019, compared to 82% in 2018, 70% in 2017, 76% in 2016, 66% in 2015, 74% in 2014, and 69% in 2013. Results from the 2019 Annual Hunter Survey showed that 27% of respondents reported that they purchased a bear hunting permit in 2019 and 21.6% reported they hunted bear during the 2019 season. Of hunters that reported hunting bear, 65.2% did so while hunting other game and 34.8% specifically targeted bear. Thirty-seven percent of bear hunters hunted during the September bear-only season; 62% of bear hunters hunted in the November season, which overlaps with deer archery season; and 77% of bear hunters hunted during the shotgun season, with only 11.9% of those hunters only targeting bear. There were 29 additional confirmed mortalities in CY 2019. These mortality records are collected by MassWildlife staff and through Environmental Police call logs and included 24 road-kills; 2 bear taken under M.G.L. Ch. 131, Sec. 37; 1 public safety kill; 1 disease; and 1 of unknown cause. MassWildlife received 241 bear calls and the Massachusetts Environmental Police received 234 bear calls.

A proposal to open bear hunting statewide and allow bear hunting during the shotgun deer season was approved by the Fisheries and Wildlife Board in 2014 and became effective for the 2015 bear season. Thirty-four bears were harvested during the new deer shotgun season in 2019 (33 in 2018, 93 in 2017, 47 in 2016, and 59 in 2015).

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; and (4) to develop a comprehensive bear management plan to guide black bear management in Massachusetts. As of June 30, 2020, 23 female bears were being monitored with GPS collars and another 14 females with VHF collars. To date, 67 female bears have been monitored with GPS collars, of which most have been monitored for at least 2 reproductive seasons. Thirteen 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 the Western Wildlife 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 1,870 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.

Furbearer Program
Dave Wattles, Furbearer Program Leader

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 1,760 furbearers were tagged at MassWildlife check stations during the 2019-20 season. The harvest (a combination of hunted, trapped, and/or salvaged) of tagged species included 672 beaver, 118 bobcat, 626 coyote, 152 fisher, 50 gray fox, 17 mink, 22 river otter, and 103 red fox. Trapper survey results indicated that a minimum of 101 raccoon, 89 muskrat, 39 skunk, 36 opossum, and 0 weasel were trapped during the 2019-20 season.

MassWildlife staff conducted a hunter survey of a random sample of license buyers that provided an email address in 2019. Coyote is the most popular furbearer that is hunted. Twenty-two percent of respondents indicated that they hunted coyote, and 40.5% of those respondents specifically targeted coyotes; 5.3% percent of all respondents hunted fox; 4.9% hunted bobcat; 2.3% hunted raccoon; and 0.7 % 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 Wildlife Management Zones (WMZ).

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. As a result, 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 672 trapped beaver during the 2019-20 trapping season, of which 83 were reported as taken under emergency permits. PAC Agents reported taking 182 beaver outside the trapping season (April 15—October 31, 2019) and 144 beaver during the trapping season under emergency permit that were not tagged. Licensed trappers reported through the voluntary trapper survey that 458 beaver were taken under the local Board of Health 10-day Emergency Permit, which includes beaver taken outside the season (369) and only beaver taken during the season that were not sealed at a MassWildlife check station (52). In total, a minimum of 369 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 513 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 coyote, red fox, gray fox, fisher, raccoon, and skunk. (See

also the "Human-Wildlife Conflict Trends Project" section, below.)

Deer Management Program
David Stainbrook, Deer and Moose Program Leader

Harvest and Population

The statewide 2019 harvest of 13,920 deer represents the second-highest harvest ever reported in Massachusetts (Figure 1), the highest of which was the 2018 season. The 2019 total harvest was about 4% lower than the 2018 record season and 0% change from the previous 5-year average. (Table 7.)

The archery season harvest was a new record high and the primitive season harvest was just shy of the 2018 record high. However, the shotgun season harvest was much lower than it was in 2018, likely because deep snow blanketed much of the state, making it difficult for hunters to find places to park and move through the woods. 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 adjusting 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.

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 WMZs. Overall, we've met or are very 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 2). Conversely, deer densities in the eastern part of the state are still above our management range, so antlerless permit allocations have been kept high in an effort to increase the harvest of females. However, challenges remain in eastern Massachusetts because of the lack of hunter-access, which limits our ability to reduce deer numbers.

The ADP allocation for 2019 was 47,300 permits. However, 44,218 permits (93% of allocated) were actually purchased/issued (Table 8). 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 buy over the counter than in previous years. Prior to 2012, we were typically issuing above 95% of the allocated permits in most zones. The solution, beginning in 2014, was to adjust the antlerless permit

Figure 1. Total white-tailed deer harvest by season and year in Massachusetts.

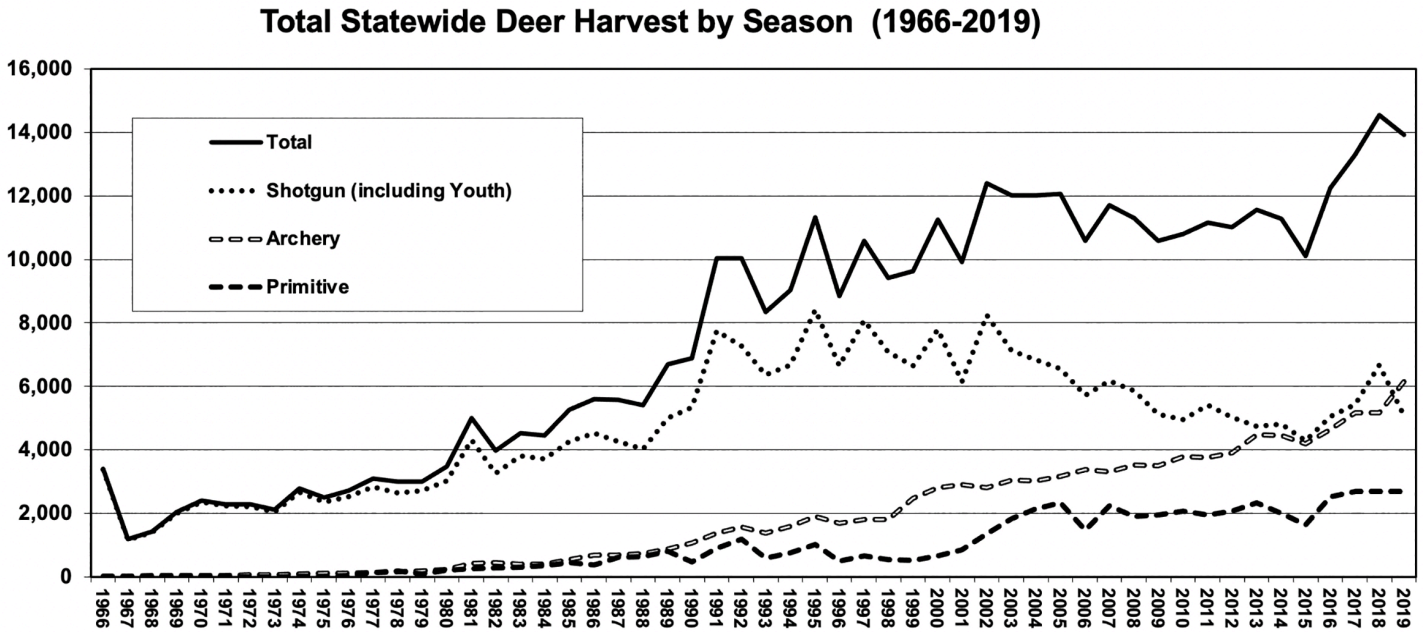


Table 7. The 2019 white-tailed deer harvest by season and sex/age class in Massachusetts, including Quabbin harvest.

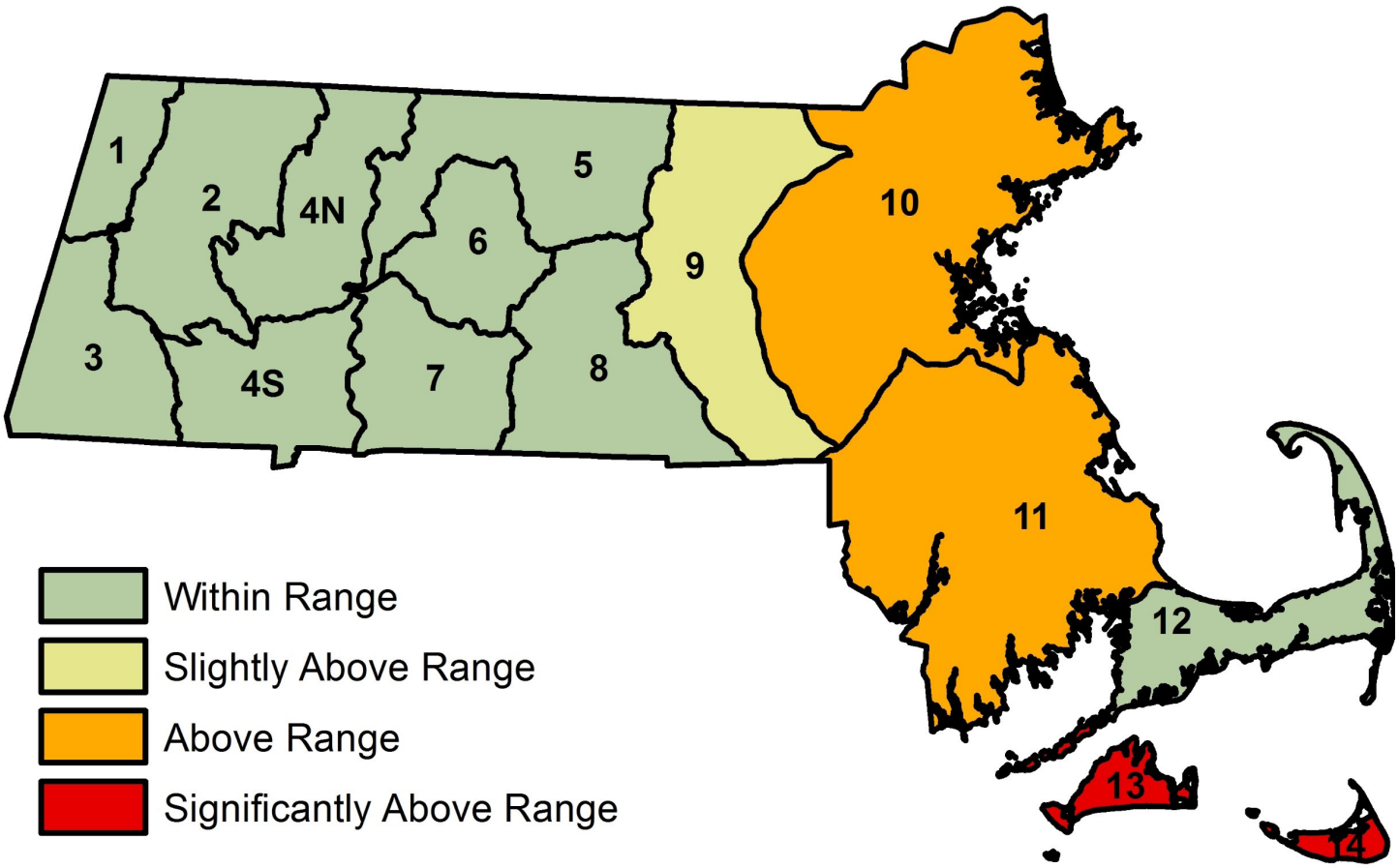
Season	Adult Male	Female	Button Buck	Total	Percent Harvest
Paraplegic/Youth	31	56	7	94	1%
Archery	4,061	1,765	323	6,149	44%
Shotgun	2,461	2,051	444	4,956	36%
Primitive	1,199	1,284	209	2,692	19%
State	**7,764**	**5,171**	**985**	**13,920**	**100%**

Table 8. The 2019 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	Deer Management	2019 Allocation	2019 Issued
1	218	84	7	309	Stabilize	600	556
2	425	79	7	511	Stabilize	300	304
3	376	148	17	541	Stabilize	1,600	1,547
4N	389	125	12	526	Stabilize	600	581
4S	228	74	10	312	Stabilize	500	514
5	512	160	25	697	Stabilize	1,500	1,423
6	136	34	1	171	Increase/Stabilize	300	279
7	421	267	38	726	Stabilize	2,400	2,287
8	554	249	42	845	Increase/Stabilize	2,600	2,446
9	689	491	106	1,286	Reduce/Stabilize	5,500	5,283
10	1,202	1,101	194	2,497	Reduce*	12,000	11,621
11	1,808	1,312	289	3,409	Reduce	13,000	12,640
12	193	88	10	291	Stabilize	1,000	954
13	344	629	146	1,119	Reduce*	2,700	2,307
14	257	315	79	651	Reduce*	2,700	1,476
Statewide	**7,752**	**5,156**	**983**	**13,891**		**47,300**	**44,218**

** Antlerless deer permits are functionally unlimited in Zones 10, 13, and 14*

Figure 2. Map depicting how the current deer densities (from harvest data so 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/tolerance.



allocation model to compensate for the significant proportion of applicants that do not come back to buy over the counter 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 buy over the counter.

Research

No deer-related research projects occurred in FY 2020.

Chronic Wasting Disease

Funding provided by the USDA APHIS ceased in early 2012, thus we did not collect or test any general hunter harvested deer from Massachusetts in 2019. Fewer than 10 disease suspect samples were taken and tested in 2019, all of which came back as not detected. We will continue to sample for CWD from disease suspect deer provided we can allocate the funds required for testing.

Moose Program

David Stainbrook, Deer and Moose Program Leader

Traditionally, MassWildlife has collected reported data of moose-vehicle accidents (MVA). In 2019, 18 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 3, reporting rate is likely low in 2007-2009). Nonetheless, these indices can be useful to biologists, along with other population trends, to monitor moose relative abundance and trends in Massachusetts. The number of reports per town can be useful when making

Figure 3. Total moose-vehicle accidents reported per year from 1980 to 2019 in Massachusetts.

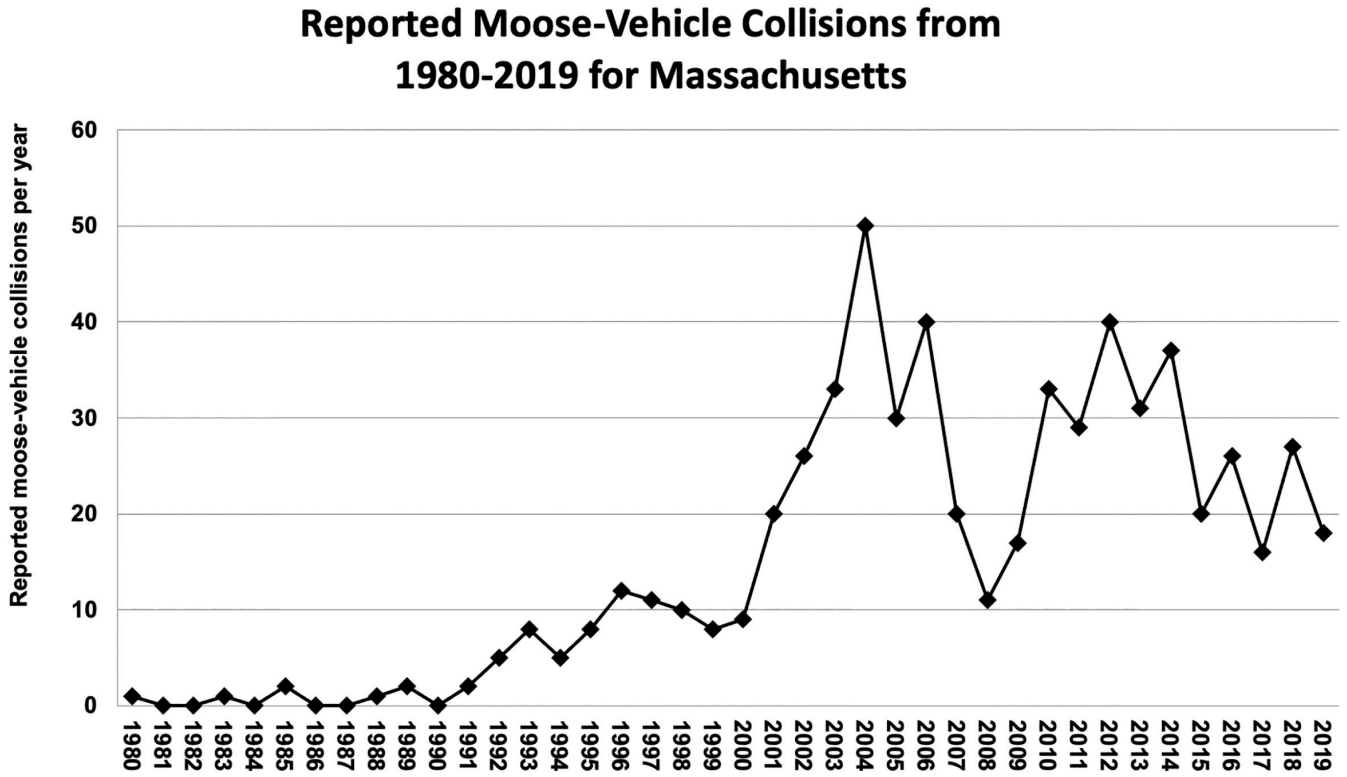


Figure 4. Total moose-vehicle accidents reported by town from 1980 to 2019 in Massachusetts.

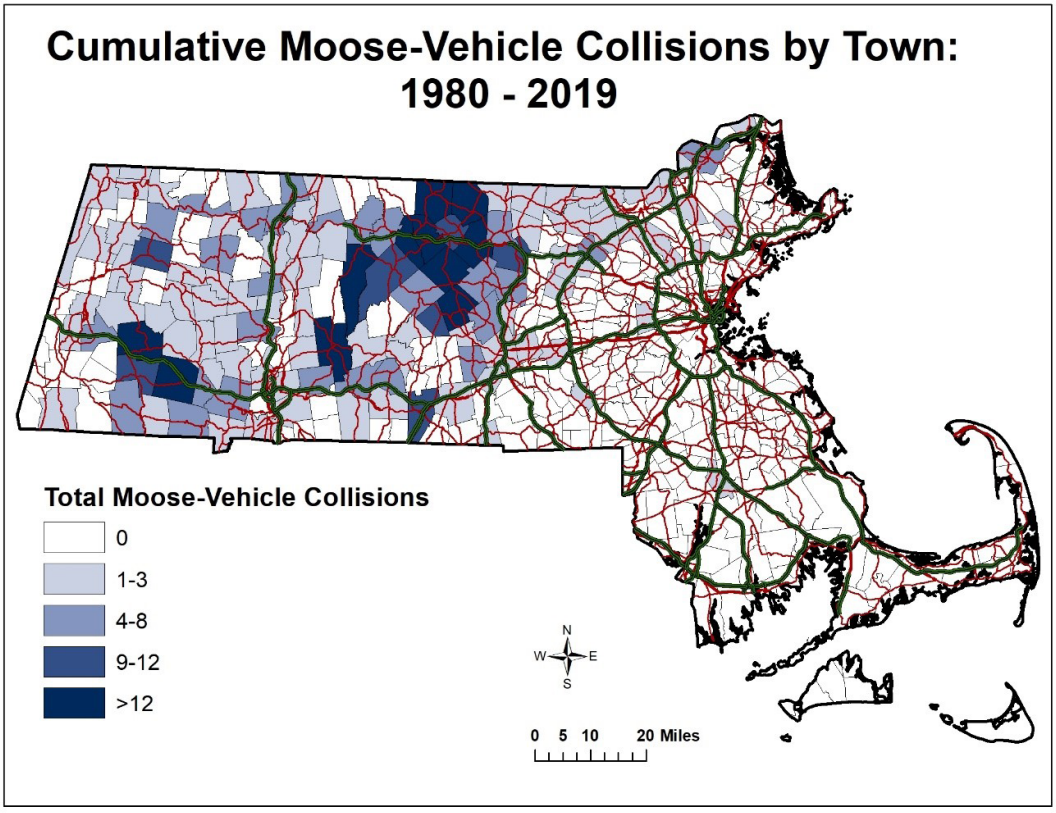
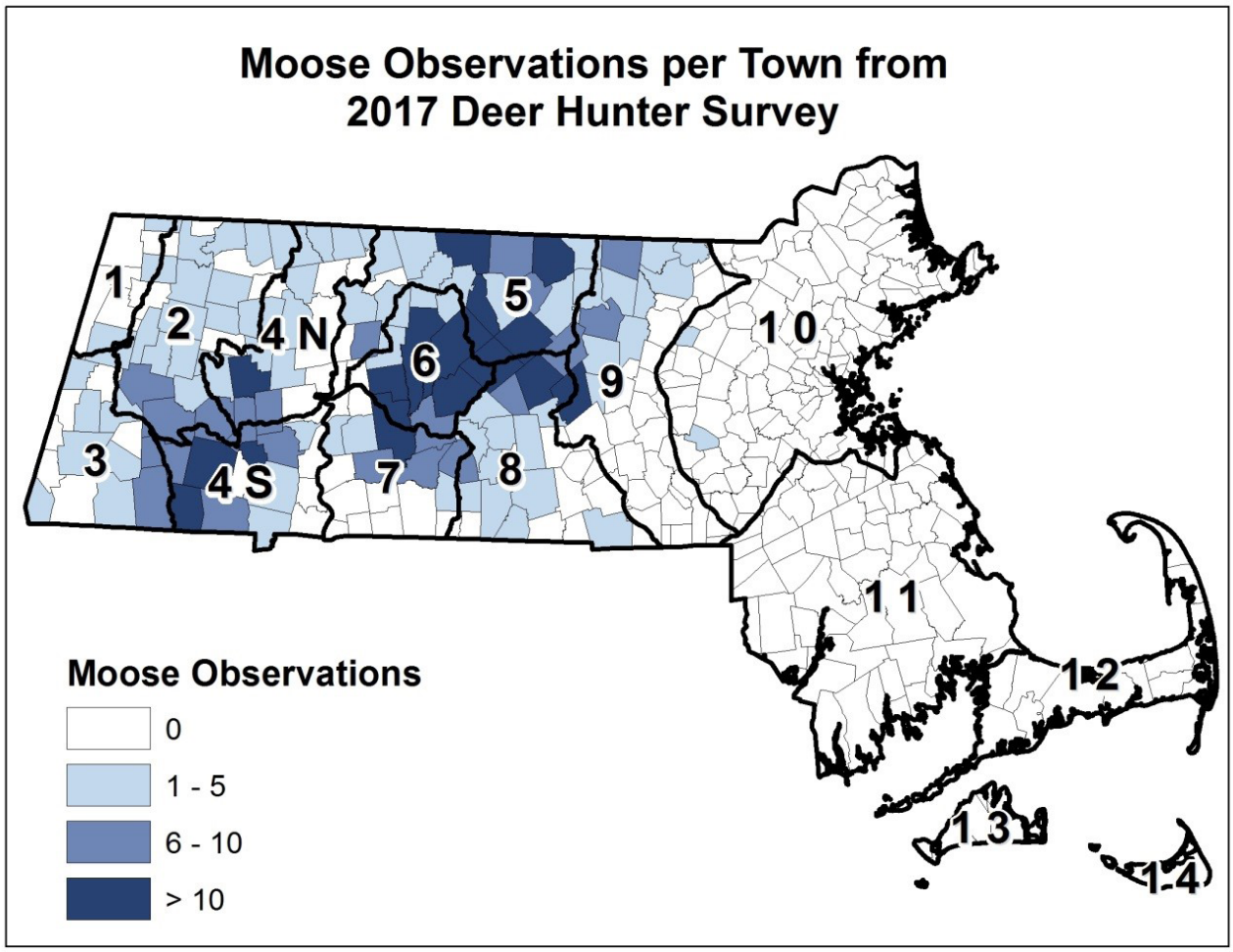


Figure 5. Observations of moose by town reported in the 2017 hunter survey in Massachusetts. The 2018 moose sighting data from the hunter survey had not been analyzed at time of publication.



decisions about areas to focus on with signage on highways (Figure 4). 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 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). We have also begun conducting deer and moose pellet count surveys throughout the state, which will supplement our knowledge.

Additionally, observation data from our hunter surveys can be used to map general moose distribution across the state (Figure 5). The two maps (Figures 4 and 5) were created from completely independent sources of information, yet show very similar spatial trends, thus providing more confidence in these methods.

Chronic Wasting Disease

Funding provided by the USDA APHIS ceased in early 2012, thus we prioritized sampling to fewer than 10 disease suspect moose in 2018, all of which came back as not detected. We will continue to sample for CWD in disease suspect moose provided we can allocate the funds required for testing.

The Human-Wildlife Conflict Trends Project
Susan McCarthy, Wildlife Biologist

Overview

Animal report data are collected at MassWildlife offices via the Massachusetts Division of Fisheries and Wildlife Ani-

mal 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, they 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, we developed a new online data collection system and emphasized the importance of rigorous data collection. The new data collection system gave us the ability to better categorize reports by providing the collector with a set of standard report types from which to choose. Also, we were able to collect data on the type of concern associated with the report. The new system has made data collection and data entry more efficient by first, allowing for multiple reports per page and second, by not requiring the collector to describe the report type therefore, not requiring the enterer to subjectively interpret and categorize the report type. Also, 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 district biologists with information to assist them when providing advice and management options to the general public regarding human-wildlife interactions/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.

Summaries

Via the new system, human-wildlife interactions were recorded in 301 of 351 towns across Massachusetts, amounting to 1,558 total reports submitted from July 1, 2019, through June 30, 2020 (Figure 6). Ninety-nine percent of records (1,548) contained one or more species (18 reports contained more than one species recorded), 99% (1,549) contained a report type, 88% (1,370) contained a concern type other than "no concern," and 87% (1,354) contained a town.

We received reports of 53 different species, of which 12 made up 85% of all reports (Figure 7). We received more reports in June (262, 17%) than any other month followed by July (251, 16%), August (211, 14%), and October (165, 11%; Figure 8). Of the 1,549 reports containing a report type, the highest number of reports were animal sightings and/or requests for general information (1,155, 75%), the second highest number of reports were of wildlife using and/or damaging property (803, 52%), and the least number of reports were those regarding public safety (79, 5%). Reports regarding threats to public safety included: wildlife approaching humans and/or pets on a leash, aggression toward humans, and human attacks. Of the 79 reports of threats to public safety, 8 were reported as human attacks involving chipmunk (1), coyote (3), fox (2), raccoon (1), and wild turkey (1). 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.

Conclusion

The electronic version of the animal report form accounts for the increased reports due to the ease of entering data via an electronic form. The new animal report form seems to have improved MassWildlife staff's ability to collect more objective and robust data regarding human-wildlife interactions. Capturing more diverse human-wildlife conflict data may be the result of several factors: an increased emphasis on collection effort, the implementation of a new electronic animal report form, an actual increase in conflicts, or a combination of some or all of these things. Regardless, MassWildlife staff has found data collection and data entry to be more efficient due to the new animal report form. Also, the new animal report form has proven effective at capturing more robust and less subjective data. Collecting these types of data, affords us the opportunity to conduct more in-depth analyses. In areas where percentage of forest increases, interactions decrease. Understanding the relationship between landscape and interactions can help MassWildlife staff focus management strategies such as education.

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 tend to report more interactions between humans and wildlife than do more rural settings. Also, the proportion of report types is quite similar from last year to this year, and the three most common species remain bear, coyote, and fox.

We can, at the very least, use these data and these results

Figure 6. Top 12 species that were reported to MassWildlife offices as being involved in human-wildlife interactions in Massachusetts between July1, 2019 and June 30, 2020.

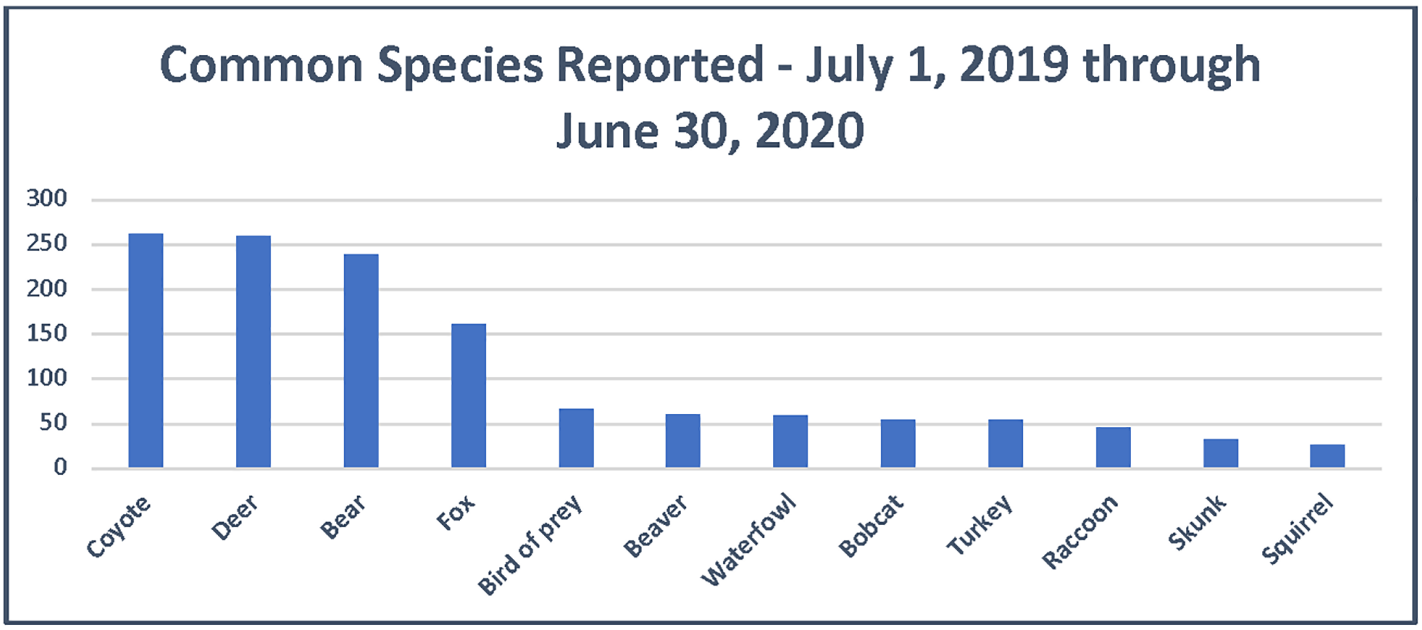


Figure 7. Total reports of human-wildlife interactions by month in Massachusetts between July 1, 2019 and June 30, 2020.

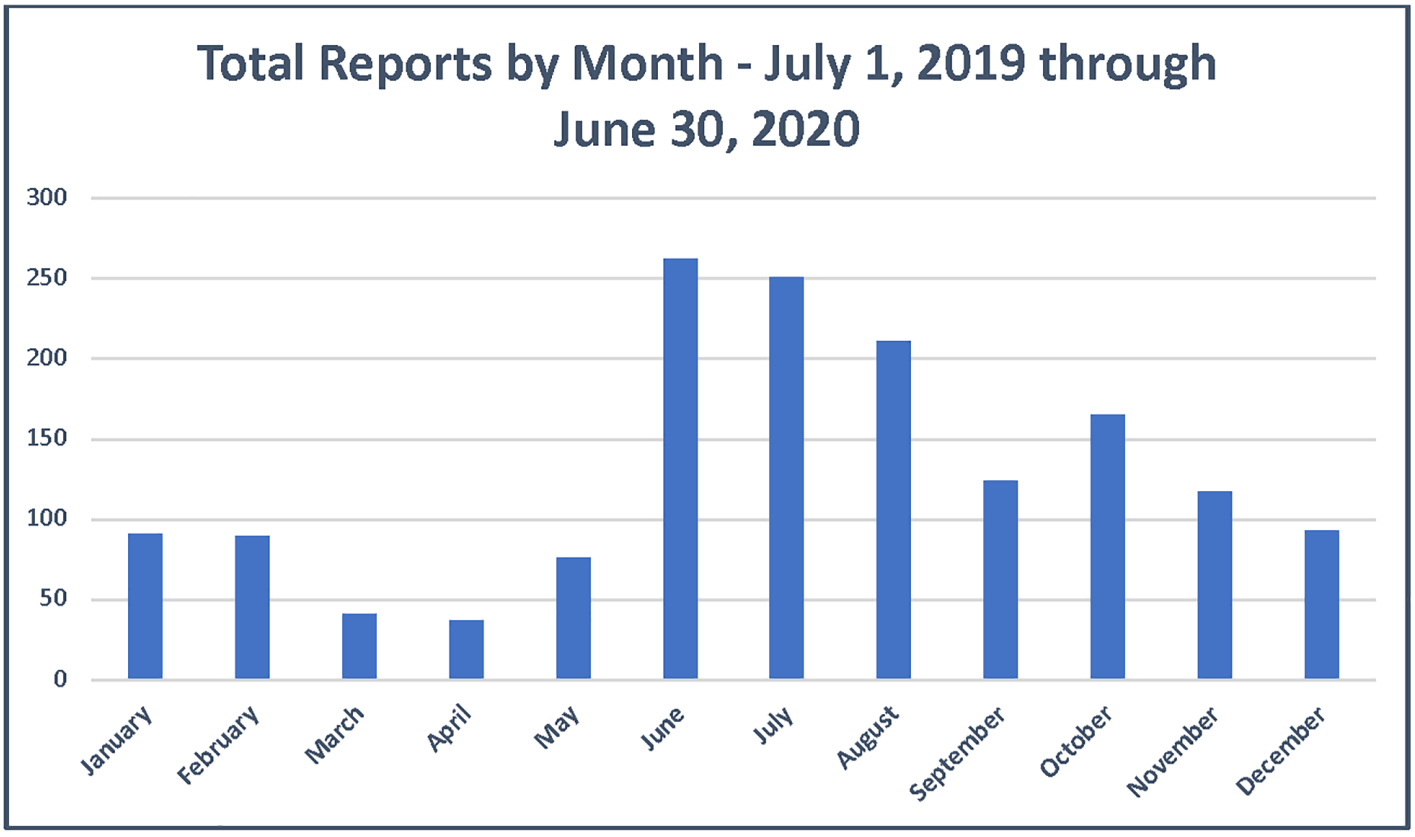
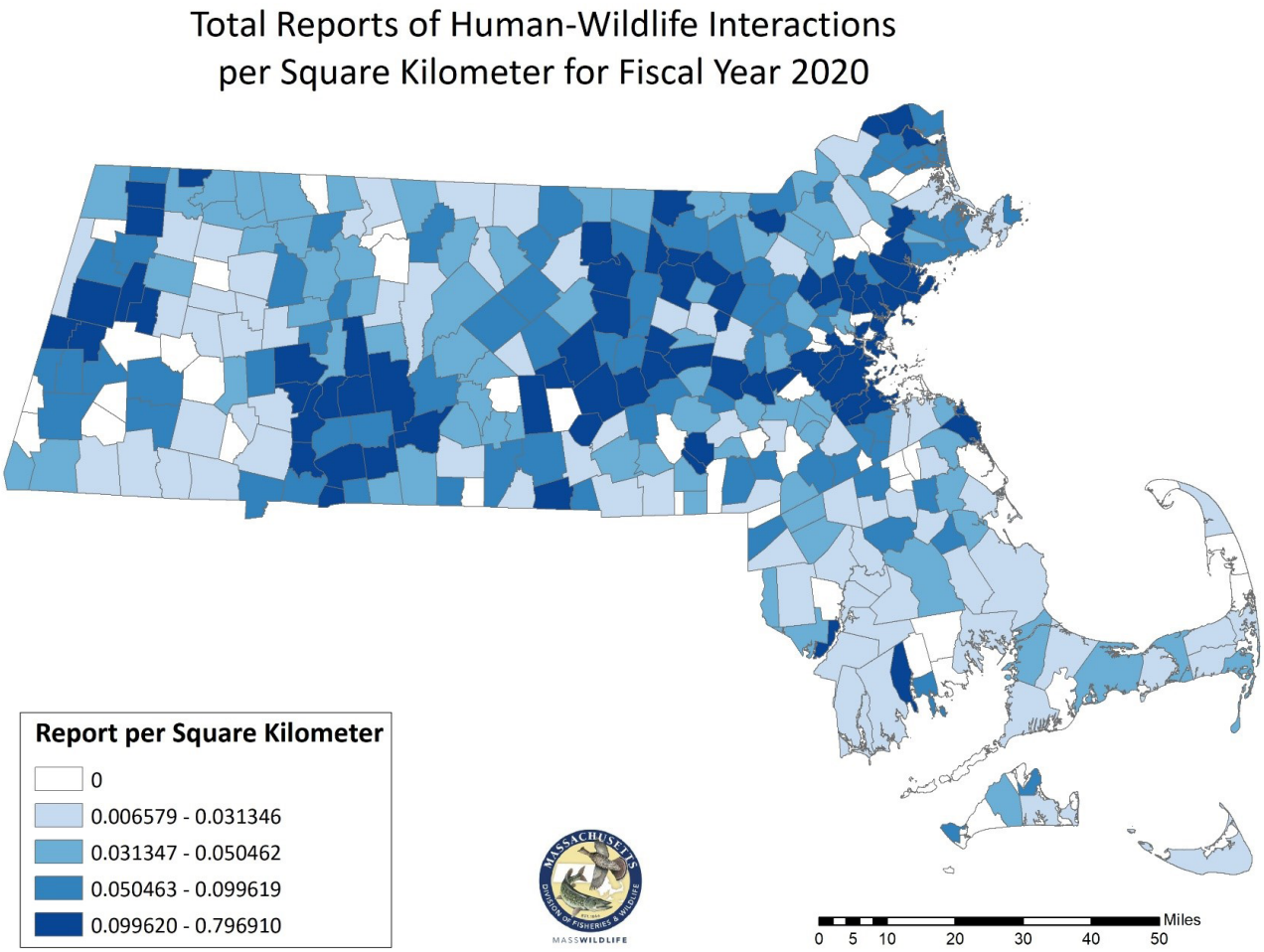


Figure 8.



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 Information and Education (I&E) staff on 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 Annual Report – Wildlife
Andrew Vitz, Ornithologist

American Kestrel Project

MassWildlife and partners continued the American Kestrel project that was initiated in 2013 in hopes of reversing the species' rapid decline in the state. Kestrels nest across Massachusetts and are most common in the Connecticut River Valley and other areas with extensive agricultural 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 on their properties and include the Massachusetts Audubon Society, Keeping Company with Kestrels, Kestrel Land Trust, 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 a few dedicated volunteers (e.g., Ron Rancatti, Ed Neumuth).

In May-June of 2020, MassWildlife and partners conducted a reduced effort on this project due to constraints resulting from the COVID-19 pandemic. However, from the data that was collected, it appears that kestrels had a good nesting

year. This was particularly the case along the Connecticut River Valley. where the Kestrel Land Trust monitors numerous nest boxes. Of the 21 boxes they maintain and monitor, 12/21 (57%) were occupied by nesting kestrels. All 12 of the boxes successfully fledged kestrel chicks and 52 chicks were banded prior to fledging. These results were dramatically improved over any prior year. Kestrels also seemed to have a good nesting season in central Massachusetts, where at least 9 nest boxes produced kestrel fledglings. These boxes were managed by MassWildlife, East Quabbin Land Trust, DCR, Davis Farm, and private landowners. An additional 21 chicks were banded at the boxes in central Massachusetts. The results reported by Joanne Mason from cranberry bogs in southeast Massachusetts were not as promising as in central and western Mass. She reported 8/30 boxes occupied by kestrels and banded young associated with the boxes.

Kestrels remain a species of conservation concern that were recently considered for state-listing as a species of Special Concern. We will continue to work with partners towards conserving this species by maintain/installing/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 to deploy tracking units on kestrels in 2021 to better understand their survival and movements and inform statewide and regional conservation efforts.

Young Forest/Songbird Project

Between early July and mid-August 2019, 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 5 sites all located within Worcester County and were at least 5 acres in size. Sites included the Muddy Brook Wildlife Management Area (Hardwick), Montague Plains Wildlife Management Area (Montague), Leominster Sportsmen's Association (Leominster), and two sites owned and managed by the city of Worcester (1 in Holden, 1 in Paxton). At each site, 9 mist-nets were deployed, and all nets were separated by > 20 meters. Sampling occurred four times at each site between June 27 – August 16, 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 providing an index of the nesting success in the area (by taking a ratio young-of-the-year to adult birds).

In total, 1,002 unbanded birds of 52 species were captured, with the most-captured species being Gray Catbird (247), Common Yellowthroat (106), Chestnut-sided Warbler (55), Ruby-throated Hummingbird (54), and Prairie Warbler (52). In addition, we recorded 136 recaptures of birds previously banded for 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. The overall goal is to establish a long-term project that monitors forest songbird populations in the state while providing information on nesting productivity and how local and landscape-level variables influence bird use of these habitats.

As part of the banding project, we also collaborated with Dr. Sean Williams at the College of the Holy Cross to document the numbers and species of ticks that birds carry during the summer. Every bird captured was scrutinized for embedded ticks, focusing on the face and chin, where ticks find featherless areas to attach to the skin. We found that forest and shrubland songbirds hosted a heavy tick load and carried both larva and nymph-stage deer (black-legged) ticks (no other species of tick was found). Ground- and shrub-foraging species (e.g., Veery, Eastern Towhee) had high numbers of ticks while mid- and upper-canopy species were generally absent of ticks (e.g., Baltimore Oriole, Ruby-throated Hummingbird). Interestingly, birds captured at sites with more fragmentation in the landscape had higher mean tick loads (2.2 ticks per bird) than those at sites in a heavily forested and unfragmented landscape (<1 tick per bird). Additionally, 100 ticks were submitted to UMass for disease testing, and 28 ticks tested positive for Borrelia, 10 for Barbesia, and 14 for Anaplasma. All analyses from this study are preliminary, and the work is ongoing.

Wildlife Staff
Westborough Field Headquarters

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
Brain Hawthorne, Habitat Planning Coordinator
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Sue McCarthy, Wildlife Biologist
Marianne Piché, Habitat Biologist
John Scanlon, Habitat Program Leader
David Scarpitti, Upland Game Project Leader
David Stainbrook, Deer & Moose Project Leader
Andrew Vitz, State Ornithologist
Thomas Wansleben, Habitat Biologist
Dave Wattles, Black Bear & Furbearer Project Leader

Natural Heritage and Endangered Species Program

Eve Schlüter, Ph.D.
Assistant Director, NHESP

Overview

The Natural Heritage & Endangered Species Program (NHESP) is responsible for the conservation and protection of hundreds of species that are not hunted, fished, trapped, or commercially harvested in the state, as well as the protection of the natural communities that make up their habitats.

NHESP currently has a total of 28 staff members distributed primarily among three sections: Conservation Science, Information Management, and Regulatory Review. Conservation Science staff is 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 is 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 Massachusetts Endangered Species Act ("MESA," M.G.L. c. 131A) 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 2 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 a year or more 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.

Background: The process of updating the current MESA list began in November 2017. Between November 2017 and January 2018, staff biologists consulted with outside experts, collated and analyzed data to inform potential list changes, and decided which list changes would be proposed by MassWildlife. Between January and March 2018, staff biologists wrote a total of 15 list change proposals; three additional proposals were received from the Massachusetts Audubon Society. By March 31, 2018, all 18 proposals had been sent to external reviewers (three or four reviewers for each proposal) for assessment and comment. All external reviews were completed and returned by May 31, 2018. Staff biologists revised list change proposals, as needed, as a result of comments and other information received from external reviewers.

In June 2018, all list change proposals were presented at a meeting of MassWildlife Senior Staff for comment and input. A second meeting was held in June 2018 to resolve any outstanding issues and finalize decisions regarding MassWildlife's recommended changes to the MESA list. It was decided that MassWildlife supported 17 of the list change proposals, including two of the bird listing proposals received from MassAudubon, but did not support MassAudubon's proposal to list the American Kestrel (*Falco sparverius*).

On July 12, 2018, all list change proposals (including the proposal to list the American Kestrel) were presented to the Natural Heritage and Endangered Species Advisory Committee, along with copies of all comments and other information provided by external reviewers. These materials were reviewed by the Advisory Committee between July and October 2018. On October 11, 2018, members of the Advisory Committee discussed and voted on all proposed changes to the MESA list. The Committee voted in support of all 17 MESA list changes supported by MassWildlife. Regarding the American Kestrel, the Advisory Committee vote was evenly split, with two votes to support MassAudubon's

Table 1. The most recent update to the MESA list occurred on January 10, 2020.

Listing of nine species;

Taxonomic group	Common name	Scientific name	Current status
Birds	Saltmarsh Sparrow	*Ammodramus caudacutus*	Special Concern
Birds	Eastern Meadowlark	*Sturnella magna*	Special Concern
Reptiles	Eastern Hognose Snake	*Heterodon platirhinos*	Special Concern
Bees	Walsh's Anthophora	*Anthophora walshii*	Endangered
Bees	American Bumble Bee	*Bombus pensylvanicus*	Endangered
Bees	Yellow-banded Bumble Bee	*Bombus terricola*	Threatened
Plants	Squarrose Sedge	*Carex squarrosa*	Threatened
Plants	Two-flowered Rush	*Juncus biflorus*	Threatened
Plants	American Chaffseed	*Schwalbea americana*	Endangered

Delisting of five species;

Taxonomic group	Common name	Scientific name	Former status
Dragonflies	Cobra Clubtail	*Gomphus vastus*	Special Concern
Dragonflies	Umber Shadowdragon	*Neurocordulia obsoleta*	Special Concern
Dragonflies	Stygian Shadowdragon	*Neurocordulia yamaskanensis*	Special Concern
Plants	Crooked-stemmed Aster	*Symphyotrichum prenanthoides*	Special Concern
Plants	Smooth Woodsia	*Woodsia glabella*	Endangered*

*Extirpated from Massachusetts.

Change in status for three species;

Taxonomic group	Common name	Scientific name	Current status	Former status
Birds	Peregrine Falcon	*Falco peregrinus*	Special Concern	Threatened
Birds	Bald Eagle	*Haliaeetus leucocephalus*	Special Concern	Threatened
Amphibians	Blue-Spotted Salamander	*Ambystoma laterale*	Threatened*	Special Concern

*Bristol and Plymouth counties only.

Updates to scientific and common names as needed; and

Rearrangement of the plant list alphabetically by scientific name (formerly arranged by taxonomic family), for ease of use and to match the animal list.

proposal to list this species under the MESA, and two votes to not list it at this time. (The fifth full, voting member of the Advisory Committee was not present at the meeting.)

On October 30, 2018, all list change proposals were presented to the Fisheries and Wildlife Board, along with the recommendations of both MassWildlife and the Advisory Committee, the only difference in the recommendations being the split vote of the Advisory Committee regarding the American Kestrel. The Fisheries and Wildlife Board voted to proceed with both a Public Hearing and a vote of the Board on the proposed changes to the MESA list at future meetings.

On August 28, 2019, all list change proposals were presented in a Public Hearing at a meeting of the Fisheries and Wildlife Board, opening the two-week public comment period on the proposed regulatory changes. At the subsequent meeting of the Fisheries and Wildlife Board on September 18, 2019, after consideration of all public comment, the Board voted to approve the 17 list changes supported by MassWildlife, but not to list the American Kestrel (*Falco sparverius*).

Between late September and December of 2019, the MESA list changes approved by the Fisheries and Wildlife Board were compiled in a Final Proposed Regulatory Amendment Package and submitted to the Executive Office of Energy and Environmental Affairs (EOEEA) for review and approval. After EOEEA approval, the Final Regulatory Amendment Package was submitted to the Executive Office for Administration and Finance (A&F) for review and approval. After A&F approval, the approved MESA list changes were delivered to the Secretary of State's Publications and Regulations Division, and the final MESA list changes were published in 321 CMR 10.90 and 10.91 on January 10, 2020.

Linking Landscapes for Massachusetts Wildlife

In 2008, MassWildlife and its 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, 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 2020, 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 collaboration with MassDOT and the Nature Conservancy (TNC), we continued to monitor existing roadway crossings (bridges and culverts) for wildlife use and connectivity. These sites have been assessed using terrestrial connectivity survey protocols and through the deployment of wildlife cameras. Collaboration with the Wildlife Section of MassWildlife and the USGS Cooperative Research Unit at the University of Massachusetts to analyze the movement patterns and use of roadways by black bear and moose continues.

In FY2020, 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, we constructed over 40 bat boxes. These boxes will be installed on MassWildlife's Wildlife Management Areas and on MassDOT's Salt Sheds and Outbuildings.

2019–2020 Field Season Summary

Birds

Piping Plover; Federally Threatened
Observers reported breeding pairs of Piping Plovers present at 181 sites; 132 additional sites were surveyed at least once, but no breeding pairs were detected at them. The population increased 8.1% relative to 2018. The Index Count (statewide census conducted 1-9 June) was 724 pairs, and the Adjusted Total Count (estimated total number of breeding pairs statewide for the entire 2019 breeding season) was 743 pairs. A total of 1,144 chicks were reported fledged in 2019, for an overall productivity of 1.54 fledglings per pair, based on data from 99.7% of pairs.

American Oystercatcher
MassWildlife coordinated annual monitoring and protection efforts for American Oystercatchers conducted by a coastwide network of cooperators. Approximately 170 sites were surveyed during May and early June 2019. Preliminary results indicate that Massachusetts supported an estimated 211 breeding pairs of oystercatchers in 2019.

Terns, Laughing Gulls, and Black Skimmers
Cooperators in Massachusetts surveyed approximately 140 coastal sites in 2019 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 2,249 pairs of Roseate Terns, 19,945 pairs of Common Terns, 3,528 pairs of Least Terns, 3,272 pairs of Laughing Gulls, a single Arctic Tern individual, and 13 pairs of Black Skimmers.

Buzzards Bay Tern Restoration Project
We documented 7,408 pairs of Roseate and Common Terns on Bird, Ram, and Penikese Is. in 2019, a 12% decrease from 2018 numbers (8,416 pairs). These islands supported 2,035 "peak season" pairs of Roseate Terns (vs. 2,280 in 2018; -11%) and 5,373 "peak season" pairs of Common Terns (vs. 6,136; -12%). 2019 was remarkable for the extremely low availability of prey, particularly for Common Terns at Bird and Ram Is., and, to a lesser extent, Roseate Terns at these sites and Common Terns at Penikese. Lack of prey was responsible for delayed nesting, small clutch sizes, reduced productivity, and possibly smaller colony sizes.

Bird Island
Vegetation was abundant on Bird I. this year. The 1,500 seaside goldenrod plugs we planted on the new fill in September 2018 survived the winter well and thrived. No flooding issues were observed despite ample rain. Median lay dates for Common Terns were 7 days later than in 2018 and for Roseate Terns, 8 days later. Clutch sizes for both species were smaller than in 2018. Common Tern numbers decreased 11% to 1,855 pairs (vs. 2,079 pairs in 2018). Productivity was poor (0.15 fledglings/nest vs. 0.61), due to lack of food. Roseate Terns decreased slightly (6%; 1,101 vs. 1,175 pairs). Productivity was fair (0.79 fledglings/pair vs. 1.04), reflecting below average food resources. There was some predation by Peregrine Falcons during the season.

Ram Island
Median lay dates for Common Terns were 9 days later than in 2018 and for Roseate Terns, 6 days later. Clutch sizes for both species were smaller than in 2018. Common Tern numbers on Ram I. decreased 14% to 2,631 pairs (vs. 3,053 in 2018), and productivity was nearly zero (0.03 fledglings/nest vs. 0.81). Roseate Terns decreased 16% to 919 pairs (vs. 1,093 in 2018). Food was below average for Roseates and productivity was fair (0.80 fledglings/pair vs. 0.98). There was substantial predation by Peregrine Falcons during the season.

Penikese Island
Median lay dates for Common and Roseate terns were similar to 2018 and for both species, clutch sizes were larger. Common Tern numbers decreased 12% (887 vs. 1,004 pairs in 2018) probably due to predation. Productivity was very low (0.28 fledglings/nest vs. 1.1 in 2018), due to heavy depredations by Black-crowned Night Herons, and, to a lesser extent, gulls. Roseate Terns increased from 12 to 15 pairs and productivity was poor (0.33 fledglings/nest vs. 1.10) due to poor hatching success (many abandonments) and poor fledging success (no survival of B-chicks). One pure pair of Arctic Terns nested and both chicks they produced probably died before fledging. The mixed Arctic Tern/Common Tern pair nested; one of two eggs hatched and the hybrid chick was predicted to fledge.

Common Loon
State-wide monitoring of nesting loons was a collaborative effort among staff at the Massachusetts Division of Fisheries and Wildlife (DFW), Massachusetts Department of Conservation and Recreation (DCR), and Biodiversity Research Institute (BRI). Prior to the nesting season, MassWildlife staff deployed nesting rafts at Cleveland Brook Reservoir (Dalton). Rafts also were deployed at the Quabbin and Wachusett Reservoirs (monitored by DCR) and the Pine Hill Reservoir (monitored by city of Worcester). Throughout Massachusetts, waterbodies with suitable loon nesting habitat were surveyed to determine if they were being used by loons during the nesting period. Sites were surveyed by a single observer 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 determine if the bird(s) had any color-bands used to identify individuals. Once territorial loons were found, they were monitored to

locate active nests and determine reproductive success.

During the 2019 nesting season, 40 territorial pairs of loons were documented on 22 waterbodeies. Reproductive success was estimated to be 0.42 chicks surviving (CS) per territorial pair (TP), just under the level thought to be necessary to support a sustainable population (0.48 CS/TP). The majority of the loon population in the state nest on the Quabbin (16 territorial pairs) and Wachusett Reservoirs (5 territorial pairs), and these birds are monitored by DCR staff. Nests were documented for 5/16 pairs on the Quabbin, and these nests produced 8 hatchlings, with 5 surviving to fledging. On the Wachusett Reservoir, nests were documented for 4 pairs, and these produced 5 hatchlings and 4 fledglings. MassWildlife and BRI staff monitored loon pairs on 18 waterbodies not managed by DCR and primarily located on lakes, ponds, and reservoirs in north-central Massachusetts. Of these, nesting was documented at 7 sites, producing at least 8 hatchlings and 6 fledglings.

Bald Eagle

During the summer of 2019, there were 72 known territorial pairs of Bald Eagles in Massachusetts. Although this represents fewer documented pairs than in 2018 (77 pairs), it is likely the lower numbers are due to reduced capacity to monitor the increasing eagle population throughout the state. The highest concentrations of eagles were along the Connecticut River (14 territories) and Quabbin Reservoir (7 territories). 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 Hopkinton, Brewster, Wareham, Plymouth, and Auburn. In total, 34 successful nests fledged 68 eagle chicks of which 32 were banded with a USGS federal band and a field readable color band uniquely identifying each individual. This is the 31st year that Bald Eagles have raised young in Massachusetts since their restoration. During these 31 years, at least 837 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.

The 2019 Spring Nesting Eagle Survey took place on April 12, 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 the state. In addition to the single day count, information on nesting eagles is gathered opportunistically throughout the year.

Peregrine Falcon

During the 2019-2020 nesting season (July 1, 2019-June 30, 2020), 46 total pairs likely nested, but 5 pairs were not confirmed and 3 confirmed pairs were not monitored closely enough to know their outcome. At least 38 pairs laid eggs (5 pairs failed), 25 pairs are known to have hatched eggs (66%) and all 25 fledged at least 1 chick. Forty chicks (23 males, 17 females) were banded from 15 nests (60% 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 Lawrence and Russel. This is the 34th year that Peregrine Falcons have raised young in Massachusetts since their restoration. During these 34 years, at least 809 wild-born chicks are known to have fledged.

Grassland Birds

The Westover Air Reserve Base (WARB) was surveyed for grassland birds in June 2019 to evaluate how the modified protocol for grassland management on the airfield was impacting state-listed grassland birds. Recently, the WARB initiated a policy to maintain grass height between 7-14 inches throughout nearly the entire airfield. Without taking any additional measures, this policy would have required the airfield to be cut approximately every 2 weeks, which would have resulted in nesting failure for many of the grassland birds at the Base. However, MassWildlife worked with natural resource managers at WARB to identify a plan to minimize mowing during the majority of the nesting period. This plan included the application of herbicide and plant growth inhibitors to reduce the early season growth of cool-season grasses and promote a little bluestem dominated grassland. Little bluestem is a native warm-season grass that naturally would require mowing until July and after most nesting occurs. This grassland was surveyed using a meandering transect methodology. The focal species for these surveys included Grasshopper Sparrow, Upland Sandpiper). Species recorded in these surveys included Upland Sandpiper, Grasshopper Sparrow, Vesper Sparrow, Savannah Sparrow, Eastern Meadowlark, Bobolink, American Kestrel, Killdeer, Northern Harrier, and Horned Lark.

During these surveys the most commonly detected birds (with total numbers in parentheses) were Grasshopper Sparrow (146), Savannah Sparrow (74), Bobolink (81), Upland Sandpiper (73), Eastern Meadowlark (88), Horned Lark (18), and Killdeer (10). Results were similar to prior surveys suggesting a stable population in recent years at this regionally important grassland site (Table 2). MassWildlife continues to work with the natural resources staff at WARB to encourage native grasses at the site and healthy bird populations. Ongoing management includes the use of a spring herbicide/growth inhibitor treatment and prescribed burning to favor little bluestem over exotic cool-season grasses. The conversion of the grassland to little bluestem results in considerably less mowing at the site during the nesting pe-

Table 2. Numbers of grassland birds documented during surveys between 2007-2019 at the Westover Air Reserve Base in Chicopee, MA. All adults were recorded for Upland Sandpiper, Eastern Meadowlark, Killdeer, Horned Lark, and American Kestrel while only singing males were documented for Grasshopper Sparrow, Savannah Sparrow, and Bobolink. * Two smaller areas could not be surveyed in 2019 due to parked military planes in those locations.

Species	2007	2009	2012	2015	2016	2019*	Average	SD
Upland Sandpiper	98	57	53	106	86	73	79	22
Grasshopper Sparrow	186	131	216	177	156	146	169	31
E. Meadowlark	104	89	67	95	83	88	88	12
Bobolink	78	51	80	135	104	81	88	28
Savannah Sparrow	84	72	62	116	118	74	88	24
Killdeer	33	4	5	10	5	10	11	11
Horned Lark	76	30	22	18	17	18	30	23
Am. Kestrel	0	3	2	2	0	1	1.3	1.2

riod (May-July).

Eastern Whip-poor-will

We trapped, removed past season GPS tags, and deployed new GPS tags (Lotek, Pinpoint) on Eastern Whip-poor-wills to collect location data on the wintering grounds and migratory pathways from birds nesting in Massachusetts. To capture the birds we used playback units to broadcast whip-poor-will calls and lure them into mist-nets. This trapping was conducted during the 3-4 hours after sunset when the birds are most active. Once birds are captured, they were fitted with a GPS unit using a backpack style leg-loop harness that is commonly used to safely and effectively attach tracking units to a variety of types of birds. The harness was constructed from Stetch Magic jewelry cord, which provides a good fit and excellent durability. During the following nesting season, these birds will be targeted for capture in order to remove the GPS tags and allow for the data to be extracted from the units. We deployed tracking tags at three sites (Bolton Flats WMA, Montague WMA, Joint Base Cape Cod) that have high densities of nesting whip-poor-wills. This will allow us to maximize our ability to recapture birds and remove units the following year.

During summer of 2019 we captured and deployed 31 Lotek Pinpoint GPS tags on Eastern Whip-poor-wills to continue to collect data on the birds' migration pathways, wintering areas, and survival. These birds will need to be recaptured and the tags removed in 2020 in order to download the data stored on the devices. We also retrieved 12 GPS units representing 57% of those deployed on males in 2018. Tags were collected for 9/10 of the after-second-years males and 3/11 of the second-year males tagged. This suggests that annual survival is high for older birds and that younger birds may not yet have secured a breeding territory. The retrieved tags collected a mean of 53 point locations (range 35-61). On average birds left for fall migration on September 13, arrived on wintering territories on November 2, remained on these territories for 147 days, and departed on spring migration on March 28. Fall migration pathways followed a land-based route to their wintering grounds that includes going east of the Appalachian Mountains and along the Gulf Coast into Mexico and Central America. The spring migration also followed a land-based path but tended to be to the west of their fall route. Some of the stop-over areas used during migration were small forest patches surrounded by an agriculture or urban matrix. Winter mean territory size was 3.2 hectares and was estimated using an average of 23 data points for each bird. Winter territories were located in landscapes with more forest cover and less agriculture than paired random locations. These data are filling in critical information on the ecology of the species, and the data will inform strategies for developing full life-cycle conservation plans for the Eastern Whip-poor-will.

The statewide nightjar survey project based on the Nightjar Survey Network's protocol continued into its ninth consecutive year. Some aspects of the project were limited due to Covid-19 considerations (ex. the Quabbin Island surveys did not occur and some routes typically run by multiple people were suspended), but still, 17 routes were run in 2020. Surveys once again took place in all of 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. Unlike previous recent years, very few chuck-wills-widow were detected. 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. Continuing a major project that has run continuously for 35 years, MassWildlife and key partners headstarted Northern Red-bellied Cooters by 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 winter season.

2019 Nesting Season.—The 2019 Northern Red-bellied Cooter nesting season lasted from 6 June to 5 July. A total of 32 nests were protected by John Crane at three ponds in Plymouth and Lakeville, which provided 114 hatchlings for the headstart program. John has coordinated nest protection efforts for MassWildlife since 2001. Additional hatchlings from Massasoit NWR and holdovers from the previous year were also included in the 2019–2020 headstart program.

2020 Headstart Release.
A total of 138 headstarted turtles were released between 6 and 28 May 2020 to four separate waterbodies in the town of Plymouth, including one pond mostly owned by MassWildlife (Cooks Pond). From 1984 to 2020, a total of 4,747 headstarted Northern Red-bellied Cooters have been released by MassWildlife and partners. Because of widespread school closures related to COVID-19 beginning in mid-March 2020, MassWildlife biologists worked with the Bristol County Agricultural High School and other key partners to relocate and house most of the young turtles about two months before they are generally released.

Species Status Assessment. MassWildlife's state herpetologist assisted the U.S. Fish and Wildlife Service to 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.

Bog Turtle; Federally Threatened
The Bog Turtle 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. MassWildlife biologists conducted formal Bog Turtle population monitoring with The Nature Conservancy (TNC) and other partners throughout 2019 at the two known extant sites. At the northern Bog Turtle site, three beaver deceiver/flow devices were maintained by MassWildlife's Western District and NHESP staff, and beavers were trapped in spring and fall to reduce ongoing flooding pressure on sensitive fen habitats. Over the past 10 years, significant progress has been made managing water levels and controlling invasive plants. Continuing a study initiated in 2018, we radiotracked roughly 20 adult Bog Turtles at two sites for a second year throughout 2019 in partnership with TNC and continued tracking these turtles into 2020. MassWildlife joined with Pennsylvania, New Jersey, Connecticut, and New York to prepare a regional Competitive State Wildlife Grant application for the implementation of a Bog Turtle Conservation Plan (Erb 2018). The grant application was submitted to the U.S. Fish and Wildlife Service in July 2019, and the award was approved in the spring of 2020. We began the initial coordination for this three-year project with the Massachusetts Cooperative Fish and Wildlife Research Unit at UMass Amherst. Our focus in the coming 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 has been extirpated across much of eastern Massachusetts in recent decades and is a regional Species of Greatest Conservation Need. The thirteen northeastern States have been working together to conserve this species for about ten years, supported by one Competitive State Wildlife Grant and three Regional Conservation Needs (RCN) grants. Having completed a Conservation Plan for the species from Maine to Virginia in 2018, MassWildlife served as the lead state on a Competitive State Wildlife Grant application to implement the Conservation Plan (Jones et al. 2018). Eight partner state agencies in the Northeastern United States joined the initiative. MassWildlife biologists also co-chaired 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.

A rangewide 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 May and June 2020.

Further, we expanded a major, 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 radio tracked in Middlesex and Essex counties to locate and protect nests. In May of 2020, headstarted Wood Turtles were released into their natal site of origin to augment the local populations.

Finally, MassWildlife staff helped to plan and organize the second Conservation Symposium for Wood Turtle conservation, held jointly with the Spotted and Blanding's Turtle

working groups in West Virginia. Research conducted by MassWildlife biologists on Wood Turtle populations statewide was published in Herpetological Review and research on Wood Turtle-mussel associations across New England was published in the Canadian Field Naturalist.

Eastern Box Turtle
MassWildlife worked closely with biologists from the Nature Conservancy to facilitate habitat protection efforts for the Eastern Box Turtle through mitigation funds for offsite conservation established through MESA Conservation and Management Permits. MassWildlife biologists also worked with Patrick Roberts, a graduate student at UMass Amherst, to continue a follow-up study of Box Turtle movements and ecology at two sites in the Connecticut Valley first studied by Willey (2010) and Erb et al. (2015), and established a contract with Kiah Walker to evaluate the effect and influence of prescribed fire on Box Turtle persistence.

Spotted Turtle
In the second full year of a Competitive State Wildlife Grant with Virginia and other states from Maine to Florida, MassWildlife conducted field surveys and trapping for the Spotted Turtle from the Islands to Berkshire County, with a major emphasis on historically studied sites in Hampshire and Worcester counties. We also continued a partnership with the USFWS Eastern Massachusetts NWR to study to significant populations on federal land. Finally, MassWildlife biologists assisted with the organization and planning of a rangewide genetic study and conservation plan for the species.

Northern Diamondback Terrapin
MassWildlife biologists helped to coordinate and standardize key methodological elements of terrapin research from 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. 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
As is now well-known, Massachusetts rattlesnake populations have dwindled to five isolated populations, several of which appear to be declining. Mass Wildlife maintained formal coordination with New Hampshire Fish and Game, Vermont Fish and Wildlife, and Connecticut Department of Energy & Environmental Protection (the three other New England states with extant rattlesnake populations). 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
In 2019, 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
With the help of volunteer monitors, we continued implementation of Year 4 of a statewide monitoring plan for Eastern Spadefoot during July–November 2019. As in previous years, monitors at a Rehoboth site observed spadefoot activity through the month of October and into early November. Adults and juveniles were observed, with the latter believed to represent three separate cohorts of metamorphs that – under the authorization of special permits – had been captive-reared and released back to the site following "tadpole rescues" during spring 2017, 2018, and 2019. Those observations continue to provide encouraging data on the effectiveness of tadpole rescue as a last-resort management option when impaired pools dry prematurely. Subsequently, the Rehoboth Land Trust worked with the NHESP in November to develop a management plan to partially restore that basin to a more viable spadefoot breeding habitat. The plan, which aims to improve water temperature for tadpole growth and reclaim some volume capacity lost to lawn construction and other landscaping activities of the past, entails removal of all trees from the basin interior, removal of trees and some overhanging limbs from portions of the southwestern bank, and removal of a strip of Phragmites sp. that had filled the southern margin. Tree and limb removal were completed later that month.

We began implementation of Year 5 of the statewide monitoring plan during April–June 2020, though the COVID-19 pandemic reduced our activity substantially. The night of May 1st marked the fourth consecutive year in which spadefoots bred at multiple sites across the state (following the 2014–2016 drought years). We documented spadefoot choruses in Wellfleet, Barnstable, Rochester, Westport, Taunton, Rehoboth, Wayland, and Hadley; a population in Edgartown bred later in the season, on May 23rd. Preliminary data indicate eggs and/or tadpoles were confirmed at Barnstable, Rochester, Westport, Rehoboth, Wayland, and Edgartown, and that metamorphs were confirmed at Edgartown. Cool weather during most of May followed by hot, dry weather at the end of the month and into June posed challenges to tadpole growth and pool longevity. Tadpoles were

not found in Taunton when that pool still had water in late May, and reproductive outcomes at Rochester and Wayland were uncertain when monitoring visits in early June found the pools dry. One of the Rehoboth pools once again dried prematurely, and so a portion of the tadpoles were collected for captive-rearing and release. Eastern Spadefoot did not breed at Westfield, nor at the constructed pool in Sunderland (Kestrel Land Trust pool). Although small numbers had been heard calling at several locations in Hadley, none of the locations appeared to receive enough rain to sustain a successful reproductive effort. The well-known breeding pool in Hadley was not monitored, nor was the East Longmeadow site. Calling, egg, and nocturnal visual surveys at the Southwick WMA did not detect presence of the species, and so the status of the attempted population introduction there is uncertain. As breeding did not occur at the donor site in Westfield, no spadefoots were introduced to the WMA in 2020. At the time of this writing, we were still awaiting results from surveys in Northampton and Ipswich (Crane Beach), where populations may be extirpated.

We continued to study the challenge of constructed pools filling with water prior to fall and while some dragonfly species are still on the wing, thereby allowing for presence of dragonfly larvae (effective tadpole predators) the following spring. At the Southwick WMA, pools were monitored into mid-October 2019; one pool ("P1") was completely dry, another ("P3") was almost dry but contained some irretrievable dragonfly larvae, and the other pool ("P2") was almost dry and had most (if not all) dragonfly larvae removed by hand. Rains shortly thereafter likely enabled all 3 pools to hold water through the remainder of the fall and into spring. No dragonfly larvae were found in P1 or P2 during spring 2020; some larvae were likely present in P3, as several Green Frog tadpoles were observed there in early May. At the Kestrel Land Trust Pool in Sunderland, a skimmer larva was observed in early May, indicating that the pool must not have remained dry deep enough into the fall to prevent dragonfly reproduction. Summer 2020 brought significant drought, and all 4 aforementioned pools were completely dry for an extended period.

Marbled Salamander

We conducted limited surveys for Marbled Salamander September 2019 – January 2020 in Westport (8 cover-object searches), Uxbridge (1 cover-object search, 13 larval searches), and Plainville (2 cover-object searches, 1 larval search). The only detections of Marbled Salamander consisted of an adult male in each of two vernal pool basins in Westport, suggesting discovery of 2 new breeding locations within a broader site of known occurrence. Most larval searches in Uxbridge were at a site surveyed unsuccessfully in previous years and were conducted on multiple dates while late October and early November rains filled vernal pool basins, just as eggs would have been hatching. The apparent absence of larvae during what was considered a good year for breeding is a sign that the local population may be extirpated, or that breeding occurs only at one or two peripheral wetlands that are relatively understudied.

Jefferson Salamander/Blue-spotted Complex

During winter and early spring 2020, we implemented Year 2 of a research project to investigate wetland habitat use by "pure" vs. "unisexual" forms of Blue-spotted Salamander (see 2019 report for background). We sampled adult salamander populations at 2 sites via aquatic funnel-trapping during the breeding season (March–April). DNA samples have yet to be analyzed, but preliminary results based on morphological measures suggested strongly that unisexuals were detected only in fishless ponds while pure individuals were present both in fishless ponds and in marshes containing fish. Sample sizes were small at one of the sites, and so we may study additional sites in similar fashion during 2021. The preliminary results from 2019 and 2020 suggest we may have identified a mechanism for local populations of Blue-spotted Salamander to be resistant to declines in male salamander abundance due to "genetic swamping" by the unisexual form. Such a finding would yield significant improvements to the criteria used for ranking habitat quality and local population viability for Blue-spotted Salamander. The project also increases the number of sites with baseline demographic data, thus aiding in development of a statewide status assessment and facilitating a long-term monitoring program to detect population trends over time. We continued our annual, exploratory surveys for pure populations of Blue-spotted Salamander in northern Bristol County and southern Norfolk County during winter and spring 2020. As noted in previous reports, these populations in southeastern Massachusetts are not influenced by the unisexual lineages found elsewhere in the state, and they represent over half the known pure populations in the eastern United States. Hence, Massachusetts has great regional responsibility for their conservation. Our surveys in 2020 resulted in discovery of one previously undocumented population in Mansfield and of two additional breeding pools for a population discovered in Norton in 2019. At a site discovered in Rehoboth in 2019, further surveying in 2020 turned up only a single individual; amazingly, it appeared to be the same individual captured in 2019, and in the same pool.

Spring Salamander

During June–October 2019, we completed the first season of a multiyear status assessment of Spring Salamander in Massachusetts (see 2019 report for background). Based on preliminary data from NHESP staff and external volunteers, we completed 76 surveys spanning 69 streams, 35 sites, and 27 towns. We detected Spring Salamander at 15 of 21 (71%) historic sites and at 5 of 14 (36%) novel sites surveyed. Detection rates (no. salamanders per rock turned) were gen-

erally low, but the preliminary results suggest the species is persisting at most sites of historical occurrence. One potentially significant threat noted during the surveys is that stream segments downslope or downstream of roads tend to have a lot of sand, which is degrading the habitat quality. Two sites of relatively high salamander density were revisited in May 2020 to collect a total of 4 specimens for donation to salamander chytrid fungus (Batrachochytrium salamandrivorans) susceptibility trials at the University of Tennessee as part of a multispecies evaluation under a Competitive State Wildlife Grants project. Surveys for the Massachusetts status assessment resumed shortly thereafter, with 7 sites of historical occurrence surveyed through June.

Terrestrial Invertebrates

Frances A. Crane Wildlife Management Area (WMA)

State-listed terrestrial invertebrates at Crane WMA have benefitted from the substantial restoration and management conducted by MassWildlife since 2013. Most notably: (1) Purple Tiger Beetle expanded its occupied habitat footprint significantly; and (2) Melsheimer's Sack-bearer colonized the site (presumably from Joint Base Cape Cod to the north).

Maple Springs Wildlife Management Area (WMA)

The five state-listed terrestrial invertebrates found at Maple Springs WMA in 2019 were expected, but so were quite a few others in this landscape. The apparent absence of many state-listed species that require pine barrens habitat with a more open vegetation structure, and occur in such habitat nearby, emphasizes the need for future habitat restoration and management at Maple Springs WMA.

Table 3. State-listed species recorded at Crane WMA in 2019.

		MA	Last
Common name	**Scientific name**	**status**	**obs.**
Frosted Elfin Butterfly	*Callophrys irus*	SC	2005
Herodias Underwing Moth	*Catocala herodias*	SC	1998
Purple Tiger Beetle	*Cicindela purpurea*	SC	2018
Melsheimer's Sack-bearer Moth	*Cicinnus melsheimeri*	T	*
Collared Cycnia Moth	*Cycnia collaris*	T	2017
The Pink-streak Moth	*Dargida rubripennis*	T	1998
Buck Moth	*Hemileuca maia*	SC	2018
Pink Sallow Moth	*Psectraglaea carnosa*	SC	2010
Pine Barrens Speranza Moth	*Speranza exonerata*	SC	1998

*Not previously documented at Crane WMA.

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. Since 1989, annual monitoring of the population of this species on Martha's Vineyard has been conducted by Tim Simmons, with the assistance of other NHESP/DFW staff and occasional volunteers.

In 2019, Tim Simmons continued annual monitoring on a contract basis. The estimated total of three sub-populations of Northeastern Beach Tiger Beetle inhabiting three separate stretches of beach/dune habitat on Martha's Vineyard was 3,453 individuals in 2019. After five consecutive years of population decline, 2019 monitoring showed a substantial increase, with an estimated total population size not seen since 2016. Although the decline in recent years had been some cause for concern, particularly at the largest of the three subpopulations along the southwest shore of Aquinnah, the 2019 count highlights that highly dynamic population fluctuations, a characteristic of most insects, is likely also the norm for the Northeastern Beach Tiger Beetle. Although the increase in 2019 is encouraging, the estimated total population is still substantially smaller than the highs of 6,393 in 2013 and 9,303 in 2010. Because the estimated total population of this species on Martha's Vineyard remains relatively small, and in addition due to its highly dynamic population fluctuations, annual monitoring of this species should continue absent consistently higher numbers needed to demonstrate long-term population viability.

Cobblestone Tiger Beetle (Cicindela marginipennis) surveys

The Cobblestone Tiger Beetle is listed as Endangered in Massachusetts. It has not been observed at its single known site since 2007, despite surveys conducted there in 2012, 2013, 2014, and 2017. In 2019, an approximately 4.5-km stretch of the Deerfield River was surveyed for this species by Mike Nelson (NHESP Invertebrate Zoologist) during the summer adult activity period of this species. Despite a substantial amount of apparently suitable habitat along the stretch of the Deerfield surveyed, no Cobblestone Tiger beetles were found.

Table 4. State-listed species recorded at Maple Springs WMA in 2019.

		MA
Common name	**Species**	**Status**
Herodias Underwing Moth	*Catocala herodias*	SC
Buck Moth	*Hemileuca maia*	SC
Pink Sallow Moth	*Psectraglaea carnosa*	SC
Pine Barrens Speranza Moth	*Speranza exonerata*	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 U.S. Fish and Wildlife Service (USFWS). However, the USFWS no longer considers long-term persistence at the single site in Massachusetts (Rainbow Beach in Northampton) an explicit recovery goal due to adverse, artificial hydrology over the past decade at this site. 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 2019 the additional threat of excessive growth of vegetation at the south end of 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).

Rare Plant Inventory

During the 2019 field season, the State Botanist and Plant Conservation Biologist searched for, discovered or verified over 350 plant population occurrences. Rare plant observations reviewed, mapped, and accepted into the Biotics database by the two botanists were 690 during this period, up from 638 the previous year. In the three years prior to 2018, the number of plant records accepted in the database increased by just over 100 records each year.

Plant Occurrences of Note

One of two known populations of state-endangered False Pennyroyal (*Trichostema brachiatum*) was relocated by the state botanist during the first survey in 36 years for this population. Down Arrow-wood (*Viburnum rafinesqueanum*) on was relocated after a 22-year absence. The state botanist was able to spend a day on Naushon Island and updated plant populations there not surveyed for 29 years. With boat transportation supplied by USFWS, the state botanist was able to twice visit Nomans Land Island and provided updates on populations not seen for decades. One new and significant plant population was also discovered of a state-threatened species not known to occur on the island. Other important, long overdue updates occurred for two populations of state-endangered sweet bay magnolia.

State Endangered new population discoveries include New England Northern Reed Grass (*Calamagrostis stricta ssp. inexpansa*) discovered by botanist Robert Bertin. This is now the third known population in the state, and it is also the most vigorous and healthy.

A new population of state-endangered purple milkweed was found by DCR forester Peter Grima. This is now the largest state population.

Special Projects

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

Sandplain Gerardia (*Agalinis acuta*); Federally Endangered, State Endangered: Population censuses or sampling procedures were conducted at nine sites, four locations on Martha's Vineyard and five on Cape Cod. The most important census was the first scientific count at the new native population that was discovered in Barnstable in 2018. The organized count, with a large group of volunteers using transects and quadrats, resulting in a count of 108,000 plants. When the populations in all the other states that count Agalinis acuta are summed together, the total number never reaches that amount. The Barnstable population therefore represents the largest known population of this federally endangered plant in the entire world.

Small Whorled Pogonia (*Isotria medeoloides*); Federally Threatened, State Endangered: The numbers at the previously known sites were similar to past years. Surveys are being monitored at 9 locations.

Northeastern Bulrush (*Scirpus ancistrochaetus*); Federally

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

General Habitat Management Projects

The Program continued its emphasis on Habitat Management Projects for rare plants during 2019. In addition, NHESP has worked with 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 begun in 2019 to enhance habitat for state-endangered Lonicera hirsuta, a native honeysuckle vine in Williamstown. In cooperation with Williams College, four staff members from NHESP as well as DFW Western District staff helped to thin several acres of forest. Monitoring of the results will occur in 2020-2021.

Success has continued with small deer exclosures that are protecting state-endangered species in the Blue Hills Reservation (for Lesser Snakeroot; *Ageratina aromatic*a) and at the Quabbin for Purple Milkweed (*Asclepias purpurascens*). Both of these projects are completed with close partnership of the DCR (Department of Conservation and Recreation). Purple milkweed bloomed at the site for the second time in many years due to the protection from deer, and also some site management.

Working with NHESP's restoration ecologist, Dan Bove, the program continued to remove invasive gray will from Coastal Plain Ponds in Plymouth. Coastal plain ponds host a large suite of plants that are globally and regionally rare. Massachusetts has the most coastal plain pond habitat in New England, but the habitat faces many threats from invasive species, development and climate change.

Invasive Plant Projects

NHESP, in cooperation with The Trustees, the DCR, The Department of Agricultural Resources, and the USFWS's Silvio O. Conte National Wildlife Refuge controlled populations of Mile-a-minute vine (*Persicaria perfoliata*) in Erving, Bridgewater, Foxborough and Greenfield.

Other Botanical Notes

The State Botanist and Plant Conservation Biologist continue to write articles for MassWildlife E-newsletter. The state botanist completed a feature article on all the milkweed species in Massachusetts for the Vol. 69, No. 2 (2019) of the *Massachusetts Wildlife* magazine.

Aquatic Species

Aquatic Species Distribution and Status Assessments
During the 2019 and early half of the 2020 field season, NHESP's Aquatic Ecologist conducted surveys for odonates, freshwater mussels, and other rare aquatic taxa in MassWildlife's Western, CT Valley and Northeast, and Southeast Districts. Surveys included updating or recording new observations of:

Dragonflies & Damselflies

Harpoon Clubtail – State Endangered Dragonfly - Updated records at two sites, including discovery of a new population on one river.

Riffle Snaketail – State Threatened Dragonfly – Updated records at 6 sites on 3 different rivers, including 2 new sites.

Riverine Clubtail - State Threatened Dragonfly – Update record at one site on one river.

Spine-Crowned Clubtail – State Special Concern Dragonfly – Updated records on one site in one river.

Pine Barrens Bluet – State Special Concern Damselfly – Updated records on one pond.

NHESP biologists observed and collected 89 specimen lots of adults, nymphs or exuviae of native dragonflies and damselflies for inclusion in the MassWildlife Odonate Collection. NHESP biologists have collaborated and assisted in developing a regional grant to New Hampshire Audubon to evaluate species status, habitat relationships, and standardized survey methods for the Ringed and Ebony Boghaunters.

Freshwater Mussels

MassWildlife is the lead on a multistate effort to evaluate the conservation needs of the State Endangered Brook Floater. As part of this project, the Aquatic Ecologist has worked with UMass Cooperative Fish & 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 – State Endangered - presence was updated at 6 sites from three populations, and one new site was found. Mark-recapture monitoring was conducted at 2 sites following a dam removal on the Nissitissit River in 2015, and one additional site in the Farmington River to evaluate population size and health.

Creeper – State Special Concern - presence was found at 2 new sites and updated at 10 sites in 6 different rivers.

State SGCN Triangle Floater presence was updated at 10 sites in 3 different rivers.

State SGCN Eastern Pearlshell presence was updated at 6 sites (1 new population) in 2 different rivers. Mark-recapture monitoring was conducted at 2 sites following a dam removal on the Nissitissit River in 2015.

Regulatory Review

Data Management and Data Products

In FY2020, NHESP processed a total of 284 new rare species, natural community, and certified vernal pool records, and updated 1229 existing records. The data processed were in the following categories:

For the FY2020 alone, 174 new people signed up for VPRS and a total of 2181 observation reports were submitted, including 139 vernal pool certification forms, 1164 plant observation forms, and 878 animal observation forms. Once submitted through VPRS, 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, NHESP Data Staff processed 4 large reports for Piping Plover, Northern Red-bellied Cooter, and Terns (including Common, Least, Arctic and Roseate).

Other Data Projects

For FY2020, 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, the PIPLODES/TERNODES database, and NestStory. The NHESP has 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. Phase one of that project has been completed and work on phase two has commenced. Lastly, the NHESP has also been engaged with EEA-IT to upgrade our Vernal Pool and Rare Species Information System and integrate the new system with the ongoing NHESP online filing effort.

Table 5. The following table summarizes the environmental reviews conducted during FY2020:

Review Type	Count
CMP - Application Received	23
Forest Cutting Plan	81
MESA Info. Request/Data Releases	240
MEPA Reviews	72
MESA Project Reviews	589
Notices of Intent	415
Scientific Collection Permits	127
Other	112
Total	1659

Table 6. Vernal Pool and Rare Species Information System (VPRS)

FY19 Totals	New Records	Updates to Existing Records
Vertebrates	120	755
Invertebrates	39	88
Plants	49	383
Communities	0	0
CVPs	76	3
Total	284	1,229

**The NHESP Community Ecologist left the Program 6/30/2016 and no work has been done on the Natural Communities in our database since that time.

Land Protection

In FY 2020, the Department of Fish and Game and MassWildlife spent about $3.4 million to protect 2,199 acres of land across the state. Several of this year's acquisitions were of particular relevance to protection of rare species and exemplary natural communities, as noted below.

Northeast District

The Squannacook River Wildlife Management Area, in Townsend, Groton, and Pepperell, was expanded by 94 acres, with habitat for Blanding's Turtle (Threat-

ened), Marbled Salamander (Threatened), and Wood Turtle (Special concern).

Southeast District
In Middleborough, protection of 149 acres adjacent to the Rocky Gutter Wildlife Management Area helps conserve two rare plants, Foxtail Clubmoss (Endangered) and Long-leaved Panic-grass (Threatened).

Central District
The addition of 45 acres to the Millers River Wildlife Management Area in Athol expanded protection of the large BioMap2 Landscape Block here.

Valley District
In Colrain, purchase of 51 acres along the Green River, next to the Vermont border, helps protect Ocellated Darner, a Special Concern dragonfly that inhabits high-quality, rocky, shaded streams and rivers.

The addition of 35 acres to the Palmer Wildlife Management Area helps conserve two Special Concern species, Climbing Fumitory and Orange Sallow Moth. The caterpillars of Orange Sallow Moths eat only the unripe seeds of false foxgloves, plants that are hemi-parasitic on the roots of oak trees.

Western District
The 7700-acre Chalet Wildlife Management Area was expanded by the acquisition of 177 acres in Windsor, which contains a Red Spruce Swamp, an uncommon type of natural community.

In Heath, purchase of a conservation restriction on 154 acres on the West Branch of the North River helps conserve the coldwater habitat needed by the Longnose Sucker, a Special Concern fish.

Natural Heritage and Endangered Species Advisory Committee

Full members are: Mark Mello (Vice Chair part year, Chair part year), Joseph Larson, Wayne Petersen, Timothy Flanagan (Vice Chair part year), William Brumback, Dave Small (part year), Kevin Powers (Secretary part year)

Associate members are: Andy Finton, Kevin Powers (part year), Dave Small (part year), Bryan Windmiller, Russ Hopping

Presentations from Agency Staff

Carbon Budgeting on MassWildlife Forests – Brian Hawthorne, Habitat Planning Coordinator

NHESP Data Improvement Initiative – Amanda Veinotte (NHESP Project Coordinator) and Sarah Maier (Information Manager)

Using iNaturalist for MassWildlife Projects – Lynn Harper, Habitat Protection Specialist

Impacts of Annual Winter Water Level Drawdowns on Littoral Zone Ecology in Massachusetts Lakes – Jason Carmignani, Aquatic Ecologist

Spring Salamander Assessment in Massachusetts – Jake Kubel, Conservation Scientist

Non-breeding Movements and Habitat Selection by the Eastern Whip-poor-Will – Andrew Vitz, Massachusetts State Ornithologist

Spotted Turtle Conservation and Management from Maine to Florida - an update from Massachusetts – Mike Jones, State Herpetologist

Presentations from Others

None

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 (part year)
Melany Cheeseman, Endangered Species Review Assistant
Karen Dolan, Finance & Projects Administrator
Tom French, Consulting Biologist/NHESP Technical Expert
Karro Frost, Conservation Planning Botanist
Lauren Glorioso, Endangered Species Review Biologist
Lynn Harper, Habitat Protection Specialist
Peter Hazelton, Ph.D., Chief of Conservation Science
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
Jesse Leddick, Chief of Regulatory Review
Jennifer Longsdorf, NHESP Program Coordinator (part year), Natural Heritage Trust Program Coordinator (part year)
Lisa MacGillivray, Habitat Mapping Biologist/Data Specialist
Sarah Maier, Information Manager
Misty-Anne Marold, Senior Endangered Species Review Biologist
Carolyn Mostello, Coastal Waterbird Biologist

Information & Education

Marion E. Larson
Chief, Information and Education

OVERVIEW

The Information and Education (I&E) Section 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

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.

R3 Plan Development

An R3 team drafted a 5-Year (2021–2026) 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 time period may be developed. The 5 Year R3 plan will be reviewed, finalized and implemented during the 2022 fiscal year.

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 will work closely with partners, agency personnel and MassWildlife senior management to develop the Annual Work Plans. A pilot annual R3 plan was created for 2020. The 2020 R3 Plan included efforts such as developing a registration system for angler education, identifying and implementing a project management system, and engaging staff in Relevancy and R3 efforts.

Relevance Roadmap Development

Carolyn Mostello and Nicole McSweeney served as co-chairs of the Relevance Workgroup in FY 2020. A formal Workgroup comprised of agency staff from varied sections and offices was formed to work on increasing MassWildlife's relevance to the general public and build the support necessary to ensure the future of wildlife conservation in Massachusetts. The formation of the Relevance Workgroup demonstrates that the agency values diverse perspectives and interests in wildlife conservation and outdoor recreation. The primary accomplishment of the Workgroup in FY 2020 was the development of the agency's draft Relevance Roadmap. This Roadmap seeks to identify, prioritize, and implement strategies to engage and serve broad constituencies. By considering barriers to relevancy implementation that have been identified nationally, MassWildlife has started to establish long- and short-term relevancy goals and initiatives for Massachusetts. The Workgroup will recommend priority projects to MassWildlife's leadership team on an annual basis. The Workgroup identified several CY 2020 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; promoting Wildlife Management Areas to the public; and, implementing activities to celebrate the 30th anniversary of the Massachusetts Endangered Species Act. Unfortunately, due to the COVID-19 pandemic, many of the pilot priority activities for the year were delayed or cancelled.

DIGITAL COMMUNICATIONS

Website

Mass.gov

Analytics

FY 2020 is the first year since our web migration in 2017 that we have had access to a full 12 months of Google Analytics data. This allows an opportunity to summarize the agency's web content and web user behavior. The following is a brief overview of the agency website; a graphical depiction of this information can be found in Figure 1 and 2.

MassWildlife web pages were viewed about 6.2 million times by about 1.5 million unique users. Visitors spent an average of just over 2 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 accounting for three-quarters of web traffic with Connecticut, New York, and others accounted for the rest. Device usage totals continue to show that most users (62%) access our content using a mobile phone. All digital media created by MassWildlife should be designed with a mobile user in mind.

Seventy-five percent of traffic to the MassWildlife website originates from a search engine or from a search within Mass.gov. Fourteen percent of users come to our content directly. Traffic is counted as direct when users do one of the following: type in a shortened url found within agency print or digital publication or that they heard about from a friend, copy and paste a url, or use a bookmark in their web browser. A smaller proportion of users make their way to our website by way of a link on another website or a social media post.

The website is large and it is difficult to evaluate all pages; however, evaluating MassWildlife pages with at least 1,000 pageviews accounts for nearly 95% of website traffic. The following is summary of the 325 pages that received at least 1,000 views throughout the year.

To get a sense of the structure and usage of the website, we

Figure 1. MassWildlife website overview.

Total pageviews	Unique pageviews	Total users	Ave. time on page
6,238,342	4,963,008	1,545,188	2:09

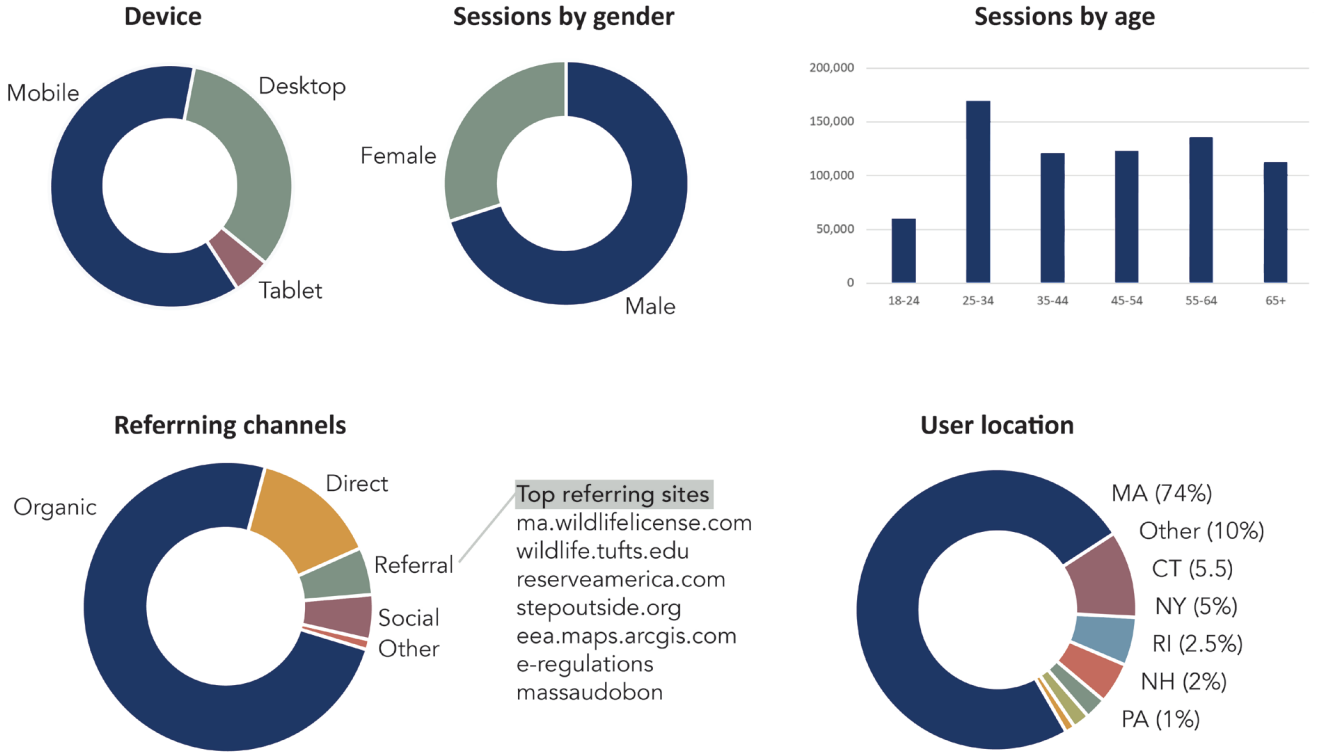
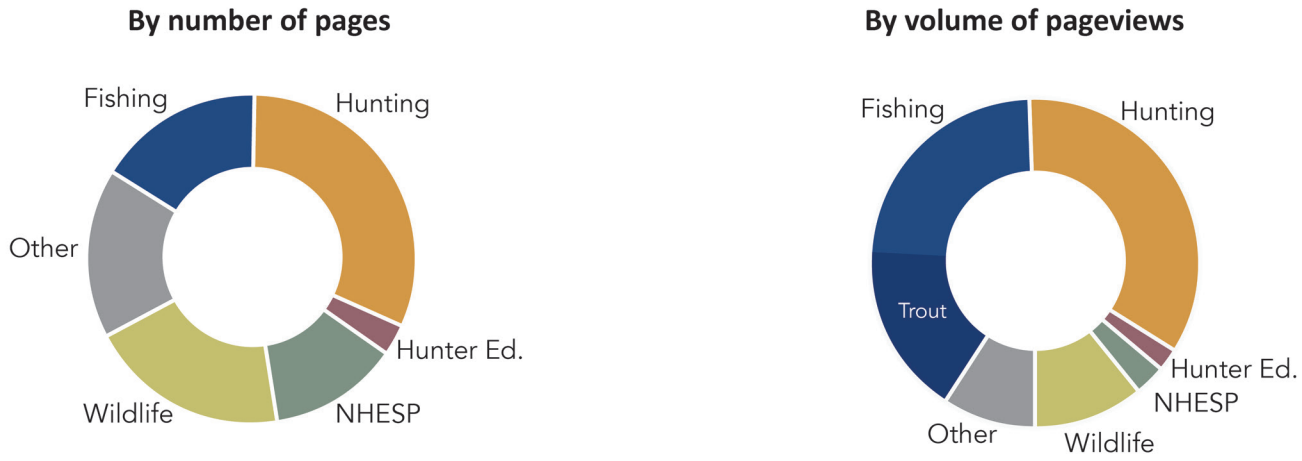


Figure 2. MassWildlife web pages receiving at least 1,000 pageviews grouped by topic; sorted by number of pages and by volume of page views.



can look at total of pages by topic—fishing, hunting, general wildlife, NHESP, Hunter Education, and other (see Figure 2). Hunting-related content accounts for the most pages; species-specific hunting regulations, antlerless deer permit information, and seasonal announcements are very popular. Fishing pages are also numerous and include trout stocking, freshwater fishing license information, and finding a place to fish. NHESP content includes MESA information, and several news stories. (News items accounted for 19% of NHESP content—a positive sign that increased NHESP outreach is effective.) Wildlife-related pages include rehabilitation, wildlife as pets, and many "learn about" page types—bobcat, coyote, black bear, and turtle being the most popular. Hunter education is included as its own group because it accounted for 10% of pages, no other topic came close.

Grouping these same topics based on the quantity of pageviews is also helpful because it shows relative content traffic. Fishing accounts for 40% of all agency content by volume of traffic. In fact, trout stocking-related content accounts for about 17% of traffic on its own. Within the hunting category, gun ownership information is by far the most popular page; deer and turkey hunting content is also very heavily trafficked. The MESA list, grouped with NHESP content, received over two and a half times the traffic of other pages in the topic. Wildlife-related content traffic was more evenly spread between pages, though wildlife rehabilitation was the most popular.

Web Maps

MassWildlife offers customers some geographic information through web maps. Maintaining and enhancing these maps is a priority for the agency to improve customer service and to promote recreation in the Commonwealth. During FY 2020, all maps were migrated to ArcGIS Online. I&E staff worked with sections and with GIS staff to ensure that a high level of usability was maintained during the transition. User testing along with map promotion via newsletter, website, and social media posts was also coordinated by I&E staff.

Some web maps allow users to search for services including wildlife rehabilitators, Problem Animal Control agents, and game check stations by location. These maps are relatively simple and did not require a great deal of development. Other web maps are built to help the public find recreational opportunities and are more complex. A new map showing pheasant stocked locations was developed and released before the 2019 pheasant hunting season and replaced five pages of hard-to-use narrative descriptions. The map was promoted and well received; user comments were positive. In addition, the freshwater fishing map was slated for a major overhaul. After months of data reorganization, user testing, and trial and error the Go Fish MA! map was released and promoted. Despite the relative improvements to the fishing map, design and functionality were constrained by the software capability. More user testing and many enhancements are planned for this product. And finally, work is nearly complete on a map layer that will give details about which DCR properties are open to hunting in Massachusetts. When added to the Wildlands Viewer in FY 2021, this addition will benefit hunters by revealing new opportunities and inspiring confidence while choosing a hunting location.

MassFishHunt

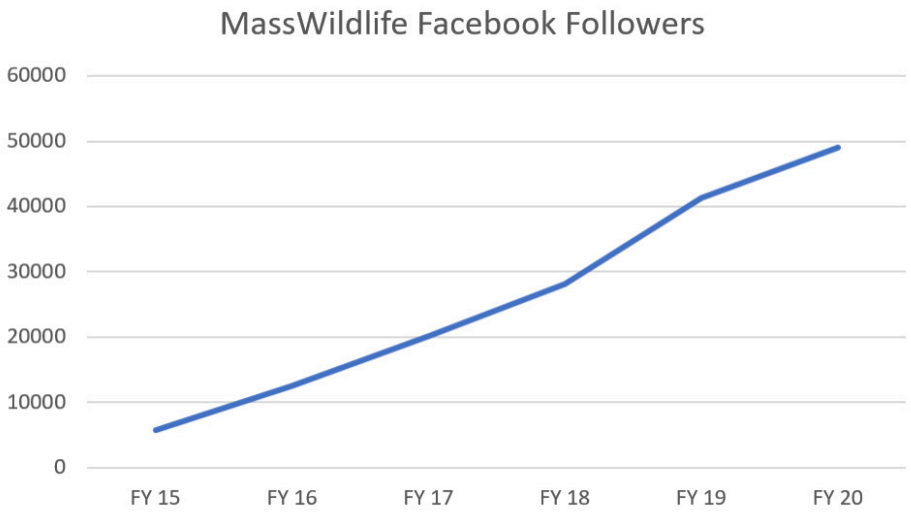
I&E staff have been heavily engaged in the process for developing a new MassFishHunt online licensing system. I&E staff have supported the procurement process by participating in RFI vendor presentations and writing requirements for the RFR related to improved customer experience, mar-

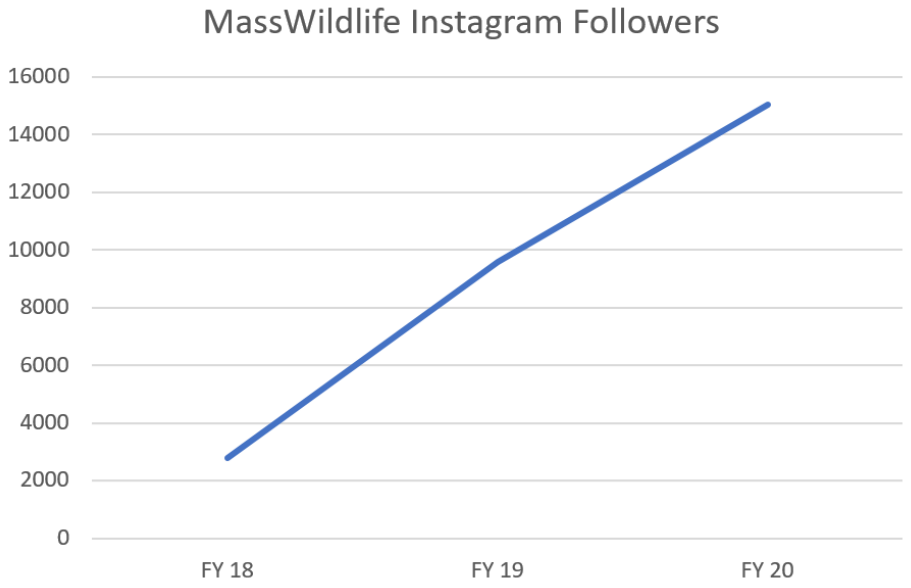
keting and communications functionality, and event management. A vendor should be selected in early FY 2021 and the new site is scheduled to launch in the winter of 2021.

Social Media

Facebook

In FY 2020, 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 2020, closing the year with over 49,000 followers.





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. In FY 2020, MassWildlife received over 2,730 private messages on Facebook from 832 unique users (up from 2,300 private messages in FY 2019), as well as nearly 33,000 post comments from 16K unique users.

In light of the COVID-19 pandemic, the agency has become increasingly reliant on digital communication to engage with the public. MassWildlife staff have begun using livestream Facebook events to connect with constituents. Wild Turkey Biologist David Scarpitti participated in a livestream event with NWTF in advance of the spring turkey hunting season, and MassWildlife organized another livestream event with NHESP staff in honor of Endangered Species Day in May. More livestream Facebook events, including fishing tutorials, are planned for the near future.

Instagram

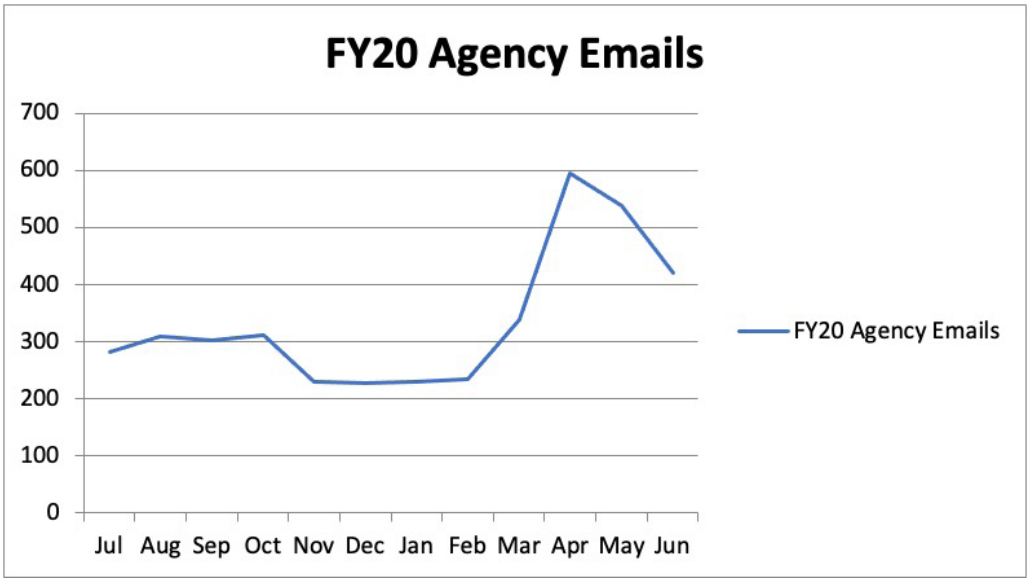
MassWildlife initiated an Instagram account (@mass.wildlife) in September 2018. The number of followers has been steadily growing over time (2,800 in FY 2018; 9,600 in FY 2019; and over 15,000 at the close of FY 2020). Instagram is a widely used, fast-growing social media platform, especially among younger 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

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 2019, 56,475 received the newsletter, and by June 2020, that number had risen to 81,342. 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. To mark the 30th anniversary of the Massachusetts Endangered Species Act in 2020, NHESP staff began contributing a "Species Spotlight" article to highlight a MESA-listed species in each monthly newsletter.



On average, 35% of subscribers open the MassWildlife Monthly email (up from 33% in FY 2019), which is considered an "above industry average" open rate. (The average open rate for other government agencies using Constant Contact is 25%.) In April 2020, we had the highest open rate of any newsletter issue (46.2%), perhaps due to the COVID-19 quarantine. MassWildlife's average click-through rate on the newsletter was 27%, which is well above the industry average of 7%, indicating that MassWildlife is producing high-quality, engaging content that subscribers want to read.

Agency Emails

Email messages to the agency rose again this year. A total of 4,020 agency email messages were managed by Biologist Bridgett McAlice, who is assigned to the Wildlife Section. (3,949 in FY 2019; 2,831 in FY 2018) The April - May spike in inquiries related mostly to trout stocking, turkey hunting, license related questions and wildlife sightings. This spike may also be associated with wildlife sightings by people staying close to home due to the COVID-19 shutdowns.

MARKETING

Fishing and Hunting Promotions

MassWildlife works to recruit, retain, and reactivate hunters and anglers through innovative communication techniques. Significant efforts to promote fishing through digital marketing was continued in FY 2020 by Nicole McSweeney (Outreach and Marketing Manager), Emily Stolarski (Communications Coordinator), and Jody Simoes (Human Dimensions Coordinator).

• Spring/summer 2019: In spring of FY 2019, MassWildlife contracted with a local marketing firm, Conventures, to manage its spring/summer campaign. MassWildlife coordinated with Conventures to implement a strategy for the campaign, select images, write ad copy, define target audiences, place ads, and evaluate performance. Based on success from previous years, MassWildlife used Google Ads, Facebook ads, and Instagram ads to promote fishing in its 2019 spring/summer campaign. Ads ran from May 2019 through July 2019, and evaluation continued through the fall of 2019. Highlights include:

— The 2019 spring/summer fishing digital marketing campaign generated $430,005–$577,157 in license sales. In addition to driving license sales, ads increased awareness and interest in fishing. Social media ads were viewed 3.14 million times, reached 927,000 people, and generated 42,000 clicks to our website. 24% of the customers who purchased from a social media ad were new and 25% were lapsed anglers. Google ads were viewed 167K times and initiated 47K visits to our website. 29% of the customers who purchased a license from a Google ad were new and 18% were lapsed.

— MassWildlife was awarded a competitive Recreational Boating and Fishing Foundation (RBFF) State R3 Program Grant to pilot a new initiative in the summer of 2019 to engage campers and increase their interest in fishing through digital ads. Because camping is the top crossover activity to fishing and growing in popularity, this recruitment effort was targeted toward campers. By partnering with DCR, MassWildlife developed and promoted a Top 10 List of Campsites for Fishing in Massachusetts. Using targeted Google search and display ads and social media ads, MassWildlife drove traffic to this list and increased interest in fishing. This camping subset of the campaign resulted in 5.4 million impressions, 71,500 link clicks, and at least 1,469 license purchases. MassWildlife created a case study in partnership with RBFF to be used by other states. Communications Coordinator Emily Stolarski also presented the results of this effort to other state agencies and partners at RBFF's State Marketing Workshop in February and through a webinar in May.

— In addition to digital ads, I&E reached 88,000 lapsed anglers through emails and postcards which encouraged license renewal. Two promotional emails sent in the spring and summer of 2019 generated over $155,000 in license sales.

• Spring/summer 2020: In January 2020, MassWildlife was selected by the RBFF as one of eight states to receive AFWA Multi-State Conservation Grant funding to implement and evaluate digital marketing efforts to increase angler participation. In the spring of FY 2020, MassWildlife contracted with a local marketing firm, Shields Design Studio, to manage a spring/summer marketing campaign promoting fishing using Google search ads, Facebook ads, and Instagram ads. MassWildlife staff initially planned to pilot ads this year to promote fishing to nonresidents in bordering states, however COVID-19 travel restrictions made it impractical to market to this group this year. A significant amount of effort went into changing original plans and developing new messages that promoted fishing, while also promoting safety and responsible recreation. Social media ads ran through the end of July 2020, while Google search ads ran through early September. Initial results suggest these efforts were extremely successful in increasing fishing participation and fishing license sales, especially with increased interest in outdoor activities due to COVID-19. Campaign evaluation continued into the next fiscal year.

Targeted emails were used to retain and reactivate hunters and anglers throughout the year and deliver important information such as regulation changes. These included:

• July 2019: Email sent to 58,600 hunters with a reminder to apply for antlerless deer permits, surplus deer permits, and other information about the fall hunting seasons. Open rate of 49.6% and 34% click-through rate.

• August 2019: Email sent to 9,400 bear hunters with information about bear hunting season dates and regulations. Open rate of 55.4% with a 33.7% click-through-rate.

• October 2019: Email sent to 60,800 hunters with information about EEE, hunting safety, fall pheasant stocking, trout stocking, turkey regulation changes, wildlife drowning laws, hunting logs, and more. Open rate of 38.1% with a 30% click-through rate. Because this email included a link to purchase hunting licenses and permits, we could also track $3,460 in sales to this email.

• January 2020: Email sent to our 57,000 newsletter subscribers (which includes hunters and anglers) featured a link to renew fishing and hunting licenses. Open rate of 30% with a click-through-rate of 23%. Because this email included a link to purchase licenses and permits, we could also track $7,419 in sales to this email.

• March 2020: Email sent to 59,700 hunters about the spring turkey hunting season and COVID-19 related hunting announcements. Open rate of 45% with a click-through-rate of 23%. Because this email included a link to purchase hunting licenses and permits, we could also track $39,434 in sales to this email.

• May 2020: Email sent to 74,800 lapsed anglers with a message to renew their fishing licenses and information on how to recreate responsibly during the pandemic. Open rate of 36.7% and click-through rate of 25%. This email generated over $168,315 in license sales.

*Average open rate for other government agencies using Constant Contact is 25% and the average click-through rate is 7%.

NHESP Fundraising

Promotion of tax-form donations
In February 2020, a tax check-off promotion was launched to increase awareness and bring in more donations to the NHESP fund. To reach tax preparers in the most convenient way, we sent an email to 83 contacts (open rate of 17%) and additional letters were mailed by postal service, to those preparers where an email address was not available. Promotional posters were also included as attachments to the emails and printed copies included with the letters. To reach the general public, a promotional video was shared on social media and a call-out placed in the March newsletter.

Donor relations
To continue engaging with donors during the pandemic, three emails were sent to past donors in April, May, and June. This is the first time the agency has emailed past donors directly asking for donations and providing updates about NHESP. The emails had an average open rate of 40% and an average click rate of 10%. The donor email list initially contained 81 contacts, but as we determined who would be included in this list, it grew to 184. The goal is to continue growing this contact list through outreach. The email sent in May was centered on Endangered Species Day and included a direct ask for donations and promotion for a Facebook Live event on Endangered Species Day.

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 re-

peat donations. A MassWildlife branded thank-you card was created to send personalized thank-you messages when a mailing address is provided.

In FY 2020, we began a long-term project to create a comprehensive donor database. Once complete, this database would allow NHESP to maintain all donation records from various sources in one place and allow key staff to access information about donors to help with outreach efforts.
Fundraising events

The Run for Wildlife, a planned fundraising event, was scheduled for May 17, 2020, at the Westborough Field Headquarters to celebrate 30 years of the Massachusetts Endangered Species Act while raising awareness and donations for NHESP. Registration had opened and sponsors were contacted, but ultimately this event was cancelled due to COVID-19 with hopes of trying again in the future.

MEDIA RELATIONS

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 MassWildlife in 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 Management - As of June 2020 the media contact list contains 606 email contacts, compared to 572 contacts in FY 2019. This year the list was heavily purged of bounced, invalid, and suspended emails. Through pro-active contact with media and organic media inquiries, new contacts are added to the list.

• 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-Beginning in January of 2020, advisories were generated 1-2 times per month and emailed to media contacts. Advisories included re-cycling Massachusetts Monthly articles or announcing newsworthy events and relevant stories occurring between newsletter issues (e.g., eaglet chick hatching and banding on Cape Cod).

• Targeted Emails and/or Phone calls - Targeted emails (pitches) often followed up by a phone call regarding a topic or story of local interest (e.g., habitat management activity, grant award recipients, land events).

MEDIA OUTREACH RESULTS

The following table lists the number and type of media outlets which utilized MassWildlife agency information that was pitched to them.

Outlets Utilizing Agency Information:

Media Types	Number
Newspaper	226
Digital Media Outlets	132
Television	7
News Service	1
Radio	1

Based on information from a newsclip service and web searches, the following information summarizes media coverage of agency outreach content.

FY 2020 Agency Outreach Media Coverage

• 94 newsletter articles and media advisories produced
• 72 newsletter articles and advisories utilized by 274 unique media outlets (173 digital; 89 newspaper; 7 television; 2 news services; 2 radio; 1 magazine)

Outreach Media Topic Coverage:

Topic/Theme Covered	**# of Mentions**
Furbearer & wanton waste regulations	175
Natural Heritage	138
Fishing	88
Hunting	78
General Wildlife	44
MassWildlife's COVID 19 Response	32

Topic/Theme Covered	# of Mentions
Habitat	21
Total	576

Events Calendar Publicity:

Event Type	# of Mentions
Public Presentations/Walks	21
Angler Education Programs	19
Jr. Duck Stamp Exhibit	19
Project WILD Workshops	4
Shows, Exhibits	3
Learn To Call Turkeys	2
Fish & Wildlife Board Meeting	1
NHES Adv Comm Meeting	1
Total	70

RESPONSE TO MEDIA INQUIRIES

The vast majority of media inquiries originate from writers hearing from local readers, scanning local social media postings or accepting editorial assignments. Nearly all media inquiries result in coverage that includes MassWildlife references or information. Notable inquiries from national media outlets included National Audubon, Newsweek, American Hunter, NPR's National Morning Edition and The Guardian (United Kingdom).

Below is information on the various media inquiries with a breakdown by type or specific outlet

- 238 media inquiries received from 89 different media outlets.
- 64 media inquiries were in response to agency communications efforts

Media inquiries, by type FY 20

Media Type	# of Inquiries
Newspaper	117
Television	55
Radio	31
Magazines	11
Digital/blog/podcast	16
News Services	4
Total	238

Television Outlet Inquiries

Television Outlet	# of inquiries FY 2020
Boston 25 WFXT	14
WCVB Channel 5, Boston	12
WHDH Channel 7, Boston	8
WBZ TV Channel 4, Boston	6
WWLP Channel 22 Fox, Springfield	3
WesternMass News Channels 3, 40	3
NBC Boston Channel 10	3
Charter/Spectrum TV 3, Worcester	3
ABC WTEN TV, Albany, NY	2
ABC Channel 6, Providence, RI	1
Total	55

Radio Outlet Inquiries

Radio	# of inquiries FY 2020
NEPR WFCR, Conn Valley & Berkshires	3
WCAI Radio, NPR (Cape & Islands)	3
WBUR Radio, Boston	2
WBZ Radio 1030, Boston	2
K Love Radio, Central and Eastern MA	1
WGBH Radio (NPR), Boston	1
Total	12

NEWSPAPERS

As in the past, inquiries from newspaper outlets are the highest among media types (117). However, the impacts of newspaper consolidation are evident with continuing declines in subscriptions. Cuts in newspaper staff has resulted in fewer media inquiries each year from this sector and less local coverage in the remaining smaller and mid-size publications. Long-time outdoor writers have experienced column space and frequency restrictions, layoff, or when retired, positions left unfilled. Environmental writers are few and far between. This spring, full and half page ads in Massachusetts newspapers have been published asking for subscriber support of local newspapers.

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

Newspaper coverage mentioning MassWildlife spanned a statewide range of 86 different newspaper outlets, from small community papers to major regional media outlets.

MassWildlife mentions: 1,576 (926 print, 650 online) Average of 131 articles per month.

People Reached (circulation totals): 158,029,769
Article Value: $6,690,859

Major newspaper outlet coverage highlights include:

121 mentions, Berkshire Eagle (63 print, 58 web);

79 mentions, Worcester Telegram & Gazette (47 print, 32 web)

76 mentions, Boston Globe (44 web, 22 print, 10 Sunday edition)

PHOTOGRAPHY

Video
I&E staff continue to create and edit video content for MassWildlife. A film student from Fitchburg State, Brooke Teves, joined I&E for a spring internship to assist with video production. 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.

Photo Projects
Since the death of MassWildlife photographer Bill Byrne in 2018, Troy Gipps, Magazine Editor and Publications Manager, has spent some time on photography for both magazine articles as well as other publications, web, and social media use. Without a full-time photographer it is an on-going challenge to keep up with the demand for fresh images.

Photo shoots included:
- American kestrel (nest box, hatchling activities)
- Milkweed (flowers and pollinators)
- Frog hunting / bullfrogs and green frogs
- Bats, Little Brown, Pepperell at a private residence
- Junior Archery, Dewey Hathaway
- Massachusetts Junior Conservation Camp: week 2 activities and graduation
- Hunter Education
- Northern red-bellied cooter (lab photo shoot of cooter "portraits")
- Junior Duck Stamp Judging at MassWildlife Field Headquarters
- Quaboag WMA forestry operation
- Stafford Hill WMA forest cutting/mulching operation
- Northern red-bellied Release Day
- General Nature Shoots: ferns, black racer, mallard nest/laying progression, American kestrel hatchlings (0–3 weeks), morel mushroom, various insects.

SIGNAGE AND PUBLICATIONS

Wildlife Management Area Signage
With goals for improving visibility of MassWildlife properties, welcoming traditional and new visitors, standardizing signage among Districts, and differentiating Wildlife Management Areas from other state-owned properties like state parks and state forests, work to update property signs continued in FY 2020. I&E staff worked cooperatively with the Assistant Director of Operations and District Managers on this project. When fully implemented, WMA property signs will be more visible to passing cars along roadways while kiosks and other signs will welcome and inform visitors on foot once they leave their vehicles. Property sign design was standardized and a process for ordering signs from the Connecticut Valley District woodshop was put in place. At the close of the fiscal year, at least 50 property name signs 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. These welcome signs include a message about MassWildlife and the agency mission as well as important WMA rules and guidelines. The next phase of the signage project is to design and install kiosks at high traffic locations (see photos on page 97).

Fact Sheets and Related Publications
New Living With Wildlife species fact sheets were written, printed and posted online in FY 2020. New species fact sheets included otter, bats and opossums. Special thanks to wildlife photographer Mark Wilson of Dunstable for providing the opossum image. A revised Homeowners Guide to Bats booklet was finalized and printed.

Massachusetts Wildlife Magazine
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 that 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 I&E staff, produced four issues of *Massachusetts Wildlife* (Number 3, 2019 – Number 2, 2020) 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:

New branded WMA property sign.

New WMA welcome sign.

Issue Number 3, 2019:
- Bat Myths Debunked by Jennifer Longsdorf (staff)
- The Crow Patrol (Winter Crow Roost in Lawrence) by Craig B. Gibson
- Students Give Endangered Turtles a Headstart (Northern red-bellied cooters) by Don Lyman
- A Hunter's Education (Hunter Education Instructor) by Tabatha Hawkins (staff)

Issue Number 4, 2019:
- Carbon and Conservation on MassWildlife Forest Lands by John Scanlon, Brian Hawthorne (staff)
- Into the Outside for Wild Edibles by Arianna Alexsandra Collins
- In Search of Wood Thrush by Melanie Klein
- Eagle Scout Project: Mill Brook Bogs WMA, by Henry Ashley

Issue Number 1, 2020:
- iNaturalist, MassWildlife, and You by Lynn Harper (staff)
- A Bobcat Cache and the Pursuit of Photographic Excellence by Troy Gipps, as told by Dave Wattles (staff)
- Bird Banding Laboratory Marks 100 Years by H W Heusmann (staff)
- Through the Lens: Massachusetts Junior Conservation Camp by Troy Gipps (staff)

Issue Number 2, 2020:
- Eagle Wars by Paul M. Roberts
- Prescription for Nature by Sara Lucia Shuff
- Belle Isle Marsh: Biodiversity in Boston by Sean Riley
- Massachusetts' Homegrown Eiders by H W Heusmann (staff)

Magazine Subscription Promotion Efforts:
MassWildlife has a contract with a vendor (Infonet) for magazine subscription fulfillment and promotion. The beginning of the fiscal year July 1, 2019, showed 20,163 subscribers for the magazine. By June 30, 2020, there were 19,556 magazine subscribers. However, the responses to the nominee promotion have not yet come in (see Nominee Renewal Promotion below). One-year subscriptions account for 69% of the total, 31% of subscriptions are for two or more years. In FY 2020, a total of 10,963 new and renewal subscriptions were sold.

Magazine Promotion Efforts by Infonet:
Subscription Renewals—During FY 2020, four renewal effort mailings were sent out to 13,632 subscribers whose subscriptions were about to expire. Total cost of these mailings was $4,771 and resulted in revenue of $21,429 from 2,215 renewals.

Nominee Renewal Promotion—This is a "refer a friend" type of promotion where current subscribers renewing their subscriptions are asked to give the name and addresses of up to 2 people (nominees) who will receive a one-year subscription for $1 paid by the current subscriber. When the subscriptions end, the nominees receive an invoice inviting them to subscribe on their own at the regular subscription rate. Nominee renewal promotion was mailed in June 2020 to 13,569 subscribers at an estimated cost of $5,000. Responses came in after the fiscal year ended, latest information (early August) indicates the results at the moment are over 1100 new subscribers gained.

Cash Acknowledgements—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 between the cost of a 1-year subscription and a 2-year subscription ($6 for 1 year, $10 for 2 years). In FY 2020, 3,568 cash acknowledgements were sent out at a cost of $1,248. There were 1,134 1-year subscribers who "stepped up" resulting in revenue of $7,941.

Gift Subscription Promotions—A gift subscription renewal effort mailing of 9,497 pieces to 2,292 donors who have given gifts, at a cost of $3,323 resulted in revenue of $26,704. A smaller promotional mailing at a cost of $2,809 went out to 8,028 subscribers who did not have a history of giving gift subscriptions. The results were 994 orders for $6,138 in revenue.

Other Magazine Outreach/Distribution Efforts

MassFishHunt—Magazine subscriptions are available for purchase through the MassFishHunt licensing system, an option that became available in FY 2018. A guest account, for those people who are not purchasing licenses offers subscribers the convenience of purchasing with a credit card, a constant request by customers who want to purchase any of agency publications. During FY 2020, 194 one-year subscriptions and 1,081 two-year subscriptions were sold through the MassFishHunt system. This represents 11.6% of the total number of new and renewal subscriptions were sold in FY 2020. In FY 2019, 199 one-year subscriptions were purchased, and 852 two-year subscriptions were purchased. In FY 2018, 934 one-year subscriptions were purchased, and 768 two-year subscriptions purchased.

Meetings, Conferences, Exhibits, Fairs, Education Workshops---Copies of back issues of magazines are made available at a variety of events where MassWildlife may have a display table, 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. In June 2019, the Hunter Education program committed to distribute magazines through the Hunter Education courses beginning in FY 2020. This effort alone will reach about 5,000 students annually.

The Guide to Hunting, Freshwater Fishing, and Trapping

The 2020 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 the sporting community. 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 begin using Adobe InCopy to edit the initial pass 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. To improve the user experience, particularly for novice hunters, and based on Hunter Education and associated hunting web page learning experiences, the Guide's hunting section was redesigned to provide a standard format of regulatory requirements for each game species. A Youth Hunters section was added for Youth Hunters (and their parents) which contains all the special youth hunt and youth licensing information. There were 177,800 copies were printed, representing a 2.8% drop in copies from last year (183,000) due to leftovers at the end of the year. This is the fifth year that guide printing numbers were reduced.

Publication Sales

Though publications information and forms have been posted on the website for a number of years, a mechanism for tracking orders and pick up of publications went into place in the spring of 2017. FY 2020 represents the third year for tracking sales of these items.

OUTREACH EVENTS

Fairs and Trade Shows

In FY 2020, MassWildlife exhibited at two fairs: the Marshfield and Franklin County (Greenfield) fairs; and three trade shows: Southeastern Massachusetts Sportsman's Show, East Bridgewater; New England Fishing and Outdoor Expo (Boxborough), and the Springfield Sportsmen's Show (West Springfield). MassWildlife was prepared to exhibit at the Boston Flower and Garden Show in March, however the event was cancelled due to COVID-19. Field Headquarters I&E staff and District staff continued the tradition of selling licenses at the two sportsmen's shows; staff also answered sportsmen's hunting- and fishing-related questions and handed out publications. At the county fairs, MassWildlife

Annual Publication Sales			
		FY 2020	
Inland Fish and Game (Books)	**PRICE**	**QUANTITY**	**AMT. COLLECTED**
Birds of Massachusetts: A Check-list*	$2.50	24	$ 60.00
Critters of Massachusetts (2001)	$5.00	31	$ 155.00
Field Guide to MA Amphibians (2013)	$3.00	52	$ 156.00
Massachusetts Homeowner's Guide to Bats* (2009)	$2.50	7	$ 17.50
Massachusetts Snake Guide	$2.00	7	$ 14.00
Field Guide to MA Reptiles (2009)	$3.00	7	$ 21.00
Field Guide to MA Amphibians and Reptiles of MA	$10.00	47	$ 470.00
Field Guide to Amp. and Reptiles of MA (Group price $8.00 for 25 or	$8.00	25	$ 200.00
The Wild Turkey in Massachusetts (2009)	$5.00	2	$ 10.00
Magazine Issue (Back issues)	$3.00	30	$ 90.00
PAC Study Guide	$15.00	43	$ 645.00
Natural Heritage and Endangered Species Program			$ -
- Massachusetts Natural Heritage Atlas	$15.00		$ -
13th Edition (CD - 2008)			$ -
- Massachusetts Natural Heritage Atlas	$25.00	8	$ 200.00
13th Edition, Individual Town Map (2008)			$ -
BioMap 2 (2010 report)*	$2.50	7	$ 17.50
BioMap 2 (2010 poster)*	$2.50		$ -
Field Guide to MA Dragonflies & Damselfies (2007)	$20.00	54	$ 1,080.00
Dragonflies & Damselfies (Group price $15.00 for 25 or more)	$15.00		0
Guide to Invasive Plants in MA (2008)	$5.00	55	$ 825.00
Guide to Invasive Plants (Group price $4.00 for 25 or more)	$4.00	50	$ 200.00
Field Guide to Animals of Vernal Pools (2009)	$12.00	82	$ 984.00
Field Guide Vernal Pools (Group price $10.00 for 25 or more)	$10.00	50	$ 500.00
- An Introduction to the Threatened Turtles of	$5.00	3	$ 15.00
Massachusetts: Why they need our help (DVD 2007)			$ -
Turtles of Massachusetts (2007)* (poster)	$2.50		$ -
- Vascular Plants of Massachusetts (CD - 2011)	$5.00	3	$ 15.00
Vernal Pool Life: A Race Against Dryness* (poster)	$2.50	2	$ 5.00
FUND AND REVENUE SOURCE CODE			
Inland Fish and Game Fund 0114/ Rev. Code 6900			$ 1,838.50
Natural Heritage and Endangered Species Program Fund 0108/ Rev. Code 4500			$ 3,841.50
TOTALS			$ 5,680.00

exhibited a display of pelts from most of the state's native furbearers so visitors could touch, handle, compare, and ask questions about them. General fishing, wildlife, and outdoor recreation questions were also answered, and publications were distributed.

Trout Stocking Events

Unfortunately, due to the COVID-19 pandemic that began in mid-March 2020, these public events could not go forward. Only 1 event was held attended by 9 people in early March before shutdowns went into effect.

Agency Exhibits and Presentations

Agency staff led or otherwise participated in public events as workloads and time permit. I&E staff coordinated with MassWildlife staff involved in outreach events, provided display equipment and literature for specific audiences, developed targeted display materials such as posters and handouts, and/or helped to staff the agency's display at these events. Note that FY 2020 presentations were impacted by the COVID-19 pandemic; many events were canceled, others were moved to an online format.

Meetings and Conferences

MassWildlife hosted and/or participated in the following

meetings and conferences: Recreational Boating and Fishing Foundation State Marketing Workshop, New England Chapter of The Wildlife Society Executive Board Meeting (hosted), Massachusetts Chapter of the National Wild Turkey Federation Meeting, Meeting of the Association of Massachusetts Bird Clubs (hosted), Northeast Association of Fish & Wildlife Agencies R3 Meeting (hosted), Information Meeting about Restoration Plan for Birds Killed by 2003 Oil Spill (hosted), Aquatic Resource Education Association Conference, Westborough (hosted), New England Society of American Foresters meeting, and USFWS Structured Decision Workshop (hosted).

Outreach Booths/Tables
MassWildlife staff set up and worked at outreach booths at the following events: Mass Audubon's Annual Birders Meeting, Worcester; Westminster Farmers' Market, Brewster Conservation Day; and the Massachusetts Forest Alliance Annual Meeting, Greenfield.

Public Presentations
Staff gave presentations on a variety of topics at a range of venues, including: All About Bats (Ashburnham Conservation Trust Annual Meeting), Black Bears in MA (Springfield, Townsend, Blandford), MA Freshwater Fish (Pioneer Valley Chapter of Trout Unlimited, Chicopee), Orchids of MA (Tower Hill Botanic Garden, Boylston—cancelled due to COVID), Living with Coyotes (Sterling), Restoring Fire-Influenced Landscapes and Wildlife in Worcester County (Athol Bird and Nature Club), Climate Adaptation (Millis), Fisher Biology & Behavior (Harwich Conservation Trust Winter Talks Series), Turtles and Turkeys and Bears, Oh My! (Sutton Senior Center), Freshwater Fisheries in Massachusetts (elementary school teachers at the New England Aquarium, Boston), Habitat Management and Land Use History (Chelmsford), Deer Management (Carlisle Deer Control Committee, Harvard Town Meeting, Sudbury Reservoir Watershed Deer Management Planning Meeting, Brewster Conservation Commission), Watershed Approach to Lake and Pond Management (Pittsfield), Conserving State-Listed Birds through Targeted Habitat Restoration Efforts (Forbush Bird Club, Worcester), and Freshwater Mussels: Living Gems In North American Waters (Rutland), Coyotes and Moose and Bears, Oh My, (Dull Men's Club, Sterling) .

Land and Habitat Events
Land celebrations took place at Norcross Hill WMA in Templeton, and North Pond in Southwick. Habitat site walks were conducted at Tully Mountain WMA/WCE in Orange and at Herman Covey WMA in Belchertown. A Department-wide habitat restoration event took place at Kent's Island (Bill Forward WMA) in Newbury.

As the COVID-19 pandemic prevented in-person meetings during the last part of FY 20, MassWildlife staff participated in online events, including: Facebook Livestream Endangered Species Day, Current Status and Silvicultural Prescriptions for Forest Cover Types Associated with Potential Cold Water Fisheries Climate Refugia in Massachusetts Webinar, Restoring Bog Turtles in Massachusetts Webinar (hosted by Massachusetts chapter of The Nature Conservancy), Turtles of Massachusetts (online presentation (hosted by Athol Bird and Nature Club), Natural History's Influence on Habitat Management Today (hosted by North County Land Trust), and Virtual Meet and Greet with MassWildlife and Backcountry Hunters & Anglers (hosted by BHA).

WILDLIFE CONSERVATION EDUCATION PROGRAMS

Due to the COVID-19 pandemic, in-person education programs were cancelled from March 1-June 30, 2020. Numbers in this report reflect programs offered July 1, 2019 - February 29, 2020.

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. Through the use of 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 curriculum to to Science, Technology, Engineering, & Math (STEM).

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.

FY 2020 Project WILD in MA Workshops Total: 11
Project WILD Workshop– 1
Combined Project WILD/Aquatic WILD – 5
Growing Up WILD – 3
Total Participants: 130 preK – grade 12 educators

15 Project WILD and Growing Up WILD facilitators conducted the above workshops, contributing 481.50 volunteer hours.
Workshop participants included undergraduate and graduate college students, formal and non-formal educators, nature center natural history guides, state park interpreters, homeschooling parents, librarians, Montessori teachers, scout leaders, and summer nature camp staff. Early-childhood educators attending workshops represented staff from: family child care and child care centers, Massachusetts Association for the Education of Young Children, Head Start and Early Head Start, Montessori schools, state and community colleges, Self-Help/Community Partnership for Children, the AmeriCorps Student Conservation Alliance, and child care resource and referral agencies.

A multiplier (75) used by the National Project WILD office would suggest that the 130 educators reached through Project WILD would ultimately educate 9,750 youth/year.
24 Project WILD facilitators attended the annual facilitator gathering. William Lynn, Ph.D., Research Scientist at The George Perkins Marsh Institute at Clark University gave a presentation on the Parable of the Wolf: Deep Compassion, Deep Rewilding.

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
Curriculum for students, educators, home school, and non-formal groups designed to spark youth interest in habitat conservation through science, art, math and technology was 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 338 (241 in FY 2019) pieces of artwork to this "Conservation through the Arts" program. Entries were received from public, private, and home-schooled students; scouts; individuals; and private art studios. The judging, by a panel of five professional wildlife artists, took place at the MassWildlife Field Headquarters, Westborough.

A colored pencil drawing of a Canada goose with goslings by Chuxian Feng from Mr. Gao's Art Studio, Boston, 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 HQ, but it was held virtually instead. The U.S. 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 in March due to the pandemic.

General Wildlife Education Programs
General wildlife education programs presented by the Education Coordinator focus on groups of educators, students, and youth gatherings. Because programs were cancelled from March 1-June 30, 2020, the numbers reflect programs offered July 1, 2019-February 29, 2020.

In FY 2020, programs were presented to 521 youth in grades pre-K-12. (1,354 FY19 youth in grades pre-K-12; 856 in FY18)

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 pro-

vide support for the event operation in coordination with the Mass. Commission on Soil, Water and Related Resources. The 2020 Envirothon was cancelled due to the pandemic.

Massachusetts Junior Conservation Camp

In August 2019, the Conservation Camp held its 2-week session at Boy Scout Camp Moses in Russell. Approximately 100 campers attended. As in the past, MassWildlife staff assisted by providing instructors and coordinating arrangements with other state-based instructors. MassWildlife staff and MassWildlife program volunteers offered Basic Hunter Education and Bow Hunter Education courses to the campers; provided instruction in wildlife management, fisheries management, game preparation, and cooking skills; conducted the information quiz that evaluates the participant's comprehension of outdoor information and skills presented during the camp session; and participated in the graduation ceremonies. The I&E Chief attended meetings of the Massachusetts Junior Conservation Camp Board serving as member of the Board of Directors. She coordinated the scheduling of classes MassWildlife, DCR and Environmental Police staff and some evening programs for camp and presented a Fish and Wildlife Careers program on one of those evenings.

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 MassWildlife's Field Headquarters for the past three years. The day following the conference participants put their knowledge to the test by attending field sessions held around the Quabbin area.

Teaching With Trout

Conducted by the Coldwater Fisheries Project Leader and the Fish Culturalist at Roger Reed Hatchery, the program provides school students with hands-on opportunities to learn about the trout life cycle, fish rearing, and how fish hatcheries contribute to recreational fishing. Schools raise trout from eggs supplied by the agency and release the young fish in suitable habitat for future recreational angling opportunities. See the full report in Fisheries Section report, page 13.

HUNTING AND FISHING SKILLS PROGRAMS

National Archery in the Schools Program

This program offers international-style target archery training with a national 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. In order 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. During FY 2020, four (4) new schools and one organization received teacher training in NASP with a total of 96 schools participating in the program. Some schools provided their own funding; others used the new loaner kits created this fiscal year.

As in the past, the R3 Coordinator set up a table at the annual meeting of the Massachusetts Association for Health, Physical Education, Recreation and Dance in Worcester.

Many NASP schools were unable to meet the 10 hours minimum of archery lessons due to cancellation of spring classes. Starting this fall, NASP will offer a free online refresher course for teachers who were unable to meet the minimum teaching hours to renew their certification.

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.

Table 2. FY 2020 Youth Pheasant Hunt Participating Clubs

Club	# of Participatng Youth
Carver	15
Essex	15
Falmouth	14
Lee	10
Norco	10
Walpole	8
Worthington	2
Total	51

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 R3 Coordinator 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.

In FY 2020, all Youth Turkey Seminars were cancelled due to COVID-19. Only past participants were eligible to hunt on the youth turkey day.

Learn to Hunt Program
The Learn to Hunt Program is designed for new hunter education graduates who want more information/experience before feeling comfortable enough to hunt on their own.

Learn to Hunt Turkey Program: The Learn To Hunt Turkey program began in 2015 with a 3-day mentored turkey hunt and 2 single day workshops. Based on annual survey feedback some adjustments have been made to the classes. The program for spring 2020 was cancelled due to COVID-19.

Learn to Hunt Deer Program: The Learn To Hunt Deer program also began in 2015 with one 3-day deer program and 2 single day workshops. Similar adjustments to classes and length have been developed from participant surveys.

FY 2020 Learn To Hunt Deer:
- 1 two-day program -- 24 participants
- 1 half-day field dressing and processing workshop -- 29 participants.

Becoming an Outdoors Woman Program
Becoming an Outdoorswoman (BOW) is a program designed for women ages 18 and older, providing basic outdoor skills sessions. The deer seminar and mentored hunt was held for new female hunting participants in cooperation with the DoD Devens Reserve Forces Training Area.

FY 2020 Deer Seminar & Hunt
- October 2019, Shirley Rod & Gun Club – 24 Participants
- December 2019, Devens RFTA – 20 Participants (1 deer harvested)
- The spring 2020 turkey seminar and hunt was cancelled due to COVID-19.

Angler Education
The Angler Education Program is an education/outreach program within the Education Section of MassWildlife. It is the main component of the Aquatic Resource Education Program. The other component is Aquatic Project WILD, which the Wildlife Education Specialist oversees. 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 outreach numbers for FY 2020 were very low as there were no in-person public programs from March through June 2020; one of the busiest blocks of time for the Angler Education Program. To reach out during the pandemic, several online learning sessions for Beginning Fishing were developed and conducted in June.

The Angler Education Program operates with the cooperation of trained volunteers. All instructors complete a volunteer application and are checked through the Criminal Offender Record Information (CORI) system. They 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.

FY 2020 Volunteers
- 93 volunteer instructors; approximately 33% active

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.

8 family fishing events. Approximately 1,520 participants.

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 and Girl Scout troops, and or other state or federal agencies that we partner with. These are generally 2-3 hours, involving a short talk 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.

77 family fishing clinics. Approximately 1,372 participants.
Fishing Classes

A few specialty fishing classes are conducted each year, such as fly tying, or pilot adult-only "Learn to Fish" classes. New this year online beginner fishing classes were developed with the assistance of the R3 Coordinator using the Zoom platform.

Conducted 12 fishing classes with 186 participants
- 3 Online Beginner Fishing Classes using the Zoom platform, June 2020 (NEW THIS YEAR)
- 5 fly tying classes
- 4 in-school classes -- Auburn High School Physical

Education Fishing Program

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 DCR, the U.S. Army Corp of Engineers, the U.S. Fish and Wildlife Service, 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.

12 events were recipients of the loaner program utilizing 323 pieces of equipment.

Cooperative Programs

Massachusetts Junior Conservation Camp – The Angler Education Program has always instructed at this camp, teaching both the fishing and the fisheries sections, as well as contributing fishing equipment, education materials, and extra manpower. The AEP taught 12 sessions: 6 sessions of basic fishing and 6 sessions of fisheries management to approximately 100 campers.

Massachusetts Envirothon – Because of the pandemic, the May 2020 Envirothon was cancelled.

I&E STAFF RECOGNITION/PRESENTATIONS FY 2020

The Marketing Team of Nicole McSweeney, Emily Stolarski and Jody Simoes received a Commonwealth of Massachusetts Performance Recognition Award for the fishing license marketing campaign. Jody Simoes was also nominated for Manuel Carballo Governor's Award for Excellence in Public Service for marketing activities.

Emily Stolarski gave a presentation about MassWildlife's marketing activities and results at the Annual RBFF's state marketing workshop and webinar in Georgia.

I&E Staff

Marion E. Larson, Chief of Information and Education
Elaine Brewer, Natural Heritage and Endangered Species Outreach Specialist (partial year)
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

Hunter Education

Susan Langlois
Administrator

OVERVIEW

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 MassWildlife, and courses are taught by agency 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 2020, 5 of the 6 disciplines were offered across the state including Basic Hunter Education, which is mandated to qualify for a first-ever hunting license, and Trapper Education, which is mandated to apply for a trap registration number. Participation in the Hunter Education program was greatly affected by the COVID-19 pandemic.

Participation levels are much lower than the five-year average of 4,055 students.

- 70 courses successfully offered
- 49 scheduled courses were cancelled directly affecting nearly 900 enrolled students and eliminated the opportunity for another 350 participants
- 2, 543 – Total number of students participated in the Hunter Education Program

To provide a pathway for new hunters during the ongoing health emergency, the Hunter Education program developed and piloted a modified format for Basic Hunter Education courses that blends online learning with half-day, socially distanced field exercises. This revised instructional model was offered at the end of FY 2020 and this format will continue in FY 2021.

Summaries of course offerings and statistics on student participation in FY 2020.

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.

FY 2020 Basic Course Summary

- 58 courses offered
- 2,193 students participated
- 1,973 successfully completed course.
- Demographics: Of those students responding to voluntarily provide demographic information
- 540 students were minors (under 18 years of age)
- 167 were minorities
- 340 were women

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 in order to apply for a trap registration number. 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.

FY 2020 Trapper Education Summary

- 3 courses offered
- 1 conducted
- 57 students participated
- 45 students successfully completed the course

Demographics: 3 minors (under 18), 4 minorities and 7 women

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.

FY 2020 Bowhunter Education Summary
- 17 courses scheduled
- 6 courses conducted
- 213 students participated
- 209 successfully completed course

Demographics: 54 minors (under 18 years of age), 15 minorities and 29 women

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.

FY 2020 Waterfowl ID Course Summary
- 2 courses scheduled
- 1 course conducted
- 11 students participated; all successfully completed course

Black Powder (Muzzleloader) Education
This course was suspended in 2016 for review and revision. It was revised and tested in FY 2018. 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 FY 2018. Adjustments will be made and additional pilot courses will be conducted. This course was not offered in FY 2020.

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.

FY 2020 Map, Compass & Survival Summary
- 8 courses scheduled
- 4 conducted (1 in Pittsfield, 3 in Westminster)
- 69 students participated
- 64 successfully completed course

Shooting Range Development and Enhancement
It is MassWildlife's objective to provide access for 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
Tabatha Hawkins, Hunter Education and Outdoor Skills Specialist
Jesse St. Andre, Hunter Education Specialist

Photo by Troy Gipps/MassWildlife

District Reports

Trina Morruzi, Assistant Director of Operations
James Pollock, Operations Specialist
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

Most people's experience with MassWildlife is most often by encountering staff from one of the agency's five Wildlife District Offices. The District offices as the agency's regional field stations, administering wildlife lands, conducting on-site management, enhancing recreational opportunities, and addressing the wildlife issues pertinent to their regions. Operations within the districts were significantly affected by the COVID-19 pandemic. As a result of the state of emergency in mid-March, district offices closed to the public on March 16, 2020. The district staff shifted to emergency operations and continued to perform core district operations while still protecting their health and safety. 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 Massachusetts Hunting, Freshwater Fishing, and Trapping Guides 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 Supervisors 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 community education and deal with a large number of bear and deer damage complaints, questions about coyotes, and other issues dealing with the impact of wildlife on human activities, and vice versa. They also assist Environmental Police Officers from the Office of Law Enforcement (OLE) to ensure public adherence to wildlife laws and regulations.

District staff also 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 enhance recreational opportunities throughout the state by stocking brown trout, Eastern brook trout, rainbow trout, tiger trout, and broodstock salmon into waters scheduled to receive them. Prior to releasing trout, they monitor the water quality of the designated lakes and streams. These operations were affected by the COVID-19 pandemic and staff shifted to emergency accelerated 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 Wildlife Management Areas (WMAs) and in open covers (suitable habitat on public land). District staff members also operate check stations, where sportsmen register deer, bear, turkeys, and furbearers taken during the designated hunting and trapping seasons.

Land stewardship is an important agency priority and has become a large part of District activities. District staff assist the Wildlife Lands Section in prioritizing 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 a Conservation Restriction (CR). They have also been dealing with mitigation of encroach-

ment issues by adjacent landowners on our WMA lands. Staff have also been assisting the Habitat program with 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 MassWildlife land.

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

NORTHEAST DISTRICT

Administration
The Northeast District made significant staff changes this fiscal year bringing us to nearly full capacity: 1) Wildlife Technician Travis Drudi transferred over to our Stewardship Specialist position, 2) Leslie Gabrilska joined us as Clerk, and 3) Derek McDermott transferred from Western District to fill our vacant Wildlife Technician III position. They brought their special talents and experience to each job making the Northeast District a cohesive, productive and pleasing work environment. Wildlife Technician Jesse Caney left to join the Concord Fire Department. There were no serious staff injuries or illnesses, or cases of COVID-19. The Northeast District staff diligently worked together to make a safe work environment as the COVID-19 pandemic swept through the state.

The Clerk and Wildlife Technician computers were updated. The septic system serving the Wildlife Technician/Biologists offices was professionally evaluated and deemed unusable. Plans and documents for the both office septic systems were delivered to Office of Fishing and Boating Access engineers to begin exploring options.

Numerous meetings and trainings were attended including: Board, Senior staff, District Manager, Stewardship trespass training, R3, Agency Relevancy, cyber security, ladder safety, deed training, CommBuys, Procurement Webinar, Lands Committee, Essex County League of Sportsmen, Norfolk County Sportsmen, The Wildlife Society, Coastal Waterbird Cooperators, Mt. Watatic Advisory Committee meetings, fish ID, deer aging, and a necropsy workshop. LART training was attended. Several Great Marsh managers meetings were attended incorporating lessons learned during a week-long Structured Decision-making seminar. Forestry operation training was attended by our Stewardship Biologist.
Draft hunt plans were reviewed for Oxbow, Assabet and Great Meadows National Wildlife Refuges. Also reviewed were draft coyote regulations, agency key priorities, property boundary contracts, ILF and National Coastal Wetlands grant application requirements, draft R3 and Agency Relevancy documents.

At the district office, a ceiling was repaired, furnace maintained, the 9-bay garage was cleaned out, the Stewardship Biologist's office was painted, and lawns were maintained.

Over 500 Martin Burns WMA target range permits were issued in 2019. The range was closed in 2020 due to COVID-19 safety concerns. No camping permits were issued. Fishing and Hunting Guides were distributed as well as deer and turkey check materials.

Land acquisition projects in Newbury, Groton, Ayer, and Sherborn were reviewed. Land Agent Anne Gagnon completed a road easement on Kent's Island Road and developed several conservation easements for staff review. Heat maps were discussed at the annual Lands Committee Retreat. A trespass prioritization meeting was held with Realty staff.

Stewardship, Management and Habitat Restoration
Stewardship projects were significantly advanced with the purchase of gravel for roads and parking lots, fence posts for trespass and new WMA signs, as well as an iPad and GPS unit to increase capacity. Much-appreciated help was received from Fishing and Boating Access and the Southeast District who provided dump trucks for distributing the gravel.

Three noteworthy habitat restoration projects were either completed or advanced this fiscal year. Top on the list was completion of the last two parts of Great Marsh II, a project partially funded through a North American Wetlands Conservation Act (NAWCA) grant. Upon completion of Kent's Island Bridge, a celebration was held on site to express gratitude for all involved in this restoration project. Commissioner Amidon, Director Tisa, Fisheries & Wildlife Board members, interested members of the public, and staff were in attendance to view the replacement bridge. This new bridge will allow restoration of 47 acres of salt marsh and provide crucial access to 170 acres of habitat restoration projects on Kent's Island.

The second NAWCA habitat restoration project entailed completion of a major herbicide project on Kent's Island. This is the first step towards establishment of native species and the enhancement of American black duck and mallard nesting habitat.

The third most important habitat restoration project to occur in the Northeast District is the establishment of the River Barrens Habitat Restoration project at Squannacook River WMA in the towns of Shirley, Groton, and Townsend. The Northeast District had for many years been interested in a forestry project at Squannacook River WMA to alter pine monoculture to more diverse wildlife habitats. Remarkably, during site walks with Habitat Program Leader John Scanlon and Senior Restoration Ecologist Chris Buelow, a surviving pitch pine community was discovered. Based on this discovery, District staff joined with the habitat staff from the Westborough Field Headquarters and moved forward with plant community mapping, habitat assessments, timber cruises, and a management plan.

Stewardship of our WMAs and WCEs switched into high gear when Travis Drudi came on the job to handle the dramatic increase of illegal ATV use caused, in part, by the COVID-19 pandemic. People were in quarantine, out of work, and found the great outdoors a great place to spend time. Unfortunately, the uptick in ATV use in May and June coincided with the nesting period of rare turtles. Rare turtles seek out open sandy-gravelly substrates for nesting putting them in direct conflict with ATVs. Using wildlife cameras, staff were able to locate offenders, provide important information to local and environmental police, and afford relief to nesting turtles.

Research into the importance of wood in rivers and streams was conducted due to interest by the Wild & Scenic River Advisory Group to create paddle-through canoe access on the Squannacook River WMA. Downed trees, branches and other woody remains in waterways are essential wildlife habitat for a suite of aquatic species and are important for creating refugia for wildlife that is inaccessible by humans. Signs were created to post along the river to educate canoeists and prevent cutting/removal of trees in the river.

A sampling of stewardship activities follows to show the breadth of matters addressed.

• Ashby WCE – Two access issues needed to be resolved at Ashby WCE with fee-holder Ashby Rod & Gun Club. Access to the pond through a public easement needed clarification to avoid public confusion and conflict. A kiosk was provided by MassWildlife and installed by club members to provide maps and information to guide the public to areas open to them. MassWildlife could not help with access to a second pond where, in our opinion, rights did not exist.

• John C. Philips Wildlife Sanctuary – Stewardship Coordinator Christine Chisholm assisted with finishing touches to the Bay Circuit Trail License Agreement, and relocation of the trail. Members of the Appalachian Mountain Club trails team handled all aspects of trail relocation in coordination with MassWildlife. This less impactful route replaced the Bay Circuit Trail previously located through the center of the sanctuary, in rare species habitat.

• William Forward WMA - District Manager Huckery provided guidance on The Trustees NAWCA Salt Marsh Resiliency project that included about 50 acres of salt marsh restoration using nature-based ditch-remediation and runnels. Wetlands were delineated prior to the herbicide project on Kent's Island. A burn plan was reviewed for Kent's Island and a hop-hornbeam forest community was mapped.

• Charles River WMA – A proposed trail system incorporating parts of Charles River WMA was reviewed and found lacking mostly due to wetlands impact. However, one positive aspect of the project was possible accessible fishing access from an abandoned railroad right-of-way.

• Crane Pond WMA – Staff assisted MassWildlife's Federal Aid Coordinator with federal taking research as part of a federal audit.

• Mt. Watatic Sanctuary – The sanctuary has experienced severe damage over the years as a result of its location between a DCR parking lot and the summit of Mt. Watatic where the Mid-State Trail passes through its center. To restore the Sanctuary, the Appalachian Mountain Club submitted a Mass Trails Grant to repair/restore the Mid-State Trail, with assistance from MassWildlife and DCR.

• Salisbury Marsh WMA – Angler access to the Merrimack River was maintained. Old wire fencing and posts were removed from the fields off Sweet Apple Tree Lane to facilitate mowing. Contract boundary work was completed, and two trespasses were discovered.

• Pantry Brook WMA – The impoundment dam at this WMA is routinely checked for beaver activity. When found, it is removed to prevent damage to the dam, maintain water levels in the impoundment for waterfowl, and prevent flooding on neighboring properties.

• Martin Burns WMA – Regular cleaning of the target range was necessary due to the large amount of trash left behind by users. Newbury Zoning Board of Appeals hearings were attended regarding a development off Pearson Drive impacting vernal pools, wildlife habitat and wildlife-dependent recreation.

• Delaney WMA – Monarch butterfly habitat was delineated, and signs erected, to protect these areas during mowing. Research was initiated by a PhD student to study Monarch butterfly habitat patch use.

Research and Conservation

Wildlife
Bluebird, kestrel, wood duck and bat boxes were constructed during the winter months. Kestrel boxes were erected at Unkety Brook WMA and William Forward WMA. Bluebird boxes were erected at Ashby and Squannacook River WMAs.

Diligence, time, and sound strategy marked the trapping of a Northeast District black bear, with cubs in tow, in the town of Shirley. The sow was tagged and fitted with a satellite collar. It is hoped she will provide MassWildlife with multiple years of needed suburban bear data, as will her cubs in future years. Staff continued to monitor the Amesbury bear, but she has crossed into New Hampshire. Staff also assisted with removal of bear hair snares state-wide.

Deer pellet browse surveys were conducted by staff and data analyzed. Fisheries Biologist John Sheedy joined waterfowl survey crews on the airboat at Great Meadows/ Concord, Ipswich River/Topsfield, Nashua River and Milford Pond.

Ruffed grouse, woodcock, mourning dove, and whip-poor-will surveys were conducted with assistance from Wildlife Technician Josh Gahagan, who also conducted bird surveys/ monitoring at Martin Burns WMA, William Forward WMA, and North Pool at Parker River National Wildlife Refuge, well as help with other Westborough-directed bird surveys. An ILF grant pre-proposal was prepared for salt marsh restoration projects in Great Marsh. Other Great Marsh grants were explored for salt marsh restoration projects. Maps of priority restoration areas within Great Marsh were created.

Fisheries
Fish survey equipment and the shocking boat were checked and maintained in anticipation of stream and pond surveys. Stream surveys were conducted in the following watersheds: Merrimack, Ipswich, Parker, Charles, Nashua, North Shore Coastal, Shawsheen, and Ten Mile. Twenty streams and 9 rivers were surveyed. Ponds surveyed included: Baldpate, Horn, Merrimack, Pleasant, Rock, Saltonstall, Sluice and Townsend Harbor.

A fish kill of shad occurred June 19 on the Merrimack River in Haverhill.

Natural Heritage and Endangered Species
A long-eared owl survey was conducted on Kent's Island at William Forward WMA in response to reports of roosting owls. None were found. Bird surveys were conducted at Martin Burns WMA to document shrubland species.

Bald eagle nest surveys were conducted during the pandemic, but eaglet banding was suspended. Fledging surveys were conducted to replace banding efforts and record successful reproduction. Fourteen viable nests were documented with three new nests discovered. Organization of the eagle nest and banding data was completed.

For the fourth year, Wildlife Technicians assisted NHESP's Chief of Conservation Science Pete Hazelton with freshwater mussel surveys as required by Turner Dam removal permits.

Enhancement of Outdoor Recreation
Fall trout stocking began in September 2019 with 12,650 trout released (11,400 rainbow trout and 1,250 brown trout). In the spring, 102,825 rainbow, brown, and Eastern brook trout were stocked. Seven major rivers were stocked, along with 64 streams, 13 ponds one time/year, 28 ponds multiple times/season.

After checking pond temperatures, spring stocking started in March 2020 only to experience dramatic changes due to the coronavirus pandemic. MassWildlife quickly adjusted stocking protocols and schedules, pulled together and safely got the fish out for anglers. A new aluminum pheasant rack facilitated another successful pheasant season. Five-thousand pheasants were released into five WMAs and 11 open covers. Pheasant stocking sites were mapped with no loss in the number of pheasant covers within the district. No one applied for a Special Pheasant Stocking Permit at Martin Burns WMA. The Danvers Fish and Game Club ran a successful Youth Pheasant Hunt at Martin Burns WMA, and the Walpole Rod and Gun Club held their hunt at Charles River WMA. Wildlife Biologist Bird talked at the Danvers Youth Pheasant Hunt seminar and Wildlife Technician Tim Mathews supervised the Danvers Youth Pheasant Hunt at Martin Burns WMA. Controlled pheasant hunts were supervised by staff every Saturday at Martin Burns WMA, during pheasant season.

Bird and Huckery assisted the towns of Harvard and Carlisle and other property owners with hunting information, with the goal of opening lands to hunting to protect the health of the forest from overbrowsing by deer.

A fishing access assessment to Cocasset Pond in Foxborough was undertaken. Research on access issues, pond ownership, history and legality of fishing at this location, and local concerns was conducted.

Twelve deer check stations operated within the District. Three hunters took part in the paraplegic hunt held at Fort Devens, where deer were seen, but none harvested.

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

Nine waterfowl hunters applied for the controlled hunt at Delaney WMA, where eleven blinds were maintained. No primitive camping permits were issued for any WMA. Over 500 target permits were issued for the Martin Burns WMA range. Issuance ceased in March of 2020 after shutdowns due to the pandemic went into place.

Staff reviewed and provided comments on the draft R3 Final Plan and participated in Zoom meeting review of the plan. District biologists emphasized hunter recruitment, retention and reactivation in their interactions with the public.

Outreach and Education
District participation in the Agency Relevancy Group is of prime importance to the education of the public. Northeast District staff stayed involved with the development of ideas to broaden MassWildlife exposure and name-recognition in the general public. In hiring Leslie Gabrilska, as Clerk, we substantially increased our capacity to help with wildlife nuisance calls. Her patience, intelligence and experience dealing with public issues in her former job will take us far in addressing the everyday wildlife crises experienced by people in the Northeast District.

The annual Carlisle Conservation Breakfast, held in February, was devoted primarily to discussing the town's controlled deer hunt, coyote, black bear, and beaver. The 4th annual Vernal Pool Discovery Walk in Groton was cancelled due to the pandemic, as was the Riverfest held by the Nashua River Watershed Association.

Staff participated in the town of Harvard's deer forum, sponsored by the Conservation Commission. Concerns for safety were uppermost in people's minds, and they were concerned the hunt was premature based on deer browse surveys. MassWildlife's David Stainbrook and Huckery emphasized the importance of managing their local deer herd in advance of evidence showing severe forest impacts from grazing.

District Manager Huckery attended the MA Trails Conference and staffed a table with Westborough's Realty staff. The emphasis was on wildlife impacts from trails and encouraging people to think through wildlife impacts when planning for new trails or re-routing them. She also attended the Rowley Municipal Vulnerability Preparedness Webinar.

A wild turkey presentation was given in Swampscott. A black bear presentation in Townsend reaped good results for Wildlife Biologist Bird in her search for sites to bait and trap. A coyote talk in Concord was well-attended as people learned to distinguish normal coyote behavior from aggressive behavior. They were instructed in hazing techniques to handle coyotes in their backyards. A wildlife presentation was given by Bird in Topsfield.

Technical Assistance
Moose calls increased this year in Townsend, Pepperell, and Boston. A cow moose fell into an old canal in the Merrimack River requiring LART rescue. Dozens of emergency responders assisted MassWildlife's Dave Wattles, Mike Morelli, Jesse Manty, and District Manager Huckery. It was a complicated rescue, with a touch-and-go moment as the moose started to sink into the river but she survived. Staff transported her further west in the Northeast District, administered reversal drug, and she made her way into the forest.

A white-tailed deer in a predicament in Lowell exposed Wildlife Biologist Bird to the frenzy of a LART city rescue. Staff was mobbed during the rescue but remained calm and focused, successfully immobilizing and relocating the deer.

A notable call was received by staff concerning turkeys trapped within a condo courtyard in Boston. The complex was surrounded by buildings and roads without any nearby suitable green space to haze them. Talented staff were able to capture and move some turkeys while others flew out of the courtyard to parts unknown. Wildlife Biologist Bird had a serious talk with condo occupants about feeding the turkeys and other wildlife.

Staff assisted with training the Carlisle Conservation Commission in conducting deer browse surveys. They also helped with coyotes at an elementary school in Revere.

SOUTHEAST DISTRICT

Administration
There were no personnel changes in the Southeast District in FY 2020.

Sadly, the Southeast District, MassWildlife and the conservation community in southeastern Massachusetts lost two very special retired staff in the past year. Ed Kraus, who worked as a Fisheries and Wildlife Technician in the District for his entire 43-year career, and Dick Turner, who worked as the District Wildlife Biologist for an amazing 63 years, both passed away. These two men were incredibly hard-working, dedicated, and passionate employees of the agency. More importantly, they were two of the kindest, genuinely good people this District Supervisor has ever known. The hole their loss leaves in the conservation and sporting community, and in the hearts of the many people fortunate enough to have known them, cannot be overstated.

The District office received a complete computer/network upgrade and now have access to view/share files through the network with Westborough staff and other Districts connected to the network, which greatly improving efficiency. The District also developed specifications for a new

F550 stocking truck and assisted with the development of the RFQ. The new stocking truck was picked up in late FY 2020 and was immediately put into use as a small dump truck and will be available for trout stocking in the fall.

While it certainly did not impact agency operations until close to the end of FY 2020, the COVID-19 pandemic was by far the most significant event of the year, affecting agency personnel both personally and professionally. Many hours were spent constantly planning and adjusting agency operations and staff schedules to continue to meet the agency's mission while keeping staff and their families safe. In the Southeast District, aside from following guidelines related to COVID-19 (masks, teleworking, etc), business went on as usual and our dedicated and hard-working staff completed all core agency functions at an extremely high level.

The Hyannis Ponds water issue continued to progress this fiscal year with District and FHQ staff working closely with DEP, USGS and the Town of Barnstable to complete and review the modeling analysis of potential impacts of groundwater withdrawals in the system. Based on the modeling, MassWildlife issued a license agreement to the Town to install a test well on the WMA to evaluate water quantity and quality. The well was installed, and initial testing completed by the Town. Results are expected to be available in early FY 2021.

Work continued on the restoration of the Hartley Reservoir WMA main outlet flume. The flume was replaced with a new flume in late FY 2019 and the District has been working with the Town Conservation Commission to plan for installation of loam and a native seed mix to stabilize some areas with minor erosion issues. This flume is critical to maintaining both the wetland habitats on the property, but also to the herring run in the Mattapoisett River flowing through the WMA.

Several cranberry bog restoration projects progressed in FY 2020. The Red Brook WMA project is in the process of being scaled back and redesigned to lower project costs while still meeting the goals of converting the former cranberry bogs into functional wildlife habitat. The goals are to minimize impacts to the wild salter brook trout habitat downstream and the existing herring run into White Island Pond. The Mill Brook Bogs WMA restoration project design is advancing, with a new consulting firm on board to finalize the design and progress into the permitting phase. At long last, permitting for the restoration of the former Dyer property in the Taunton River WMA was completed late in FY 2020, which will allow the project to be put out to bid in early FY 2021.

The Cape Cod Rail Trail project expected to cross the Hyannis Ponds WMA also reached an important step with the ENF being filed. District staff reviewed the ENF and were involved in making comments to MEPA on various aspects of the project.

District staff worked with the District Attorney's office on an investigation into Peterson Oil, who had been the provider of heating oil to the District HQ for a number of years. The investigation centered around the company allegedly providing customers with heating oil that had a higher than allowable level of biofuel, which can damage heating systems if they are not properly set up for that type of fuel. Interestingly, the furnace at the District HQ had significant issues costing the agency money during the time period when this fuel type was discovered to have been delivered. The investigation is still ongoing.

District staff continued their involvement in both agency R3 and Relevancy initiatives, attending meetings, reviewing draft R3 and Relevancy plans and researching both topics in order to better serve the agency and our mission.

The District Supervisor began working on the development of a Hunters for the Hungry program in Massachusetts in coordination with the Deputy Director. Contacts were made to the Board of Health and known butcher shops in several Towns in the District with the goal of having something in place for Fall 2020. However, once COVID-19 hit, the ability to coordinate/meet with Towns was greatly impacted providing a major setback to the program.

There are always ongoing issues that arise in the Districts, certainly too many to list in an annual report, however two issues in the Southeast this year deserve particular mention. First, and perhaps most significant, was the successful completion of a multi-year, multi-agency effort to remove homeless encampments from the Hyannis Ponds WMA. This property has had a significant issue with illegal and often dangerous homeless camps for many years. Dealing with these camps quickly becomes very complex due to the variety of factors involved. The main issue is trying to cooperatively and compassionately work with both state and local law enforcement and social workers as they assess each individual and individual camp. The goal is to find the homeless individuals suitable housing if they meet certain criteria. That is not always possible, but as fellow human beings we owe it to them to at least try. Once the people either found housing or are removed from the area, another equally difficult task remains; site cleanup. We worked closely with the state and town police and the MA Environmental Police to assess each site and then determined a course of action for cleaning. It was determined that many of the sites we could clean up in-house safely, but due to a few serious issues (drugs, human waste, diseases) we were required to contract the cleanup of one site via a professional environmental remediation company, which cost the

agency thousands of dollars.

The second major issue of significance relates to improper/illegal use on the Plymouth Town Forest WCE. MassWildlife has an excellent and long-standing relationship with the Town of Plymouth and, without their efforts and support, this might have been a much more difficult issue to address. What started as a minor nuisance associated with people illegally parking and utilizing a small sandy beach area on Great South Pond quickly, and certainly due in large part to COVID-19 placing many people out of work, progressed into a major issue causing damage to globally rare coastal plain pond shore habitat. Thanks to the persistent efforts of the local residents who were the best first-hand witnesses to the problem, continued site visits and photographs by MassWildlife staff and enforcement efforts taken by the Town of Plymouth, the issue was resolved in late FY 2020. Shoreline restoration efforts are planned for early FY 2021.

District staff attended several trainings in FY 2020. All fire crew members successfully completed an online/virtual prescribed fire refresher course, several staff completed a hose lay workshop for prescribed fire, the District Manager and Wildlife Biologist attended a wildlife necropsy workshop and Wildlife Technicians Dan Fortier and Connor Fleming successfully completed pesticide applicator training and progressed towards certification. District staff participated in the annual deer management and aging class. District staff also attended the annual employee conference hosted at the Connecticut Valley District Office in Belchertown. District staff, particularly the District Manager and Wildlife Biologist, were intimately involved with the ongoing development, review and outreach associated with the new coyote and wanton waste regulations that were ultimately passed by the agency this year. They attended all of the public hearings and internal meetings, met many times with interested members of both the sporting community and the general public to listen to their questions, comments and concerns to ensure they were taken into consideration in the decision-making process.

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 surveys (Rochester, Brewster). District staff also conducted annual winter American black duck trapping, capturing just over 300 ducks (55 recaptures). Further, we completed both summer and winter mallard banding using a tub launcher. Scouting was completed for goose banding sites in late FY 2020, but goose banding was not completed this year due to COVID-19 restrictions.

Nesting boxes for wood ducks and Eastern bluebirds were monitored, maintained, and replaced on MassWildlife lands and other public and private lands. A total of 83 wood duck boxes were maintained at 27 different sites throughout the District. Two new boxes were installed at Clapps Pond WMA in an attempt to establish a new breeding/study site. The District was involved in a few LART responses in FY 2020 including a fawn stuck in a fence in Fairhaven and an adult doe running around downtown Boston near Boston University. The fawn ended up having to be euthanized due to its injuries. The doe in Boston was chemically immobilized in coordination with OLE and Boston Police and then District staff transported it to a WMA in the Southeast for successful reversal and release.

Deer browse surveys and deer pellet transects were completed in a number of sites in FY 2020. These projects lend themselves very well to complying with COVID-19 guidelines and are also important aspects of our overall deer management program. Browse surveys were completed at MassAudubon's Daniel Webster Wildlife Sanctuary in Marshfield and several Town of Brewster properties including Mother's Bog Area, Punkhorn Parklands and the Sheep Ponds Woodlands. Pellet transects were completed at the Daniel Webster Wildlife Sanctuary, Wompatuck State Park, Myles Standish State Forest, Town of Barnstable lands, Frances A. Crane WMA, Hyannis Ponds WMA, Cape Cod National Seashore, Nickerson State Park, Punkhorn Parklands, Mothers Bog Area and Sheep Pond Woodlands.

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

A significant spotted turtle research project was completed in cooperation with Mike Jones from NHESP at our Atwood Reservoir WMA. This is part of an ongoing project associated with the rescue of primarily hatchling turtles from cranberry processing plants in the fall and is an effort to better understand post-release survival of these turtles. A total of 25 spotted turtles were collected from the cranberry plants, marked and released at the WMA in fall 2019. Traps were placed on the WMA in May 2020 and a total of 14 spotted turtles were captured, two of which were recaptures of marked turtles from 2019. DNA samples, to assist with a regional spotted turtle research project, were obtained from 20 of the turtles.

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.

Southeast District staff assisted with common eider banding in southeastern Massachusetts in spring 2020, along with H Heusmann, other Westborough staff and cooperating volunteers. Eiders were surveyed for and banded on offshore islands on the North Shore, in Boston Harbor and the Elizabeth Islands.

As part of a multi-state collaborative effort to restore New England cottontails to historical ranges, District staff spent 10 days to live-trap 14 New England cottontails from three areas in Sandwich and Mashpee. The rabbits were delivered to the Bristol County Agricultural School where they received care and were established as part of the captive breeding program in cooperation with the Roger Williams and Queens Zoos.

District staff also investigated numerous reports of sick, injured or dead wildlife as a result of a variety of causes and took the appropriate action, depending on the situation. The staff also uses this interaction with the public to educate them on wildlife biology and management. The most common species are birds, including gulls, songbirds, waterfowl and other water birds; however, mammals such as raccoon, fox, and opossum are also common along with the occasional reptile. Several injured hawks were picked up and brought to wildlife rehabilitators. District staff responded to reports of both cormorant and gull mortality events in a couple locations and collected specimens that were sent to labs for testing.

District staff also operated game check stations during deer season, collecting biological data used in management of this important game species. Several District staff assisted in the collection of ticks from deer brought to check stations as part of ongoing studies to look at diseases carried by the various species of ticks. Further, as we have for the past few years, District staff entered all biological deer and turkey data collected into the MassFishHunt online system, allowing our biologists to review and analyze the data more efficiently.

Fisheries

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, 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, and 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 were 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.

Land Stewardship

The District Stewardship Biologist completed annual monitoring visits and reports on all District Wildlife Conservation Easements (WCE) that were his responsibility in FY 2020.

Boundary marking efforts continued in FY 2020, 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. Further, inspection of the recently completed Camp Edwards WMA boundary project was conducted for compliance with bid specifications. All road frontage on every Southeast District WMA was surveyed by District staff and boundary marking completed or refreshed in FY 2020.

A major off-highway-vehicle (OHV) issue at our Taunton River WMA was addressed this year through site visits, boundary marking, signage, installation of boulders and letters being sent to abutters with OHV trails leading into the WMA from their land. Further, EPOs assisted with multiple enforcement visits to the WMA.

Prescribed fires were completed at the SE Pine Barrens WMA and Frances A. Crane WMA. Fire breaks were created or maintained at the Mashpee Pine Barrens WMA, SE Pine Barrens WMA, Camp Cachalot WCE and Frances A. Crane WMA. Snags were also cut at the Camp Cachalot WCE and SE Pine Barrens WMA as part of prep for prescribed fires. The District obtained a roller chopper attachment from the USFWS and demonstrated its use for habitat management to staff from Camp Edwards and then utilized the machine to complete habitat management in several burn units at the southern section of the Frances. A. Crane WMA.

New main WMA signs were installed at the Agawam Mill Pond Access, Peterson Swamp WMA, Atwood Reservoir WMA, Frances A. Crane WMA and Burrage Pond WMA. The latter two sites receiving the new composite signs fabricated by the Valley District.

Management roads and access paths were mowed and/or maintained at all stocked WMAs, as well as the Burrage Pond WMA and Hartley Reservoir WMA. Fields were mowed at the Myles Standish State Forest and Old Sandwich Game Farm WMA.

Gates were installed to control illegal motorized vehicle access at the Frances A. Crane WMA, Red Brook WMA and Taunton River WMA.

District staff worked with Wildlife Population Ecologist Jonathan Brooks to enter all District habitat management activities into a new GIS database that will be used to keep track of projects and prepare reports on active habitat management completed by the agency.

One significant encroachment that has been ongoing for close to seven years was successfully resolved at the Frances A. Crane WMA. An agreement was reached with the landowner whereas they finally agreed to the location of the boundary line and will be removing a horse fence and debris installed on the WMA.

Water control structures and water levels were managed/maintained at the Hartley Reservoir WMA and Burrage Pond WMA to enhance emergent wetland habitats for wildlife and wildlife-dependent outdoor recreational opportunities. Routine custodial functions continued with trash/dumping issues addressed at all properties. The most significant dumping areas in FY 2020 continued to be the Hyannis Ponds WMA, Hockomock Swamp WMA, Rocky Gutter WMA, Ashumet Pond Boat Ramp, Mashpee River WMA, Great Herring Pond Boat Ramp, Snake River Boat Ramp and Taunton River WMA.

Parking areas and roadways were maintained at all WMAs and Access sites in the District. Significant improvement projects were completed at the Erwin Wilder WMA (road and parking area), Frances A. Crane WMA (multiple parking areas), Mattapoisett River WMA (parking area), Taunton River WMA (parking area) and Burrage Pond WMA (new parking area, interior roadway and OLE driveway).

Invasive plants were controlled at several WMAs through hand pulling and/or herbicide applications at the Burrage Pond WMA (primarily gray willow, phragmites and Calamagrostis epigejos), Mill Brook Bogs WMA (phragmites, purple loosestrife, gray willow, etc.) and Frances A. Crane WMA (spotted knapweed).

A significant hazard tree was addressed at the Burrage Pond WMA. The District Manager and Stewardship Biologist conducted a site visit and then worked with the District Clerk and Westborough staff to contract out the removal of the large pine tree that was threatening to fall on an abutter's

home.

District worked with Westborough staff and DCR to assist in marking out trees in habitat management units at the Myles Standish State Forest, SE Pine Barrens WMA and Camp Cachalot WCE as part of an ongoing, multi-year/multi-agency habitat project to mitigate wildfire potential and restore pitch pine/scrub oak barrens habitats in the region.

Natural Heritage and Endangered Species
The District cooperated with the Natural Heritage & Endangered Species Program (NHESP) staff on a variety of projects this fiscal year.

The District took on an even larger role in the shorebird projects this year as seasonal staff and volunteers were not able to be utilized for the projects due to COVID 19 restrictions. Staff committed two days per week exclusively to shorebird work, with the vast majority of that dedicated specifically to the tern project. Staff assisted with a variety of habitat projects on the 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 a prescribed fire on the Tubbs section of Penikese Island Sanctuary to enhance nesting habitat.

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. Staff also assisted with installing a deer exclosure to protect rare plants in Falmouth.

Staff assisted with the construction of bat boxes, part of a collaboration with MassDOT. The boxes will be installed at WMAs across the state.

Staff assisted with coastal plain pondshore habitat restoration projects at Hyannis Ponds and Cooks Pond WMAs. The District also continued implementing the water level management plan at Cooks Pond WMA in Plymouth to support/enhance coastal plain pondshore habitat.

In spring 2020 the District also participated in the annual spring bald eagle survey, monitoring all of the known/active bald eagle nesting locations within Bristol, Plymouth and Barnstable counties. However due to COVID-19 restrictions, chick banding was limited to a single chick at one nest on Cape Cod. (See Table 1 below)

A very significant milestone was reached in American bald eagle restoration in Massachusetts with the first confirmed chick hatched and fledged on Cape Cod in over 100 years. The last active eagle nest on the Cape (and the entire state) was in 1905 in Sandwich. The new nest in Barnstable was monitored closely and District staff banded the single, healthy eagle chick in May. There was significant media coverage across the state and beyond about this historic hatching event.

District staff monitored known peregrine nesting sites in Fall River, New Bedford, Brockton, Taunton and Sandwich/Bourne and investigated a possible new site in Plymouth.

Southeast District supported the annual Northern red-bellied cooter release in May at Burrage Pond WMA.

Table 1.

TOWN	LOCATION	RESULTS
Lakeville	Anuxanon Island	Nest failure
Middleboro	Pocksha Pond	2 chicks fledged
Plymouth	Halfway Pond	Incubation documented
Plymouth	Billington Sea	New nest location, 2 chicks fledged
Carver	Sampson Pond	2 chicks fledged
Pembroke	Silver Lake	Nest failure
Wareham	Tihonet Pond	Nest failure
Plymouth	Big Sandy Pond	Incubation, no success observed
Barnstable	Mystic Lake	1 chick fledged (first on Cape since 1905!)
Martha's Vineyard	Unknown	Nest failure
Fall River	North Watuppa Reservoir	1 chick fledged
Marshfield	North River	1 chick fledged
Dighton	Bristol Agricultural High School	1 chick fledged

Enhancement of Outdoor Recreation

District staff stocked its fall 2019 allocation of trout into 25 ponds and stocked its spring 2020 allocation of trout into 48 ponds and 23 streams. The COVID-19 pandemic necessitated an accelerated stocking program this year. Further, Southeast District staff assisted other districts by delivering/stocking broodstock trout out of Sandwich in all 5 districts. 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 & Game Club grounds, the Falmouth Rod & 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 Correllus State Forest and Katama Farm are stocked on Martha's Vineyard and 8 locations are stocked on Nantucket.

Significant time and effort was directed towards one private cover that is very popular with pheasant hunters as it has been under development pressure and recently had some of it sold off and developed as a large solar array. District staff worked with the landowner to install signage and adjust stocking locations to ease concerns about damage to the solar panels while maintaining this area and opportunity for hunters.

In addition to pheasants, staff also stocked 3500 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 MassWildlife'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 MassWildlife's Young Adult Pheasant Hunt.

The District operated and managed controlled-access hunting opportunities for white-tailed deer, wild turkey, and coyotes at Camp Edwards on Joint Base Cape Cod. 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 51 deer and 13 turkeys. Further, the District worked closely with base personnel to offer the Division's annual paraplegic deer hunt, with three participants all seeing deer and one successfully harvesting a doe. The District also worked with base staff to again provide very successful youth deer and youth turkey hunting programs. District staff supported the implementation of the Blue Hills Reservation Deer Management Plan by assisting with the controlled deer hunt.

The District Supervisor issued permits for a total of 40 special winter game bird hunts, 18 at the Erwin Wilder WMA and 22 at the Frances A. Crane WMA. A total of 364 pheasant and 840 bobwhite quail were stocked during these hunts. One field dog trial and two training days were reviewed and permitted by the District Supervisor at the Frances A. Crane WMA. Further, a number of 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 Hockomock Swamp WMA.

Several land projects were completed that greatly benefit public access and outdoor recreation including the acquisition of the former Harju property as an amazing addition to the Rocky Gutter WMA. Not only will the property provide excellent access into the WMA, but the property contains the only open water habitat on the WMA and offers excellent outdoor recreational opportunities.

As mentioned previously in the Land Stewardship Section, the District continued to maintain and improve roads, trails, parking areas and fields on our wildlife management areas and access areas to provide for safe and effective access to our properties for all forms of passive outdoor recreation. A significant amount of funding, time and effort went into creating or improving parking areas and access roads at many properties including the Frances A. Crane WMA, Burrage Pond WMA, Erwin Wilder WMA, Taunton River WMA and Mattapoisett River WMA.

District staff worked to collect or take photos at all OFBA freshwater access sites as part of an effort to improve online tools and information for the public looking to access ponds and streams for boating and fishing.

The District Wildlife Biologist worked closely with Deer and Moose Project Leader David Stainbrook to assist the Town of Brewster in making deer management/deer hunting access decisions on their lands. In addition to staff completed both deer browse surveys and pellet transects, the Biologist attended several meetings and gave presentations on the results and deer management in general.

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 through-

out the region. The Division's annual Guide to Hunting, Fishing & 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, Thornton Burgess Society Animal Day, the Boston Bowhunters Group annual event and several other environmental career days and youth events.

The District Wildlife Biologist installed wood duck boxes at the Burrage Pond WMA with an eagle scout as part of his eagle scout project.

The District Supervisor and Wildlife Biologist gave a presentation; "Bald Eagles on the Cape" and assisted with the release of two juvenile eagles that were successfully treated and rehabbed at WildCare. The District Supervisor also gave a talk on fishers hosted by the Harwich Conservation Trust and a talk on bald eagles to the Lakeville Lions Club. The Supervisor also attended several elementary schools career days to talk about his job, as well as giving several general wildlife talks. The Wildlife Biologist gave coyote talks at Wing's Neck and in Pocasset. The Fisheries Biologist gave multiple electrofishing and/or PIT tagging demonstrations to school groups and gave a lecture on cranberry bog restoration and trout habitat.

The District Supervisor 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 Supervisor participated in a Learn To Hunt workshop organized by Astrid Huseby, R3 Coordinator, in Westborough to provide newer hunters with experience and information on field dressing and butchering deer and donated a recently harvested deer providing participants with some fresh venison to cook and eat at home.

The District Supervisor and Jon Regosin, Deputy Director, participated in a live Zoom event with the Backcountry Hunters and Anglers.

The Fisheries Manager attended regular meetings of the River Herring Network, Eastern Brook Trout Joint Venture and Sea Run Brook Trout. The District Supervisor attended 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. Numerous site visits were made to meet with concerned citizens and information was provided to either quell their concerns or empower them to take steps to reduce the probability of conflicts such as proper yard maintenance, harassment and pet husbandry.

Numerous nuisance and aggressive turkey complaints were again reported in the District including Barnstable, Brockton, Eastham, Sandwich, Swansea and Yarmouth. In a few cases, an aggressive bird was captured and euthanized.

Aggressive hawks also continue to be a common theme in the District. Staff responded to reports of aggressive hawks in Mansfield and Kingston. The Mansfield situation was basically resolved by waiting for the chicks to fledge and disperse, while the Kingston situation required more immediate action due to the number of people attacked and the severity of injuries sustained. Staff climbed the tree safely, removed the chicks and then removed the nest. The chicks were transferred to Norman Smith, a cooperator who fostered them into another active nest. Our climber was hit by the hawk no less than 20 times during the ordeal, but only sustained very minor injuries due to wearing a helmet and other proper protective gear.

Reports of aggressive coyotes has once again become a common occurrence in the Southeast District. While we have always received annual calls with concerns about bold coyotes, this year seemed to have a significant increase in reports/calls. Most significantly, we responded to two locations where the reported or documented behavior of coyotes was a major concern to the agency. In Chatham, a large male coyote was reportedly approaching/stalking small children within a few feet and attacking leashed dogs within 6 feet of their owner. The District worked closely with Dave Wattles, OLE and the town police to come up with both an educational campaign in the surrounding neighborhoods, but also to enlist the assistance of a licensed, coyote certified PAC agent. The suspected aggressive individual was removed very quickly by the PAC agent and, through that effort and abundant education in the neighborhood, the issue was resolved.

A second and even more significant coyote situation which,

unfortunately remains ongoing into FY 2021, involved another large male coyote in Fall River that has bitten two children and acted boldly/aggressively towards multiple adults. This situation is much more difficult because of discharge setbacks and the inability to enlist a PAC agent. District staff have conducted multiple site visits and coordinated with OLE and the local police, however efforts to respond and dispatch the animal have been unsuccessful.

The District staff 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 DISTRICT

Administration

The District Supervisor and District Biologists provided input to the MassWildlife Lands Committee on potential land acquisition projects, focusing on wildlife habitat and recreational opportunities. The largest acquisition this year was in Paxton adding 55 acres to the Moose Hill WMA. This particular piece of land has some frontage on Laurel St. and represented a "doughnut" hole in the middle of the WMA. This land had significant development potential, and the DFG District Land Agent, James McCarthy had been in contact with the owners frequently for a number of years trying to work out a deal. It is gratifying to finally see this transaction come to pass. In addition to our in-fee acquisition activities the District Stewardship Biologist and Wildlife Technicians provided annual monitored work on dozens of Conservation Easements throughout the District.

License agreements were issued by the District for agricultural leases on WMAs. During FY 2020 the District managed 35 agreements. Six license agreements were either new or renewals this year. These six were issued on the following WMAs: Millers River, Moose Brook, Norcross Hill, Oakham, Popple Camp, and Sucker Brook. The 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 professional development and training related to Large Animal Response and Safe Capture was cancelled due to the COVID-19 pandemic. We hope that it will be able to resume in FY 2021. Staff have engaged in continuing education to maintain Hoisting Licenses, and Ladder Safety through online course work.

Many meetings were attended including: Senior staff, District Manager, Stewardship Biologist, R3, Agency Relevancy, Lands Committee, coyote listening sessions in Bourne, Lenox, Westford, Buckland and Westborough, and Worcester County League of Sportsmen (monthly from Sept. 2019 – Feb. 2020).

New equipment acquisitions included a compound miter saw which replaced an old, non-OSHA compliant, radial arm saw, and a 30,000 pound gooseneck trailer designed to complement the 2019 Ford F550 stocking truck the District received last year. This combination will ensure that we are able to safely, reliably and efficiently transport the heavy equipment we use for habitat and WMA maintenance work (tractors, bulldozer, skid steer) for many seasons to come.

Stewardship and Management

Habitat maintenance was conducted on 22 Wildlife Management Areas, including seasonal mowing at 16 Wildlife Management Areas during the summer of 2019. Mowing was done aggressively at some management areas to knock back invasive plants and other woody debris in an effort to promote grassland habitats. Field and orchard maintenance was completed at Richardson WMA. A large island of trees was removed from one of the fields, edges were trimmed back to facilitate mowing, and apple trees were released and pruned.

The large timber harvest being conducted at Norcross Hill WMA in Templeton began late in 2019. This harvest was planned as part of the sale of the property and the former owners have two years to complete the project. MassWildlife staff participated in the forestry plan and will monitor the cut to ensure it complies with requirements. District staff have also been involved in the monitoring work of the timber cut at Quaboag WMA on Long Hill Road in Brookfield. District personnel also participated in a small amount of additional cutting and clean-up work at Muddy Brook WMA in March of 2020.

Our District Stewardship Biologist continues to be busy addressing vehicle and abutter encroachment issues. District staff noticed an uptick in illegal OHV encroachments and illegal trail cutting activity since the COVID-19 pandemic began.

Staff have also been busy with boundary marking; both new boundaries and refreshing previously marked areas. In addition, all District habitat maintenance activities were documented in the agency's Managed Area Inventory database for future tracking.

Access Grant funding was made available to the District in

the spring of 2020. With this funding staff was able to improve four WMA parking areas by spreading gravel, or refreshing existing gravel surfaces, with 600 tons of 2 inch or less locally sourced and contracted gravel. District staff used a skid steer to spread and smooth the product making parking access available for most passenger vehicle types. Site improvements were made at the Ware River, Oakham, and Richardson WMAs. Some of this grant funding also allowed for two new signs to be made for the Bolton Flats WMA. More new signs are planned for next fiscal year.

Research and Conservation

Wildlife
District staff monitored 11 active bald eagle nests, including a new territory in Fitchburg. All monitoring this season was conducted from the ground; no climbing or bird banding was scheduled due to the COVID-19 pandemic. Nesting pairs were observed at the Quabbin Reservoir via boat access and field glasses.

Five research bear trapping sites were operated with no female bears captured. Seven males were captured and released. A total of six collared research bears were monitored during the winter, and we conducted six bear den site visits during February and March 2020. Interestingly, of the females with newborn cubs, two of them produced four cubs each. It is much more common for a sow to have two or three cubs in a given year. All obsolete collars were replaced and biological data was collected.

The District responded to three public safety moose calls during the peak of the fall breeding season, including two in Worcester and one in Princeton. The Princeton moose was a young bull stuck in an electrified pasture fence. The power to the fencing was turned off and the moose was able to free itself. The two moose in Worcester were also young bulls. In the spring of 2020, District staff found themselves again busy responding to several bear and moose calls, including one bear call in a residential neighborhood in Worcester where the bear was chemically immobilized and relocated.

Despite unfavorable ice conditions in central Massachusetts, 47 Wood Duck boxes were checked and maintained at 8 sites; two new boxes were erected. The District partnered with Assabet Valley Regional Technical High School to construct additional boxes for future placement.

During the pheasant hunting season, 13,596 adult pheasants were stocked onto 19 properties (16 WMAs and 3 DCR). The stocking report on the MassWildlife website was updated routinely to notify hunters and provide information for this outdoor recreational opportunity. Supplementing our regular stocking activities, 6944 pheasant chicks delivered to eight sporting clubs and a Dept. Of Corrections facility for the club bird rearing program. Once grown to adulthood, these pheasants were also stocked to hunting lands open to the public.

Canada goose banding was also cancelled in the spring of 2020 due to the COVID-19 pandemic. It was not feasible to maintain social distancing among staff while trying to gather and band the geese.

In the fall, District personnel staffed eight deer check stations, including the station at the District Office in W. Boylston. The District assisted with deer data collection during the Wachusett Zone controlled deer hunt by providing staffing for the first Saturday of the shotgun season. Based on our experience in FY 2019, it was determined that staffing the check station beyond the first weekend was not necessary.

In addition to the deer check stations, District staff oversaw a total of seven turkey check stations, five coyote check stations, and two bear check stations.

Research work also included assisting Field HQ Staff in waterfowl breeding plot surveys, ruffed grouse drumming surveys, woodcock surveys, and approximately 30 miles of white-tailed deer pellet count surveys.

Fisheries
District staff surveyed 80 sites on the Millers, Nashua, Blackstone, Chicopee and Quinebaug drainages during the months of July, August, and September. The surveys conducted using electro shocking equipment gathering information on fish identification, lengths, dissolved oxygen, pH, conductivity and temperature.

District staff also conducted electroshock boat surveys on three waterbodies with total warmwater species pickup protocol. The locations were: Long Pond, Rutland, Whitehall Pond, Rutland and Chauncy Lake in Westborough.

Multiple nights were spent assisting Field HQ staff with lake trout sampling on Quabbin and Wachusett Reservoirs, setting gillnets and measuring captured fish for both age and growth rates.

District staff surveyed 1 waterbody during safe ice conditions using ice fishing equipment and minnow traps. This survey work is designed to gain information on state WMAs and conservation areas with waterbodies.

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.

Fall trout stocking began on September 27th and continued through October 10th with daily stocking runs throughout the District. Nearly 11,000 rainbow trout were stocked at 16 different locations. Due to low water levels, no rivers or streams were stocked, all stocking was done into ponds and lakes.

With early season ice out and favorable pH and oxygen meter readings, the spring fish stocking trucks started rolling March 9th. The normal stocking routine changed drastically the week of March 16th with the concern over the COVID-19 pandemic, accelerating the pace of our stocking runs to ensure all fish were stocked out as quickly as possible. The rationale at that time was that without knowing the ramifications of the COVID-19 situation we might be facing a complete shutdown of all fish stocking operations. District staff worked extremely well in this effort, completing two and even three loads of fish per day compared to normally delivering one load. All the while they were very conscientious about maintaining the health and safety of themselves, their co-workers and those around them under very stressful circumstances.

We continued stream monitoring work at several sites in the District; Goodrich Brook in Lancaster – monitoring the trout population due to proposed housing development upstream; continued oversight at Bartlett Pond in Lancaster to reintroduce wild eastern brook trout from the lower section of Wekepeke Brook to the Nashua River; Slack Brook in Leominster – follow up survey after a new retaining wall was installed along the brook; Cooledge Brook in Berlin and Northborough - monitoring issue with water quality to sustain native brook trout.

A section of the Whitman River in Westminster was found to have contaminated soil on the riverbank due to past industrial activity. These contaminant were leaching towards the river. We conducted a stream survey in the summer of 2019 recording all species found to gain baseline information prior to a scheduled site clean-up project. The soil was removed and a follow up survey will be conducted in the summer of 2020, and subsequent seasons, to determine if the fish community has changed.

Natural Heritage and Endangered Species
The District renewed two scientific research study License Agreements. One with a Tufts researcher studying bumblebees and another with NOAA and NASA who installed soil / climate monitoring stations on several WMAs in the District. The research team will be monitoring soil moisture, as well as moisture levels in wood samples as part of a climate change study. Both of these studies are continuations of research that began last season. The original timeline of the NOAA/NASA study effort was disrupted by the COVID-19 pandemic and, although techs have been monitoring the stations throughout the spring of 2020, it is anticipated that the work will not conclude this season as planned and will likely finish in early 2021.

Permission was also granted to two researchers from Antioch University New England who are studying ant and moth species in the barrens habitat of Birch Hill and Muddy Brook WMAs.

Outreach and Education
The DIstrict provided stocked tagged trout on the Mill River as part of the state tagged trout program. The Polish American Club in Blackstone was the sponsoring entity for their annual Fishing Derby. Staff also conducted trout stocking events with local interest groups including N.E. Flytyers, Cub Scouts, Boy Scouts and local high school students.

The District Supervisor met with candidates and began planning for two internships with area students. One was to job shadow District Staff for six weeks this spring, and the other was planning a project to do some habitat maintenance and signage work at Bolton Flats WMA. Unfortunately both of these had to be cancelled due to the COVID-19 pandemic.

The District Supervisor also attended all scheduled FY 2020 Worcester County League of Sportsmens meetings and sent a monthly highlights report of the District activities to a regional subscriber email list.

CONNECTICUT VALLEY DISTRICT

Administration
The District Manager served as local representative on the MassWildlife Lands Committee again this year providing guidance and input on 7 new land acquisition projects. These acquisitions will serve to protect critical wildlife habitat and provide recreation opportunities for the sporting community throughout the district. This year over 134 acres of new property were acquired to either expand existing Wildlife Management Areas (WMAs) or create new ones. See the Realty 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). 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 1,573 Quabbin One Day Fishing Licenses. These licenses were issued at the three boat launch areas on the Quabbin Reservoir and totaled $7,865 this fiscal year. New this

year, DCR is accepting credit cards at the three Quabbin boat access areas in 2020. At this time 12 fishing licenses have been purchased using credit cards.

The Swift River primitive camping area was closed for the summer of 2020 due to COVID-19. There were however 34 Swift River Camping permits issued July–Sep 2019 prior to the statewide closures in spring of 2020. This is just one less permit than last year which is quite remarkable considering the camping area was closed for more than half the camping season this year.

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.

Research and Conservation

Wildlife

Valley District staff contributed to the statewide wildlife survey efforts by completing 11 ruffed grouse drumming survey routes, 7 deer pellet transects and conducted wild turkey brood survey. Staff also banded 43 Canada geese at three sites. A total of 79 wood duck boxes were checked and maintained at 21 sites. Blue bird and kestrel nesting boxes were maintained at several WMAs as well.

Valley District staff monitored the survival and reproduction of 23 radio-collared female black bears during this reporting period. Two collared adult reproducing females were hit by cars, one was shot by a landowner for killing chickens, and one died of unknown causes during the reporting period. Attempts were made to capture 18 collared females in their dens to determine reproductive success and first-year cub survival, 14 of the females were successfully immobilized and handled in dens. It was determined that 11 females had newborn cubs, 4 had yearling cubs, and 1 did not produce 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 (3 males, 3 females).
The Conn. Valley District office in Belchertown was staffed to check all harvested game species that require reporting in the fall of 2019. In addition, there were eight other check stations set up throughout the district to make checking hunter harvested animals more accessible to hunters. The District also staffed five biological deer check stations during the first week of the shotgun deer hunting season. However, the 2020 spring turkey season check was a different story. All state offices were closed to the public due to COVID-19. Spring turkey check had to be completed online or via a call-in check process. Conn. Valley district staff staffed district phones to allow hunters to call in their harvest if they did not have computer access.

All WMAs were posted with rules and regulations. Signs are posted at public access entrance points at 35 WMAs throughout the district.

Approximately 76 acres of fields were mowed at six WMAs (23 acres at Southwick WMA, 19 acres at Southampton WMA, 18 acres at Herman Covey WMA, 5 acres at Poland Brook WMA, and 24 acres at Leyden WMA). In addition, thirteen acres of old field was reclaimed by brush mulching with the skid steer mulching head (5 acres at Tully Mountain WMA and 8 acres at Satan's Kingdom WMA). Also, staff converted fields to warm season grasses at Southwick WMA (5 acres) and Herm Covey WMA (1.5 acres). 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.

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.

Fisheries

The Valley District continued its involvement in a number of district-specific fisheries projects on the Connecticut and Swift rivers, as well as the Quabbin Reservoir. These included the third year of the Connecticut River Juvenile Shad Project, an 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, which usually begins in June after the completion of trout stocking efforts; therefore only portions of 2019 and 2020 field seasons are included in this document.

In summer of 2019, a expanded mark recapture study continued to focus on the movement of stocked rainbow trout. As in previous iterations, the mark groups were sourced from rainbow trout in the summer and fall stocking seasons. A combination mark was attempted this year, that designated release time as well as release location by using several different fin clips. Time of release, summer 2019 or fall 2019, was indicated by differential fin clips. All fish stocked in July of 2019 were marked with an adipose fin clip, and all fish stocked in October 2019 were marked with a right pelvic fin clip. For both the summer and fall release

groups, stocking location was indicated by the presence or absence of a hole punched into the caudal fin. All fish stocked above the Route 9 Bridge, in the year-round catch and release area, were marked with a caudal hole punch, while all fish stocked below the Route 9 bridge did not have a caudal punch. With these two marks, MassWildlife staff and anglers could quickly and easily assess the basic time and location of each fish's release. Similar to last year's project, each stocking and marking event was followed by recapture efforts at set intervals of one week, one month, and three months post release. Basic informational flyers were posted at popular river access locations in an effort to inform anglers of the project goals, specifics of each mark combination, and to advise on upcoming sampling efforts. The 2019 sampling efforts helped justify project expansion and the purchasing of additional equipment and VIE (Visual Implant Elastomer) marking gear. Unfortunately, the start of this expanded project coincided directly with deteriorating circumstances with the COVID-19 pandemic, and was postponed until March 2021. Another main goal for next season's work is to expand a public outreach and information component in the form of a dedicated website.

The third year of the Connecticut River juvenile American shad assessment project was completed in the summer and fall of 2019. This cooperative project with the U.S. Fish and Wildlife Service began in 2017, and has been presented at Connecticut River Atlantic Salmon Commission (CRASC) and Southern New England Chapter of the American Fisheries Society, and MassWildlife staff and electro fishing vessels completed 13 sampling nights, on reaches of the Connecticut River between the Holyoke and Turner Falls dams. 42 electro fishing runs were completed between August 8, 2019 and November 11, 2019, resulting in capture and assessment of 589 individual juvenile shad. Catch rates are compared and used to estimate juvenile shad abundance in a variety of different temporal and geographic strata. A project poster was presented at the 2020 Southern New England Chapter of the American Fisheries Society, a copy is hosted on the website of the USFWS at the following web address: https://www.fws.gov/r5crc/pdf/Mattocks_SNEC_winter_2020_shad_poster.pdf/

Similar to the past several years, the Valley District Fisheries Biologist led field crews for the Quabbin Reservoir lake trout netting project. Crews of 5 staff sampled on six separate nights between Oct. 21 and Nov. 20, 2019. Several gill nets are set after sunset each night, and soaked for 30-45 min. Captured fish are removed and processed; lake trout are scanned and implanted with an individually identifiable passive integrated transponder (PIT) tag if there is none detected. In the 2019 field season, crews captured 169 lake trout, 26 of which were recaptures from previous years. Additionally, 59 landlocked salmon were sampled in the gillnets. An exciting find from this season was the recapture of a relatively large, 13.34 pound individual first tagged in 2017.

In addition to the larger scale research projects outlined in the sections above, District staff also completed numerous smaller scale electrofishing surveys. Several large river systems were sampled in multiple reaches with both backpack and boat electrofishing. District staff and equipment were deployed to a considerable number of waters year-round within this reporting period; both leading and assisting with a variety of new and exciting projects. Nineteen smaller scale electrofishing surveys were completed, which included a large number of tributary streams to the Manhan River drainage.

Land Stewardship

Boundary marking of WMAs continues to be a priority throughout the district. This year in the Connecticut Valley District a total of 28 miles of WMA property boundary lines were marked. Many of the marked boundaries were on new acquisitions, including parcels at: Green River WMA, Montague WMA, and Satan's Kingdom WMA. While agency staff did some of this work, contractors were used to complete large and/or complicated boundary tracks. In addition to contributing to boundary marking, the contractors also helped by reporting encroachments, conflict with abutting landowners, and other issues they encountered while in the field.

Annual monitoring visits and reports were conducted on 36 Wildlife Conservation Easements (WCE) throughout the district. Annual monitoring is a legal obligation under the terms of each easement and is also critical to protecting the conservation values of these properties. Each landowner participating in a WCE was contacted and invited to join staff during the site visit. Participants who decided to join the staff for the site visits provided a good perspective on the land's history and current use, as well as a chance to build landowner relationships.

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 has been working with Appalachian Mountain Club (AMC), the Kestrel Land Trust, and North Quabbin Trails Association to bring sections of the New England Trail, Robert Frost Trail, and the Tully Trials into compliance with this policy.

Parking areas and access points were improved by District staff at several of the WMAs throughout the district. One parking area improvement, the Tully Mountain WMA parking improvements, were done in collaboration with the Massachusetts chapter of the National Wild Turkey Federation. Other improvements to hunting access were completed at Palmer WMA, Herman Covey WMA, Facing Rock

WMA, Leyden WMA and Montague Plains 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/maintenance of existing gates and motorized vehicle trespass deterrence.

Several trespass issues were addressed in a cooperative effort with the Environmental Police, including an abandoned vehicle within a WMA, illegal trail building, dumping and illegal OHV use.

Natural Heritage and Endangered Species Program
The Valley District staff continues its efforts to monitor and census band eagles covering Hampshire, Hampden and Franklin counties. District staff identified and monitored 31 breeding bald eagle territories.

The District cooperated with the Natural Heritage & Endangered Species Program (NHESP) staff on a variety of projects throughout the district this year. Valley District staff assisted FHQ staff with Eastern box turtle surveys and whip-poor-will surveys within the district.

Enhancement of Outdoor Recreation
Trout stocking in the fall 2019 season proceeded without issue and began on Oct. 4 and was completed on Oct. 18, 2019. In total 12,175 trout were stocked across district waters, weighing 15,063 pounds. In total 32 waters; 26 ponds and 6 rivers, were stocked with 14-inch rainbow trout from McLaughlin Hatchery.

The 2020 spring trout stocking season started at approximately the same time that the COVID-19 virus pandemic situation which resulted in emergency closures and restrictions in Massachusetts and the rest of the United States. The first loads of stocked trout in the Connecticut Valley District were stocked on March 11–13, 2020. The week following was met with emergency closures statewide, and a need to quickly reevaluate the season's approach to trout stocking given the deteriorating situation.

Despite the circumstances, the District staff and hatcheries were able to complete the stocking season without any issue. Staff worked extremely efficiently, without sacrificing any stocked waters or sites and were able to exceed stocking totals of the past several years. This was accomplished through the cooperation and dedication of the staff to this important task, and by fitting in multiple stocking runs each day, sometimes as many as four individual loads for a given crew each date. All stocking in the district took place over 26 stocking days, which is 41% fewer stocking days than the average of the past 5 stocking seasons. In total 113,947 individual trout, weighing 91,871 pounds, were stocked in the valley district waters in the spring of 2020. This total includes the special summer stocking on the Swift River in Belchertown, Ware, and Palmer. The total fish stocked in spring 2020, despite the reduced time frame, is greater than the last five seasons, exceeding the 2016 to 2019 yearly average by 15% (and exceeded the 2016 to 2019 total stocked weight by 13%).

Valley District staff stocked 10,000 pheasants on 10 WMAs, 6 town owned properties, and 11 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. Six sportsmen's clubs within the Valley District participated in the Club Pheasant Program this year. District staff received and distributed 1,576 seven-week-old pheasants to these clubs in July. These birds were 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. Nine groups of hunters applied for this year's raffle style permits and all nine were drawn to participate in the hunt.

Outreach and Education
Valley District staff provided a presence at the Springfield Sportsmen's Show in West Springfield, selling licenses, stamps, and permits and answering questions from the visiting public.

This year's outreach and education programs were largely impacted by the crisis situation created by the COVID-19 pandemic. In the fall of 2019, fisheries staff were able to continue a valuable partnership with Professor David Christensen of Westfield State University. After skipping 2018 due to a shift in classroom scheduling, this year's collaboration followed the same format as years prior. District staff worked with Professor Christensen's students by providing field experience in the form of hands-on demonstrations of boat electrofishing on Hampton Ponds, and then backpack electrofishing on Munn Brook, both in Westfield. Later in the semester, the district fisheries biologist provided a classroom guest lecture about district and agency-wide fisheries projects.

The unfortunate timing of the pandemic crisis and downstream impacts on public space and social gatherings result-

ed in sweeping cancelations of all scheduled public events. All public events in and around trout stocking season were canceled this year.

The District Supervisor attended regular meetings of the Hampden County Sportsmen's Council, where he gave various presentations. The District Supervisor and the District Biologists participated in various meetings with federal, state, and local agencies and land trusts, focusing primarily on land acquisition, management, and informational talks.

Technical Assistance

Our district offices are often our first line of contact to the general public. As such, the Valley District staff fielded hundreds of calls requesting technical assistance regarding wildlife and fisheries concerns. Staff also addressed the needs of walk-in visitors ranging from hunting and fishing license sales, requests for information, and provided assistance with nuisance-animal complaints. District personnel were often called upon to provide technical assistance to other agencies or user groups. Numerous injured hawks and owls were transported to rehabilitators. Additional field responses included assistance sought on behalf of deer, moose, and bear.

WESTERN DISTRICT

Administration

Fiscal Year 2020 saw more staffing changes in the Western District. Eli Pease was hired as a Wildlife Technician II in March of 2020 filling one of the two vacant Technician positions. Eli brings experience from Fish and Game Departments in Kentucky and Pennsylvania, the Franklin Land Trust and an American Fisheries Society Internship with MassWildlife. Wildlife Technician III, Derek McDermott transferred from the Western District to the Northeast District in June 2020. His knowledge and skills will be greatly missed.

The operational changes brought on by the COVID-19 pandemic created many challenges for the District in the spring of 2020. Throughout the pandemic, District Staff reported to work and executed agency responsibilities despite the elevated risk associated with in-person work. District Staff stocked fish, managed properties, answered phones, and provided continual service to constituents and the public every day throughout the pandemic. Western District Biologists and Technicians demonstrated great commitment to the agency and public service.

It was another successful year for land protection in the Western District. The District Manager and the Stewardship biologist assisted the outstanding Western District DFG Land Agent in protecting more than 850 acres across nine towns. These efforts involved site visits, deed research, parcel evaluation and stewardship.

Capital funding provided opportunity for the demolition and removal of four dilapidated structures on Western District WMAs. Two collapsing barns were removed on the Eugene Moran WMA, a heavily damaged barn was removed on the Stafford Hill WMA, and an old house was removed on the Fox Den WMA. The Field Headquarters Administrative Staff assisted with the procurement process and contract oversight. The District Manager spent considerable time on these projects. Removal of the structures eliminates safety hazards, restores habitats, and saves money in the long term.

Large Animal Response Team (LART) cases in FY 2020 included immobilization and relocation of a young bull moose from the town of Blandford because of proximity to heavily trafficked roads. Western Staff also removed an injured bear in Cheshire and a sick bear in Worthington.

District Staff participated in numerous training courses throughout FY 2020 including: Wildland Fire Training, Large Animal Response, Hoister Licensing, Rivers and Roads Training, Dive Safety Training, and Stream Continuity Training.

The District Manager worked on issues related to damage along snowmobile trails on WMAs, including the investigation and cleanup of a hydraulic fluid spill on the Eugene Moran WMA.

Research and Conservation

Wildlife

Annual surveys for woodcock (1), ruffed Grouse (5) and waterfowl indicated pairs (5) were conducted in the District. Staff also cleaned, constructed and installed nesting boxes for wood ducks, bluebirds and kestrels.

Western District personnel provided support for Wildlife Section Project Leaders through data collection at biological check stations for deer, bear and turkey. Staff conducted deer pellets counts in multiple locations.

Western District personnel implemented multiple habitat projects including brush mowing over 300 acres across 13 different WMAs and pruning apple trees at the Hinsdale Flats WMA, and hand brush cutting at the Swift River WMA. The District deployed loon rafts at Cleveland Reservoir in Hinsdale and Ashley Reservoir in Pittsfield. The Cleveland raft was used successfully by loons for the third consecutive year.

The District had continued success with the bear trapping and collaring program. We collared 3 new sows in 2020 bringing the total number of actively monitored bears to 11. Bear trapping requires substantial effort but has provided some very important local data which has been direct-

ly relevant in explaining and, in some cases, reducing bear conflicts in the region. District staff also helped take down the remaining 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.

Fisheries

A total of 24 fisheries surveys were conducted on 19 rivers and streams in the Western District from July to September 2019. All the surveys were conducted using backpack electrofishing gear, with 1 survey conducted on Hop Brook using minnow traps. Surveys were conducted primarily by Western District personnel; 6 surveys were conducting with assistance from Field Headquarters staff.

Due to reduced staff levels, COVID-19 safety requirements, and other district obligations, only 1 pond survey was conducted in 2020. Benedict Pond in Monterey was surveyed in June.

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.

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. Two days were spent removing water chestnut from Three Mile Pond in Sheffield to control spread to other parts of the waterbody. Crews consisted of 4 District staff each day pulling plants by hand from kayaks. Less than 1 pickup truck bed of water chestnut were removed from the site. Overall coverage of the plant in 2019 has significantly decreased from 2018 levels, indicating annual pulling efforts are making an impact on water chestnut density. Monitoring and removal efforts will continue annually to control the plant's spread within the waterbody.

The District Fisheries Biologist responded to fish kills on the North River in Colrain and Laurel Lake in Lee. The District Manager and Fisheries Biologist participated in interagency meetings on zebra mussels and lake/pond management and provided technical assistance with environmental review.

Land Stewardship

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 39 miles of boundaries were marked in FY 2020, in combined efforts between district staff and contractors. Property surveys were contracted and completed on three Western District WMAs (Upper Westfield River, J.J. Kelly, and Day Mountain). These surveys were important in establishing boundary lines and determining clear ownership.

The Stewardship Biologist completed 41 monitoring visits to Conservation Easements. The Biologist reviewed multiple forest management plans, in conjunction with the Realty Section and habitat management program, for operations on Conservation Easements.

The COVID-19 situation has resulted in increased use at many WMAs in the District, including a notable uptick in illegal use of OHVs on WMAs. District Staff obstructed OHVs trails on the Chalet WMA, Hinsdale Flats WMA, and Tekoa WMA.

District Staff maintained parking areas at 12 WMAs and four Public Access ramps. With stewardship funding from the Realty Section, we were able to contract installation of a gate in a remote part of the Walnut Hill WMA to protect the historic Keystone Arches. We acquired lumber, gates, and equipment to install new parking areas at the Stafford Hill WMA and the George Darey WMA. District staff installed a new gate at the Dolomite Ledges WMA.

District Technicians removed barbed wire which surrounded and agricultural field on a part of the recently acquired Maple Hill WMA.

Staff spent multiple days maintaining the Three Mile Pond dam, including vegetation removal and maintenance of the outflow structure.

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.

District Staff participated in the Bald Eagle Nesting Survey. There are 8 confirmed active nests known in the Western District: Russell, Pittsfield, Lee, Monterey, Buckland, Great Barrington, Richmond, and Otis. Due to restrictions related to COVID-19, no eagle chicks were banded in FY 2020.

We conducted winter bat hibernaculum surveys at five locations. The District Manager began work to gate a newly acquired vertical mine shaft.

District Biologists and Wildlife Technicians partnered with NHESP to manage and enhance habitat for endangered bog turtles by conducting surveys, clearing habitat, and maintaining water levels.

The District Aquatic Biologist and Wildlife Technicians assisted the NHESP program with mussel surveys at multiple locations on the Farmington River. The Stewardship Biolo-

gist assisted NHESP botanists to daylight rare plants in Williamstown. District staff spread pollinator seed on an abandoned agricultural field at the George Darey Housatonic Valley WMA in Lenox to support listed butterflies and other pollinator species.

District Staff participated in a Rattlesnake Working Group to discuss the latest research and address threats. The District Manager and Wildlife Biologist are both members of the Rattlesnake Response Team. Along with the State Herpetologist, District staff met with the Mass. Climbers Coalition to discuss illegal climbing at the Tekoa WMA.

District Technicians and Biologists constructed bat boxes 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 in the spring to distribute fish and support the sporting community.

Pheasant were stocked 3 days per week throughout the fall 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 2020.

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.
Fall trout stocking commenced on September 30 and concluded on October 11. Sixteen waterbodies were stocked in the fall of 2019; 16 lakes/ponds and 2 rivers (Deerfield River and East Branch Westfield River). All but two waterbodies were stocked with 14+" rainbow trout from Sunderland Hatchery; the remaining two (Ashfield Pond and North Pond) were stocked only with 9+" brown trout.

Spring stocking commenced on March 12, 2020, 4 days prior to the state shutdown in response to the pandemic, which occurred on March 16-17, 2020. Stocking resumed on March 17 at an accelerated pace, as it was unclear what future operations would be in light of the pandemic. Both Western District trucks moved fish from McLaughlin hatchery exclusively for the next few weeks until April 2. Deliveries were made by Bitzer and Sunderland staff at that time to move Western District's allotments up to April 3. Thereafter, a pause in stocking occurred to reduce contact at hatchery facilities. Stocking resumed on May 4, with trucks running primarily through Bitzer hatchery, with some deliveries by Sunderland staff as well. Stocking concluded on June 2, 2020, for a total of 29 stocking days.

Changes were made to stocking practices during this time, to heed physical distancing guidelines. Personnel were limited to one person per vehicle, with personnel designated to a single vehicle. Personnel were designated as drivers to and from the hatchery, while a second team of personnel were designated to meet the drivers at the stocking site and assist with fish distribution. Disinfection of the vehicle's interior was conducted if a driver was switched.

Despite the challenges in staffing and procedures, a total of 65 waterbodies were stocked during the spring season; 22 lakes and ponds, 43 rivers and streams.

A cooperative agreement was made with Berkshire National Fish Hatchery (BNFH) in New Marlborough, to stock 12+" brook trout from their hatchery into local waters. These fish were initially allotted for local sporting clubs, however that changed due to the pandemic. A total of 1,375 12+" Brook trout were stocked in Goose Pond, Konkapot River and Otis Reservoir on May 19-20 by BNFH staff.

Outreach and Education
District field staff interacts with the public daily, providing information and sharing enthusiasm for outdoor activities. In addition, Western District staff also participated in more formal events focused on educating the public about the agency and the environment, including the Springfield Sportsmen's Show, which was staffed by District Biologists and the District Manager.

The District Supervisor attended monthly meetings and provided updates to the Berkshire County League of Sportsmen. When shutdowns due to COVID-19 restricted meeting size groups, the District Supervisor set up online meetings through Zoom with the League, allowing for meetings to occur.

The District Stewardship Biologist, Land Agent, and District Manager staffed a booth at the Berkshire Natural History Conference.

The Fisheries Biologist worked with Wahconah Regional High School on numerous occasions demonstrating trout stocking and fisheries survey techniques. The District Biologists promoted outdoor education at talks to the Mt Everett School District, Mass. Junior Conservation Camp, and the Berkshire Humane Society camp.

The District Manager and Wildlife biologist spent considerable time with outreach related to the proposed changes in coyote regulations and wanton waste, including coordinating and attending public listening sessions.

Technical Assistance
The District Clerk fielded hundreds of calls requesting technical assistance. District personnel responded to these inquiries with professionalism and expertise. The Clerk addressed the needs of walk-in visitors and issued permits and licenses to hundreds of sportsmen. The closure of the office to the public presented challenges in meeting public service needs. The District Staff continues to find creative ways to interact with our constituents, issuing them necessary permits and licenses when they are unable to do so themselves.

The District Fisheries Biologist served as an alternate to the Westfield River Wild and Scenic Committee and attended the Becket Municipal Vulnerability Workshop. She also participated in the Franklin County River Access Forum.

District Staff worked with the Pittsfield Board of Health to address ongoing intentional bear feeding in the city limits. We have had some success in reducing feeding in a particularly egregious case. In coordination with the Black Bear Project Leader we provided guidance to the towns of Stockbridge, Great Barrington, Pittsfield and Lee to implement wildlife feeding ordinances.

The Western District responded to numerous wildlife situations. Staff picked up multiple hawks and owls over the course of the year. Spring of 2020 was particularly busy with bear calls. The increased number of people using second homes in the Berkshire probably accounted for some of the increase in calls and conflicts. The District received multiple calls per day throughout the spring and early summer. District staff conducted frequent site visits. Bear trapping was attempted in the Town of Sheffield in response to bear home entry. Trapping was unsuccessful.

District Personnel

Northeast Wildlife District
Patricia Huckery, District Supervisor
Chalis Bird, Wildlife Biologist
Jesse Caney, Wildlife Technician
Travis Drudi, Stewardship Biologist
Anne Gagnon, Land Agent (DFG)
Joshua Gahagan, Wildlife Technician
Tim Mathews, Wildlife Technician
Derek McDermott, Wildlife Technician (part year)
Leslie Gabrilska, Clerk (part year)
John Sheedy, Fisheries Biologist

Southeast Wildlife District
Jason E. Zimmer, District Supervisor
Aaron Best, Wildlife Technician
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
Nancy Dewkett, Wildlife Technician
Leanda Fontaine Gagnon, Fisheries Biologist
Debra Lipa, Clerk
Derek McDermott, Wildlife Technician (part year)
Peter Milanesi, Land Agent (DFG)
Jacob Morris-Siegel, Land Stewardship Biologist
Eli Pease, Wildlife Technician

Wildlife Lands
Acquisition and Realty Stewardship

Elizabeth Wroblicka
Chief of Wildlife Lands

OVERVIEW

The Realty Section worked diligently this past year to ensure that the many thousands of acres owned and managed by MassWildlife remain protected wildlife habitat. Realty staff coordinated their stewardship efforts with their colleagues in the five District offices to achieve many miles of boundary marking, surveys, and conservation restriction monitoring. 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 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. A map of agency properties can be viewed at mass.gov/dfw/wildlife-lands.

Stewardship Activities

MassWildlife is committed to stewarding the land and CRs that it owns for the benefit of the public. As part of fulfilling its stewardship obligations, MassWildlife has fulfilled its obligation to create Baseline Documentation Reports for all of the CRs in its portfolio and can now prepare reports within a year of acquisition. The stewardship team strives to monitor all CRs annually and continues to inventory and mark boundaries of all of its lands. This past year stewardship and GIS staff worked to refine tools and methods used to track and analyze the status of this effort, providing real-time data via on-line dashboards. District staff and Realty Section staff worked together to promote access, and in some cases limit inappropriate access with gates and boulders.

Conservation Restriction (CR) Stewardship

Stewardship Staff including CR Stewardship Coordinator Liz Newlands, and District Stewardship Biologists Aaron Best, Jenn Jones, Scott Kemp, Travis Drudi, Jacob Morris-Siegel, and other District staff completed annual monitoring visits on 180 CR properties. During these annual monitoring visits staff walked portions of CR boundaries and the interior, checking for compliance with the terms and conditions of the CR and noting inconsistent uses (if any). Overall CR lands are in good condition. Issues noted include persistent problems that will likely continue: ATV and dirt bike use, and the presence of exotic invasive plants. Field staff also noted several properties that required additional boundary signage to clarify the public's right to access the land, or to prevent access to private abutting lands. Staff installed a gate at a CR in the town of Hanson to discourage ATV use.

Staff also worked collaboratively to review forest management plans for six CR landowners, and responded to all landowner requests for other allowable uses such as trails development and agricultural use. In each of these instances, staff worked with the landowner to achieve their land management goals and objectives while protecting the agency's interest in wildlife and wildlife habitat.

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 6 different properties among the Districts.

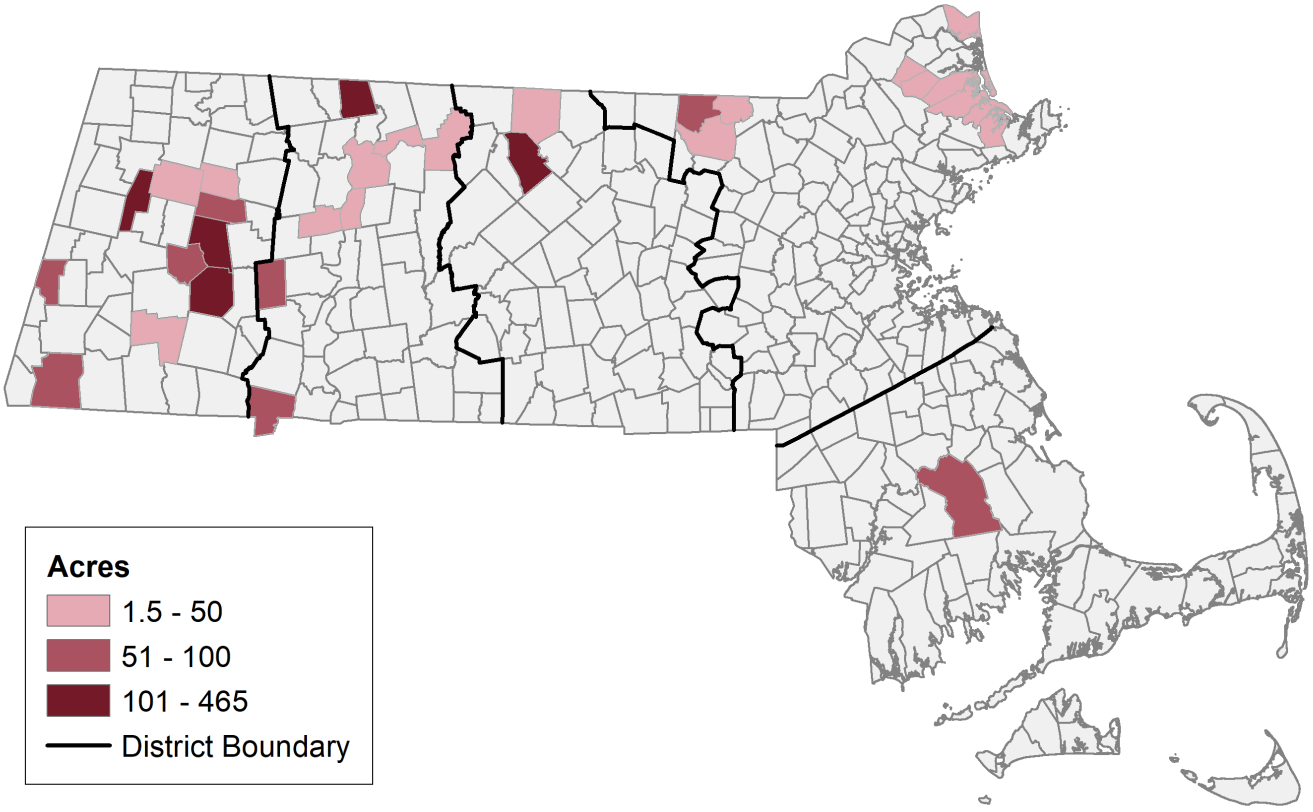
Boundaries

MassWildlife engaged the services of six experienced contractors in FY 2020 for the purpose of confirming over 122 miles of property boundaries at various WMAs and WCEs in each of the five Wildlife Districts. All of the Districts reported excellent progress on this much-needed project, with some variation in accomplishment depending on location, field conditions (terrain, wetlands) and parcel configuration. Boundaries on larger parcels with less intricate boundaries typically were easier to confirm and mark. District staff, with assistance from Realty staff in 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 2020

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

FY 2020 Acquisitions by Town and Acreage



FY 2020 Wildlands Acreage Summary

	WESTERN	VALLEY	CENTRAL	NORTHEAST	SOUTHEAST	TOTAL
WMA	49,760.88	20,832.99	40,664.27	15,141.04	44,861.48	171,260.47
WCE	15,638.11	8,465.51	8725.50	2,839.73	11,433.64	47,102.49
Access	35.82	554.41	692.55	235.12	59.91	1,577.81
Sanctuary	427.50		367.91	552.48	78.50	1,426.39
WCR	69.40	2.39	746.41	127	37.90	983.10
Installation	2.35	579.22		106.42	114.36	802.35
Other				371.70	5.94	377.64
TOTAL	65,933.86	30,434.52	51,196.64	19,373.49	56,591.73	223,528.29

WMA (Wildlife Management Area) – Land owned outright by DFG/MassWildlife. Open to the public for hunting, fishing, trapping and other passive recreation. Subject to Wildlife Management Area Regulations.
WCE (Wildlife Conservation Easement) – DFG/MassWildlife owns development and recreation rights. Open to the public for hunting, fishing, trapping and other passive recreation.
Access Areas – Property providing public recreation access to water bodies or adjacent conservation lands owned by a third party. (Does not include Office of Fishing and Boating Access boat launches, ramps or fishing piers.)
Wildlife Sanctuary – Wildlife properties donated to MassWildlife and governed by statue and regulation, fishing, hunting, and trapping are prohibited; other public recreation access is permitted.
WCR (Wildlife Conservation Restriction) – DFG or MassWildlife owns development rights, but public access is not allowed/ These lands buffer wildlife habitat by preventing unwanted development.

for hunting, trapping, and fishing. To accomplish this dual mission, the Land Protection Program uses funding from the Environmental Bond and the Wildlands Stamp Fund to purchase land and conservation restrictions from willing landowners who seek to conserve their property. Some landowners donate their land or a conservation restriction to DFG/MassWildlife, which may result in an income tax deduction for the landowner.

Fiscal Year 2020 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 36 projects covering 2,200 acres, of which 628.63 acres were acquired by gift. The total acquisition cost of $3,841,416 improves Massachusetts' climate change resiliency by protecting forests that absorb carbon dioxide, keeping land open along rivers, streams, and wetlands that work to absorb flood waters 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.

Eight projects were completed in the Connecticut Valley District protecting 261.25 acres at a cost of $617,366. The Connecticut District's signature acquisition this past year was a 124-acre property in Ware abutting the Coy Hill WMA increasing the WMA's footprint to almost 1,000 acres in size. With steep, rocky outcrops, mature hardwood ridges, and stands of mature white pine, the additional acreage also increases the property's recreational and habitat values. Access to the property will be from a new parking area on the eastern portion of the WMA.

Two parcels of land along the eastern shore of Forest Lake in Palmer and connected by Gates Brook, a coldwater fishery resource, constitute another important acquisition. The property will provide the only public fishing access to the lake and offers road frontage with ample space for parking and a boat ramp. A favorite among anglers, Forest Lake ranks 6th out of 53 lakes in the District for total submissions to the sport fishing program.

The Palmer WMA gained an additional 50 acres. Dominated by oak-hickory and mixed-oak forests, the property will increase recreational opportunities for nearby Springfield area residents. The property also includes Priority Habitat for two state-listed species of special concern.

The purchase of two in-holdings at the Facing Rock WMA, on 10 acres and another 13 acres, provides important hunting access, strengthens the protection of this landscape, and helps to conserve a diverse plant community which thrives on the rich, sweet soils located within.

A +3,000-foot, relatively undisturbed corridor on the Green River was protected through the purchase of 78 acres in Colrain. The property consists of two parcels and will be managed as part of the Green River WMA, facilitating the District's capacity to stock fish. The property will also provide good fishing and hunting access.

The Department of Fish and Game received a gift of 2 acres from the Conservation Land Tax Credit program. The property in Greenfield provides fishing access and 200 feet of frontage along the Deerfield River. The site is also Priority Habitat for endangered plants and animals and has been designated as BioMap2 Core Habitat for a variety of plants and animals of conservation concern.

In the Southeast District four projects were completed covering 184 acres for a total cost of $1,266,200. The Southeast District's most significant project this year was the acquisition of 182 acres of land in Middleborough which will be managed as part of the Rocky Gutter WMA. The property consists of uplands, red maple swamp, and expanses of open water - all of which will enrich biological diversity at the site. The property has been designated as Priority Habitat and includes Core Habitat for wetlands, forest, and aquatic resources as well as being designated Critical Natural Landscape. Furthermore, the property contains promising locations for parking areas improving overall public access to the WMA.

A small but significant 1-acre parcel was protected in Middleborough. This land is situated on the Nemasket River and provides an ideal location for informal cartop boat access. The property has solid footing and an existing footpath from the road to the river. Boasting the second-largest herring run in the state, habitat for Northern red-belled cooter, and tidewater mucket, the river has been identified in BIoMap2 for its significant aquatic resources.

For over 10 years the Southeast District has envisioned the purchase of a 7-acre parcel in Halifax and it is now complete. The flat, dry and largely forested site is located at the southern end of the Burrage Pond WMA. With this acquisition the threat of development has been eliminated and an opportunity to increase access, including the establishment of a parking area, has been realized. In addition to securing access, the site includes Priority Habitat and Critical Natural Landscape.

In the Northeast District, 11 land acquisition projects were completed this fiscal year conserving 753 acres of land at a cost of $781,450. This year the Northeast District completed its Federal North American Wetlands Conservation Act (NAWCA) match requirements in FY 2020 with the help of conservation partners, Essex County Greenbelt Association, Inc. (ECGA) and The Trustees. ECGA gifted a conservation restriction (CR) on approximately 375 acres of salt marsh that

it owned in Newbury, after providing other match in the form of CRs in previous years. The Trustees gifted a CR over roughly 200 acres of its Old Town Hill property in the Town of Newbury. ECGA also worked closely with the District to acquire the fee of roughly 34 acres along the Parker River in Newbury with in-lieu-of-fee funds. ECGA will be donating a CR on approximately 65 acres of abutting land in the coming fiscal year as part of that cooperative effort.

Greater landscape connectivity, increased public access, and increased hunting opportunities were secured with the acquisition of a 49-acre Conservation Restriction in Groton. The property is located between the Squannacook River and Nashua River and is key to protecting huntable open space. The parcel contains a variety of habitats including wooded uplands, shrub swamps, and deciduous swamps. A portion of the property is within BioMap2 vernal core habitat, as well as a Critical Natural Landscape block.

Two strategic acquisitions through the In-Lieu-Fee Program help build a connection between the Martin Burns and William Forward WMAs. A 13.8-acre parcel was acquired in partnership with the ECBA and features over 1,500 feet of frontage on the Parker River. In addition to improving access, the property is featured in BioMap2 as core habitat for its aquatic and wetland resources, its contribution to a landscape block and buffer, as well as a Coastal Adaptation Area. The other "connector" is the acquisition a 20-acre parcel in the salt marshes along the banks of the Parker River in Newbury. This property contributes to the landscape connectivity and resiliency, as well as providing hunting and fishing opportunities.

A MESA Conservation Management Permit issued in the town of Groveland resulted in the gifting of 10.7 acres of land adjacent to the Upper Parker River WMA. The entire parcel is within BioMap2 Core Habitat for species of conservation concern and is considered an amphibian and reptile reserve by MassWildlife's NHESP. Access to the property can be gained through the existing WMA.

Another gifted property located in Georgetown abuts the Crane Pond WMA. The 18-acre parcel features extensive wetlands and frontage along the Parker River and includes a variety of woodland, shrub swamp, and shallow marsh habitat. The acquisition will add a buffer to the south and expand hunting opportunity on the WMA.

The Town of Pepperell and the Dunstable Rural Land Trust (DRLT) is partnering with MassWildlife to conserve land with frontage on Unkety Brook. An initial acquisition of 18 acres from DRLT will provide public access along the brook and is seen as the first "jewel in the crown" of future acquisitions in the area, including a 4.3 acre parcel to be conveyed by the Town of Pepperell next year. Unkety Brook supports a rich amphibian and reptile community and is mapped as Core Habitat for species of conservation concern.

The Western District completed 10 land acquisition projects that protected approximately 892 acres of land and added to nine different WMAs. Total cost of these projects was $881,400. A Conservation Restriction on 7.5 acres of land gifted from the Berkshire Natural Resource Council adds to the protection of and access to Stedman Pond at the Stedman Pond WCE, a 1,171-acre holding in Monterey. The CR includes over 500 feet of shoreline along the pond which is located within a BioMap2 designated Critical Natural Landscape Block.

A Landscape Partnership Grant was used to acquire property in Rowe at no cost to the agency. The property will be managed as part of the Maxwell Brook WMA and features an entrance to an abandoned mine that now supports three species of Endangered bats. This acquisition significantly increasing MassWildlife's ability to protect these imperiled mammals.

Also gifted to MassWildlife were two acres with 655 feet of frontage along the Swift River in Cummington. This property is located within a designated BioMap2 Core and Critical Natural Landscape for its aquatic resources.

Additional protection of the Swift River environs was made possible with the purchase of 20 acres in Plainfield. The land abuts both the Swift River WMA and land protected by a conservation restriction held by the Franklin Land Trust. Acquiring this land eliminates hunting setbacks and provides for additional parking greatly benefitting the WMA's recreational value.

The purchase of 105 acres in Windsor and Savoy increases acreage at the Savoy WMA. The parcel is somewhat of an in-holding and has been designated as a Core Parcel as well as BioMap2 wetlands core, and Critical Natural Landscape due to relatively undisturbed wetlands and upland buffer within the property. Acquisition of the parcel helps to secure the ecological integrity of the WMA.

Fifty acres in Plainfield and Cummington were added to the Meadow Pond WMA/WCE complex. This acquisition features wet meadow and early successional forest habitat, and 2,900 feet of frontage along Meadow Brook, an excellent coldwater stream.

The Franklin Land Trust placed an additional 145 acres under a conservation restriction with MassWildlife, increasing the size of the North River West Branch WCE by 145 acres. This property in Heath lies wholly within BioMap2 core habitat and a large landscape block, includes 2,720 feet of frontage along the river nearly doubling the amount of river

frontage on site. Protecting this coldwater fishery resource and the surrounding lands benefits two state-listed species of special concern and helps to promote climate and landscape resiliency within the dynamic river system.

A critical east-west connection between the Eugene Moran and Chalet WMAs was secured with the purchase of 176 acres in Windsor. The property features a variety of habitat types including a prime example of a red spruce swamp and 15 acres of field. The landscape has been designated as BioMap2 core and Critical Natural Landscape, primarily for its wetland resources.

Protection of 5 acres in Windsor will increase access to the Day Mountain WMA in Dalton and could allow for parking area on an old woods road located on the property. Equally important, this acquisition eliminates hunting setbacks and buffers interior portions of the WMA from development.

The Tower Brook WMA expanded with the addition of a 279 acre parcel located on the East Branch of the West River in Worthington. Containing Critical Natural Landscape and coldwater fisheries resources, the site provides habitat for lake chub and ocellated darner, two state-listed species.

The Central District land acquisition staff completed three projects protecting 110.5 acres of land at a cost of $295,000. The highlight of this year's acquisition is a 55.5-acre parcel at the Moose Hill WMA in Paxton. Conservation of this property was made possible with the partnership of the Greater Worcester Land Trust, Inc (GWLT). Working with the DFG the partners devised a funding strategy whereby GWLT would first purchase the land, convey the fee to MassWildlife, and then purchase a permanent trail easement on a section of existing foot paths connecting to the Mid-State Trail that would be stewarded by the GWLT.

A sand and gravel operation had been excluded in a previous purchase of land at the Whortleberry Hill WMA. Operations have now ceased, and with the fee now in DFGs hands, restoration of the site can begin, either through natural means over time or by grading and planting native species such as little bluestem grasses. In addition to providing this habitat diversity to the site, the opening of this land will also improve access to the WMA with 90 feet of road frontage and parking for up to six vehicles.

The Millers River WMA saw the addition of a 45 acre inholding on Dyer Road in Athol. This acquisition provides the agency with the opportunity to better manage illegal motorized vehicle access in the area, protect biological diversity along 1,300 feet of Gulf Brook (a coldwater fisheries resource), connect over 2,000 acres of WMA lands mapped as Critical Landscape for a Landscape Block in BioMap2, and expand public recreational access.

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. The current total number of acres conserved by DFG/MassWidlife is 221,138. A map of all of our protected properties can be viewed at mass.gov/dfw/wildlife-lands.

Realty Staff

Elizabeth Wroblicka, Chief of Wildlife Lands
Elizabeth Newlands, CR Stewardship Coordinator
Christine Chisholm, Land Stewardship Coordinator

Archivist

James E. Cardoza, CWB®
Wildlife Biologist
Contract Librarian and Archivist

Jim Cardoza submitted his final formal report for FY 2020 as MassWildlife archivist and librarian as his contract will not be renewed. He expressed pleasure to be able to work on contract for the past several years. While much has been accomplished, there is still work to be done, and he plans to continue with these duties as a volunteer cooperator.

During the past year, the archivist has primarily been sorting, processing, and cataloguing the substantial amount of slides, prints, film, and other photographic materials held by the I&E section. The initial part of this is about 75% completed. However, in many instances, he has only been able to sort the material and properly box and package it for storage, i.e., processed and catalogued in a general sense. He has also processed, sorted, and catalogued some individual boxes or items that have been turned over by other sections. There is still some of this work remaining.

Ron Morley developed a draft database which merged the electronic databases for the library and archives and sent that to the archivist just before the outbreak of COVID-19 in March. He reviewed it and finds it excellent, but there are a few minor tweaks to the entry form and instructions that are needed before it can be made available to all staff.

Photo ©Troy Gipps

Federal Aid Program Administration

Mike Sawyers
Federal Aid 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, as well as serving as liaison between the grantee and Federal agencies, including the Region 5 office of the U.S. Fish and Wildlife Service (USFWS) grant administrator 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, $6,203,940, was a decrease 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, land acquisition, and program coordination.

Federal Aid in Sport Fish Restoration (Dingell-Johnson and Wallop-Breaux)
MassWildlife's Sport Fish Restoration Act apportionment, $3,697,251, was a decrease 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 $554,587 (15%); and the balance of $3,142,663 was equally divided between the Division of Marine Fisheries and MassWildlife ($1,571,331.50 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 nine boat accommodation grants active in FY 2020.

State Wildlife Grant Program (SWG)
MassWildlife's State Wildlife Grant apportionment of $768,424 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.

Through a regional effort, New Hampshire, Connecticut, New York, Maine, and Massachusetts were awarded a total of $3,000,000 through the FY 2010, FY 2011, FY 2013, and FY 2014 national State Wildlife Grant competitive programs to implement the Rangewide New England Cottontail (NEC) Initiative. Massachusetts' share of the funds ($723,475) will be used to restore NEC habitat in Massachusetts. The implementation of the 4th of these competitive grants was completed during FY 2020.

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 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 will continue into 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 2020 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 will begin in FY 2021 and continue through FY 2023.

The Endangered Species Act (Section 6)
In FY 2020, MassWildlife received $47,110 in Section 6 funding from the USFWS. Funds will be used to reimburse the federally listed Plant Monitoring and Management project, the Piping Plover Piping Plover Monitoring, Management, and Research project, and Northern Red-bellied Cooter Adaptive Management.

North American Wetlands Conservation Act (NAWCA)
During FY 2015, MassWildlife was awarded $720,002 under the North American Wetlands Conservation Act for a proposal to fund wetland protection, restoration, and enhancement in the Great Marsh in Essex County. MassWildlife established partnerships with other state agencies, municipalities, conservation organizations, and private individuals to accomplish the goals of the project. Project implementation was completed in FY 2020.

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 2021.

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 Federal Aid Program Personnel have spent considerable time facilitating the audit by providing records, performing additional data analysis, and coordinating the audit efforts within the agency. The OIG audit report is expected to be issued during FY 2021. 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 projects 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 Staff
Kris McCarthy, Associate Director of Administration and Finance
Mike Sawyers, Federal Aid Coordinator
Lori Cookman, Federal Aid and Compliance Manager
Debra Chamberlain, Federal Aid Coordinator Assistant
Debbie McGrath, Program Coordinator


Photo © Troy Gipps

Personnel Report

Johanna Zabriskie
EEA Deputy Human Resources Director / Dept. of Fish and Game

New Hires - Employee			
Name	**Title**	**Action**	**Date of Action**
Carmignani, Jason	Conservation Biologist IV	Hired	October 27, 2019
Gabrilska, Leslie	Clerk IV	Hired	March 29, 2020
Pease, Eli	Wildlife Technician II	Hired	February 2, 2020
Seasonals & Interns Hires			
Name	**Title**	**Action**	**Date of Action**
Hosage, Elizaveta	Wildlife Technician I – Sunder-land Hatchery	Long-Term Seasonal Hire	March 1, 2020
Stanmyer, Elise	Wildlife Technician	Contract Seasonal	January 19, 2020
New/Rehires - Contractors			
Name	**Title**	**Action**	**Date of Action**
Sawicki, Caitlin	Communications & Outreach Spe-cialist - Contractor	Contractor	February 9, 2020
Simmons, Kenneth	Fisheries Consulting Biologist	Post Retirement	November 10, 2019

Terminations – Employee			
Name	**Title**	**Action**	**Date**
Caney, Jesse	Wildlife Technician II	Resigned	November 22, 2019
Hahn, James	Aquatic Biologist IV	Retired	June 26, 2020
Hartley, Richard	Aquatic Biologist IV	Retired	April 15, 2020
Hawkins, Tabatha	Game Biologist I	Resigned	March 27, 2020
Simmons, Kenneth	Environmental Analyst V	Retired	October 25, 2019
Williams, John	Fish Culturist III	Retired	August 2, 2019
Wroblicka, Elizabeth	Environmental Analyst V	Resigned	February 28, 2020
Terminations - Contractors			
Name	**Title**	**Action**	**Date**
Cardoza, James	Archivist	Contract Not Renewed	June 29, 2020
French, Thomas	NHESP Technical Expert	Contract Not Renewed	June 29, 2020
MacDonnell, Craig	Realty Specialist	Contract Not Renewed	June 29, 2020
Simmons, Kenneth	Fisheries Consulting Biologist	Contract Not Renewed	June 29, 2020
Walker, Kiah	Waterbird Specialist	Resigned	May 8, 2020

Terminations - Seasonals / Interns			
Name	**Title**	**Action**	**Date of Action**
Asta-Ferrero, Joseph	Fisheries Technician – Con-necticut	Seasonal Closure	September 27, 2019
Averka, Jacob	Laborer I	Seasonal Closure	November 29, 2019
Burt, Adam	Wildlife Technician I	Seasonal Closure	September 28, 2019
Callahan, Michael	Predator Control Technician	Seasonal Closure	August 2, 2019
Danielson, Lord	Fisheries Technician-Merrimac	Seasonal Closure	July 12, 2019
Grasso, Kyle D.	Fisheries Technician	Seasonal Closure	August 31, 2019
Harmon, Nicole	Fisheries Technician-Connecticut	Seasonal Closure	September 27, 2019
Holly, David	Tern Colony Manager	Seasonal Closure	July 19, 2019
Hosage, Elizaveta	Wildlife Technician I	Resignation	June 26, 2020
Lagacy, Eli	Fisheries Technician-Connecticut	Contract Seasonal	September 27, 2019
Liljesthrom, Marcela	Tern Colony Manager	Contract Seasonal	July 19, 2019
Morgan, Campbell	Fisheries Technician-Merrimac	Contract Seasonal	July 12, 2019
Rawinski, Peter T.	Fisheries Technician	Contract Seasonal	September 7, 2019
Upham, Megan	Wildlife Technician	Contract Seasonal	August 30, 2019

Promotions			
Name	**Title**	**Action**	**Date**
Blajda, Andrew	Wildlife Technician II	Promotion	September 29, 2019
Bressette, Raymond	Wildlife Technician III	Promotion	September 29, 2019
Drudi, Travis	Game Biologist I	Promotion	September 29, 2019
Hubert, Holly	Fish Culturist III	Promotion	September 15, 2019
Longsdorf, Jennifer	Program Coordinator II	Promotion	April 26, 2020
Magowan, Kevin	Fish Culturist II	Promotion- Transfer	November 10, 2019
Nye, Timothy	Fish Culturist II	Promotion	February 16, 2020
Slater, Caleb	Environmental Analyst V	Promotion	March 15, 2020
Reclassifications			
Name	**Professional Titles**	**Action**	**Effective Date**
n/a			

Transfers			
Name	**Professional Titles**	**Action**	**Effective Date**
n/a			

Financial Report

Kris McCarthy
Associate Director of Administration & Finance

INLAND FISH AND GAME FUND REVENUE
07/01/2019 - 06/30/2020

DEPARTMENTAL REVENUES:		
Fishing,Hunting, and Trapping Licenses	$	6,069,311.30
Archery Stamps	$	181,800.90
Primitive Firearm Stamps	$	188,672.30
Waterfowl Stamps	$	55,037.50
Wildlands Stamps	$	1,144,910.00
Trap Registrations	$	2,580.00
Antlerless Deer Permits	$	225,385.00
Bear Permits	$	79,105.00
Turkey Permits	$	137,575.00
Special Licenses,Tags and Posters	$	39,063.00
Magazine Subscriptions	$	81,070.35
Timber Sales,Other	$	194,994.60
Fines and Penalties	$	17,150.40
Rents	$	57,100.01
Prior Year Refunds	$	-
Donations	$	39,455.86
Miscellaneous Income	$	10,183.26
PAC	$	33,101.00
NSF Charge/Debt. Collection	$	200.00
Total	$	8,556,695.48

FEDERAL AID REIMBURSEMENTS;		
Dingell-Johnson (Fisheries)	$	1,711,722.54
Pittman-Robertson (Wildlife)	$	7,353,582.19
Total	$	9,065,304.73

TAXES;		
Gasoline Tax Apportionment	$	916,100.46

OTHER FINANCIAL SOURCES;		
Reimbursement for Half-Price Licenses	$	218,301.75
Investment Earnings	$	18,664.45
Total	$	236,966.20

TOTAL REVENUE	**$**	**18,775,066.87**

FUND EQUITY AS OF JUNE 30, 2020	**$**	**11,026,837.16**

INLAND FISH AND GAME FUND LICENSES AND STAMPS					
07/01/2019 - 06/30/2020					
Code	**Type of License**	Cost	Quantity		Amount
F1	Resident Citizen Fishing	22.50	140,620		3,163,950.00
F2	Resident Citizen Minor Fishing	FREE	9,529		0.00
F3	Resident Citizen Fishing (Age 65-69)	11.25	10,487		117,978.75
F4	Resident Cit. Fishing (Over 70)	FREE	14,432		0.00
F4	Resident Cit. Fishing (Disabled)	FREE			0.00
F6	Non-Res. Citizen/Alien Fishing	32.50	12,922		419,965.00
F7	Non-Res. Citizen/Alien Fishing (3 day)	18.50	2,942		54,427.00
F8	Resident Fishing (3 day)	7.50	3,013		22,597.50
F9	Non-Resident (Citizen) Minor Fishing	6.50	490		3,185.00
	Quabbin 1-Day Fishing	5.00	1,935		9,675.00
T1	Resident Citizen Trapping	30.50	677		20,648.50
T2	Resident Citizen Minor Trapping	6.50	5		32.50
T3	Resident Citizen Trapping (Age 65-69)	15.25	57		869.25
H1	Resident Citizen Hunting	22.50	14,331		322,447.50
H2	Resident Citizen Hunting (Age 65-69)	11.25	979		11,013.75
H3	Resident Citizen Hunting (Paraplegics)	FREE	3		0.00
H3	Non-Resident Citizen Hunting (Paraplegics)	FREE			0.00
H4	Resident Alien Hunting	22.50	159		3,577.50
H5	Non-Res. Cit./Alien Hunting (Big Game)	94.50	3,431		324,229.50
H6	Non-Res. Cit./Alien Hunting (Sm. Game)	60.50	1,335		80,767.50
H8	Resident (Citizen) Minor Hunting	6.50	1,178		7,657.00
S1	Resident Citizen Sporting	40.00	35,508		1,420,320.00
S2	Resident Citizen Sporting (Age 65-69)	20.00	4,422		88,440.00
S3	Resident Citizen Sporting (Over 70)	FREE	11,592		0.00
S4	Resident Sporting Paraplegic	FREE	33		0.00
	TOTAL LICENSE SALES (GROSS)		**270,080**		**6,071,781.25**
	Type of Stamp				
M1	Archery Stamps	5.10	35,650		181,815.00
M2	Waterfowl Stamps	5.00	11,009		55,045.00
M3	Primitive Firearm Stamps	5.10	36,998		188,689.80
W1	Wildlands Stamps	5.00	207,740		1,038,700.00
W2	Non-Resident Wildlands Stamps	5.00	21,242		106,210.00
	TOTAL STAMP SALES (GROSS)		**312,639**		**1,570,459.80**
	Previous Years Stamp Sales				
M1	Archery Stamps				
M2	Waterfowl Stamps		0		
M3	Primitive Firearm Stamps				
	TOTAL STAMP SALES (GROSS)		**0**		**0.00**
	Fees Retained and Adjustments by Clerks				(241.65)
	Refunds				(2,267.40)
	TOTAL				**-2,509.05**
	TOTAL LICENSE/STAMP SALES (NET)				**7,639,732.00**

INLAND FISH AND GAME FUND EXPENDITURES

Administration:		**FY 2020**
Administration	$	2,261,202.61
Information-Education	$	1,095,246.90
ISA DCAMM Field Headquarters	$	88,074.84
Total	**$**	**3,444,524.35**
Fisheries and Wildlife Programs:		
Hatcheries	$	2,782,768.79
Game Bird Program	$	637,725.12
Seasonals	$	71,830.29
Cooperative Units	$	150,643.87
Fisheries and Wildlife Management	$	5,742,200.93
Total	**$**	**9,385,169.00**
Other Programs:		
Land Acquisitions	$	1,237,799.75
Waterfowl Management Program	$	44,036.00
Hunter Safety Program	$	305,073.11
Total	**$**	**1,586,908.86**
Other Assessments:		
Payroll Taxes	$	238,862.30
GI and Other Fringe Benefits	$	3,462,243.00
Total	**$**	**3,701,105.30**
TOTAL EXPENDITURES*	**$**	**18,117,707.51**

NATURAL HERITAGE AND ENDANGERED SPECIES FUND

07/01/2019 - 06/30/2020

REVENUES:

Natural Heritage and Endangered Species Tax Checkoff Donatior	$	232,451.16
Sales	$	3,648.00
NAWCA	$	143,827.25
NRCS/Wildlife Habitat Incentives Program (WHIP)	$	28,991.22
Section 6	$	14,422.05
RCPP	$	57,769.97
State Wildlife Grant (SWG)	$	1,047,020.70
Massachusetts Endangered Species Act Fees	$	379,750.00
Contracts	$	795,935.00
Direct Donations	$	29,638.62
Interest	$	1,668.84
TOTAL REVENUES:	**$**	**2,735,122.81**

EXPENDITURES:

Natural Heritage and Endangered Species Program	**$**	**2,351,237.11**

FUND EQUITY AS OF JUNE 30, 2020	**$**	**2,770,005.35**

OTHER EXPENDITURES 07/01/2019 - 06/30/2020

Capital Outlay Funds:	FY 2020
Land Protection : Habitat Management- CR Stewardship	$1,013,241.84
Staffing for Land and Infrastructure Programs	$495,904.01
Hatchery/District/Westborough Field Headquarters Repairs	$128,849.17
Habitat Grant Program	$258,297.53
Dam Safety and Repair	$1,399,664.01
TOTAL CAPITAL EXPENDITURES	**$3,295,956.56**

Interdepartmental Service Agreements	
Massachusetts Highway Department (MassDOT)	$159,992.79
Executive Office of Energy and Environmental Affairs	$295,763.33
Total ISA	**$455,756.12**

Natural Heritage and Endangered Species Line Item:	$207,640.05

Federal Grant Accounts	
New England Cottontail	$9,262.42

Other Trust Accounts	
Federal Duck Stamp (e-stamp)	$112,148.00

Administrative Staff
Kris McCarthy, Associate Director of Administration & Finance

Procurement and Payables
Yunus Khalifa, Program Coordinator
Kathleen Plett, Program Coordinator
Mary Cavaliere, Program Coordinator

Revenue
Robert Oliver, License Revenue/Utilty Payables Supervisor
David Manzer, License Receiving Teller
Carl Lui, Accountant I
Gail L. Gibson, Accountant II

Permits
Robert Arini, Fish & Wildlife Permit Specialist

Business Operations
Rick Kennedy, EDP Systems Analyst III
Robert Morley, Business Analyst
James Pollack, Operations Specialist

Clerical
Jill Durand
Colleen Hubbard

Appendix A: FY 2020 Wildlife Lands Inventory

Row Labels	Sum of Report Acres
Central District	**51196.64**
Access	**692.55**
Bare Hill Pond Access	1.45
Blackstone / West River Access	28.00
Cusky Pond Access	23.00
Five Mile River Access	178.52
Glen Echo Lake Access	1.00
Leadmine Pond Access	0.05
Moose Brook Access	20.13
Moosehorn Pond Access	9.00
Mossy Pond Access	17.00
Natty Brook Access	95.17
North Pond Access	0.18
Quag Pond Bog Access	31.00
Quinapoxet River Access	32.00
Quinsigamond Marsh Access	59.00
Quinsigamond River Access	18.60
Sevenmile River Access	77.00
South Meadow Pond Access	0.25
Sputtermill Pond Access	58.50
Tully River Access	1.00
Ware River Access - Barre	40.00
Webster Lake Access	1.70
Sanctuary	**367.91**
Mount Watatic Sanctuary	228.00
Susan B. Minns Sanctuary	139.91
WCE	**8725.50**
Benjamin Hill WCE	87.50
Breakneck Brook WCE	526.00
Burnshirt River WCE	100.00
Carter Pond WCE	300.50
Fish Brook WCE	75.00
Fitchburg Watershed WCE	1875.00
Hitchcock Mountain WCE	110.50
Lawrence Brook WCE	462.60
Leadmine Mountain WCE	826.37
Long Pond WCE	8.85
McKinstry Brook WCE	31.00

Millers River WCE	194.22
Moose Brook WCE	125.00
Mt. Pisgah WCE	19.12
Muddy Brook WCE	575.69
Newton Reservoir WCE	622.00
Nineteenth Hill WCE	623.75
Potter Hill WCE	90.80
Quisset WCE	247.00
Savage Hill WCE	234.00
Secret Lake WCE	311.30
Slater Woods WCE	73.90
Stuart Pond WCE	28.70
Taft Hill WCE	394.60
Wekepeke WCE	564.00
Whitmanville WCE	118.10
Winimusset WCE	100.00
WCR	**746.41**
Breakneck Brook WCR	176.00
Five Mile River WCR	17.27
Hitchcock Mountain WCR	499.50
McKinstry Brook WCR	26.00
Raccoon Hill WCR	22.00
Williamsville Pond WCR	5.64
WMA	**40664.27**
Barre Falls WMA	650.18
Bennett WMA	281.20
Birch Hill WMA	4560.55
Bolton Flats WMA	1319.88
Breakneck Brook WMA	707.00
Chockalog Swamp WMA	52.50
Clinton Bluff WMA	42.00
Coy Hill WMA	1137.50
E. Kent Swift WMA	157.00
Fish Brook WMA	142.50
Four Chimneys WMA	200.00
High Ridge WMA	2240.87
Hitchcock Mountain WMA	268.41
Hubbardston WMA	361.00
Lackey Pond WMA	174.54
Lawrence Brook WMA	295.50
Leadmine WMA	826.00
Long Pond WMA	5.60

Martha Deering WMA	232.58
McKinstry Brook WMA	291.30
Merrill Pond WMA	1037.06
Millers River WMA	3794.76
Mine Brook WMA	1062.15
Moose Brook WMA	849.20
Moose Hill WMA	695.60
Mt. Pisgah WMA	88.80
Muddy Brook WMA	1842.68
Nineteenth Hill WMA	293.60
Norcross Hill WMA	464.93
Oakham WMA	911.20
Phillipston WMA	3224.03
Popple Camp WMA	1459.91
Poutwater Pond WMA	391.74
Prince River WMA	748.95
Quaboag WMA	1822.53
Quacumquasit WMA	179.82
Quisset WMA	424.69
Raccoon Hill WMA	646.16
Richardson WMA	467.22
Savage Hill WMA	930.96
Scripture Hill WMA	121.00
Stone Bridge WMA	505.17
Sucker Brook WMA	102.60
Thayer Pond WMA	131.00
Ware River WMA	185.36
Wayne F. MacCallum WMA	894.58
West Hill WMA	350.00
Whortleberry Hill WMA	334.36
Winchendon Springs WMA	854.06
Winimusset WMA	670.17
Wolf Swamp WMA	1233.88
Connecticut Valley District	**30434.52**
Access	**554.41**
Connecticut River Access	94.80
Deerfield River Access	23.00
Forest Lake Access	26.40
Lake Lorraine Access	0.26
Lake Quinsigamond Access	6.49
Lake Rohunta Access	2.49
Little Alum Pond Access	0.50

Mill River Access	14.15
Millers River Access	60.50
Packard Pond Access	0.54
Sawmill River Access	52.00
Tully Brook Access	154.88
Ware River Access	39.00
Westfield River Access	79.40
Installation	**579.22**
Bitzer Fish Hatchery	74.54
Reed Fish Hatchery	316.00
Sunderland Fish Hatchery	45.59
Wilbraham Nature and Cultural Center	143.09
WCE	**8465.51**
Amethyst Brook WCE	36.90
Brushy Mountain WCE	78.00
Chestnut Hill WCE	175.40
Facing Rock WCE	190.00
Flagg Mountain WCE	345.00
Great Swamp WCE	0.94
Honey Pot WCE	52.74
Lake Rohunta WCE	59.00
Little Tully Mountain WCE	461.38
Ludlow Reservoir WCE	1750.00
Orange WCE	877.97
Paul C. Jones Working Forest WCE	3486.00
Satan's Kingdom WCE	198.00
Southwick WCE	61.31
Tully Mountain WCE	692.87
WCR	**2.39**
Wendell WCR	2.39
WMA	**20832.99**
Bachelor Brook WMA	93.70
Bennett Meadows WMA	201.00
Brewer Brook WMA	456.69
Brushy Mountain WMA	181.38
Catamount WMA	413.00
Darwin Scott WMA	27.30
East Mountain WMA	604.45
Facing Rock WMA	1388.89
Flagg Mountain WMA	223.69

Great Swamp WMA	724.85
Green River WMA (Valley District)	558.85
Herman Covey WMA	1492.98
Honey Pot WMA	178.42
Lake Warner WMA	98.00
Leyden WMA	759.00
Montague Plains WMA	1977.59
Montague WMA	2004.29
Mt. Esther WMA	328.95
Mt. Toby WMA	724.10
Mt. Tom WMA	79.90
Orange WMA	388.50
Palmer WMA	1513.49
Pauchaug Brook WMA	161.30
Poland Brook WMA	707.53
Rainbow Beach WMA	45.90
Satan's Kingdom WMA	2194.60
Shattuck Brook WMA	178.80
Southampton WMA	170.60
Southwick WMA	348.28
Sunderland Islands WMA	15.00
Tully Mountain WMA	704.00
Wales WMA	207.15
Warwick WMA	379.00
Wendell WMA	591.19
Westfield WMA	234.03
Whately WMA	388.59
Williamsburg WMA	88.00
Northeast District	**19371.53**
Access	**235.12**
Baddacook Pond Access	0.16
Concord River Access	0.25
Flint Pond Access	89.18
Ipswich River Access	1.79
Knops Pond Access	0.60
Lake Attitash Access	6.03
Long Sought For Pond Access	1.00
Mascuppic Lake Access	0.25
Nashua River Access - Dunstable	15.00
Nashua River Access - Groton	10.10

Nashua River Access - Pepperell	11.20
Nashua River Access - Shirley	31.20
Sudbury River Access	51.86
Weymouth Back River Access	16.50
Installation	**106.42**
Ayer Game Farm	90.72
Northeast District HQ	15.70
Other	**371.70**
Gov. Thos. Dudley Park	4.50
King Phillip Woods	87.20
Mount Watatic Reservation	280.00
Sanctuary	**552.48**
Carr Island Sanctuary	110.50
Henry Cabot Lodge Bird Sanctuary (Egg Rock)	2.00
J. C. Phillips Sanctuary	390.98
Milk Island Sanctuary	29.00
Ram Island Sanctuary (North)	20.00
WCE	**2839.73**
Concord River WCE	18.90
Cow Pond Brook WCE	127.00
Devil's Den WCE	28.00
Great Marsh North WCE	426.13
Great Meadows WCE	16.00
Great Swamp Brook WCE	106.00
Groton Town Forest WCE	513.00
Hunting Hills WCE	84.59
Martin H. Burns WCE	113.44
Meadow Pond WCE	81.90
Pepperell Springs WCE	255.00
Squannacook River WCE	348.82
Sucker Brook WCE	12.00
Surrenden Farm West WCE	169.70
Throne Hill WCE	177.50
William Forward WCE	213.75
Wright Ponds WCE	148.00
WCR	**127.00**
Mill Creek WCR	59.00
Squannacook River WCR	68.00
WMA	**15139.08**
Ashby WMA	946.76
Boxborough Station WMA	124.10
Castle Neck River WMA	54.67
Crane Pond WMA	2623.21
Delaney WMA	658.00
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
Great Marsh North WMA	459.12
Hauk Swamp WMA	61.00
Hunting Hills WMA	430.02
Martin H. Burns WMA	1576.70
Mulpus Brook WMA	496.43
Nissitissit River WMA	428.06
Pantry Brook WMA	449.95
Salisbury Salt Marsh WMA	865.87
Squannacook River WMA	1758.72
Townsend Hill WMA	658.82
Trapfall Brook WMA	45.38
Unkety Brook WMA	826.14
Upper Parker River WMA	208.89
Whittier WMA	42.00
William Forward WMA	1957.56
Southeast District	**56591.73**
Access	**59.91**
Agawam Mill Pond Access	1.40
Agawam Mill Pond Access WCE	0.50
Bakers Pond Access	1.75
Barnstable Harbor Access	2.78
Big Sandy Pond Access	0.20
Childs River Access	0.25
Cook Pond Access	3.00
Dogfish Bar Beach Access	2.40
Great Herring Pond Access	1.06
Johns Pond Access	0.52
Mashpee-Wakeby Pond Access	25.00
Nemasket River Access	0.46
Popponesset Beach Access	1.50
Robbins Pond Access	1.00

Scorton Creek Access	5.48
Shubael Pond Access	0.35
Snipatuit Pond Access	0.50
South Watuppa Pond Access	5.26
Spectacle Pond Access	0.50
Tispaquin Pond Access	6.00
Installation	**114.36**
Lobster Hatchery	14.80
Sandwich Fish Hatchery	69.76
Southeast District HQ	29.80
Other	**5.94**
SE Massachusetts Bioreserve	5.94
Sanctuary	**78.50**
Billingsgate Island Sanctuary	12.00
Penikese Island Sanctuary	60.00
Ram Island Sanctuary (South)	2.00
Tarpaulin Cove Sanctuary	4.50
WCE	**11433.64**
Acushnet River WCE	30.20
Agawam River WCE	3.98
Angeline Brook WCE	100.70
Assawompsett Pond Complex WCE	3065.00
Bettys Neck WCE	329.22
Billington Sea WCE	69.74
Brandt Island Cove WCE	109.52
Bread and Cheese Brook WCE	5.52
Camp Cachalot WCE	789.00
Copicut WCE	486.22
Halfway Pond WCE	28.00
Lake Nippenicket WCE	8.35
Maple Springs WCE	156.25
Pickerel Cove WCE	78.30
Pilgrim Springs WCE	17.05
Plymouth Pine Hill WCE	240.70
Plymouth Town Forest WCE	296.00
Poor Meadow Brook WCE	101.00
Quashnet River WCE	14.10
Santuit Pond WCE	293.00
Sippican Woods WCE	390.14
South Triangle Pond WCE	47.50
Stump Brook Reservoir WCE	174.00
Taunton River WCE	290.07
Watuppa Reservation WCE	4300.00
Weweantic River WCE	10.08
WCR	37.90
Plymouth Grassy Pond WCR	33.90
Taunton River WCR	4.00
WMA	**44861.48**
Atwood Reservoir WMA	511.07
Bearse Pond WMA	5.80
Black Brook WMA	411.32
Blueberry Pond WMA	1.50
Brayton Point WMA	2.20
Burrage Pond WMA	1842.17
Camp Edwards WMA	15013.16
Canoe River WMA	116.60
Chase Garden Creek WMA	56.40
Clapps Pond WMA	68.35
Cooks Pond WMA	69.18
Copicut WMA	3992.56
Dartmoor Farm WMA	473.00
Dennis Grassy Pond WMA	7.24
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	2302.31
Gosnold WMA	3.45
Halfway Pond WMA	122.64
Hartley Reservoir WMA	70.00
Haskell Swamp WMA	3111.22
Head Of The Plains WMA	2.00
Hockomock Swamp WMA	4552.54
Hog Ponds WMA	24.50
Hyannis Ponds WMA	365.00
Katama Plains WMA	18.57
Maple Springs WMA	774.57
Marconi WMA	1211.00
Mashpee Pine Barrens WMA	198.35
Mashpee River WMA	55.80
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
Noquochoke WMA	204.50
North Attleborough WMA	36.46
Old Sandwich Game Farm WMA	93.13
Olivers Pond WMA	12.00
Peterson Swamp WMA	250.00
Pickerel Cove WMA	15.90
Plymouth Grassy Pond WMA	25.50
Poor Meadow Brook WMA	161.61
Provincetown Corridor WMA	122.00
Purchade Brook WMA	106.00
Quashnet River WMA	51.54
Quashnet Woods State Reservation & WMA	360.00
Red Brook WMA	683.20
Rocky Gutter WMA	3318.56
Sandwich Hollows WMA	224.20
SE Pine Barrens WMA	436.84
Sly Pond WMA	192.00
South Shore Marshes WMA	22.40
South Triangle Pond WMA	10.26
Taunton River WMA	650.42
Triangle Pond WMA	81.90
Wasque Point WMA	99.50
West Meadows WMA	231.72
Western District	**65933.86**
Access	**35.82**
Deerfield River Access - Charlemont	0.62
Hoosic River Access	5.90
Housatonic River Access	17.00
Konkapot River Access	8.80
Westfield River Access - Chester	3.50
Installation	**2.35**
Western District - Old HQ	2.35
Sanctuary	**427.50**
E. Howe Forbush Sanctuary	365.50
Grace A. Robson Sanctuary	62.00

WCE	**15638.11**
Abbott Brook WCE	1782.00
Alford Spring WCE	889.82
Allen Mountain WCE	208.00
Boulders WCE	642.53
Cold Brook WCE	405.00
Cole Meadow WCE	101.00
Flag Rock WCE	41.38
Hawks Brook WCE	23.19
Housatonic River East Branch WCE	114.83
Jug End Fen WCE	81.57
Jug End WCE	262.48
Knightville WCE	676.00
Meadow Brook WCE	126.04
Mt. Darby WCE	319.29
Mt. Plantain WCE	1337.44
North Egremont WCE	21.50
North River West Branch WCE	250.20
Rockhouse Mountain WCE	78.00
Scout Pond WCE	175.90
Shales Brook WCE	5.60
Silver Brook WCE	162.00
Stage Brook WCE	581.00
Steadman Pond WCE	1178.71
Thorpe Brook WCE	266.20
Umpachene River WCE	239.00
Westfield Watershed WCE	2300.00
Widow White's Peak WCE	85.00
Windsor Brook WCE	3284.43
WCR	**69.40**
Windsor Brook WCR	69.40
WMA	**49760.68**
Abbott Brook WMA	18.00
Agawam Lake WMA	785.75
Ashfield Hawley WMA	284.00
Barton's Ledge WMA	88.60
Bullock Ledge WMA	15.50
Chalet WMA	7791.33
Cummington WMA	288.97
Day Mountain WMA	387.54

Dolomite Ledges WMA	389.87
Eugene D. Moran WMA	1870.43
Fairfield Brook WMA	164.90
Farmington River WMA	1901.10
Fisk Meadows WMA	638.17
Flat Brook WMA	273.15
Fox Den WMA	5686.95
George L. Darey Housatonic Valley WMA	812.93
Green River WMA (Western District)	489.12
Hawks Brook WMA	509.83
Hinsdale Flats WMA	2025.51
Hiram H. Fox WMA	3754.19
Hop Brook WMA	527.53
Housatonic River East Branch WMA	27.50
Hubbard Brook WMA	195.93
John J. Kelly WMA	342.00
Jug End Fen WMA	112.54
Jug End State Reservation and WMA	1169.80
Jug End WMA	20.00
Kampoosa Fen WMA	72.00
Knightville Dam WMA	0.00
Lilly Pond WMA	350.70

Long Mountain WMA	958.84
Maple Hill WMA	643.85
Maxwell Brook WMA	129.30
Meadow Brook WMA	50.00
Misery Mountain WMA	1336.04
North Egremont WMA	25.96
Oak Hill WMA	712.30
Peru WMA	5013.47
Powell Brook WMA	404.58
Ram Hill WMA	468.83
Richmond Fen WMA	22.90
Savoy WMA	1985.37
Shales Brook WMA	234.00
Shaw Brook WMA	153.33
Stafford Hill WMA	904.60
Stage Brook WMA	148.30
Swift River WMA	867.46
Tekoa Mountain WMA	1383.30
Three Mile Pond WMA	1141.82
Tower Brook WMA	579.61
Tracy Pond WMA	225.07
Upper Westfield River WMA	328.72
Walnut Hill WMA	988.70
Williams River WMA	60.50
Grand Total	**223528.29**

Photo by Troy Gipps/MassWildlife

JUNIOR DUCK STAMP