2019 Annual Report

Massachusetts Division of Fisheries & Wildlife

Annual Report 2019

Massachusetts Division of Fisheries & Wildlife

Mark S. Tisa, Ph.D., M.B.A.
Director

Table of Contents

Front Cover:
Jim Lagacy, MassWildlife Angler Education Coordinator, teaches Fisheries Management to campers at the Massachusetts Junior Conservation Camp in Russell.
Photo by Troy Gipps/MassWildlife

Back Cover:
A blue-spotted salamander (*Ambystoma laterale*), a state-listed Species of Special Concern, rests on an autumn leaf at the Wayne F. MacCallum Wildlife Management Area in Westborough.
Photo by Troy Gipps/MassWildlife

Printed on Recycled Paper.

The Board Reports

Joseph S. Larson, Ph.D.
Chairperson

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 continued its tradition of holding monthly meetings at locations around the state whenever possible, holding public hearings on proposed regulatory changes, and addressing many issues of specific concern. 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 incorporates 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 the 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

In July 2018, MassWildlife started the new fiscal year with a new Director when the Board voted unanimously to permanently appoint Mark S. Tisa, Ph.D., M.B.A., to the position at the start of the July 17, 2018, monthly Board meeting. At the time he was appointed, Director Tisa brought almost 32 years of experience with MassWildlife, including as the Assistant Director of Fisheries for 25 years; as the Deputy Director of the agency for the previous 3 years (March 2015—April 2018); and most recently as its Acting Director, effective April 30, 2018. The Fisheries and Wildlife Board appointed Director Tisa because of his lifelong commitment to wildlife and fisheries conservation and his excellent record of service to the agency and the Commonwealth. The Board looks forward to working closely with the new Director to achieve his goals for the agency in the coming years.

On October 30, 2018, the Board was very proud to honor former Board Chair George L. (Gige) Darey with the Francis W. Sargent Conservation Award for his many contributions to the sporting community and to the conservation of the Commonwealth's natural resources as chair for 35 years. Mr. Darey was the fourteenth recipient of the award. Established in 2000 by the Fisheries and Wildlife Board, the Sargent Award honors the former governor and noted conservationist who directed MassWildlife in 1963–1964.

Longtime Board member Frederic Winthrop, representing the Northeast District and Agricultural Interests, stepped off the Board at the end of his term, effective November 6, 2018, citing his intention to retire and spend more time with his family, after serving on the Board since 2001. Mr. Winthrop noted in his resignation letter to Governor Baker that "it has been my honor to represent the citizens of Northeastern Massachusetts in particular, as well as the agricultural interests of the Commonwealth, in helping to assure that MassWildlife fulfilled its mission to conserve the wildlife resources and habitats of…Massachusetts." The Board members, staff, and visitors attending his last meeting thanked Mr. Winthrop for his dedicated service and wished him much happiness – and fewer long drives – in his retirement. This left the Northeast District seat of the Board open for several months, until, on May 22, 2019, Mr. Bob Durand of Marlborough, having been duly appointed by the Governor, was sworn in by Lieutenant Governor Karen Polito at the State House as the Board's member representing the Northeast District for the remainder of the existing term. Mr. Durand attended his first Board meeting as a member on June 18, 2019, and was welcomed by the Board and the attendees.

Administrative Matters

The Board held its annual election of officers during the No-

vember Board 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

2019-2020 Migratory Game Bird Season Regulations

In February 2019, the Board heard the staff's proposals, which as always were based on the federal frameworks for migratory bird hunting; in April, it held the public hearing; and, at the close of the hearing, during a discussion of the proposal and in response to public comments during the hearing, it voted to change the proposed opening day in the Berkshire Zone to the Saturday before the Monday opening in the Central Zone, so that the two zones had different opening days, as has been traditional. The Board voted unanimously to adopt the regulation package as amended. For the final regulations, see the Waterfowl sub-report in the Wildlife Section of this Annual Report on Page 68).

2018 Annual Deer Review and 2019 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 2019 Antlerless Deer Permit (ADP) allocations, which were unanimously approved by the Board. Please refer to Page 71 in the Wildlife Section of this Annual Report for the details of the review and of the ADP allocations for 2019.

Turkey Review; Public Hearing; Public Comment Review and Vote: Proposed Turkey Hunting Regulations

Staff came before the Board several times during the fiscal year to discuss an analysis of and potential proposals to amend the turkey-hunting regulations that were based in part on suggestions from state chapter representatives of the National Wild Turkey Federation. Turkey and Upland Game Project Leader David Scarpitti introduced the Board to some preliminary research the staff was conducting in October 2018, then Mr. Scarpitti returned to the Board in March 2019 with fleshed-out recommendations for amendments to the regulations at 321 CMR 3.02(9) and asked for the Board's approval to formally develop and then take proposed regulations to a public hearing. The Board voted unanimously to do so. The hearing was scheduled for May 15, 2019, and, at the June meeting, after a public-comment review by Assistant Director of Wildlife Michael Huguenin, the Board voted unanimously to adopt the regulations as proposed for the 2020 turkey hunting seasons. Please refer to Page 65 in the Wildlife Section of this Annual Report for the details of the turkey-hunting review and of the regulations as adopted for 2020.

Proposals for New, Updated, or Amended Regulations

Proposed MESA List Changes

At the October meeting, Invertebrate Zoologist Dr. Michael Nelson detailed the proposed MESA list changes developed by the Natural Heritage and Endangered Species Program staff. Staff had typically been reviewing the MESA list for possible changes every 2 years; the agency is required to do it every 5 years, and that the time of Dr. Nelson's report to the Board it had been about 5 years since the last updates. The Board was informed that the Natural Heritage and Endangered Species Advisory Committee had reviewed and approved the proposed amended list, and the Board voted unanimously to send the amended MESA list to a public hearing. The hearing had not yet been approved for scheduling at the close of the fiscal year.

Agency Program Reviews

Southeast District Activities (Southeast Wildlife District Manager Jason Zimmer)

August meeting

Connecticut Valley Wildlife District Activities (Connecticut Valley Wildlife District Manager Joseph Rogers)

September meeting

Trout Fisheries in Massachusetts (Coldwater Fishery Resource Project Leader Adam Kautza)

November meeting

Spring Fishing Marketing Campaign (Outreach and Marketing Coordinator Nicole McSweeney)

December meeting

Land Protection Review (Chief of Wildlife Lands Elizabeth Wroblicka)

December meeting

Linking Landscapes and Other DOT Projects Update (Senior Endangered Species Review Biologist David Paulson)

January meeting

Fee and CR Land Stewardship Review (Fee Stewardship Coordinator Christine Chisholm and Conservation Restriction Stewardship Coordinator Elizabeth Newlands)

February meeting

Carbon Budgeting on MassWildlife's Forests (Habitat Planning Coordinator Brian Hawthorne)

June meeting

Other Presentations on Topics of Interest to the Board

State Agency Vulnerability Assessment and Priority Actions

At the July meeting, Dr. Rebecca Quiñones, Rivers and Streams Project Leader for the Fisheries Section and MassWildlife's point person for climate-change-related work, was before the Board to report on MassWildlife's input to the state's Hazard Mitigation and Climate Adaptation Plan. This work began when Governor Baker signed Executive Order (EO) 569 in FY 2017, establishing an integrated climate change strategy for the Commonwealth. In the EO, state agencies were directed to complete the State Agency Vulnerability Tool, which would be used to develop priority climate adaptive actions. Dr. Quiñones became involved as the lead for MassWildlife and then also as the coordinator for the entire Department of Fish and Game when DFG Chief of Staff Bob Greco reached out looking for someone to take the lead to coordinate completion of the assessment for the other DFG agencies (DER, OFBA, DMF) and then-Director Buckley assigned the work to her.

Dr. Quiñones met with MassWildlife staff from both the FHQ and the Districts, reviewed the scientific literature, and conducted analyses before completing the assessment in January 2018. She explained to the Board that the goal of the assessment had been to evaluate the vulnerability of the agency's assets, like the hatcheries and BioMap areas, and services like angler education and regulatory review to different climate-change drivers such as sea-level rise and more extreme weather events, which was an effort of several months. An environmental consultant subsequently took the MassWildlife assessment and provided a summary in the form of a report. The eleven Climate Adaptation Priority Actions identified through this process were incorporated into the state's Hazard Mitigation and Climate Adaptation Plan and included upgrades to hatchery infrastructure, updates to BioMap, and restoration of Great Marsh salt marshes.

Tracking Dog Review

Assistant Director for Wildlife Michael Huguenin provided a report at the September meeting on a matter that the Board had requested staff look into, based on a request from a constituent to allow a study of the use of dogs to track wounded, unfound deer. Assistant Director Huguenin reviewed the agency's mandate, its general deer management goals, and the details of the request that resulted in this inquiry. He reported that the study proposed was in violation of the existing statutes as well as the regulations, and that the statute took the matter out of agency hands. He also reported that staff had determined that the study would not provide any benefit to the work of the agency relative to its deer management goals, and that, taking all the circumstances together, staff did not recommend taking any steps to pursue it.

Chronic Wasting Disease Update

The January meeting brought a report of great interest to the Board and the attendees from Deer and Moose Project Leader David Stainbrook, who updated the progress of the spread of Chronic Wasting Disease (CWD) in North America. Briefly, CWD is an infectious disease that is 100% fatal to cervids (members of the deer family). It is believed to be caused by prions, which are a form of folded proteins that are extremely stable and can exist on the landscape for over 10 years. The CWD prion causes neurological damage that continues to progress until the animal dies. The incubation period can be more than 18 months, during which the animal is not showing any symptoms but spreading infectious material. Deer will typically die within a few months once symptoms, which include "wasting" emaciation, abnormal behavior, drooping head and ears, loss of bodily functions, and drooling, appear.

Mr. Stainbrook stressed the following important points: CWD has not been detected in Massachusetts and we have strong regulations in place to reduce the risks, noting that, since regulations adopted in 2005, no live deer can be brought into the state and there is a carcass ban from CWD-positive areas. He also stressed that Massachusetts has had no documented cases of CWD in humans or livestock. In other states with CWD, there is evidence of decreased hunter interest and corresponding loss of license sales, as well as deer population decreases in areas with an incidence rate greater than 20%.

Mr. Stainbrook also reviewed the history of funding of CWD research, the places where CWD is found, the spread of the disease over time, recent research, steps to reduce the risks to Massachusetts deer, and the outreach efforts that are being undertaken in Massachusetts to publicize the issue and educate hunters. Please refer to Page 73 in the Wildlife Section of this Annual Report for a recently updated map of the incidence of CWD in the U.S. and Canada.

National Wild Turkey Federation, Massachusetts Chapter: National Recognition Award (Mark Tisa)

During the March meeting, Director Mark S. Tisa introduced Mr. Keith Fritze, whose Massachusetts Chapter of the National Wild Turkey Federation (NWTF) recently received a

coveted National Recognition award at the NWTF annual meeting in Nashville. The Director thanked Mr. Fritze as a longtime and very active partner in mentoring and encouraging new hunters, particularly, to take up turkey hunting in Massachusetts.

Massachusetts Fisheries and Wildlife Board
Joseph S. Larson, Pelham (Chair)
Michael Roche, Orange (Vice Chair)
Bonnie Booth, Spencer (Secretary)
Bob Durand, Marlborough (part-year)
Ernest W. Foster IV, Scituate
Stephen A. Sears, Dalton
Brandi Van Roo, Douglas
Frederic Winthrop, Ipswich (part-year)

Photo by Troy Gipps/MassWildlife

In 2019, the Massachusetts Youth Turkey Hunt Program was honored with a national award by the National Wild Turkey Federation (NWTF). The Youth Turkey Hunt Program was recognized as one of the top five youth programs in the country. The Program was also selected as the national winner of the NWTF Recruitment, Retention, and Reactivation (R3) Award for its achievements in engaging with young hunters. Pictured are members of the Massachusetts Fisheries & Wildlife Board and Keith Fritze (second from right), President of the Mass. Chapter of the NWTF.

Fisheries

Todd A. Richards
Assistant Director, Fisheries

Overview

The Commonwealth possesses an enormous quantity and variety of freshwater fishing opportunities. Our lakes, ponds, streams, and rivers provide excellent fishing for warm and coldwater species of fish from Cape Cod to the Berkshires. Anglers can find themselves successfully catching bass, trout and panfish in urban settings or remote wildlife management areas. The enormous popularity of our freshwater fishery is not only a benefit to our anglers, but also to our economy, providing more than $100 million in wages, salaries, business earnings and state and federal tax revenues.

The Fisheries Section responsibilities include a mix of management and research activities designed to enhance and promote recreational opportunities and gain an in depth understanding of the fishery resource, its' status and trends. Fisheries activities require expertise in fisheries management, policy, and aquaculture.

This year our hatchery program once again provided one of the best trout fisheries in the Northeast, meeting production goals for Brook, Brown, Rainbow, and Tiger Trout as well as the continued stocking of landlocked salmon for Quabbin Reservoir. While the pounds of fish we produced remained the same, we had a larger than usual proportion of fish achieving the 14+ inch category, providing a remarkable fishery. Surplus Landlocked Salmon were once again available for trade for Northern Pike surplus made available from the state of New Jersey. The hatcheries were also the focus of a comprehensive feasibility study, funded through EOEEA, to plot the course for the next 50 years of fish culture in the Commonwealth. HDR, Inc. was contracted to evaluate and prioritize the most critical needs of the hatchery system in order to maintain production for the foreseeable future. The study covered all critical aspects of hatchery production, from water supply to infrastructure to biosecurity, and provided recommendations, a prioritized list of actions and opinions of probable cost for each priority action. Options for energy efficiency, alternative energy generation and climate resiliency were also incorporated into the report.

The Field Headquarters fisheries staff also had a productive year. We continue to search for innovative data collection tools that allow us to better manage the fishery, create publication-grade reports, and provide high quality products for the public. This year we implemented improvements in the data entry process, submitted three journal articles for publication, and played a leadership role in regional efforts to holistically identify coldwater climate refugia and manage Coldwater Fishery Resources. We are also engaged in efforts to more critically assess many of catch and release areas to get a better understanding of the effectiveness of our management efforts. We collected new bathymetry and upgraded pond map information on over 100 additional ponds in FY19. Members of the section have also served on Committees for students in the UMass Cooperative Fish and Wildlife Research Unit, given talks to many educational institutions, participated in deer check station, trout stocking and controlled burn activities, and have helped to develop and implement MassWildlife's R3 strategies.

I. Stream and River Project, Rebecca Quiñones, Ph.D., Project Leader

1. Assessment of warm- and coolwater stream and river resources.

Fourteen warm- and coolwater rivers were sampled in FY19 in collaboration with corresponding District staff. Data from 10 of the waterbodies will be used to calculate or recalculate indices of percent similarity to Target Fish Communities (TFC, as in Kashiwagi and Richards 2009; Table 1). Fish communities will categorized as being in good (% similarity > 75), fair (% similarity = 50 to 75), or poor (% similarity < 50) condition. TFC and similarity index information will be shared with the Department of Environmental Protection for their assessment of Aquatic Life Use in rivers with cold and warm water fisheries (R. Maietta). Surveys (2016-2019) to update TFC calculations of all major rivers in Massachusetts were completed in FY19. This data will facilitate a more intensive analysis of the status of major rivers using non-metric multidimensional scaling (NMDS). When completed alongside generalized linear models of watershed characteristics, NMDS should provide information on the direction and probable causes of changes in fish communities that can be used to identify management recommendations. The intensive analysis is planned for completion in winter 2020.

Additional sampling priorities were identified in collaboration with District biologists and in accordance with fisheries needs (e.g., juvenile shad and post restoration surveys). Surveys were conducted in the Connecticut River (n = 12) in

Table 1. Warm- and coolwater sampled in FY19 for calculating or updating Target Fish Community Dissimilarity Indices.

Waterbody surveyed	No. of surveys
Blackstone River	8
Charles River	11
French River	5
Millers River	3
Mystic River	4
Neponset River	4
Parker River	8
Quinebaug River	3
Shawsheen River	3
Taunton River	3
Total	52

spring 2019 to look for burbot. The Nemasket (n = 2), Fort (n = 5), Coonamesett (n = 5) rivers and other parts of the Connecticut River (n = 4) were also sampled.

2. Serve as the agency representative for climate change and climate science activities.

In FY19, 50% of designated hours were devoted to coordination and completion of climate change- related work, including the identification of potential coldwater climate change refugia. Working in collaboration with the USGS Conte Anadromous Fish Research Center and the Northeast Climate Adaptation Science Center, this work will be included as a case study in an article to be published in Frontiers of in Ecology and the Environment in late 2019. The article's title, abstract and Massachusetts case study are included below.

Managing climate refugia for vulnerable freshwater fishes under an expanding human footprint

Joseph L. Ebersole[1], Rebecca M. Quiñones[2], Shaun Clements[3], and Benjamin H. Letcher[4].

1. US EPA, Office of Research and Development, NHEERL, Western Ecology Division, Corvallis, OR 97333
2. Massachusetts Division of Fisheries & Wildlife, Westborough, MA 01581
3. Oregon Department of Fish and Wildlife, Corvallis, OR 97333
4. USGS, Leetown Science Center, Conte Anadromous Fish Laboratory, Turners Falls, MA 01376

Abstract

Within the context of climate adaptation, the concept of climate refugia has emerged as a potential framework for addressing future threats to fish populations. Our aim is to evaluate recent cold-water refugia management within the context of water use and landscape modification by comparing efforts in two USA states (Oregon and Massachusetts) with contrasting land and resource use patterns. From these case studies, we illustrate tools, principles and guidelines that can be broadly applied. While many early efforts at identifying climate refugia focused on water temperature, significant gains in evaluating other factors and processes regulating climate refugia (eg stream flow and groundwater withdrawal) are allowing refined mapping and assessment of ecological value. Significant challenges remain for incorporating climate refugia into water quality standards, evaluating trade-offs among policy options, addressing multiple species' needs and planning for uncertainty. But with a procedurally-transparent and conceptually-sound framework to build upon, recent efforts illustrate a promising path forward.

Integrating climate change and land use to model refugia for cold-water species in Massachusetts

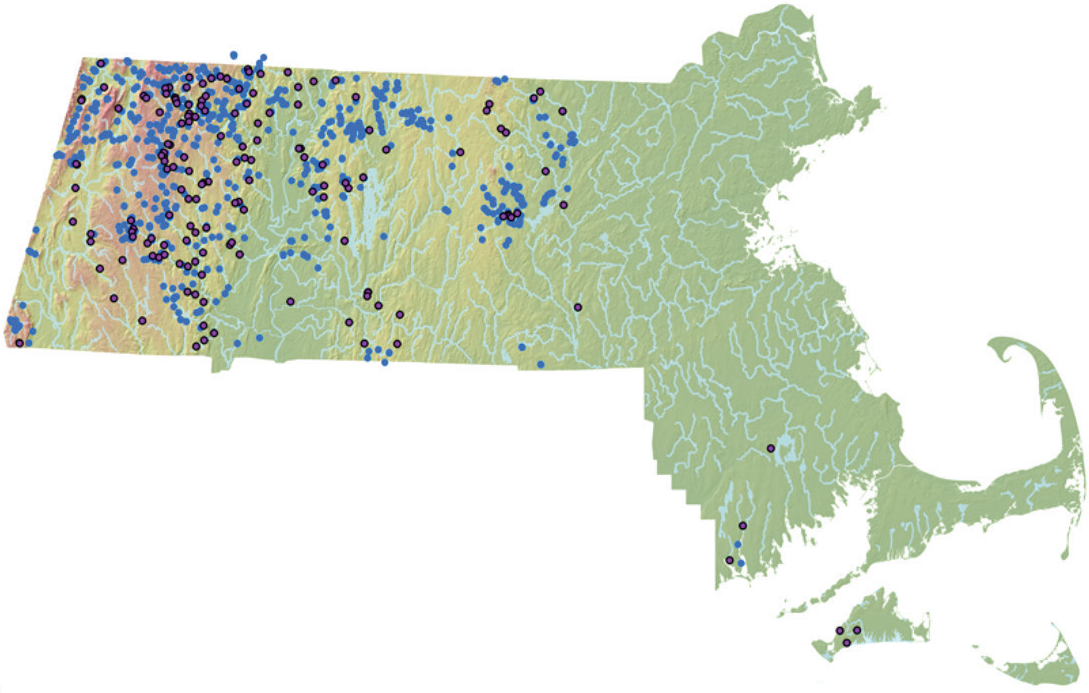
Land uses in Massachusetts have altered freshwater habitats for centuries. Deforestation for agriculture is thought

to have increased soil erosion and sediment transport to the detriment of many freshwater ecosystems by the 1850s (Moore et al. 1997). More recent land use changes, particularly from dam and road building, have resulted in many rivers and streams seasonally exceeding temperature tolerances for cold-water species such as Eastern Brook Trout (Salvelinus fontinalis) (Hall et al. 2002; Hudy et al. 2008). Although more than 80% of all flowing waters in the state likely were once cold-water habitat, this type of habitat is now largely restricted to smaller rivers and streams. Today, 78% of the watersheds evaluated in Massachusetts have <50% of their historical cold-water habitat to support self-sustaining Brook Trout populations (Hudy et al. 2008).

Climate change has affected stream conditions concurrently with changes in land use. Annual average air temperatures have increased in the Northeast by approximately 0.26°C per decade since 1970 (NECASC 2018), further shrinking cold-water habitat. Additionally, there has been an ~70% increase in the number of extreme precipitation events since 1958 (Melillo et al. 2014), especially in winter (Blum et al. 2018). These events increase soil erosion and sediment delivery to streams which reduces recruitment of young age classes and limits adult migration in some salmonid species (reviewed in Groot and Margolis 2003). Earlier snow- and ice-melt and more frequent winter rain have resulted in earlier (7-14 days) and higher peak flows in New England (Hayhoe et al. 2007; Hodgkins et al. 2003). As the magnitude of peak flows increases so do stream velocities that scour river channels, affecting the survival of cold-water species that use stream substrate at some point in their life history (eg Brook Trout, spring salamander Gyrinophilus porphyriticus, freshwater pearl mussel Margaritifera margaritifera; Goode et al. 2013; Hastie et al. 2003; Lowe 2012).

Given that cold-water species have been identified as some of the most sensitive to climate change (MCCS 2010), Massachusetts has initiated a process to identify and map key refugia features as a first step in their conservation (Morelli et al. 2016). Refugia could lessen the exposure of rising temperatures and changing stream flow on species able to disperse into suitable habitats (Bush and Hoskins 2017). Populations in refugia are expected to have higher adaptive capacity over the long term because adverse impacts to population demographics (eg survival, recruitment; Letcher et al. 2015, Lynch et al. 2016) should be attenuated.

Using data from extensive MassWildlife efforts (>10,000 surveys since 1980), potential cold-water climate refugia where identified based on the presence of cold-water species during summer surveys. Surveys conducted in 2016, the worst drought year in recent history, also identified locations where cold-water species can persist despite drought (Figure 1). These data were incorporated into existing models (see ice.ecosheds.org for details) to further evaluate the effects of land use (e.g., agriculture, forest cover) and



.

Figure 1. Areas likely to support Brook Trout (>50% probability of occurrence) with an increase of 6°C in average July air temperatures (blue) and areas where coldwater species were captured during the 2016 drought (red). Areas that overlap show potential refuges that buffer cold-water species from both warming temperatures and drought conditions. Not all areas in blue were sampled in 2016

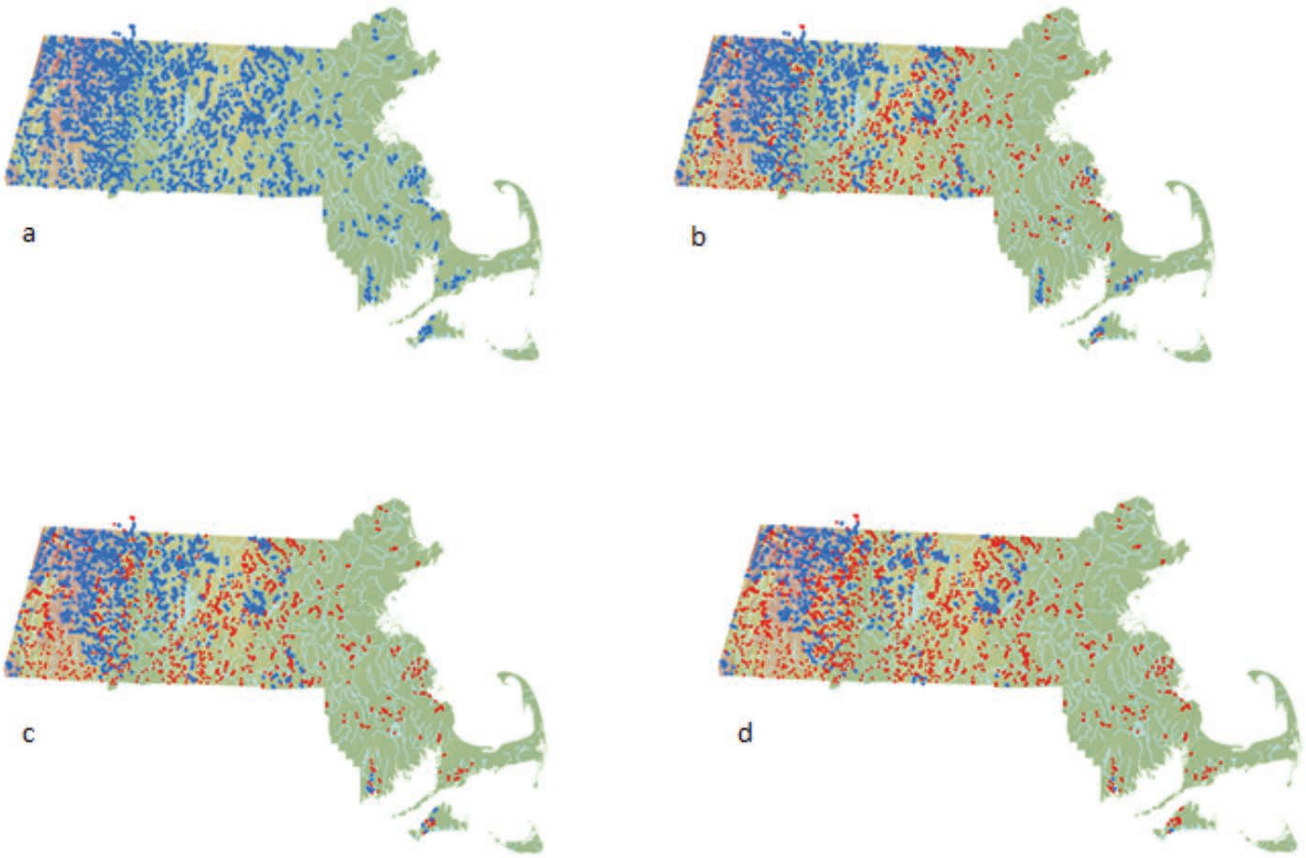


Figure 2. Distribution of cold-water refuges (blue dots) under current conditions (a) and modeled warming scenarios of 2°C (b), 4°C (c), and 6°C (d) increases of average July air temperatures. Red dots indicate existing cold-water refuges that will likely lose cold-water habitat in summer months. Reductions in cold-water habitats associated with 2°C (~30%) and 4°C (~50%) increases in average summer temperatures may occur as quickly as the 2040s and 2070s (Bradley *et al.* 2018). The timing associated with a 6°C increase in summer temperatures has not been estimated at this time. (Data from: Massachusetts Division of Fisheries and Wildlife and ice.ecosheds.org).

watershed characteristics (e.g., geology) on the resiliency of refugia under three warming scenarios (Figure 2). Preliminary results suggest that the number of sites across the state with >50% occurrence probability for cold-water species may decrease by 36-75% in a warming (2-4°C) climate by the 2070s.

The article above is part of a special issue focused on climate change refugia. Input was also provided to the issue's introductory article with the title and abstract below.

Climate Change Refugia: Biodiversity Change in the Slow Lane

Toni Lyn Morelli, Cameron Barrows, Aaron Ramirez, Jennifer Cartwright, David D. Ackerly, Tatiana Eaves, Joe Ebersole, Meg Krawchuk, Benjamin Letcher, Mary Mahalovich, Garrett W. Meigs, Julia Michalak, Connie Millar, Rebecca M. Quiñones, Diana Stralberg, James H. Thorne

The field of climate change adaptation is focused on conducting as well as translating research in order to minimize climate change's dire impacts to biodiversity. One adaptation strategy is to focus conservation actions on climate change refugia, areas where a slower pace of climate change is happening thus enabling longer term persistence. We highlight papers in this special issue that exemplify the considerable methodological and conceptual advances in refugia science in recent years. This young subdiscipline is moving forward to improve scientific understanding and conservation in the face of climate change; advances include explicit scaling of refugia processes, inclusion of ecosystem dynamics, and looking beyond climate exposure to sensitivity and adaptive capacity. Additionally, we propose considering refugia in the context of a multi-faceted, long-term network approach. After years of discussion confined primarily to the scientific literature, researchers and resource managers are now working together to put refugia conservation into practice.

In order to validate the modeled results mentioned in the Massachusetts case study, 32 hobo pro V2 water tempera-

ture loggers were deployed in four watersheds: Blackstone River, Manhan River, Squannacook River and Ammonoosuc River (NH). Loggers were deployed in locations modeled as providing coldwater habitat into the near future (2070s) but likely to transition to warmwater as the July temperatures warm. Loggers were deployed by trained volunteers in July 2019 from several organizations (Connecticut River Conservancy, Squanatissit Trout Unlimited, Ammonoosuc Trout Unlimited, Blackstone River Watershed Association). Temperatures will be monitored through spring 2020. Locations with loggers in Massachusetts will also be surveyed in FY20 in order to document coldwater species and assess the quality of the habitat.

Time was also spent fulfilling duties in several official roles, including as the NEAFWA representative on the AFWA Climate Change Committee, as member of the Northeast Climate Adaptation Science Center's Science Advisory Committee, and as chair of MassECAN's (Massachusetts Ecosystem Climate Adaptation Network) coldwater streams expert working group. MassWildlife was also a primary planner and the host for the first all-day MassECAN conference (October 30, 2018). Lastly, talks were given on the integration of resource management and climate adaptation at the Ecological Society of America conference (August 2018), NEAFWA conference (April 2019), MassECAN conference (October 2018) and Millers River Trout Unlimited Chapter (March 2019).

3. Serve as the MassWildlife Governing Council representative on the Instream Flow Counci**l**

In FY19, work continued as the Massachusetts representative and Secretary to the Instream Flow Council (IFC). A large amount of time was spent helping to plan and organize, the five-day biennial meeting scheduled for spring 2020. The Secretary is in charge of taking and editing minutes for all Executive Council meetings, initiating approval of minutes at subsequent meetings, maintaining a roster and member list of all current IFC members, working with the IFC Treasurer to identify the active status of each participant, and sending out letters for dues when appropriate.

4. Informs Assistant Director of activities, issues and potential problems and performs other fisheries research and management assignments as required.

Other fisheries research and management assignments in FY19 included:

1. Manning the fish kill phone as scheduled (2 weeks);

2. Providing help to Districts as needed
    a. Surveys of the Fort and Coonamesett Rivers

3. Providing help to other staff as needed
    a. American shad surveys (Connecticut River)
    b. Swift River surveys
    c. Lake trout surveys (Wachusett and Quabbin Reservoirs)
    d. Sportfishing awards entry review
    e. Sportsfishing awards ceremony

4. Providing technical review of projects in large rivers and streams potentially impacting fisheries
    a. Dam removal in the Charles River (Watertown Dam)
    b. Review of Water Management Plans (Parker River, Hamant Brook)

5. Input to Agency Relevancy work
6. Review of Massachusetts Environmental Trust grants
7. Review of Municipal Culvert Replacement grants
8. Fisheries representative to State House Day (May 2019)

II. Watershed Project - Jason Stolarski, Ph.D., Project Leader

Major Projects

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 33 waterbodies throughout the commonwealth (Table 1).

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 begin-

Table 1. Fisheries Surveys on waterbodies in FY 19

Waterbody Name	Palis	Date Sampled	Town	District	Watershed
Stiles Pond	92063	7/12/18	Boxford	North East	Ipswich
Fresh Pond (1)	94040	7/13/18	Plymouth	South East	South Coastal
Metacomet Lake	34051	7/19/18	Belchertown	Conn. Valley	Connecticut
Fitchburg Reservoir	81043	7/24/18	Ashby	North East	Nashua
Williams Pond	96341	7/30/18	Wellfleet	South East	Cape Cod
Boons Pond	82011	7/31/18	Stow	North East	Concord
Stetson Pond	62182	7/31/18	Pembroke	South East	Taunton
Glasheen Pond	36179	8/14/18	Phillipston	Central	Chicopee
Winnecunnet Pond	62213	8/14/18	Norton	South East	Taunton
Pearl Lake	72092	8/21/18	Wrentham	North East	Charles
Sputtermill Pond	36180	8/23/18	Petersham	Central	Chicopee
Baddacook Pond	84036	8/23/18	Groton	North East	Merrimack
Forest Lake	36063	8/31/18	Palmer	Conn. Valley	Chicopee
Field Pond	92019	9/4/18	Andover	North East	Ipswich
Knops Pond Lost Lake	84084	9/5/18	Groton	North East	Merrimack
Buel Lake	21014	9/5/18	Monterey	Western	Housatonic
Heart Pond	82059	9/14/18	Westford	North East	Concord
Triangle Pond	34138	9/26/18	Northampton	Conn. Valley	Connecticut
Hockanum Road Pond	34034	9/26/18	Northampton	Conn. Valley	Connecticut
Oxbow	34066	9/26/18	Northampton	Conn. Valley	Connecticut
Stockbridge Bowl	21105	9/27/18	Stockbridge	Western	Housatonic
Onota Lake	21078	10/10/18	Pittsfield	Western	Housatonic
Bartons Cove Pond	34122	10/19/18	Gill	Conn. Valley	Connecticut
Russell Pond	32061	10/25/18	Russell	Western	Westfield
Forge Pond	84015	6/14/19	Littleton	North East	Merrimack
Badacook Pond	84036	6/12/19	Groton	North East	Merrimack
Whitmanville Reservoir	81109	6/10/19	Westminster	Central	Nashua
Norton Reservoir	62134	6/7/19	Norton	South East	Taunton
Chauncy Lake	82017	6/6/19	Westborough	Central	Concord
Walker Pond	41052	6/5/19	Sturbridge	Central	Quinebaug
Dark Brook Reservoir	51035	5/31/19	Auburn	Central	Blackstone
Farm Pond	82035	5/29/19	Framingham	North East	Concord
Scarsboro Pond	72107	5/15/19	Boston	North East	Charles

ning 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.

Date 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 calculates 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 2019, a total of 234 Lake trout were tagged; 163 within Quabbin Reservoir and 71 within Wachusett Reservoir (Table 2). Within Quabbin Reservoir, 30 of the 163 fish captured were recaptures which displayed a modal recapture interval of 3 years and a maximum of 12 years. Among the 178 fish recaptured in Quabbin since 2007, 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, 5 of the 71 Lake trout were recaptures; 2 originally tagged in 2016, 2 from 2017 and one from 2014. Among the 23 fish recaptured in Wachusett since 2015, the annual growth rate expressed as a percentage of body length is 1.6% which equates to approximately 10.25mm 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.

Within Quabbin Reservoir, relative condition has increased since 2014, and mean length at catch rose relative to 2017. However, these metrics appear to be trending downward over the entire period of record (Figs 1 and 2). Intradecadal oscillations in these measures are likely a function of changes in forage fish abundance as one qualitative measure of forage fish decreased by 10 fold between 2009 and 2011. 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 remained stable relative to 2017 while length at catch rose slightly (Figs 3 and 4). 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. Efforts to locate additional spawning habitat are ongoing.

Analysis of the entire Quabbin Reservoir Lake Trout dataset has been ongoing since 2017. The last time the Lake Trout data was analyzed in its entirety was in the early 1970's as summarized in Bridges and Hambly (1971). The recent analysis was published in Northeastern Naturalist and encompassed some 4723 tagged Lake Trout and 331 recaptures collected between 1964 and 2017 (Stolarski 2019)

Table 2. Lake Trout Tagging

	Quabbin Reservoir		Wachusett Reservoir	
Year	Tagged	Recaptured	Tagged	Recaptured
2006	279	NA		
2007	57	2		
2008	109	6		
2009	191	13		
2010	177	30		
2011	6	0		
2012	0	0		
2013	254	16		
2014	290	14	110	NA
2015	398	31	161	6
2016	277	7	67	3
2017	158	29	78	9
2018	163	30	71	5
Total	2359	178	487	23

Quabbin Salmon Marking:

Each spring approximately 10000 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

Figure 1. Lake Trout relative condition, Quabbin Reservoir, 1974 – 2018

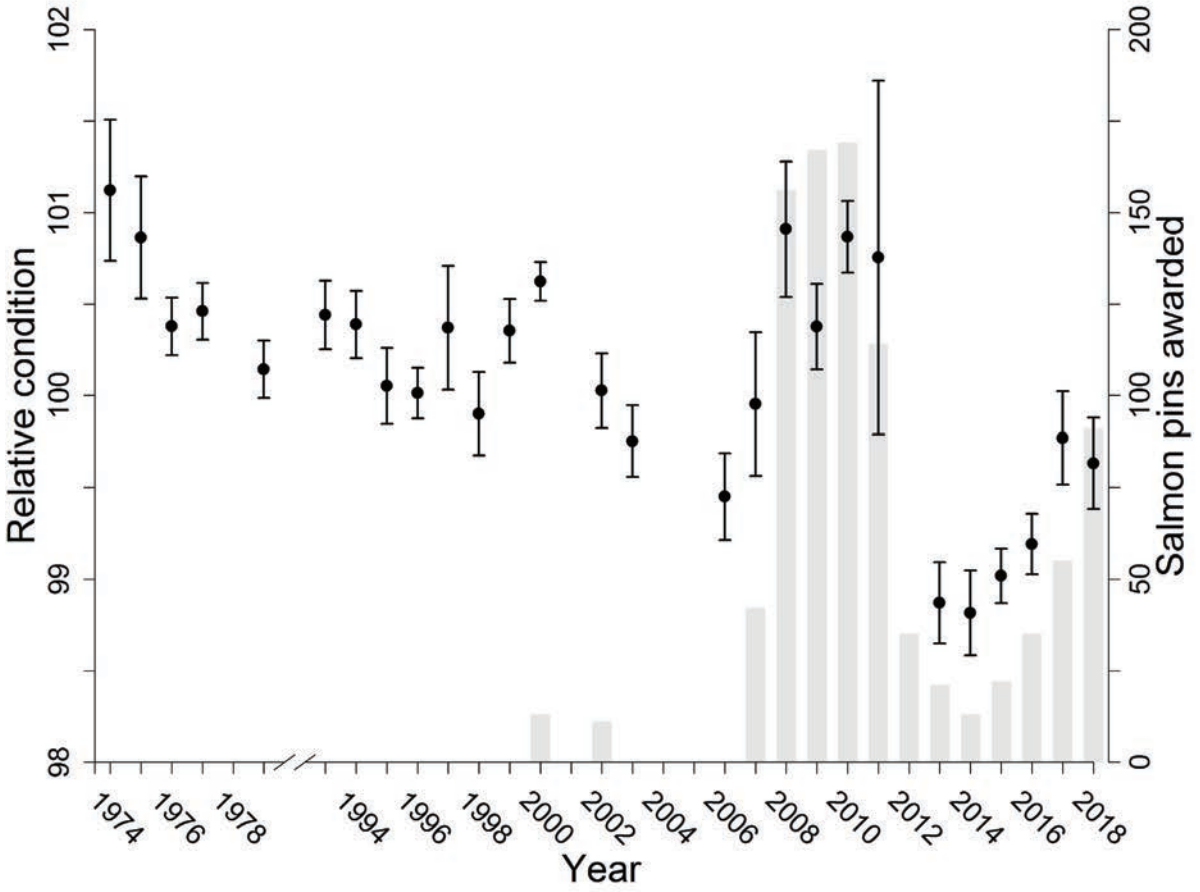


Figure 2. Lake Trout mean length at catch, Quabbin Reservoir, 1964 – 2018

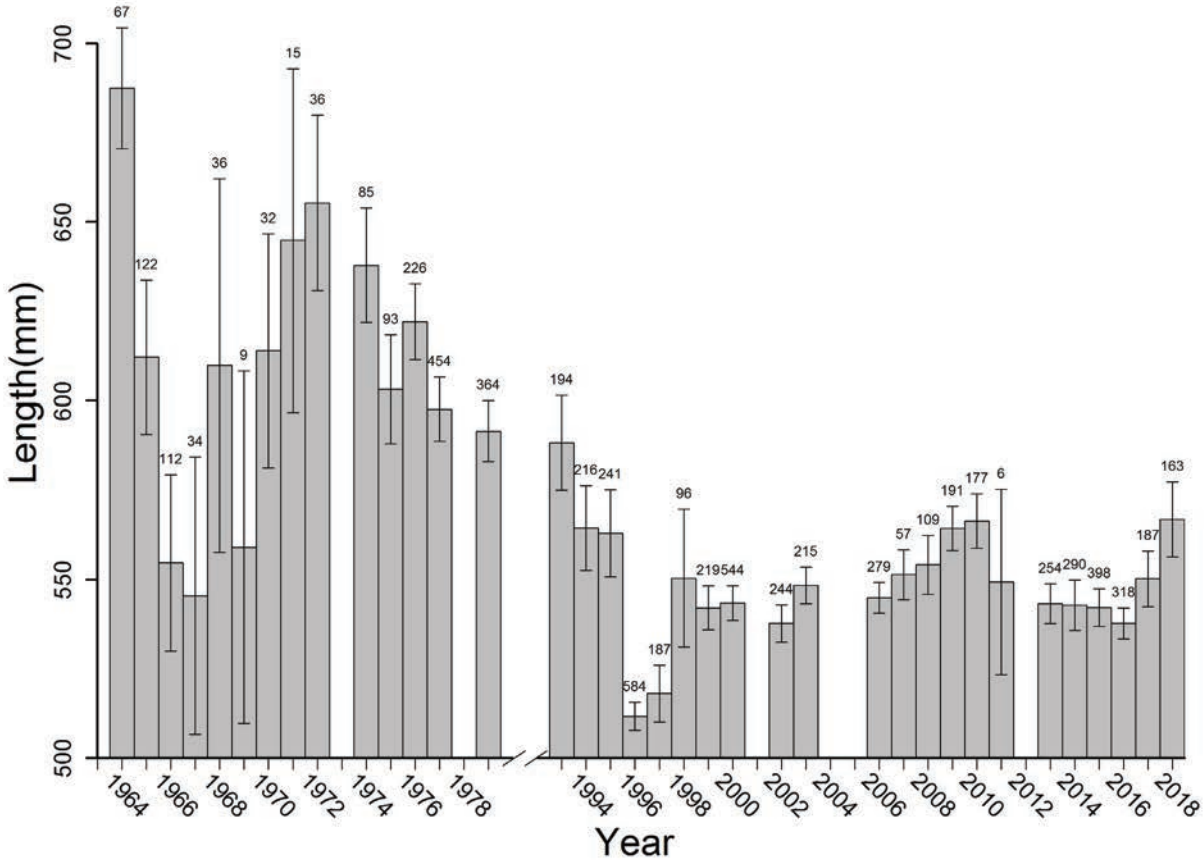


Figure 3. Lake Trout relative condition, Wachusett Reservoir, 2014 – 2018

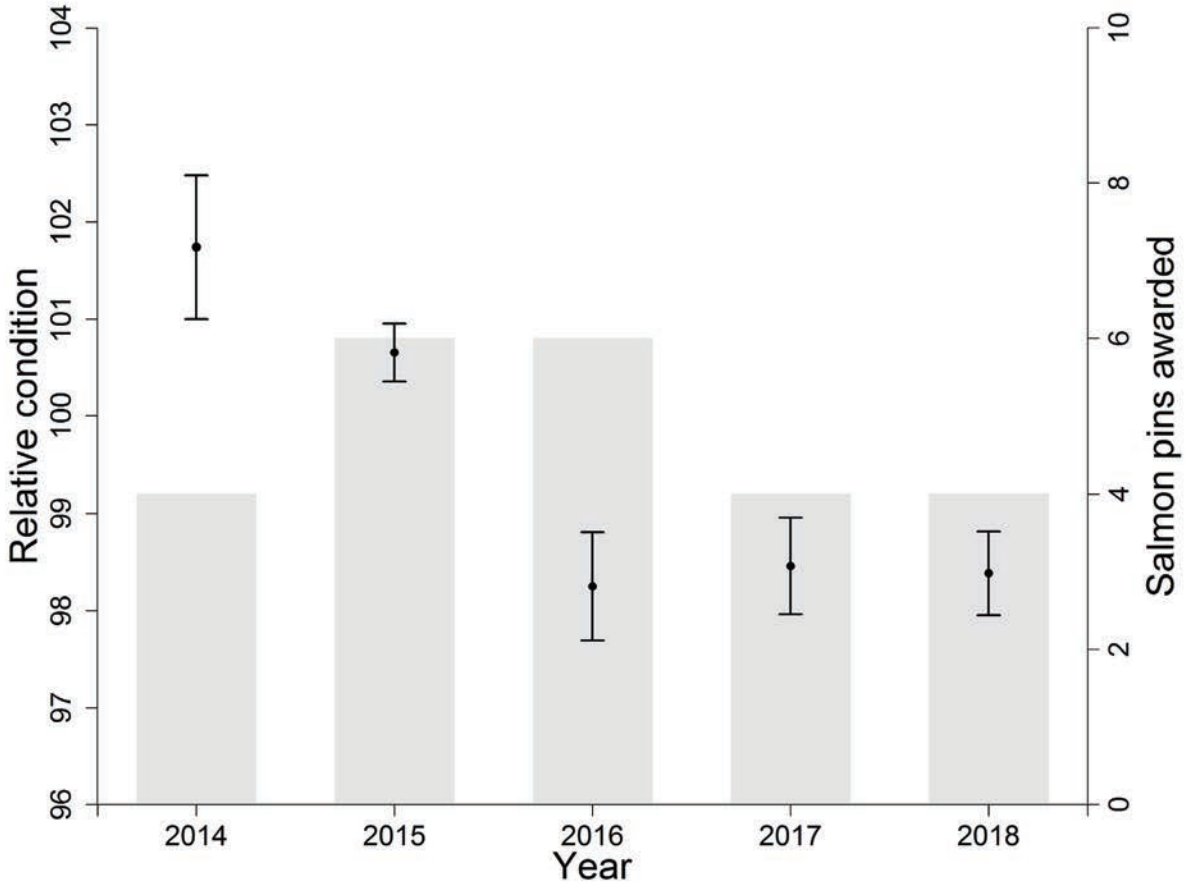
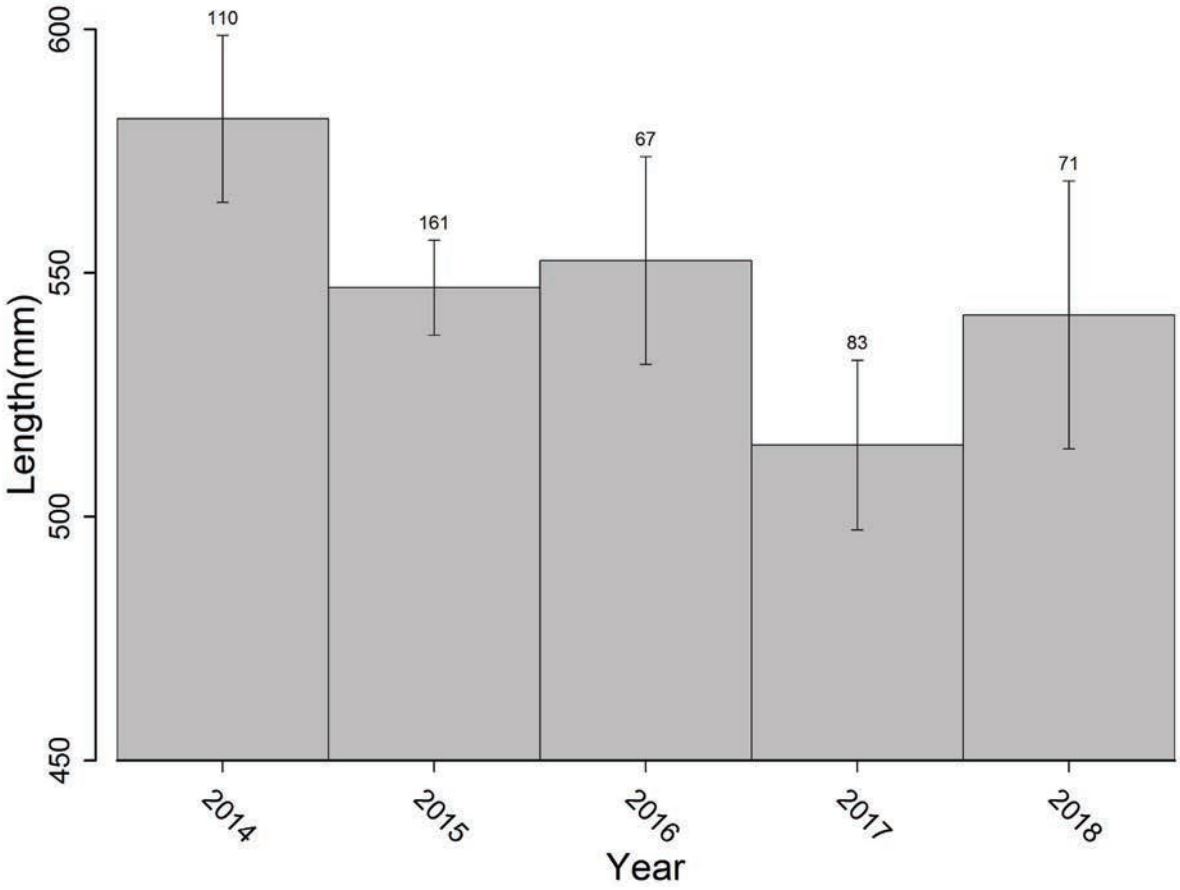


Figure 4. Lake Trout mean length at catch, Wachusett Reservoir, 2014 – 2018



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.

Fisheries Database:
This year roughly 150 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 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, close to 4500 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.

Modern 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.

Smaller projects

Public version fisheries GIS layers

Modified data import and export scripts to create a light version of the fisheries GIS layers for release on MASSGIS. The layers await internal review.

Ecological effects of seasonal water level drawdowns in Massachusetts lakes and ponds

MassWildlife continues to support research conducted by the University of Massachusetts and graduate student Jason Carmignani concerning the effects of seasonal water level drawdowns on lakes and ponds throughout the state. In FY 2019, MassWildlife assisted these efforts by sampling Lake Buel and Stockbridge Bowl in the fall. Boat electrofishing, beach seining, and minnow traps were used to collect fish and lengths and weights were collected. Furthermore,

as a member of Jason Carmignani's thesis committee I have reviewed 1 manuscript resulting from his research and met to discuss methods and statistics pertaining to the direction and scope of his work. Finally I have taken over the maintenance and downloads of the pressure transducers at his 23 study sites.

Fisheries seasonal technicians

I hired and managed a seasonal fisheries technician for the summer who was extremely beneficial to the fisheries section. The technician's primary duties were to assist biologists sampling fish in the field, and enter these and other historic data into our database. The technician was particularly helpful with lake/pond and river sampling as it is preferable to have a crew of 4 while boat shocking and even more when working in rivers. Within a section as small as fisheries, scheduling can become difficult as multiple projects are being conducted concurrently. Technicians allow additional flexibility in scheduling and permit biologists to complete their sampling within the necessary timeframes. Furthermore, since the section began hiring seasonal technicians in 2016 we have collectively entered into electronic form and organized almost all of the quantitative and qualitative data collected by the section since 1900, a task that would not have been possible without the additional help.

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

III. Fisheries GIS - David Szczebak, Project Leader

Activities included in this project in FY 19 concentrated primarily on continued development of the stocked waters application, revision of pond maps and narratives, and development of a catch and release datalayer.

1. Stocked Waters Application

In FY2019 there was continued effort to improve our trout stocking web application. The internal component, an online Google-based database, was designed to house annual stocking schedules, orders, and allocations in one repository. Information from the database automatically populates the public stocking list accessible on the Division's website. The resulting system has eliminated much of the manually generated orders, lists, and emails that were previously used to generate the same stocking orders and schedules.

Improvements to the online stocking application in FY2019 included a review of all currently stocked waters by Westborough and District staff. The resulting lists were then included on both the website and hard copy lists circulated by the Districts. Additional improvements included a new section in the internal database that District Biologists can fill out in order to indicate whether a particular waterbody is still due to be stocked in a given year. This will update the status of the water body in the online list and map of stocked waters, resulting in timely stocking information for the public.

We also produced a spatial data layer for internal use that depicts trout stocking since the inception of the new stocking application in 2016. The GIS layers show stocking by species, numbers, and seasons. Biologists can now use this information to better inform aquatic survey, management and protection efforts.

The web application on www.masswildlife.org/trout continued to garner very positive reaction from the public. For the periods of spring and fall trout stocking, from August 1, 2019 - June 30, 2020, the stocking application web pages received a total of 387,460 unique page views, making it the most-visited web page in the Department during that period. The trout stocking report is one of the most popular items in the mass.gov. portal, and during the spring stocking season it is consistently in the top 5 most visited pages on mass.gov. The number of visitors to the trout stocking pages indicates a positive and growing appreciation of the application by the public.

2. Pond Map and Narrative Revision

In FY2019, the Fisheries section conducted more bathymetric surveys of lakes and ponds and updated the pond maps available to the public on the MassWildlife website. There was a particular effort to map ponds in Northern and Central Massachusetts. Pond map fact sheets, which describe fisheries resources, aquatic habitat, and recreational access, were updated based on the most recent sampling and information provided by the MassWildlife District Offices. New pond maps begun in FY2018 and accompanying write-ups were posted to the MassWildlife web site. A total of 74 new pond maps were posted to the website in FY2019 (Table 1).

Bathymetric surveys were conducted on an additional 31ponds from fall, 2018, through spring, 2019 (Table 2). Maps of these ponds will be made available to the public once maps and write-ups are complete:

Table 1. Pond Maps posted to the web in FY 2019

Pond Name	Town
Agawam Mill Pond	Wareham
Big Benton	Otis
Buckley-Dunton	Beckett
Canton Reservoir	Quincy
Chebaco Lake	Essex
Cleveland Pond	Abington
Cliff pond	Brewster
Cranberry Meadow Pond	Spencer
Crystal Lake	Haverhill
Curlew Pond	Plymouth
Dark Brook Reservoir	Auburn
Dug pond	Natick
East Brimfield Reservoir	Sturbridge/ Brimfield
Eddy Pond	Auburn
Ezekiel Pond	Plymouth
Falls Pond	North Attleboro
Fearing Pond	Plymouth
Field Pond	Andover
Fitchburg Reservoir	Fitchburg
Flint Pond	Tyngsboro
Forest Lake	Methuen
Forge Pond	Westford
Furnace Pond	Pembroke
Glen Charlie	Wareham
Halfway Pond	Plymouth
Hallockville Pond	Plainfield
Hardwick Pond	Hardwick
Heart Pond	Chelmsford
Hinckleys Pond	Harwich
Hopedale Pond	Hopedale
Horn Pond	Woburn
Jamaica Pond	Boston
Jemima Pond	Eastham
Knops Pond	Groton
Lake Attitash	Amesbury/ Merrimac
Lake Lashaway	N Brookfield
Lake Pentucket	Haverhill

Pond Name	Town
Lake Saltonstall	Haverhill
Lake Warner	Hadley
Laurel Lake	Erving
Little Alum Pond	Brimfield
Little Cliff Pond	Brewster
Long Pond	Lakeville
Long Pond	Yarmouth
Long Pond	Barnstable
Long Pond	Littleton
Lower Spectacle Pond	Sandisfield
Mansfield Pond	Great Barrington
Mascuppic Lake	Tyngsboro
Metacomet Lake	Belchertown
Mill Pond	Harwich
Mystic Lake	Barnstable
Nabnasset Pond	Chelmsford
Pentucket Pond	Georgetown
Pleasant Pond	Wenham
Ponkapoag Pond	Randolph
Rock Pond	Georgetown
Sluice Pond	Lynn
Spectacle	Sandwich
Stiles Pond	Boxford
Sudbury Reservoir	Sudbury
Upper mystic Lake	Medford
Upper Spectacle	Otis/Sandisfield
Walden Pond	Concord
Walker	Sturbridge
Walkers	Brewster
Watershops Pond	Springfield
White Island Pond	Plymouth
White Pond	Concord
Whiting	North Attleboro
Williams Pond	Wellfleet
Windsor	Windsor
Windsor Lake	North Adams
York	New Marlborough

Table 2. Bathymetric Surveys conducted in FY 2019

Pond Name	Town	MassWildlife District
Baddacook Pond	Groton	Northeast
Billington Sea	Plymouth	Southeast
Carbuncle Pond	Oxford	Central
Colburns (Barrett) Pond	Leominster	Central
Crocker Pond	Westminster	Central
East Brimfield Reservoir	Sturbridge	Central
Farm Pond	Framingham	Northeast
Forest Lake	Palmer	CT Valley
Jordan Pond	Shrewsbury	Central
Leadmine Pond	Sturbridge	Central
Little Pond	Plymouth	Central
Long Pond	Brimfield	CT Valley
Lower Highland Lake	Goshen	Western
Massapoag Pond	Tyngsboro	Northeast
Mckinstry Pond	Oxford	Central
Moulton Pond	Rutland	Central
Newfield Pond	Chelmsford	Northeast
Norton Reservoir	Norton	Southeast
Paradise Pond	Leominster	Central
Puffers Pond	Amherst	CT Valley
Rohunta Pond	Orange	CT Valley
Sandy Pond	Ayer	Northeast
Scarboro Pond	Boston	Central
The Quag	Sterling	Central
Tully Lake	Athol	Central
Upper Crow Hill	Leominster	Central
Upper Highland Lake	Goshen	Western
Upper Mill	Brewster	Southeast
Watson Pond	Taunton	Southeast
Whitmanville Reservoir	Westminster	Central
Winthrop Lake	Holliston	Northeast

In addition to the pond maps and fact sheets available to the public, we also updated the GIS layer of bathymetry collected during our surveys. This data was made available to the public as both an interactive and downloadable GIS layer. The downloadable bathymetric contour layer allows users to display the data at 5-foot contour intervals, and is available from MassGIS at:

http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/dfwbathy.html

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

3. Online Fishing Application

In FY2019 the Fisheries section began development of an online fishing application designed to guide the public to waters that are both easy to access and which will offer consistent opportunities to anglers of all ages and experience. The foundation of this online application is a layer of featured fishing sites, which was produced through input by both Westborough and District staff. The beta version of this Fishing Application is available through the Division's website, in the Freshwater Fishing section.

In addition to the featured sites layer, the application currently includes shaded bathymetry for lakes and ponds, where available, links to pond maps and writeups, indications of trout-stocking, and access, including both shore access and boat ramps.

In order to make the application as user-friendly and useful as possible, several user-driven, hands-on testing sessions were conducted to get some initial user feedback. User experiences were recorded as they navigated through common tasks in the application. The sessions were extremely helpful, and will help guide continued development of the application. These user-testing sessions were widely seen as a model with which to evaluate future rollouts of online applications. In the next fiscal year, we hope to incorporate a number of comments and suggestions into the next version of the application.

4. Fisheries data collection and agency collaboration

In FY2019, the Fisheries section contributed general GIS

support to the Division, with emphasis on the updating and support of aquatic data. Fisheries GIS is part of the National Hydrographic Dataset (NHD) network, and in FY2019 participated in collaborative working groups on the direction of hydrographic data development as well as adding new, field-verified streams that were incorporated into the national data. Since the NHD data were originally developed at a 1:24k scale, many smaller streams are missing from the data, some of which may be of conservation concern. As DFW Fisheries samples these new streams, they may be incorporated into the national data, providing better protection for these resources.

Fisheries GIS also conducted numerous bathymetric surveys (see Table 2) on lakes and ponds, resulting in new maps information for the angling and boating public. We also participated in stream and pond sampling throughout the state.

IV. Anadromous Fish Investigations - Caleb Slater, Ph.D., Project Leader

1. General

In FY 19, 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 45 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.

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.

FERC

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.

During FY 19, 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 a license at the Watershops Pond Project on the Mill River in Springfield, MA.
- Application for relicensing of the Holyoke City #1 Project on the Holyoke Canal in Holyoke
- Application for relicensing of the Holyoke City #2 Project on the Holyoke Canal in Holyoke
- Application for relicensing of the Holyoke City #3 Project on the Holyoke Canal in Holyoke
- 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
- Application for non-capacity amendment Deerfield #5 on the Deerfield River

Low Impact Hydropower

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.

- Methuen Falls, Spicket River
- Red Bridge Project, Chicopee River
- Putts Bridge Project, Chicopee River

Other MassWildlife Activities

During FY 19 the Project Leader assisted in the Bathymetry project by collecting depth data on 21 ponds and vertical Temperature/Dissolved Oxygen profiles in 19 ponds.

In FY 19 the project leader participated in MassWildlife's controlled burn program by attending the annual fireline refresher course and by participating in four controlled burns on MassWildlife lands.

In FY 19 the project leader spent three days working the MassWildlife deer check station on Martha's Vineyard during the first week of the shotgun deer season.

In FY 19 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 19 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 19 the project leader assumed 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. $1.15 million has been allocated for dam repair/removal projects in FY19. The Welsh pond dam removal project in Sutton started in the last quarter of FY 19. Activities included coordination with MassWildlife's engineering and permitting consultants, Tighe & Bond, as well as several informational meetings with the public and town officials in both Sutton and Tyngsboro.

In FY 19 the Project leader continued to serve as the coordinator of MassWildlife's Teaching with Trout Program, an engaging educational program that introduces K-12 students to the concepts of ecosystems, fishery biology, freshwater ecology, water quality, and habitat conservation by raising Brook Trout from egg to fingerling in the classroom and then releasing them into appropriate habitat. In FY 19 the program included 53 schools/organizations and approximately 4,800 students. This is a net increase of one school compared to FY 18. There were actually 8 schools new to the program and 7 lost. Those that discontinued did so for a variety of reasons – teacher retirement, changes to teacher classroom assignments, lack of interest, etc.

Geographically the program covered most parts of the state with the exception of the mid and outer Cape and Islands. Most of the classrooms participating in the program are middle and high school grade levels. There are only ten schools using the program at the elementary level.

The Massachusetts Outdoor Heritage Foundation provided funds to enable purchase of three new chillers. This brought to a total of ten, the number of units the Foundation has provided in the last three years.

Brook Trout eggs were delivered between December 10th and 19th to 35 schools and between January 7th and 31st to the remaining schools. A total of approximately 10,000 brook trout eggs were provided, about 200 per tank. At the same time feed was also provided for the schools in sufficient quantity to raise the fish as long as the teacher intended. Fish are generally fed from early January until release in April, May, or early June.

Several schools were able to visit the Palmer hatchery in combination with the release of their fish during the spring. MassWildlife also assisted in one off-site release event in Monson.

In FY 19 the project leader assumed 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 2019 fish passage operations are ongoing at this time, this report summarizes the 2018 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 65 days during in the spring season passing a total of 285,703 anadromous fish (Table 1). 91 Shortnose Sturgeon were lifted during 2018. The number of days that passage was greater than 1% of the seasonal total was considerably less than

Table 1. Daily anadromous fish passage at Holyoke 2018.

	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 - 4/22: no lift operations - temperature < flows > 40,000 cfs														
4/23	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/24	7	7	0	0	0	0	0	0	0	0	0	0	0	0
4/25	7	14	0	0	0	0	0	0	0	0	0	0	0	0
4/26 - 5/8: no lift operations - flows > 40,000 cfs														
5/9	0	14	0	0	0	0	0	0	0	0	0	0	0	0
5/10	1,945	1,959	32	32	2	2	0	0	0	0	4	4	0	0
5/11	4,312	6,271	30	62	2	4	0	0	0	0	2	6	0	0
5/12	2,974	9,245	0	62	9	13	1	1	0	0	0	6	0	0
5/13	4,302	13,547	2	64	5	18	0	1	0	0	0	6	0	0
5/14	16,521	30,068	324	388	230	248	0	1	0	0	3	9	0	0
5/15	19,527	49,595	184	572	55	303	0	1	0	0	4	13	0	0
5/16	18,246	67,841	87	659	102	405	0	1	0	0	6	19	0	0
5/17	25,782	93,623	41	700	352	757	2	3	0	0	4	23	2	2
5/18	18,110	111,733	11	711	284	1,041	2	5	0	0	1	24	0	2
5/19	12,933	124,666	7	718	129	1,170	2	7	0	0	5	29	0	2
5/20	17,760	142,426	34	752	183	1,353	4	11	0	0	0	29	0	2
5/21	9,179	151,605	11	763	182	1,535	2	13	0	0	0	29	0	2
5/22	13,293	164,898	26	789	122	1,657	1	14	0	0	0	29	0	2
5/23	11,416	176,314	18	807	271	1,928	0	14	0	0	1	30	0	2
5/24	7,974	184,288	27	834	134	2,062	3	17	0	0	1	31	0	2
5/25	11,764	196,052	117	951	295	2,357	1	18	0	0	1	32	0	2
5/26	16,499	212,551	10	961	420	2,777	5	23	0	0	1	33	0	2
5/27	5,990	218,541	20	981	161	2,938	2	25	1	1	3	36	1	3
5/28	4,249	222,790	10	991	25	2,963	0	25	0	1	3	39	1	4
5/29	6,925	229,715	2	993	1,015	3,978	11	36	0	1	6	45	0	4
5/30	6,125	235,840	51	1,044	2,421	6,399	10	46	0	1	4	49	0	4
5/31	3,608	239,448	8	1,052	424	6,823	15	61	0	1	1	50	1	5
6/1	3,546	242,994	1	1,053	509	7,332	26	87	0	1	1	51	0	5
6/2	4,479	247,473	4	1,057	1,302	8,634	23	110	0	1	0	51	0	5
6/3	3,309	250,782	1	1,058	487	9,121	17	127	0	1	2	53	0	5
6/4	2,049	252,831	0	1,058	78	9,199	13	140	1	2	1	54	1	6
6/5	2,753	255,584	2	1,060	652	9,851	6	146	0	2	7	61	2	8
6/6	434	256,018	0	1,060	45	9,896	14	160	0	2	0	61	0	8
6/7	648	256,666	0	1,060	32	9,928	10	170	0	2	0	61	0	8
6/8	1,356	258,022	0	1,060	86	10,014	19	189	0	2	0	61	0	8
6/9	2,041	260,063	0	1,060	86	10,100	26	215	0	2	2	63	0	8
6/10	1,286	261,349	0	1,060	19	10,119	13	228	0	2	0	63	1	9
6/11	942	262,291	0	1,060	20	10,139	2	230	0	2	0	63	0	9

	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
6/12	919	263,210	0	1,060	12	10,151	2	232	0	2	0	63	0	9
6/13	465	263,675	0	1,060	2	10,153	1	233	0	2	0	63	0	9
6/14	926	264,601	0	1,060	8	10,161	8	241	0	2	0	63	0	9
6/15	306	264,907	0	1,060	13	10,174	1	242	0	2	0	63	0	9
6/16	594	265,501	0	1,060	5	10,179	4	246	0	2	0	63	0	9
6/17	980	266,481	0	1,060	5	10,184	0	246	0	2	0	63	0	9
6/18	753	267,234	0	1,060	1	10,185	2	248	0	2	0	63	1	10
6/19	674	267,908	0	1,060	0	10,185	0	248	0	2	1	64	0	10
6/20	1,429	269,337	0	1,060	2	10,187	4	252	0	2	2	66	0	10
6/21	547	269,884	0	1,060	0	10,187	0	252	0	2	1	67	0	10
6/22	517	270,401	0	1,060	0	10,187	0	252	0	2	0	67	0	10
6/23	246	270,647	0	1,060	0	10,187	1	253	0	2	1	68	1	11
6/24	250	270,897	0	1,060	0	10,187	1	254	0	2	0	68	0	11
6/25	88	270,985	0	1,060	0	10,187	0	254	0	2	0	68	0	11
6/26: no lift operations - dewatered to make modifications for sturgeon passage														
6/27	276	271,261	0	1,060	0	10,187	2	256	0	2	0	68	0	11
6/28	264	271,525	0	1,060	0	10,187	0	256	0	2	0	68	0	11
6/29: no lift operations - Secchi depth < 2 ft.														
6/30	183	271,708	0	1,060	0	10,187	1	257	0	2	0	68	0	11
7/1	854	272,562	1	1,061	0	10,187	0	257	0	2	1	69	0	11
7/2	555	273,117	0	1,061	0	10,187	0	257	0	2	0	69	3	14
7/3	414	273,531	0	1,061	0	10,187	0	257	0	2	0	69	2	16
7/4	73	273,604	0	1,061	0	10,187	0	257	0	2	0	69	0	16
7/5	117	273,721	0	1,061	0	10,187	0	257	0	2	0	69	0	16
7/6	46	273,767	0	1,061	0	10,187	4	261	0	2	0	69	0	16
7/7 - 7/8: no lift operations - summer schedule / no weekend operations														
7/9	25	273,792	0	1,061	0	10,187	1	262	0	2	0	69	3	19
7/10	27	273,819	0	1,061	0	10,187	0	262	0	2	0	69	0	19
7/11	94	273,913	0	1,061	0	10,187	0	262	0	2	0	69	3	22
7/12	34	273,947	0	1,061	0	10,187	0	262	0	2	0	69	5	27
7/13	32	273,979	0	1,061	0	10,187	0	262	0	2	0	69	1	28

65. 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, 91% of 273,979 in 24 days; Blueback Herring, 93% of 1,061 in 13 days; Sea Lamprey, 92% of 0,187 in 18 days; Striped Bass, 90% of 262 in 20 days; Gizzard Shad, 100% of 69 in 27 days.

2.1.1 Atlantic Salmon

Two Atlantic Salmon were counted during the spring fish passage season at the Holyoke fishlift (Table 1). 2018 passage was 0.5% of the record passage of 1992, 8% of the previous five year mean, and 5% of the previous ten year mean (Table 2). All salmon were released and allowed to continue their upstream migration. No salmon were radiotagged in 2018.

Table 2. Anadromous fish passage recorded at the Holyoke fishlift, Connecticut River, Massachusetts 1955-2018

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	-
1980	380,000	200,000	126	148	34,000	-
1981	380,000	420,000	319	510	53,000	-
1982	290,000	590,000	11	231	26,000	-
1983	530,000	450,000	25	346	29,000	-
1984	500,000	480,000	66	110	22,000	-
1985	480,000	630,000	285	369	40,000	-
1986	350,000	520,000	260	187	20,000	27
2011	244,000	138	72	138	19,000	423
2012	495,000	39	29	336	14,000	337
2013	393,000	976	69	250	22,000	827
2014	373,000	976	27	69	22,000	410
2015	413,000	87	13	21	22,000	84
2016	386,000	137	3	638	35,000	598
2017	537,000	875	10	338	22,000	738
2018	273,979	1,061	2	262	10,187	69

2.1.2 American Shad

273,979 American shad were passed upstream. This was 38% of the record high passage of 1992. 2018 passage was 65% of the previous five year mean, and 83% of the previous ten year mean (Table 2). The total number of shad lifted in 2018, including shad transferred to trucks for transport (2,234) and sacrificed for biological sampling and agency studies (99), was 276,312. Examining the cumulative percent of shad passed at Holyoke, 50% of fish passed this project on the 13th day of passage, May 20 (Table 3). A total of 1,073 American shad were sampled for biological data on 48 days from May 9 through July 2. 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 0.2% and 100% (mean 3%) 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 2018 was 42% males and 58% females. Demographic information from the sample are displayed in Table 3.

2,234 shad were trapped and trucked for various restoration efforts (Table 4). 214 of these shad were trucked to the USFWS Nashua Fish Hatchery for spawning where 3,028,000 fry were produced, 288,000 fry were stocked in Merrimack River, 2,440,000 fry were released into the Lamprey River, NH, and 300,000 fry were released into the Charles River. 354 shad were trucked to the USFWS North Attleboro Fish Hatchery for spawning where 4,165,500 fry were produced. 2,980,000 fry were released into the Pawcatuck River, RI, and 1,185,000 fry were released into the Pawtuxet River, RI.

2.1.3 Shortnose Sturgeon

An unprecedented 91 individual Shortnose Sturgeon were passed by the fish lifts in 2018, including 28 during the spring/summer anadromous fish passage season and 63 during the dedicated Shortnose Sturgeon passage season. (Table 1). All sturgeon, except for one mortality, were processed and released to the exit flume and allowed to continue their migration upstream of Holyoke Dam. 41 Shortnose Sturgeon lifted from June 4 through September 6 were tagged with a surgically implanted radio transmitter by Kleinschmidt Associates and fish lift monitoring staff before release per HG&E's post-construction sturgeon monitoring plan and NMFS' Biological Opinion. Two sturgeon mortalities occurred within the exit flume. It was determined that the cause of mortality was likely compounded stress and related to handling and high water temperatures (>26°C), and was not the direct result of lifting or tagging methods.

2.1.4 American Eel

Only 16 American Eels were observed either in the fish lift hopper buckets or passing by the monitoring windows. The exit flume grating does not restrict eel movement to passing by the monitoring windows. Therefore, actual upstream passage should only be considered an index of abundance. It suggests low abundance relative to observations of recent years. For example, 1,077, 481, and 205 eels were observed in 2015, 2016, and 2017, respectively. Juvenile eel collections from the eel specific ladders totaled 8,562 in 2018 (Figure 2), a notable reduction compared to recent years, and ranked 10 out of the 16 years since 2003 when specific eel collection and upstream passage efforts began. The South Hadley ramp contributed 6.5% of the annual total collections and 83.5% were collected from the ramps in the Holyoke fish lift structures with 56.1% from the tailrace fish lift entrance ramp and 37.4% from the stilling basin ramp (Table 5).

Table 3. Temporal characteristics of American shad passage at Holyoke, 2018

	Cumulative Percentage of Total American Shad Passage				
	25%	50%	75%	90%	Highest Day
Holyoke Fishlift:					
Day*	9	13	19	26	8
Date	5/16	5/20	5/26	6/2	5/16

* Day one is 24 April, the first day shad were lifted at the Holyoke fish passage facility.

Table 4. Population age structure of American shad sampled at the Holyoke fishlift 2018. (from CTDEEP)

2018 American Shad Age Structure at the Holyoke Lift						
Age	**3**	**4**	**5**	**6**	**7**	**Total**
%Bucks	2.6%	37.7%	45.2%	13.8%	0.7%	
Shad (n)	3,018	43,387	52,065	15,846	755	115,071
		4	**5**	**6**	**7**	
%Roes		9.6%	51.3%	37.8%	1.4%	
Shad (n)		15,212	81,491	60,032	2,173	158,908
	3	**4**	**5**	**6**	**7**	
% All	0.9%	19.2%	49.2%	29.6%	1.1%	
Shad (n)	2,463	52,641	134,835	80,962	3,078	273,979

Table 5:
Date Range, Number of Collections, Total Eels Collected, and Descriptive Statistics for Catch and Catch-Per-Unit-of-Effort Holyoke 2018.

			Catch (eels/collection)					CPUE (eels/hour)		
Trap	**Date Range**	**N**	**Sum**	**Min**	**Max**	**Mean**	**SD**	**Max**	**Mean**	**SD**
Tailrace Ramp	5/17-10/22	115	4,803	0	695	41.8	99.1	29.47	1.6	3.6
Stilling Basin Ramp	5/16-10/26	115	3,199	0	684	26.7	82.7	27.45	1.0	3.3
South Hadley Ramp	5/16-10/26	120	560	0	68	4.7	12.1	3.19	0.2	0.5
Total	5/16-10/26	350	8,562							

Table 6. 2018 Daily Fish Passage through the Turners Falls Fish Passage Complex.

	Cabot Shad		Spillway Shad		Gatehouse Shad		Lamprey	
	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative
5/11/2018	0	0	0	0	0	0	0	0
5/12/2018	86	86	32	32	27	27	0	0
5/13/2018	238	324	12	44	49	76	0	0
5/14/2018	429	753	22	66	23	99	0	0
5/15/2018	1668	2421	57	123	51	150	0	0
5/16/2018	2290	4711	165	288	637	787	0	0
5/17/2018	1806	6517	581	869	520	1307	6	6
5/18/2018	1440	7957	688	1557	664	1971	10	16
5/19/2018	1678	9635	1682	3239	1811	3782	42	58
5/20/2018	1165	10800	1298	4537	2145	5927	10	68
5/21/2018	661	11461	1568	6105	3511	9438	24	92
5/22/2018	1489	12950	1538	7643	2959	12397	48	140
5/23/2018	573	13523	791	8434	1227	13624	19	159
5/24/2018	625	14148	773	9207	568	14192	29	188
5/25/2018	655	14803	887	10094	2824	17016	78	266
5/26/2018	1146	15949	1320	11414	1828	18844	75	341
5/27/2018	624	16573	1320	12734	1395	20239	64	405
5/28/2018	415	16988	1087	13821	2100	22339	200	605
5/29/2018	491	17479	1025	14846	2100	24439	200	805
5/30/2018	680	18159	1928	16774	1345	25784	97	902
5/31/2018	794	18953	2271	19045	2808	28592	336	1238
6/1/2018	761	19714	4000	23045	3738	32330	489	1727
6/2/2018	940	20654	2349	25394	2239	34569	287	2014
6/3/2018	584	21238	1886	27280	2398	36967	708	2722
6/4/2018	341	21579	1135	28415	1253	38220	476	3198
6/5/2018	265	21844	1045	29460	831	39051	112	3310
6/6/2018	275	22119	569	30029	721	39772	54	3364
6/7/2018	233	22352	657	30686	482	40254	34	3398
6/8/2018	201	22553	447	31133	473	40727	64	3462
6/9/2018	152	22705	328	31461	419	41146	90	3552
6/10/2018	151	22856	265	31726	459	41605	159	3711
6/11/2018	118	22974	190	31916	317	41922	124	3835

6/12/2018	87	23061	241	32157	350	42272	64	3899
6/13/2018	121	23182	169	32326	225	42497	41	3940
6/14/2018	88	23270	97	32423	150	42647	23	3963
6/15/2018	57	23327	60	32483	47	42694	13	3976
6/16/2018	87	23414	23	32506	56	42750	6	3982
	Cabot Shad		Spillway Shad		Shad		Lamprey	
	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative
6/17/2018	62	23476	19	32525	53	42803	5	3987
6/18/2018	136	23612	16	32541	25	42828	10	3997
6/19/2018	107	23719	9	32550	100	42928	8	4005
6/20/2018	92	23811	14	32564	18	42946	1	4006
6/21/2018	49	23860	1	32565	49	42995	0	4006
6/22/2018	31	23891	9	32574	55	43050	1	4007
6/23/2018	12	23903	7	32581	24	43074	1	4008
6/24/2018	8	23911	2	32583	34	43108	0	4008
6/25/2018	9	23920	4	32587	7	43115	1	4009
6/26/2018	12	23932	2	32589	5	43120	0	4009
6/27/2018	7	23939	1	32590	6	43126	0	4009
6/28/2018	18	23957	0	32590	3	43129	0	4009
6/29/2018	25	23982	1	32591	7	43136	1	4010
6/30/2018	32	24014	1	32592	8	43144	0	4010
7/1/2018	17	24031	1	32593	2	43146	0	4010
7/2/2018	0	24031	0	32593	0	43146	0	4010

2.1.4 Other Anadromous Fish Species

Blueback Herring passage in 2018 (1,061) was 310% of the previous five-year mean and 78% of the previous ten year mean (Table 2).

Sea Lamprey passage in 2016 (21,526) was 11% of the record passage of in 1998 and was 41% of the previous five-year mean and 37% of the previous ten year mean (Table 2).

Gizzard Shad passage in 2016 was 738. This was 13% of the previous five-year mean and 17% of the previous 10 year mean (Table 2).

2.1.5 Resident Fish

A total of 1,654 fish representing 20 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 (36% of resident fish count), Sea Lamprey (parasitic juveniles, 25%), and White Sucker (19%).

2.2 Turners Falls

The fish ladders at Turners Falls were operated for a total of 54 days from May 11 through July 2, 2018. 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 2018 was 43,146 (Table 6) was 81% of the maximum passage of 1992, 91% of the previous 5 year mean and 141% of the previous 10 year mean (Table 7).

The number of shad passing the Spillway fish ladder in 2018 (32,593) (Figure 3, Table 6) was 40% of the maximum passage of 2015, 144% of the previous 5 year mean and 251% of the previous 10 year mean (Table 7).

The number of shad passing the Cabot fish ladder in 2018 (24,031) (Table 6) was 46% of the maximum passage of 1992, 56% of the previous 5 year mean and 141% of the previous 10 year mean (Table 7).

Examining the cumulative percent of shad passed at Gatehouse, 50% of fish passed this ladder on the 21st day of the migration 28 May, 2018 (Table 8).

Examining the cumulative percent of shad passed at Spillway, 50% of fish passed this ladder on the 23rd day of the migration, 30 May, 2018 (Table 8).

Examining the cumulative percent of shad passed at Cabot, 50% of fish passed this ladder on the 15th day of the migration, 22 May, 2018 (Table 8).

Only 16% of the shad lifted at Holyoke (273,979) passed the Gatehouse observation window, well below the restoration goal of 50%.

2.2.2 Other Anadromous Fish Species

4,010 Sea Lamprey passed the gatehouse fishway in 2018 (Table 6). This represents 13% of the maximum passage of 2008, 45% of the previous 5 year mean and 41% of the previous 10 year mean (Table 7).

3. Westfield River

In 2018 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 9).

50% of the American shad passage had occurred by the 20th day of the run, May 21 (Table 11).

3.1 Anadromous fish

The West Springfield fish passage facility operated for 92 days in the spring of 2018. The number of days that passage was greater than 1% of the seasonal total was considerably less than 100. 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 5,762 in 18 days; sea lamprey, 95% of 138 in 21 days.

A total of 5,762 American Shad; 0 Atlantic salmon; 138 Sea Lamprey; 0 Striped Bass; 4 Blueback Herring; and 0 Gizzard Shad were passed upstream in spring/summer 2018. The 2018 shad passage was 56% of the record high of 10,373 in 2012 (Table 10).

3.2 Non-anadromous fish

White Sucker (2,201), Brook Trout (10), Brown Trout (9), Rainbow Trout (16), Tiger Trout (3), and Smallmouth Bass (363) were documented passing upstream through the West Springfield fish passage facility in 2018 (Table 9).

4. Merrimack River

4.1 Essex Dam

The Essex Dam fish elevator operated for 73 days between 2 May and 15 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:

Ten adult Atlantic Salmon were lifted at the Essex fishlift during spring 2018 (Table 12). This was 2.5% of the record passage of 2011 (402). Salmon returns were 58% of the previous 5 year mean, and 11% of the previous 10 year mean (Table 13). No salmon were captured in the fall.

4.1.2 American Shad:

The total number of shad lifted in 2018 was 29,069 (Figure 6, Table 12) was 33% of the record passage (89,421) of 2015. 2018 shad passage was 50% of the previous five year mean and 75% of the previous ten year mean (Table 13). 214 shad were sampled for biological data collection on 22 days between May 14 and June 29. The sample was 75%

female, and 58% were repeat spawners. The age frequency of the sample is shown in Table 14.

4.1.3 River Herring:

2018 passage was an all-time record at 449,356 (Table 12) this was 107% of the previous record high passage (417,240) of 2016. 2018 herring passage was 326% of the previous five year mean (Table 13) and 642% of the previous ten year mean. 152 herring were sampled for biological data collection on 29 days between May 15 and May 22.

4.1.4 Other Anadromous Fish:

Total number of Sea Lamprey, Striped Bass, and Gizzard Shad passing through the Lawrence fishlift were 5, 619, 470, and 16 respectively (Table 12).

4.1.5 American Eel

An estimated 97,008 elvers were passed in the lift hopper or the permanent eelway at the dam. 828 yellow eels were observed passing upstream at the counting window.

4.2 Pawtucket Dam

Operation of the Pawtucket Dam fish elevator began April 30 and concluded on July 13. 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 CHI 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 30 and to July 13 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 2018 was 129,599. 182,268 river herring were counted passing the ladder. Therefore, we estimate the Lowell Project as a whole passed about 311,867 River Herring in 2018 (Table 15).

4.2.2 American Shad:

The estimated total number of American Shad passed at the Lowell lift in 2018 was 3,875. 10,171 American Shad were counted passing the ladder. Therefore, we estimate the Lowell Project as a whole passed about 14,046 American Shad in 2018 (Table 15).

4.2.3 Other Anadromous fish:

2,207 Sea Lamprey were counted passing the ladder. We estimate the Lowell Project as a whole passed about 2,407 Sea Lamprey in 2018 (Table 15).

Table 16 lists the annual runs of anadromous fish counted at the facility from 1986, the first year of operation, through 2018.

Assorted riverine species have been noted but not counted.

5. Index Site Samples

2019 stream sampling was hindered by heavy rains and high water throughout August and September. Many, but not all of the index survey sites were successfully sampled.

River herring in the Nissitissit River.

Photo by Peter Hazelton/MassWildlife

Table 7. Historic anadromous fish passage through the Turners Falls project.

Year	Location	American Shad	Blueback Herring	Striped Bass	Sea Lamprey	Atlantic Salmon	Gizzard* Shad
1980	Cabot	687	0	11	187	0	
	Spillway	5	0	0	0	0	
	Gatehouse	298	0	1	66	1	
1981	Cabot	224	0	0	1,622	7	
	Spillway**						
	Gatehouse	200	0	0	935	8	
1982	Cabot						
	Spillway**						
	Gatehouse	11	4	0	210	0	
1983	Cabot	26,697	106	6	859	0	
	Spillway	263	1	1	649	0	
	Gatehouse	12,705	28	7	703	0	
1984	Cabot	1,831	4	0	334	1	
	Spillway	4,563	12	0	851	1	
	Gatehouse	4,333	21	0	683	1	
1985	Cabot	31,000	1,726	0	3,198	2	
	Spillway	843	243	0	3,185	3	
	Gatehouse	3,855	301	0	1,809	3	
1986	Cabot	22,144	7,091	0	1,424	5	
	Spillway	5,857	6,248	0	2,230	4	
	Gatehouse	17,858	9,578	0	1,961	10	
1987	Cabot	33,114	2,866	0	1,324	2	
	Spillway	3,679	2,841	0	2,921	3	
	Gatehouse	18,959	5,091	0	2,590	12	
1988	Cabot	28,546	349	0	335	2	
	Spillway	3,354	865	0	1,912	2	
	Gatehouse	15,787	1,079	0	1,175	7	
1989	Cabot	14,403	199	0	578	1	
	Spillway	1,494	279	0	947	0	
	Gatehouse	9,511	510	1	868	2	
1990	Cabot	31,056	711	0	1,304	8	1
	Spillway	5,898	768	0	1,013	2	0
	Gatehouse	27,908	1,585	0	1,301	16	13
1991	Cabot	87,168	6,433	1	2,089	2	0
	Spillway	6,282	2,718	0	3,026	2	0
	Gatehouse	54,656	7,522	3	4,090	4	1
1992	Cabot	94,046	1,765	1	1,836	9	0
	Spillway	11,760	884	0	3,275	6	0
	Gatehouse	60,089	2,157	2	2,710	14	7
1993	Cabot	21,045	243	0	711	7	0
	Spillway	898	90	0	2,082	3	0
	Gatehouse	10,221	278	0	1,637	7	0
1994	Cabot**						
	Spillway	1,507	17	0	1,740	1	0
	Gatehouse	3,729	97	0	1,702	5	0
1995	Cabot	33,938	4,234	0	1,417	2	1
	Spillway	543	31	0	1,372	0	0
	Gatehouse	18,369	2,957	0	1,813	4	4
1996	Cabot**						
	Spillway	2,293	13	0	2,651	4	0
	Gatehouse	16,192	515	0	4,556	3	3
1997	Cabot	22,518	231	0	2,374	2	4
	Spillway	3,473	15	0	2,219	1	3
	Gatehouse	9,216	128	0	2,265	2	2
1998	Cabot	14,947	2	0	8,707	6	1
	Spillway	4,721	0	0	8,642	2	2
	Gatehouse	10,527	4	0	7,579	5	2
1999	Cabot	11,501	5	0	2,014	2	543
	Spillway	4,215	0	8	1,449	2	440
	Gatehouse	6,751	2	0	916	0	275
2000	Cabot	12,289	0	0	1,455	0	9
	Spillway	2,240	0	0	1,962	4	358
	Gatehouse	2,590	0	0	1,350	5	199
2001	Cabot	20,933	0	0	3,678	0	0
	Spillway	2,344	0	0	5,280	0	0
	Gatehouse	1,540	0	0	2,144	0	0
2002	Cabot	7,922	0	0	14,709	0	0
	Spillway	5,372	0	0	12,367	0	0
	Gatehouse	2,870	0	0	10,160	0	0
2003**							
2004	Cabot	5,933	0	0	13,352	0	0
	Spillway	1,980	0	0	5,821	0	0
	Gatehouse	2,192	0	0	8,418	0	0
2005	Cabot	5,404					
	Spillway	1,626					
	Gatehouse	1,581					
2006	Cabot	11,991	1	198	5,377	4	9
	Spillway	2,577	0	153	5,133	8	0
	Gatehouse	1,810	0	46	3,005	7	0
2007	Cabot	11,130	**	**	11,061	5	**
	Spillway	1,793	**	**	5,555	3	**
	Gatehouse	2,248	**	**	15,438	5	**
2008	Cabot	15,089	**	**	**	6	**
	Spillway	627	**	**	**	5	**
	Gatehouse	3,995	**	**	32,035	10	**
2009	Cabot	13,391	**	**	**	0	**
	Spillway	919	**	**	**	5	**
	Gatehouse	3,814	**	**	8,296	8	**
2010	Cabot	30,232	**	**	**		**
	Spillway	2,735	**	**	**		**
	Gatehouse	16,768	**	**	6,352	8	**
2011	Cabot	27,077	**	**	**	2	**
	Spillway	1,966	**	**	**	6	**
	Gatehouse	16,798	**	**	2,032	7	**
2012	Cabot	51,901	**	**	**	2	**
	Spillway	10,608	**	**	**	3	**
	Gatehouse	26,727	**	**	4,503	1	**
2013	Cabot	46,886	**	**	**		**
	Spillway	10,571	**	**	**		**
	Gatehouse	35,494	**	**	6,016		**
2014	Cabot	40,666	**	**	**	3	**
	Spillway	24,262	**	**	**	8	**
	Gatehouse	39,914	**	**	5,553	11	**
2015	Cabot	47,588	**	**	**	3	**
	Spillway	41,835	**	**	**		**
	Gatehouse	58,078	**	**	8,436		**
2016	Cabot	34,709	**	**	**	3	**
	Spillway	19,399	**	**	**		**
	Gatehouse	54,760	**	**	15,128		**
2017	Cabot	43,269	**	**	**		**
	Spillway	16,741	**	**	**		**
	Gatehouse	48,727	**	**	9,223		**
2018	Cabot	24,031	**	**	**		**
	Spillway	32,593	**	**	**		**
	Gatehouse	43,146	**	**	4,010		**

* 1990 was the first year gizzard were recorded.

** Not monitored

Table 8. Temporal characteristics of American shad passage at the Holyoke and Turners Falls fish passage facilities, 2018

Passage Facility	Cumulative Percentage of Total American Shad Passage 25%	50%	75%	90%	Day of Highest Daily Passage
Holyoke Fishlift:					
Day*	9	13	19	26	8
Date	5/16	5/20	5/26	6/2	5/16
Spillway Fishladder (Turners Falls):					
Day*	16	23	26	29	25
Date	5/23	5/30	6/2	6/5	6/1
Gatehouse Fishladder (Turners Falls):					
Day*	22	21	25	29	25
Date	5/15	5/28	6/1	6/5	6/1
Cabot Fishladder (Turners Falls):					
Day*	10	15	23	29	9
Date	5/17	5/22	5/30	6/5	5/16

* Day one is 24 April the first day shad were lifted at the Holyoke fish passage facility.

Downstream from the Holyoke Dam. Photo by Bill Byrne/MassWildlife

Table 9. Daily Fish Counts
WestSpringfield Fishway 2018

Date	American Shad	Sea Lamprey	Blueback Herring	White Sucker	Small-mouth	Brown Trout	Rainbow Trout	Brook Trout	Tiger Trout	Max. H2O Temp. (C°)
4-Apr	0	0	0	0	0	0	0	0	0	4.5
5-Apr	0	0	0	0	0	0	0	0	0	4.0
6-Apr	0	0	0	0	0	0	0	0	0	3.5
7-Apr	0	0	0	0	0	0	0	0	0	3.0
8-Apr	0	0	0	0	0	0	0	0	0	3.5
9-Apr	0	0	0	0	0	0	0	0	0	4.0
10-Apr	0	0	0	0	0	0	0	0	0	3.5
11-Apr	0	0	0	0	0	0	0	0	0	4.0
12-Apr	0	0	0	0	0	0	0	0	0	4.5
13-Apr	0	0	0	0	0	0	0	0	0	5.5
14-Apr	0	0	0	1	0	0	0	0	0	6.0
15-Apr	0	0	0	7	0	0	0	0	0	7.0
16-Apr	0	0	0	0	0	0	0	0	0	7.5
17-Apr	0	0	0	0	0	0	0	0	0	3.5
18-Apr	0	0	0	0	0	0	0	0	0	no data
19-Apr	0	0	0	0	0	0	0	0	0	no data
20-Apr	0	0	0	0	0	0	0	0	0	no data
21-Apr	0	0	0	0	0	0	0	0	0	4.5
22-Apr	0	0	0	0	0	0	0	0	0	4.5
23-Apr	0	0	0	5	0	0	0	0	0	6.0
24-Apr	0	0	0	35	0	0	0	0	0	6.5
25-Apr	0	0	0	0	0	0	0	0	0	8.5
26-Apr	0	0	0	309	0	0	1	0	0	8.5
27-Apr	0	0	0	26	0	0	0	0	0	10.5
28-Apr	0	0	0	0	0	0	0	0	0	9.0
29-Apr	0	1	0	5	0	0	0	0	0	9.0
30-Apr	0	0	0	2	0	0	0	0	0	10.0
1-May	0	0	0	1	0	0	0	0	0	9.0
2-May	11	0	0	441	3	0	0	0	0	9.5
3-May	11	8	0	620	22	0	0	0	0	13.5
4-May	34	17	0	401	30	0	0	0	0	15.0

5-May	14	28	0	12	26	0	0	0	0	16.5
6-May	25	1	0	18	12	0	1	0	0	16.0
7-May	10	3	0	3	0	0	0	0	0	15.0
8-May	0	0	0	0	0	0	0	0	0	14.0
9-May	131	0	0	24	15	0	0	0	0	no data
10-May	511	3	0	51	24	0	0	1	0	16.0
11-May	333	7	0	35	34	1	0	0	0	16.0
12-May	109	0	0	2	7	1	0	0	0	16.0
13-May	13	0	0	0	0	0	0	0	0	14.5
14-May	0	0	0	0	0	1	0	0	1	12.0
15-May	347	2	1	16	27	0	1	0	0	12.0
16-May	907	2	0	144	17	1	0	0	0	16.5
17-May	166	0	0	7	22	0	0	0	0	16.5
18-May	180	0	1	7	26	0	0	0	0	15.5
19-May	34	2	0	1	3	0	0	0	0	17.0
20-May	31	0	0	0	0	0	0	0	0	16.0
21-May	21	0	0	2	2	0	0	0	1	15.0
22-May	173	2	1	4	13	0	0	0	0	16.0
23-May	61	3	0	2	11	0	0	1	0	16.5
24-May	133	1	0	0	13	0	0	0	0	18.0
25-May	711	10	0	7	17	0	1	0	0	18.5
26-May	391	0	0	3	10	1	1	1	0	20.0
27-May	163	3	0	0	3	0	0	0	0	19.5
28-May	11	1	0	0	1	0	0	1	0	19.0
29-May	19	0	0	1	0	0	1	1	0	15.5
30-May	294	3	0	0	7	0	0	0	0	17.5
31-May	344	4	1	0	0	0	0	1	0	20.0
1-Jun	136	7	0	0	4	0	0	0	0	20.5
2-Jun	63	11	0	0	2	0	0	1	0	19.5
3-Jun	43	3	0	0	4	0	0	1	0	20.0
4-Jun	49	5	0	0	0	0	0	0	0	21.0
5-Jun	5	1	0	2	0	0	0	1	0	18.0
6-Jun	2	0	0	0	0	0	0	0	1	16.0
7-Jun	15	0	0	0	1	0	0	0	0	15.5
8-Jun	6	0	0	0	0	1	1	0	0	17.0
9-Jun	16	0	0	0	0	0	0	0	0	17.0

10-Jun	44	6	0	1	3	0	1	0	0	18.0
11-Jun	9	1	0	0	0	0	0	0	0	18.5
12-Jun	23	0	0	0	0	1	0	0	0	18.0
13-Jun	19	0	0	0	0	0	1	0	0	19.0
14-Jun	1	2	0	2	0	0	0	0	0	19.0
15-Jun	33	0	0	0	0	0	0	0	0	20.0
16-Jun	2	0	0	0	0	0	0	0	0	18.5
17-Jun	9	0	0	0	1	0	0	0	0	19.0
18-Jun	17	0	0	0	0	0	0	0	0	19.5
19-Jun	40	1	0	1	0	1	0	1	0	21.0
20-Jun	15	0	0	0	1	0	1	0	0	23.0
21-Jun	1	0	0	0	0	0	1	0	0	23.0
22-Jun	8	0	0	0	1	0	2	0	0	21.5
23-Jun	1	0	0	0	0	0	1	0	0	21.0
24-Jun	2	0	0	0	0	0	0	0	0	21.0
25-Jun	1	0	0	0	0	1	1	0	0	19.5
26-Jun	2	0	0	0	0	0	0	0	0	19.5
27-Jun	1	0	0	0	0	0	0	0	0	20.5
28-Jun	0	0	0	0	0	0	0	0	0	20.0
29-Jun	0	0	0	0	0	0	0	0	0	no data
30-Jun	0	0	0	2	0	0	0	0	0	17.0
1-Jul	3	0	0	1	0	0	1	0	0	20.0
2-Jul	0	0	0	0	0	0	0	0	0	23.0
3-Jul	8	0	0	0	1	0	0	0	0	24.5
	5,762	138	4	2,201	363	9	16	10	3	
	American Shad	Sea Lamprey	Blueback Herring	White Sucker	Small-mouth	Brown Trout	Rainbow Trout	Brook Trout	Tiger Trout	

Table 10. Historic yearly passage totals, Westfield River fish passage facility, West Springfield, Massachusetts, 1992-2018.

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

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

Table 11. **Temporal characteristics of American shad passage at the West Springfield fish passage facility, 2018**

	Cumulative Percentage of Total American Shad Passage				
Percent Passage	25%	50%	75%	90%	Day of Highest Daily Passage
Day*	14	20	25	30	15
Date	5/15	5/21	5/26	5/31	5/16

*Day one is May 2, the first day of shad passage.

A school of American shad.

Photo by Bill Byrne/MassWildlife

Table 12. 2018 Anadromous Fish Passage at Essex Dam, Lawrence, MA

Date	River Herring	American Shad	Sea Lamprey	Atlantic Salmon	Gizzard Shad	Striped Bass
4/18	-	-	-	-	-	-
4/19	-	-	-	-	-	-
4/20	-	-	-	-	-	-
4/21	-	-	-	-	-	-
4/22	-	-	-	-	-	-
4/23	-	-	-	-	-	-
4/24	-	-	-	-	-	-
4/25	4	-	-	-	-	-
4/26	30	-	-	-	-	-
4/27	23	-	-	-	-	-
4/28	74	-	-	-	-	-
4/29	54	-	-	-	-	-
4/30	68	-	-	-	-	-
5/1	-	-	-	-	-	-
5/2	25	-	-	1	-	-
5/3	26	-	-	-	-	-
5/4	617	1	1	-	-	-
5/5	881	8	5	-	-	-
5/6	4,201	8	8	1	-	-
5/7	1,853	20	1	-	-	-
5/8	2,159	7	1	-	-	-
5/9	20,291	11	51	-	-	-
5/10	9,466	21	45	1	-	-
5/11	58,130	105	276	-	-	-
5/12	2,400	73	22	-	-	-
5/13	43,246	126	23	1	-	-
5/14	5,107	122	1	-	-	-
5/15	112,070	245	279	-	-	-
5/16	67,983	368	52	-	-	-
5/17	19,958	123	17	-	-	-
5/18	34,863	127	186	1	-	-
5/19	9,547	175	12	-	-	-

5/20	2,912	213	27	-	-	-
5/21	1,332	58	13	-	-	-
5/22	1,953	746	80	-	-	-
5/23	3,631	435	537	-	-	-
5/24	17,895	1,330	542	-	-	1
5/25	10,715	1,101	352	-	-	2
5/26	9,700	1,871	1,416	-	-	1
5/27	874	863	180	3	1	1
5/28	1,225	822	7	-	1	2
5/29	1,610	1,421	343	-	-	7
5/30	3,097	1,184	327	-	1	6
5/31	185	1,205	143	-	2	15
6/1	334	1,199	136	-	2	13
6/2	225	1,827	175	-	-	12
6/3	235	1,680	145	1	3	9
6/4	51	1,494	22	-	1	7
6/5	2	894	10	-	-	7
6/6	1	921	8	-	-	31
6/7	277	841	38	-	1	8
6/8	16	640	12	-	-	13
6/9	-	508	23	-	2	14
6/10	-	488	21	-	-	14
6/11	-	550	25	1	-	15
6/12	-	388	22	-	-	24
6/13	-	642	9	-	-	13
6/14	-	500	2	-	-	15
6/15	-	287	2	-	-	13
6/16	-	391	4	-	-	16
6/17	-	222	-	-	-	21
6/18	-	332	14	-	-	14
6/19	-	203	2	-	-	12
6/20	-	213	2	-	-	16
6/21	-	170	-	-	-	14
6/22	-	230	-	-	-	12
6/23	-	260	-	-	-	21
6/24	-	95	-	-	-	9

6/25	-	101	-	-	-	11
6/26	-	146	-	-	-	12
6/27	-	192	-	-	-	12
6/28	-	99	-	-	-	6
6/29	-	127	-	-	1	12
6/30	-	117	-	-	1	13
7/1	-	170	-	-	-	15
7/2	-	101	-	-	-	4
7/3	-	36	-	-	-	-
7/4	-	19	-	-	-	-
7/5	10	81	-	-	-	3
7/6	-	27	-	-	-	1
7/7	-	17	-	-	-	-
7/8	-	33	-	-	-	-
7/9	-	11	-	-	-	1
7/10	-	8	-	-	-	-
7/11	-	5	-	-	-	1
7/12	-	6	-	-	-	1
7/13	-	-	-	-	-	-
7/14	-	-	-	-	-	-
Total	449,356	29,060	5,619	10	16	470
	River Herring	American Shad	Sea Lamprey	Atlantic Salmon	Gizzard Shad	Striped Bass

Table 13. Historic Anadromous Fish Passage at Essex Dam, Lawrence, MA

Year	Atlantic Salmon[1]	American Shad	River Herring[2]	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**

1. Captured and transported to Nashua National Fish Hatchery for broodstock.
2. River herring is an undetermined mix of both alewife and blueback herring.

* 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 14: Age Frequency of American Shad Sampled At the Essex Fish Lift 2018

Age	n	%
4	23	11%
5	61	29%
6	76	36%
7	43	20%
8	8	4%
Grand Total	211	

The Westfield Dam and fish ladder.

Photo courtesy of Joseph Boulia

Table 15. Fish passage at the Pawtucket Dam Fishlift, Lowell, MA in 2018.

Date	Herring			Shad			S Bass			Lamprey		
	Lift	Ladder	total	Lift	Ladder	total	Lift	Ladder	total	Lift	Ladder	total
4/30/2018	0	0	0	0	0	0	0	0	0	0	0	0
5/1/2018	0	0	0	0	0	0	0	0	0	0	0	0
5/2/2018	0	0	0	0	0	0	0	0	0	0	0	0
5/3/2018	0	0	0	0	0	0	0	0	0	0	0	0
5/4/2018	0	1	1	0	0	0	0	0	0	0	0	0
5/5/2018	21	4	25	0	0	0	0	0	0	0	0	0
5/6/2018	0	12	12	0	0	0	0	0	0	0	0	0
5/7/2018	0	90	90	0	0	0	0	0	0	0	1	1
5/8/2018	0	167	167	0	0	0	0	0	0	0	-1	-1
5/9/2018	0	160	160	0	0	0	0	0	0	0	0	0
5/10/2018	103	1063	1166	0	0	0	0	0	0	0	0	0
5/11/2018	265	7893	8158	0	0	0	0	0	0	0	0	0
5/12/2018	15776	7004	22780	4	0	4	0	0	0	0	0	0
5/13/2018	5389	9302	14691	0	0	0	0	0	0	0	0	0
5/14/2018	8175	11681	19856	8	3	11	0	0	0	0	0	0
5/15/2018	7231	20440	27671	4	8	12	0	0	0	1	3	4
5/16/2018	38881	37501	76382	9	23	32	0	0	0	6	2	8
5/17/2018	30233	32966	63199	29	19	48	0	0	0	2	10	12
5/18/2018	11792	16301	28093	8	15	23	0	0	0	0	20	20
5/19/2018	17687	11886	29573	6	16	22	0	0	0	2	22	24
5/20/2018	14623	13826	28449	32	15	47	0	0	0	3	44	47
5/21/2018	3348	426	3774	4	3	7	0	0	0	1	34	35
5/22/2018	3758	0	3758	19	0	19	0	0	0	0	7	7
5/23/2018	3117	3	3120	1	-1	0	0	0	0	2	26	28
5/24/2018	1032	1225	2257	80	0	80	0	0	0	34	109	143
5/25/2018	-22710	822	-21888	182	28	210	0	0	0	37	74	111
5/26/2018	-6057	1874	-4183	89	153	242	0	0	0	8	75	83
5/27/2018	-14270	4806	-9464	64	418	482	0	0	0	14	730	744
5/28/2018	-6675	2100	-4575	149	127	276	0	0	0	7	211	218
5/29/2018	-1809	680	-1129	174	98	272	0	0	0	10	95	105
5/30/2018	6471	-326	6145	224	26	250	0	0	0	9	77	86
5/31/2018	6446	11	6457	280	10	290	0	0	0	27	108	135
6/1/2018	11281	190	11471	369	192	561	0	0	0	10	83	93

6/2/2018	-863	82	-781	287	108	395	0	0	0	12	123	135
6/3/2018	136	58	194	205	221	426	0	0	0	0	111	111
6/4/2018	5106	0	5106	249	199	448	0	0	0	8	71	79
6/5/2018	-349	1	-348	235	151	386	0	1	1	5	34	39
6/6/2018	-2996	2	-2994	92	98	190	0	0	0	1	12	13
6/7/2018	-3138	7	-3131	141	65	206	0	0	0	2	5	7
6/8/2018		4	4		95	95		0	0		12	12
6/9/2018		4	4		125	125		0	0		24	24
6/10/2018		1	1		21	21		0	0		23	23
6/11/2018	-243	0	-243	105	107	212	0	0	0	-2	14	12
6/12/2018	-361	-2	-363	113	464	577	0	0	0	1	17	18
6/13/2018	-287	0	-287	98	1324	1422	0	0	0	0	14	14
6/14/2018	-440	0	-440	90	1276	1366	0	0	0	1	8	9
6/15/2018	-149	1	-148	31	589	620	0	0	0	0	1	1
6/16/2018	-123	1	-122	57	295	352	0	0	0	0	2	2
6/17/2018	81	0	81	25	404	429	0	0	0	0	3	3
6/18/2018	-197	1	-196	42	550	592	0	0	0	-1	-1	-2
6/19/2018	-208	0	-208	45	603	648	0	0	0	0	3	3
6/20/2018	53	0	53	71	78	149	0	0	0	0	1	1
6/21/2018	-158		-158	18		18	0		0	0		0
6/22/2018	-363		-363	25		25	0		0	0		0
6/23/2018	-59		-59	17		17	1		1	0		0
6/24/2018	44		44	29		29	1		1	0		0
6/25/2018	-37	0	-37	40	63	103	0	0	0	0	0	0
6/26/2018	2		2	20		20	-2		-2	0		0
6/27/2018	38		38	26		26	0		0	0		0
6/28/2018	0		0	13		13	0		0	0		0
6/29/2018	0		0	65		65	1		1	0		0
6/30/2018			0			0			0			0
7/1/2018		0	0		286	286		0	0		0	0
7/2/2018		0	0		355	355		0	0		0	0
7/3/2018		0	0		239	239		0	0		0	0
7/4/2018		0	0		393	393		0	0		0	0
7/5/2018		0	0		56	56		0	0		0	0
7/6/2018		0	0		43	43		0	0		0	0
7/7/2018		0	0		237	237		0	0		0	0
7/8/2018		0	0		41	41		0	0		0	0

7/9/2018		0	0		53	53		0	0		0	0
7/10/2018	0	0	0	0	30	30	3	0	3	0	0	0
7/11/2018	0	0	0	0	136	136	0	0	0	0	0	0
7/12/2018	0	0	0	1	291	292	2	0	2	0	0	0
7/13/2018	2	0	2	0	22	22	-3	0	-3	0	0	0
	129,599	182,268	**311,867**	3,875	10,171	**14,046**	3	1	4	200	2,207	**2,407**
	River Herring			American Shad			Striped Bass			Sea Lamprey		

Table 16. 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	
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

* 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.

V. Hatchery/Trout Program – Ken Simmons, Ph.D., Project Leader

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 FY2019 are listed in Tables 1 and 2, respectively. Overall, a total of 515,604 brook trout, brown trout, rainbow trout and tiger trout with a combined weight of 443,519 pounds were stocked, which met the Division's annual trout production goal of 400,000 to 450,000 pounds. 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 permit 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 FY2019 as well; 76% (394,037 fish) of the fish met or exceeded this goal, including 292,153 rainbow trout, 47,345 brook trout, 51,525 brown trout and 3,014 tiger trout.

The Division has both a fall and spring trout stocking season. During the FY2019 fall season, which ran from late September through mid-October 2019, 98 ponds and lakes, and 12 rivers and streams in 79 cities and towns across the 5 Wildlife Districts were stocked. A total of 65,040 trout comprised of 42,111 14+ rainbow trout, 18,929 12+ rainbow trout and 4,000 9+ brown trout with a combined weight of 64,220 pounds were stocked. Ninety six percent of the fish stocked during the fall were in the 12+ or larger size category.

In the spring stocking season, which ran from March through early June 2019, a total of 450,564 trout with a combined weight of 379,299 pounds were stocked in 185 lakes and ponds and 257 rivers and streams in 252 cities and towns. Overall, 74% of the fish that were stocked met or exceeded the 12+ size category. A total of 238,713 rainbow trout stocked of which 231,113 (97%) were in the 12+ category or larger and 184,491 (77%) were 14+ and weighed an average of 1.2 pounds each. Many of the rainbows were over 16 inches long and weighed more than a pound and a half apiece. A total of 90,285 brook trout were stocked

in spring FY2019, of which 47,345 (52%) were in the 12+ size category or larger. More than a 1,000 of 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 50,019 pounds. A total of 117,558 brown trout between 6 inches and 18+ inches with a total weight of 77,785 pounds were also stocked. Forty four percent (51,525 fish) of the brown trout were at least 2 ½ years old and 12 inches or larger with an average weight of 1.2 pounds apiece. Close to 1,000 of these brown trout were longer than 18 inches and weighed an average of 4.1 pounds apiece. Sandwich Hatchery produced 4,008 tiger trout of which 3,014 fish averaged 14+ inches and weighed an average of 1.3 pounds apiece (Tables 1 and 2). 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 520,075 fertilized brown trout eggs and 847,015 fertilized brook trout eggs in FY2019. Sandwich Hatchery produced a total of 206,700 fertilized brown trout eggs, 259,296 fertilized brook trout eggs and 200,300 fertilized tiger trout eggs (Table 3).

2. Landlocked Salmon Production and Stocking

The Roger Reed Hatchery produced a total of 16,150 landlocked Atlantic salmon in FY2019 (Table 3). 6,050 of these salmon that weighed a total of 378 pounds were transferred in September 2108 to the New Jersey Division of Fish and Wildlife Hackettstown Hatchery in exchange for northern pike fry and fingerlings. The remaining 10,100 salmon which averaged between 8.7 and 9.3 inches and weighed a total of 2,695 pounds were stocked in Quabbin Reservoir in May 2019.

3. Northern Pike Stocking

In September 2018, a total of 2,097 northern pike yearlings that averaged between 8 and 12.2 inches long were stocked in the Quinsigamond Lake/Flint Pond (Worcester and Shrewsbury). In April 2019, Quaboag Pond (Brookfield/East Brookfield) was stocked with 23,171 northern pike fry that averaged 2.4 inches long. 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 1980's. 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 FY2019 are in Table 4. Furunculosis was the only pathogen diagnosed that is listed by the NEFHC (NEFHC 2015). Furunculosis is a widespread, common fish pathogen with varying degrees of pathogenicity thus the NEFCH recommends that efforts be made to limit its distribution. Furunculosis was detected in one lot of brown trout fingerlings at Sunderland Hatchery and was successfully treated with a Food and Drug Administration-approved furunculosis antibiotic that was prescribed by a veterinarian in accordance with the Food and Drug Administration's Veterinary Feed Directive (VFD). Cold water disease (Flavobacterium psychrophilum) was diagnosed in the Erwin/Arlee strain of rainbow trout at McLaughlin Hatchery, Sandwich Hatchery and Sunderland 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 and Sunderland 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). The rainbow trout at Sandwich Hatchery recovered fully without requiring treatment.

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. Deliverables of the study will include recommendations to improve, enhance and maximize efficiency at the 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

Species	Size Category (inches)	Number of Fish					Total Number of Fish
		Bitzer	McLaughlin	Palmer	Sandwich	Sunderland	
Rainbow	6+	0	0	0	0	0	0
Trout	9+	7600	0	0	0	0	7600
	12+	0	0	0	8783	56768	65551
	14+	23000	177179	0	26423	0	226602
	Sub-total	**30600**	**177179**	**0**	**35206**	**56768**	**299753**
Brook	6+	0	0	0	0	42500	42500
Trout	9+	0	0	440	0	0	440
	12+	30221	0	0	8616	7466	46303
	14+	0	0	418	0	0	418
	18+	0	0	0	624	0	624
	Sub-total	**30221**	**0**	**858**	**9240**	**49966**	**90285**
Brown	6+	20000	0	0	0	22350	42350
Trout	9+	4000	22973	710	0	0	27683
	12+	19500	0	0	9983	20707	50240
	14+	0	0	345	0	0	345
	18+	0	0	57	883	0	940
	Sub-total	**43550**	**22973**	**1112**	**10866**	**43057**	**121558**
Tiger	9+	0	0	0	994	0	994
Trout	14+	0	0	0	3014	0	3014
	Sub-total	**0**	**0**	**0**	**4008**	**0**	**4008**
Total		104371	200152	1970	59320	149791	515604

Table 1. Number of trout produced at each of the Division's five fish hatcheries in FY2019 (fall 2018 and spring 2019).

Species	Size Category (inches)	Total Weight of Fish (Pounds)					Total Pounds of Fish
		Bitzer	McLaughlin	Palmer	Sandwich	Sunderland	
Rainbow	6+	0	0	0	0	0	0
trout	9+	3763	0	0	0	0	3763
	12+	0	0	0	8233	39416	47649
	14+	24749	202266	0	30844	0	257859
	Sub-total	**28512**	**202266**	**0**	**39077**	**39416**	**309271**
Brook	6+	0	0	0	0	9876	9876
Trout	9+	0	0	200	0	0	200
	12+	22072	0	0	10113	5277	37462
	14+	0	0	915	0	0	915
	18+	0	0	0	1566	0	1566
	Sub-total	**22072**	**0**	**1115**	**11679**	**15153**	**50019**
Brown	6+	4662	0	0	0	4176	8838
Trout	9+	2301	8262	283	0	0	10846
	12+	20098	0	0	9876	25322	55287
	14+	0	0	1235	0	0	1235
	18+	0	0	388	3492	0	3880
	Sub-total	**27061**	**8262**	**1906**	**13359**	**29498**	**80086**
Tiger	9+	0	0	0	293	0	293
Trout	14+	0	0	0	3850	0	3850
	Sub-total	**0**	**0**	**0**	**4143**	**0**	**4143**
Total		77645	210528	3021	68258	84067	443519

Table 2. Pounds of trout produced at the Division's five fish hatcheries in FY2019 (fall 2018 and spring 2019).

Hatchery	Species	Size Category (inches)	Number	Weight (Pounds)
Palmer	Landlocked salmon	8+ inches	16,150	3,073
Palmer	Brook trout	eggs	847,015	N/A
	Brown trout	eggs	520,075	N/A
Sandwich	Brook trout	eggs	259,296	N/A
	Brown trout	eggs	206,700	N/A
	Tiger trout	eggs	200,300	N/A

Table 3. Summary of landlocked salmon, brook trout eggs, brown trout eggs and tiger trout eggs produced in FY2018 (fall 2017 and spring 2018).

Table 4. Results of fish health tests conducted at the Division's 5 fish hatcheries in FY2019.

			Pathogen[1]							
									Protozoa	
Hatchery	Species[2]	Number of Fish Tested	IPNV	VHSV	OMV	IHNV	BF	BRM	WD	Other[3]
Bitzer	BK (SA)	60	negative	negative	negative	negative	negative	negative	negative	
	BT (SA)	60	negative	negative	negative	negative	negative	negative	Negative	
	RT (E/A)	60	negative	negative	negative	negative	negative	negative	negative	
McLaughlin	BT (SA)	60	negative	negative	negative	negative	negative	negative	negative	
	RT (E/A)	60	negative	negative	negative	negative	negative	negative	negative	
	RT (SH)	60	negative	negative	negative	negative	negative	negative	negative	
	RT (E/A)	30								+CWD
	RT (SH)	30								+CWD
Palmer	LLS (GL)	60	negative	negative	negative	negative	negative	negative	negative	
	LLS (GL)	10	negative	negative	negative	negative	negative	negative	negative	
	BK (SA)	15	negative	negative	negative	negative	negative	negative	negative	
	BK – (SA)	158[4]	negative	negative	negative	negative	negative	negative	negative	
	BT (SA)	15	negative	negative	negative	negative	negative	negative	negative	
	BT (SA)	86[4]	negative	negative	negative	negative	negative	negative	negative	
Sandwich	BK (SA)	60	negative	negative	negative	negative	negative	negative	negative	
	BK (SA)	81[4]	negative	negative	negative	negative	negative	negative	negative	

	BT (SA)	60	negative	negative	negative	negative	negative	negative	negative	
	BT (SA)	115[4]	negative	negative	negative	negative	negative	negative	negative	
	RT (E/A)	60	negative	negative	negative	negative	negative	negative	negative	
	RT (E/A)	10						negative		+CWD
	RT (E/A)	10						negative		+CWD
	TT	30	negative	negative	negative	negative	negative	negative	negative	
Sunderland	BK (SA)	60	negative	negative	negative	negative	negative	negative	negative	
	BT(SA)	60	negative	negative	negative	negative	negative	negative	negative	
	BT (SA)	10						negative		+CWD
	BT (SA)	10						positive		+BF
	RT (E/A)	60	negative	negative	negative	negative	negative	negative	negative	
	RT (E/A)	10						negative		+CWD
	RT (E/A)	10						negative		+CWD

[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, BF – *Aeromonas salmonicida,* BRM – *Yersinia ruckeri*, WD – *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.

- backup emergency power generation
- minimization of worker risk for occupational injury
- tourism enhancement and educational outreach for visitors

The potential impacts from climate change and recommended means to mitigate them were required to be included for each hatchery.

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 will be completed in August 2019.

Other hatchery capital projects conducted in 2018 included a complete rebuilding of the back-up emergency power generator at Sandwich Hatchery, upgrade of the electrical system at Palmer Hatchery and cleaning/redevelopment of the primary water supply well at Sunderland Hatchery.

Hatchery Program Personnel

Arthur Pellegri retired from Roger Reed Hatchery in May 2018 after more than 28 years of service. Christopher Marsden was hired as a Wildlife Hatchery Technician II at McLaughlin Hatchery in February 2019. He replace Christopher Kielbasa who resigned in October 2018. Michael Clark was promoted from Seasonal Wildlife Hatchery Technician I to Wildlife Hatchery Technician II at Sandwich Hatchery. He replaced Cameron Young who transferred to Roger Reed Hatchery.

References

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

VI. Coldwater Fisheries Project, Adam Kautza, Ph.D., Project Leader

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 west, 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 Northeast Fisheries Administrators 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 the MassWildlife 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, we have begun the process of my taking over as the coordinator for the Teaching with Trout program. Some additional details on individual projects are outlined below.

1. 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 start 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 2018, we surveyed 13 study reaches from upstream of the Cold Spring Road Bridge to the very upstream source of the tailwater near the Y-Pool. We found 1616 Brook Trout across all size classes from abundant young-of-the-year to a few truly large individuals 16+ inches. On average we found almost 1900 Brook Trout/mile throughout the tailwater section of the Swift River. This was slightly lower than 2017 (2300/mile) but with only two years of surveys no conclusions can be made as to whether or not this is a trend or simply that this amount of annual variation is the norm in the Swift River. The upper half of the tailwater retained an exceptionally abundant population of wild Brook Trout with 3150 fish/mile. We found 41 Rainbow Trout in our comprehensive surveys, almost exactly as many as the previous year.

Again, as in 2017, 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 surveyed three times as many Brown Trout in 2018 than in 2017 (12 v. 35) and although we did not turn up the truly exceptional 33-inch fish we did capture a 28-inch 13 pound Brown Trout in the same stretch of river. Similar to 2017 we found juvenile Rainbow Trout near the Pipe Pool area and downstream (potential wild reproduction of rainbows but more likely hatchery escapees) and no evidence of Brown Trout reproduction anywhere in the river. High water in early summer 2019 forced us to push off our usual survey dates from late June to July so these data will be included in next year's report.

In summary, the Swift River supports an abundant population of wild Brook Trout of all age classes. The Swift also supports larger individuals than 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 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. For example, in July 2018 we pelvic fin-clipped all Rainbow Trout stocked into the Swift River upstream of Route 9 (530 individuals) and monitored how many remained in that reach after one week, one month, and three months post-stocking. Fall stocked Rainbow Trout above Route 9 (376 individuals) were adipose-clipped for the same purpose. Of the Rainbow Trout stocked into the year-round catch-and-release section above Route 9 in July 2018 only 38% remained in the reach one week post stocking, 16% remained one month post stocking, and barely 5% remained in the reach three months post stocking. Of the fall stocked Rainbow Trout only 12% remained in the reach one week post stocking and only 1% were still in the area one month post stocking. We were unable to complete the three month post stocking survey because of high flows. This first attempt was only a preliminary investigation to form a rough idea about mortality and/or movement of stocked fish out of the year-round catch-and-release section. We are developing more rigorous studies for the entire tailwater, and including spring stocked fish as well, going forward.

2. 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 over the next few years and a long-term plan put into place shortly thereafter. 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 a list of potential "prime" 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 continued in 2018 in which we surveyed another 31 reaches on 24 streams. The streams we surveyed were again located throughout western Massachusetts mostly in the Westfield, Kinderhook, Hoosic, and Housatonic drainages. Unlike in the 2017 surveys, 13 of the 24 streams surveyed in 2018 did not meet expectations set for what we considered to be the best-of-the-best wild trout streams in Massachusetts and so are indicated as being potentially excluded from the master list of prime wild trout waters moving forward. Of the 11 streams that met our criteria for the highest-quality wild trout fisheries, 1 was a Brown Trout-dominated fishery, 3 supported abundant populations of both Brown and Brook Trout and the remainder were dominated by Brook Trout.

The winter of 2018/2019 was spent working on various aspects of the wild trout management plan including 1) continuing on work started in 2017/2018 by further refining and summarizing the large amount of wild trout data in our database into useful formats and distribution maps, and 2) completing a first draft of the wild trout management plan working document.

3. Deerfield River Wild Brown Trout:

Partly as a result of the FERC dam operation 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. We will be assessing abundance, size structure, growth, and the contribution of wild fish to the fishery.
Deerfield Trout Unlimited has also begun a project on the Deerfield River to gain insight into the overall success of Brown Trout reproduction in the river. They are identifying the location of Brown Trout redds and assessing the presence and viability of eggs deposited in these redds to understand the effects of hydropeaking flow regulation on Brown Trout spawning and egg survival. The Trout Unlimited project will provide interesting information on the very early stages of the Brown Trout life cycle in the river.

One of the most 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.

We fully outfitted and tested our electrofishing raft in October 2018 with great success. The data collection phase of the Deerfield River Brown Trout Project began with initial electrofishing surveys and tagging of captured Brown Trout in early May 2019 followed by adipose-clipping and stocking 1000 Brown Trout into the upper river (same protocol as the previous year). Future surveys are scheduled for July, August, and September 2019 and then May, June, July, August, and September for 2020 through 2022.

Initial surveys in May 2019 yielded a low number of Brown Trout, only nine fish collected in approximately 7-8 miles of river sampled and about four-and-a-half hours of actu-

al electrofishing time. Five were tagged with individually-numbered Floy tags. Brown Trout ranged in size from juvenile (presumably wild) individuals 95-150 mm up to large adults 490 mm in length. We also collected 19 Rainbow Trout, 1 Brook Trout, as well as White Sucker, Slimy Sculpin, Common Shiner, and American Eel. We expect to collect and tag substantially more Brown Trout in future surveys as our technique improves and as the water warms and trout move out of their winter pools. One of the initial batch of tagged Brown Trout (#4; 489 mm, 1322 g tagged on 8 May 2019) was caught and released by angler on 22 June 2019.
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 to the end of the fiscal year we received 38 responses from anglers. Anglers who responded to the survey spent 150.5 hours fishing over 38 trips (mean = approximately 4 hours; ranging from 0.5 to 12 hours) and caught 131 Rainbow Trout (0.87/hour), 63 Brown Trout (0.42/hour), and 6 Brook Trout. 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. To date, no adipose clipped or tagged Brown Trout were recorded in the survey results.

4. 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. One of my initial tasks for this committee was to pull together and summarize all of the wild trout management plans, trout stream management plans, etc. for all of the participating states and Canadian provinces. In addition to that we have now held three conference calls with fisheries biologists and managers from 12 states and 2 provinces. In the calls we have finalized formal "Problem" and "Need" statements (shown here).

Problem
Targeted management and diverse angling opportunities for wild stream-dwelling salmonids (e.g., native, naturally-reproducing Brook Trout in most cases, but also introduced, naturally-reproducing Brown Trout and Rainbow Trout in some situations, and native or introduced naturally-reproducing Landlocked Atlantic Salmon in a few cases) have become increasingly important outcomes desired by the angling public. States and provinces in the region are addressing this by developing, or revising, wild trout or trout stream-specific management plans. However, many state and provincial resource management agencies lack some of the necessary data, experience, and/or resources to support the development or timely revision of a wild trout management plan.

Need
Fisheries managers working on wild trout management in rivers and streams throughout the region need an avenue to share their knowledge and experiences with other managers who have been or are currently dealing with similar issues. Providing a means of sharing useful knowledge and experience will allow managers to learn from one another and help to inform the development of useful wild trout management plans with a greater likelihood of successfully meeting intended goals and objectives.

These statements are bring used to to guide the committee direction. We have also compiled a list of major threats to wild trout and obstacles to effective wild trout management each state/province experiences, and briefly discussed which data and information to share and how best to share it. Our next steps will be to further discuss data/information sharing and move forward with that in an attempt to benefit all participants as they develop new wild trout management plans or revise existing wild trout management plans.

In October 2018 the Rivers and Streams Technical Committee met Blue Lake, NY at the MinnowBrook Conference Center as part of the annual Northeast Fisheries and Wildlife Administrators meeting. This face-to-face meeting was an opportunity for all of the participants to meet one another in person and to outline how each of us, and our respective agencies, perceive and manage wild trout fisheries in rivers and streams under our jurisdiction. The meeting was attended by 12 of 14 members, either in person or remotely. Each member gave a presentation outlining wild trout management in their agency. Questions, answers, and discussion followed. At the end of the larger meeting the committee gave a summary to the gathered fisheries administrators. The administrators suggested two products come out of this meeting. One, a comprehensive spreadsheet compiling all the pertinent information that explains how and why wild trout are managed in each represented agency (this was completed and distributed in late winter 2019); and two, develop a "Wild Trout Management Symposium" for the upcoming 2019 Northeast Fish and Wildlife Conference. We received abstracts for nine presentations, enough to fill up a full afternoon session at the conference. Talks were given by agency staff from throughout the region (including some committee members and colleagues) as well as by researchers in academia.

5. 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.

6. Teaching with Trout:

The program this year included 53 schools/organizations with approximately 4,800 student exposed to the program. This is a net increase of one school compared to the previous year. There were actually 8 schools new to the program. Those that discontinued did so for a variety of reasons – teacher retirement, changes to teacher classroom assignments, lack of interest, etc.

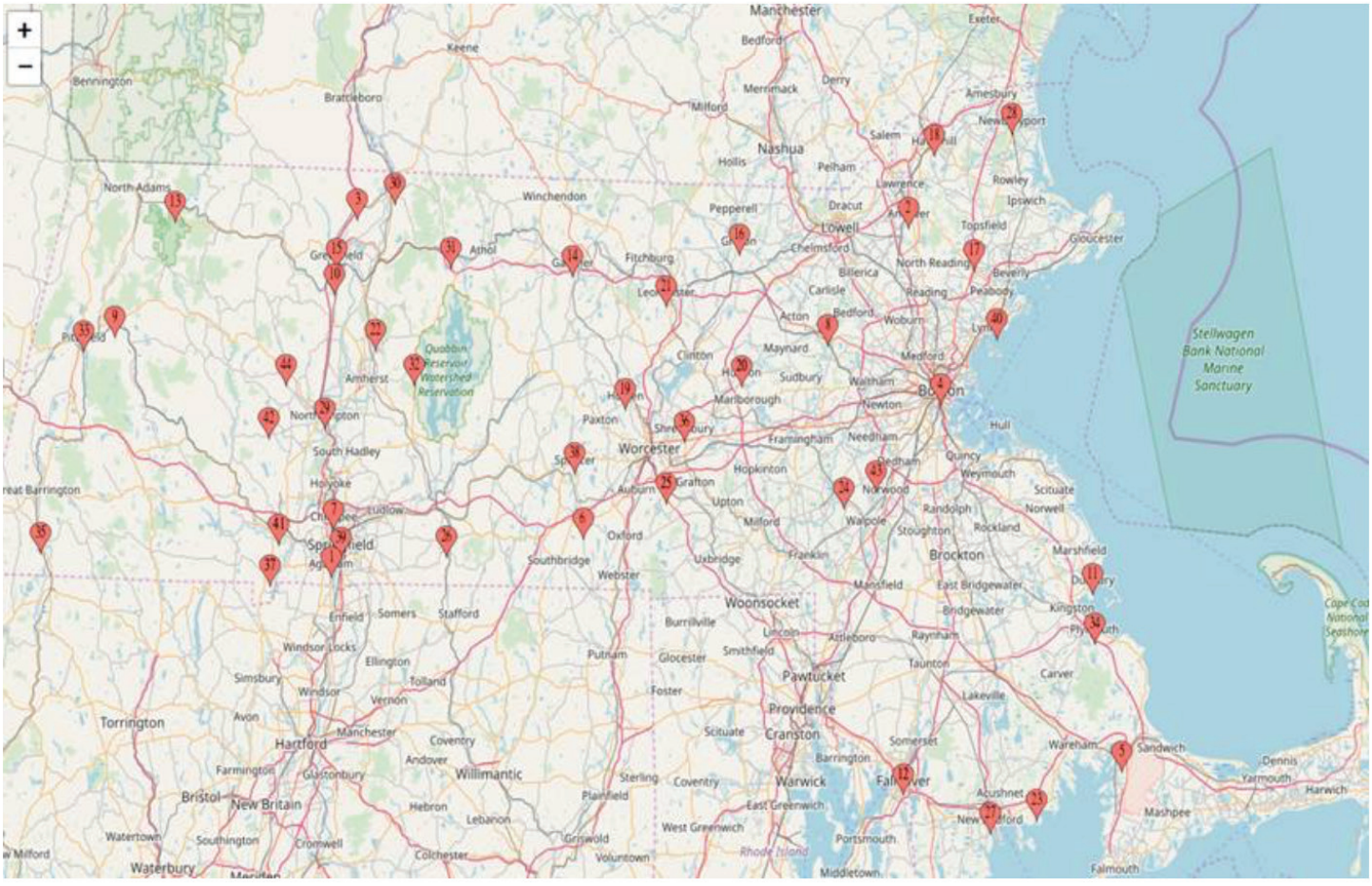
Geographically the program covered most parts of the state with the exception of the mid and outer Cape and Islands. Most of the classrooms participating in the program are middle and high school grade levels. There are only ten schools using the program at the elementary level.

The Massachusetts Outdoor Heritage Foundation provided funds to enable purchase of three new chillers. This brought to a total of ten, the number of units the Foundation has provided in the last three years.

At the end of the 2019 program, several schools indicated they would not continue with the program and the chillers were returned to Palmer Hatchery.

MassWildlife distributed new chillers obtained through the Foundation to three schools and assisted in equipment setup. Other new schools were also inspected prior to egg delivery to ensure proper setup and operation of the equipment.

Egg delivery was made between December 10th and 19th to 35 schools. Between January 7th and 31st the remaining eggs were distributed. A total of approximately 10,000 brook trout eggs were provided, about 200 per tank. At the same time feed was also provided for the schools in suffi-



Towns where schools or organizations are participating in Teaching With Trout

cient quantity to raise the fish as long as the teacher intended. Fish are generally fed from early January until release in April – June.

A couple schools were able to visit the hatchery in combination with the release of their fish during the spring. MassWildlife also assisted in one off-site release event in Monson.

Future plans - The Teaching with Trout Program manual will be updated in FY2020. With assistance from MassWildlife I&E more content may be added to the website.

VII. Fisheries Operations, Steven Mattocks

Fisheries Operations, FY19 Annual Report – Steven Mattocks, Fisheries Operations Biologist

1. Biological sampling for fish community assessment

Prioritizing biological sampling activity is an essential component of the Fisheries Operations Biologist duties. Statewide sampling priorities were developed for fisheries staff based on multiple selection criteria and included implementation of both new and ongoing projects throughout the state. Much of the criteria is informed by FHQ fisheries staff, and includes gaps in current fisheries data, streams with historical surveys, potential rare and endangered species occurrences, potential locations for naturally reproducing coldwater fish, environmental review, and climate refugia locations. Other survey needs required analytical/spatial approaches, such as gaps in sampling locations, gaps in time, new tributary sampling, important confluence locations, overlapping projects etc. New project needs were also incorporated into sampling priority lists (statewide pre- and post-dam removal-UMass/USGS, fish assemblages related to dwarf wedgemussel communities-UMass/USGS, flow restoration monitoring-DER). 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 fisheries staff meeting.

The annual fisheries meeting was held on June 4th, 2019, 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 throughout the meeting and in the lab 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 as well as the updated fisheries database, fisheries GIS layers, and voucher collection specimen needs.

A new online data entry system was developed for districts in an effort to increase and enhance data efficiency, data best practices and use, and data storage standardization. Google drive folders containing relevant documents (data entry template, priority list, voucher log, stream photos) were created and shared with district biologists. Data entry spreadsheets were formatted in an effort to simplify data entry procedures and to match the database template. Three primary spreadsheets were created for data entry (sample, habitat, and fish data). Districts were trained and encouraged to enter biological data directly into the shared Google drive folder for instant access by all staff. This has been a drastic improvement over the former method where

Photo by Steven Mattocks/MassWildlife

Table 1: Number of samples conducted in each watershed within Massachusetts during FY19.

Watershed	Number of Samples
Blackstone	8
Buzzards Bay	1
Cape Cod	12
Charles	15
Chicopee	16
Concord	10
Connecticut	24
Deerfield	15
Farmington	1
French	5
Hoosic	7
Housatonic	22
Ipswich	5
Kinderhook	2
Merrimack	5
Millers	5
Mt. Hope Bay	1
Mystic	4
Nashua	29
North Coastal	1
Parker	9
Quinebaug	9
Shawsheen	6
South Coastal	12
Taunton	14
Westfield	41

districts send in their completed, scanned data sheets, and staff from the field headquarters office (Fisheries Operations Biologist) transcribes all hand-written data to static sheets before reformatting and uploading to the database.

Logistical challenges that occurred during sampling coordination and prioritization among field headquarters staff were addressed. Weekly communication with field headquarters project leaders and regular correspondence with district staff was integral in maximizing sampling and overall operation efficiency.

The Fisheries Operations Biologist continued to lead the Juvenile American Shad Monitoring and Productivity Study in the Connecticut River, in coordination with the MassWildlife Connecticut River Valley District Biologist (Brian Keleher) and USFWS Connecticut River Project Leader (Ken Sprankle). Random stratified boat electrofishing runs were conducted in 3 dam sections within the Connecticut River: Holyoke to Turner's, Turner's to Vernon, and Vernon to Bellows. MassWildlife covered the Holyoke to Turners dam section with nighttime electrofishing. An updated annual monitoring report was produced, titled "Juvenile American Shad Assessment in the Connecticut River from Holyoke Dam to Bellows Falls Dam, 2017-2018", which can be found on the USFWS Connecticut River Conservation web page (https://www.fws.gov/r5crc/pdf/Juvenile_Shad_Assessment_5_30_19.pdf).

2. Data entry and QAQC

Massachusetts Division of Fisheries and Wildlife staff conducted 279 surveys throughout the state during FY 2019. Stream surveys were conducted in all districts throughout Massachusetts, and sampling locations filled many data gaps. Some surveys were conducted on streams and rivers that had recent samples completed, while other surveys occurred on streams with historical surveys or even no previous data. Additional CFR's were added, which document the presence and 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 (Table 1). Species summaries were produced, which include counts, and the minimum, maximum, and average lengths of each species captured (Table 2a, 2b). This information captures sizes and approximate age classes, along with community structure of fishes sampled in FY 2019.

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.
Unidentifiable specimens were submitted to the Filed Headquarters office for confirmation/identification. Additionally, 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.

Table 2a: Table shows the total number (count), minimum, maximum, and mean sizes (mm) of fish species (Alewife to Green Sunfish) captured in FY19 surveys.

Fish Code	Count	Minimum Length	Maximum Length	Mean Length
A	203	27	87	37
AE	953	10	795	210
ATS	4	40	59	55
B	2696	19	248	67
BB	122	43	361	235
BBH	5	95	118	106
BC	124	36	295	96.5
BF	2	314	330	322
BM	127	34	59	43
BND	3999	8	165	59
BNM	120	30	95	67
BS	28	36	228	58
BT	353	40	386	71
C	60	264	820	571.5
CCS	9	51	242	89
CM	22	56	86	68
CP	407	56	527	182
CRC	995	21	168	71
CS	867	20	143	61
EBT	2737	30	284	112
F	865	22	282	63
FSS	93	17	66	31
GS	435	32	245	83
GSF	18	67	160	88.5

3. Data summaries and requests

Multiple data requests were received during FY 2019. 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.

Table 2b: Table shows the total number (count), minimum, maximum, and mean sizes (mm) of fish species (Gizzard Shad to Yellow Perch) captured in FY19 surveys.

Fish Code	Count	Minimum Length	Maximum Length	Mean Length
GZ	16	99	155	123
K	64	29	90	60
LC	6	93	107	103
LLS	154	48	753	103.5
LMB	816	31	560	85.5
LND	1010	12	396	75
LT	234	397	1011	553.5
M	91	21	85	62
NP	2	575	709	642
P	1345	21	284	95
RB	150	38	264	148
RBS	165	44	176	96
RP	228	51	230	134.5
RT	10	214	436	318.5
S	102	54	104	73
SC	913	20	110	64
SD	12	31	65	46.5
SK	7	32	87	74
SL	62	58	185	120
SMB	126	41	526	75
SS	118	10	107	66.5
TD	335	25	90	63
TT	4	168	221	190.5
WP	97	48	289	196
WS	955	28	511	83
YB	189	17	345	149
YP	1509	41	315	120

4. Other management assignments and activities

Public engagement is critical for communicating the science and management practices of MassWildlife, and engaging stakeholders is important for recruiting anglers and support for recreational fishing. The Operations Biologist participated in multiple electrofishing demonstrations for various organizations, including boat and backpack demonstrations for USGS and UMass Amherst. In addition, multiple natural resource meetings were attended to increase outreach and collaboration (Northeast Climate Science Center, USFWS, USGS). Regular communication with other state agencies including DER, DCR, DOT, DMF, and DEP was integral for maximizing interagency collaboration and resource monitoring efficiency.

To update and maintain field equipment for fisheries sampling, new gear was budgeted for, and ordered. Major gear purchases and upgrades during FY 2019 include gillnets, boat electrofishing upgrades, a new generator for a portable electrofishing units (barge, portable crestliner, raft), a new backpack electrofishing unit, and a myriad of other items integral to fisheries surveys. Outboard motors and small engines (generators) were winterized and maintained according to manufacturer specifications.

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

VIII. Fisheries Staff Recognition/Publications:
Jason Stolarski, published a paper in the *Northeastern Naturalist* Vol. 26 Number 2, April 2019 Observations on the Growth, Condition, and Ecology of Lake Trout in Quabbin Reservoir, Massachusetts.

Fisheries Staff

Westborough Field Headquarters Staff

Todd A. Richards, Assistant Director, Fisheries
Richard Hartley, Environmental Review and Sportfish Awards Project Leader (No report submitted due to extended leave)
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, Ph.D., Chief Fish Culturist
Caleb Slater, Ph.D., Anadromous Fish Project Leader
Jason Stolarski, Ph.D., Watershed Project Leader
David Szczebak, Fisheries GIS Project Leader
Joseph Asta-Ferrero, Seasonal Employee
Joseph Boulia, Seasonal Employee
Adam Burt, Seasonal Employee
Eli Lagacy, Seasonal Employee
Nicole Harmon, Seasonal Employee
Lord Danielson , Seasonal Employee
Samuel Tawa, Seasonal Employee
Campbell Morgan, Seasonal Employee
Kyle Grasso, Seasonal Employee
Peter Rawinski, 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
Chris Kielbasa, Wildlife Technician (resigned October 2018)
Chris Paterson, Wildlife Technician
Megan Cruz, Wildlife, Technician
Christopher Marsden, Wildlife Technician (replaced Kielbasa)

Montague Hatchery Staff

John Williams, Manager
Holly Hubert, Assistant Manager
Chester Hall IV, Wildlife Technician
Joe Kendal, Wildlife Technician

Roger Reed Hatchery Staff

Daniel Marchant, Manager
Arthur Pellegri, Assistant Manager (retired)
Cameron Young , Wildlife Technician (transferred from Sandwich)

Sandwich Hatchery Staff

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

Sunderland Hatchery Staff

Charles Bell, Manager
Brian Guerin, Assistant Manager
Timothy Nye, Wildlife Technician
Andrew Ostrowski, Wildlife Technician
Richard Pecorelli, Wildlife Technician
Heather Sadler, Wildlife Technician

Wildlife

Michael Hugenin
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 is comprised 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 in order to enhance wildlife based recreation, 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 in order 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.

Aside from 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, 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 provide technical assistance on habitat assessments for proposed management on DCR and other public and private forestlands, serve as the wildlife representative on the agency's land acquisition committee, direct and coordinate with the University of Massachusetts and the USGS Cooperative Fish and Wildlife Research Unit on scientific wildlife research projects within the Commonwealth of Massachusetts. Project leaders and managers serve as the state representatives on the Northeast Association of Fish and Wildlife Agencies' various technical committees and Northeast Association of Wildlife Administrators respectively.

Habitat Program
John Scanlon, Habitat Program Supervisor

The Habitat Program is a component of the MassWildlife 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, prescribed burning, and tree clearing.

Habitat Program staff contract and administer these practices across >170,000 acres of Wildlife Management Areas (WMAs), and provide technical assistance to other public and private landowners interested in applied management

to conserve wildlife. In addition, Habitat Program staff assist the MassWildlife Realty Program and District offices with land acquisition, monitoring of >150 Wildlife Conservation Easements (WCE's) on >50,000 acres of private lands, and with providing technical assistance to private and other public landowners interested in enhancing wildlife habitat for native birds and mammals through forest harvesting operations. The Habitat Program also assists with reviewing and prioritizing applications for funding under the MassWildlife Habitat Management Grant Program.

The Habitat Program's objectives are to:

Provide a spatial and temporal distribution of habitats for birds, mammals, and other species of conservation concern (including but not limited to grassland, marshland, shrubland, young forest, and late-seral stage forest habitats) on WMA and WCE lands throughout Massachusetts.
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 Massachusetts Department of Conservation and Recreation (DCR) state forest and state watershed lands, town conservation lands, and private conservation lands (e.g., land trusts).

To achieve the first objective, the Habitat Program follows landscape composition goals for WMAs approved by the Massachusetts Fisheries & Wildlife Board that include 20-25% early-successional habitat (including 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 participate 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 conduct small scale invasive plant control efforts on WMAs in compliance with all local, state, and federal permitting requirements.

In addition, Habitat Program staff contract and administer 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 contract and administer commercial forest harvesting operations designed to create young forest habitat through a public, competitive bidding process in compliance with all local, state, and federal permitting requirements.

To accomplish the second objective, Habitat Program staff conduct technical reviews and site visits of proposed management activities on USACE, DCR, town, and private conservation lands. Two Habitat Program staff work in coordination with Natural Resource Conservation Service (NRCS) staff under the Working Lands for Wildlife initiative and the Young Forest Regional Conservation Partnership Program (RCPP) effort to conduct active management for early-successional habitats on private lands.

Project Accomplishments

Project Administration:

Habitat Program staff conducted biological monitoring, management planning, and applied active management practices at more than a dozen sites in FY2019 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 WMA's, 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 FY2019, Habitat Program staff conducted monitoring of herbaceous and woody vegetation on managed portions of the Herman covey WMA, Montague Plains WMA, Quaboag WMA, Tully Mountain WMA, and William Forward WMA totaling 350 acres (Table 1). Breeding bird surveys were conducted on five previously managed sites totaling 520 acres (Table 1). In addition, a unique archaeological survey of potential historical/cultural artifacts was conducted at the Fox Den WMA on 120 acres (Table 1).

Habitat Management Planning:

Habitat Site Plans were developed for two properties total-

Table 1. FY2019 Biological Monitoring Sites

Site Name	Town	Type of Monitoring	Acres
Birch Hill WMA	Bolton/Lancaster	Breeding Bird Survey	70
Bolton Flats WMA	Bolton/Lancaster	Breeding Bird Survey	80
Fox Den WMA	Middlefield	Archaeological Survey	120
Frances Crane WMA	Falmouth	Breeding Bird Survey	280
Herman Covey WMA	Belchertown	Vegetation Survey	110
Montague Plains WMA	Montague	Vegetation Survey	20
Quaboag WMA	West Brookfield	Vegetation Survey	20
Southwick WMA	Southwick	Breeding Bird Survey	90
Tully Mountain WMA	Orange	Vegetation Survey	120
William Forward WMA	Newburyport	Vegetation Survey	80
Total			**990**

ing 1,250 acres, and companion Fire Management and/or Prescribed Burn Unit Plans were developed at eight properties totaling 2,322 acres (Table 2) in FY2019. 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.

Habitat Management Practices:

Nearly 2,400 acres were treated with one or more management practices across 14 different sites by Habitat Program staff and contractors in FY2019 (Table 3). Specific practices for individual sites are described below.

Birch Hill WMA – Two wood products sales were completed, one of 55 acres to regenerate young forest habitat in an area of declining white pine plantations on upland glacial till soils, and one of 110 acres to restore pitch Pine/Scrub Oak barrens habitat on deposits of glacial sandy outwash soils.

Burrage Pond WMA - Invasive plant control for exotic grey willow occurred on 54 acres.

Dunstable Brook WMA – Ten acres of invasive plant control for black swallowwort was completed within abandoned field habitat maintained by northeast District staff.

Frances Crane WMA – Prescribed burning occurred on 160 acres of existing grassland habitat to maintain native warm-season grasses, and on 175 acres of open pitch pine/oak woodlands to promote a dense understory of scrub oak, blueberry, huckleberry and other native shrubs. An additional 150 acres of existing pitch pine/oak woodlands was treated to control invasive quack grass and stump sprouts from oak trees to favor native scrub oak and lowbush blueberry. Another 50 acres of open pitch pine/oak woodlands were cleared of blown-down trees that were uprooted in a significant Nor'easter storm in March of 2017. Removal of blown-down trees reduces fuel loads to allow application of prescribed burning to promote a dense understory of scrub oak, blueberry, huckleberry and other native shrubs. Many of the largest blown-down trees, including attached root balls, were transported to the Town of Falmouth Coonamessett Conservation Area to assist the Town and the Massachusetts Department of Ecological Restoration with reclaiming an abandoned cranberry bog wetland.

Herm Covey WMA – Prescribed burning occurred on 36 acres of existing shrubland habitat.

Jug End Fen WMA – Four acres of invasive plant control for phragmities occurred in the unique calcareous fen.

Table 2. FY2019 Habitat Management & Prescribed Fire Planning Sites

Site Name	Town	Plan Type	Acres
Birch Hill WMA	Royalston & Winchendon	Prescribed Burn Unit Plan	165
Hop Brook WMA	Lee	Prescribed Burn Unit Plan	160
Jug End Fen WMA	Egremont	Prescribed Burn Unit Plan	10
Mashpee WMA	Mashpee	Prescribed Burn Unit Plan	290
Montague Plains WMA	Montague	Habitat Site Plan Addition	20
Montague Plains WMA	Montague	Prescribed Burn Unit Plan	227
Muddy Brook WMA	Hardwick	Prescribed Burn Unit Plan	345
Noquochoke WMA	Dartmouth	Prescribed Burn Unit Plan	135
Quaboag WMA	West Brookfield	Prescribed Burn Unit Plan	680
Tully Mountain WMA	Orange	Habitat Site Plan	645
William Forward WMA	Newburyport	Prescribed Burn Unit Plan	310
Winimusset WMA	New Braintree & Barre	Habitat Site Plan	585
Total			**3572**

Leyden WMA – Invasive plant control occurred on 6 acres of abandoned orchard habitat, and 15 acres of prescribed burning occurred on previously restored (tree cleated) lowbush blueberry shrubland habitat.

Montague Plains WMA – Understory mowing/mulching occurred on 116 acres of open pitch pine/oak woodland to reduce fuel loads for future prescribed burning. Invasive plant control and treatment of stump sprouts from harvested tree oak occurred on another 112 acres of pitch pine/oak woodland to favor understory growth of scrub oak and lowbush blueberry. Prescribed burning was carried out on 17 acres of mixed grassland/shrubland habitat, and 6 acres of soil scarification was done to favor herbaceous plant restoration to diversify this barrens habitat for more native songbirds.

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 that is undergoing restoration for pine barrens habitat. A total of 584 acres was treated with a combination of tree mulching/mowing and fuel break mowing to recude fuel loads for future prescribed burning.

Muddy Brook WMA -Prescribed burning occurred on 115 acres of open oak woodlands to promote a dense understory of scrub oak, blueberry, huckleberry and other native shrubs, and an additional 150 acres of full-canopy oak-pine forest was heavily thinned to favor restoration of pitch pine/oak woodlands.

Quaboag WMA – A total of 15 acres of abandoned field that was highly infested with invasive exotic plants was cleared, stumped, harrowed, and planted to native warm season grasses. In addition, 9 acres of invasive plant control was done to suppress buckthorn and bittersweet in woodlands.

Southwick WMA – Tree clearing, harrowing, and seeding of native warm season grasses occurred on 31 acres to expand previously reclaimed grassland, and invasive plant control occurred on another 100 acres of open oak woodland and adjacent grassland to control quack grass and stump sprouts from harvested tree oak to favor understory growth of scrub oak and lowbush blueberry. In addition, 138 acres of prescribed burning occurred in previously restored native warm season grasses and adjacent shrublands.

Tully Mountain WMA – Invasive plant control was done to control common buckthorn within maintained abandoned field habitat.

Unkety Brook WMA – A total of 75 acres of young forest habitat was established through a wood products harvest in mixed white pine/oak forest that included areas of declining white pine plantations.

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

Table 3. FY2019 Habitat Management Sites

Site Name	Town	Habitat Type	Practice	Acres
Birch Hill WMA	Royalston	Young Forest	Tree Clearing	55
Birch Hill WMA	Winchendon	Pitch Pine/ Oak Woodland	Tree Clearing	110
Burrage Pond WMA	Halifax	Freshwater Wetland	Invasive Control	54
Dunstable Brook WMA	Tyngsboro	Abandoned Field	Invasive Control	10
Frances Crane WMA	Falmouth	Grassland	Prescribed Burn	160
Frances Crane WMA	Falmouth	Pitch Pine/ Oak Woodland	Prescribed Burn	175
Frances Crane WMA	Falmouth	Pitch Pine/ Oak Woodland	Tree Clearing	50
Frances Crane WMA	Falmouth	Pitch Pine/ Oak Woodland	Invasive Control	150
Herman Covey WMA	Belchertown	Shrubland	Prescribed Burn	36
Jug End Fen WMA	Egremont	Freshwater Wetland	Invasive Control	4
Leyden WMA	Leyden	Lowbush Blueberry Shrubland	Prescribed Burn	15
Leyden WMA	Leyden	Abandoned Orchard	Invasive Control	6
Montague Plains WMA	Montague	Pitch Pine/Oak Woodland	Prescribed Burn	117
Montague Plains WMA	Montague	Pitch Pine/Oak Woodland	Mowing	116
Montague Plains WMA	Montague	Pitch Pine/Oak Woodland	Soil Scarification	6
Montague Plains WMA	Montague	Pitch Pine/Oak Woodland	Invasive Control	112
Myles Standish Complex*	Carver	Pitch Pine/Scrub Oak Woodland	Tree Clearing & Fuel Breaks	584
Muddy Brook WMA	Hardwick	Pitch Pine/Oak Woodland	Prescribed Burn	115
Muddy Brook WMA	Hardwick	Pitch Pine/Oak Woodland	Tree Clearing	150
Quaboag WMA	W. Brookfield	Grassland	Tree Clearing	15
Quaboag WMA	W. Brookfield	Pitch Pine/Oak Woodland	Invasive Control	9
Southwick WMA	Southwick	Grassland & Oak Woodland	Prescribed Burn	138
Southwick WMA	Southwick	Grassland & Oak Woodland	Invasive Control	100
Southwick WMA	Southwick	Grassland	Tree Clear/Harrow & Seed	31
Tully Mountain WMA	Orange	Young Forest	Invasive Control	2
Unkety Brook WMA	Dunstable	Young Forest	Tree Clearing	75
Total				**2395**

lands where MassWildlfie owns development and public access rights. In FY2019, monitoring of Forest Management Plans and/or active Forest Cutting operations occurred at four properties totaling over 1,200 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 >2 ha 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:

The Habitat Program provided technical assistance to DCR by reviewing six proposed harvesting operations totaling 561 acres on state forest lands across Massachusetts in

FY2019 (Table 5). MassWildlife Habitat Program staff advocated for inclusion of >2 ha young forest openings, and for consideration of barrens restoration efforts where appropriate.

Lastly, Habitat Program staff provided technical assistance to Westfield State University Forest Resources class by conducting a field trip for students to on-going harvests at the Montague Plains WMA in Montague, and to the University of Massachusetts at Amherst Forest Ecology class by conducting a field trip to recently completed harvesting at the Muddy Brook WMA in Hardwick.

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

Wild Turkey:

Hunter participation:

In Massachusetts, a hunter who obtains a wild turkey hunting permit can harvest no more than 2 turkeys total in a calendar year. They have the option to harvest up to 2 bearded turkeys during the spring hunting season which then precludes them from fall turkey hunting. If one or zero turkeys are harvested in the spring hunting season, hunters may then have the opportunity to harvest one turkey of either sex during the fall hunting season.

In 2019, approximately 20301 regular (non-youth) wild turkey permits were issued prior to the spring hunting season. The number of spring turkey hunting permits issued in 2019 is similar to previous years and in excess of 20000 permits for the 8th consecutive year. Fall only permit (turkey permits issued after the completion of the spring season) issuance in 2018 was strong (4444) and similar to recent years demonstrating continued demand for fall turkey hunting opportunity.

Fall 2018 Harvest: The 12 day fall wild turkey hunting season occurred from 22 October – 3 November 2018. Fall season length was expanded from a 6-day to a 12-day season

Table 4. FY2019 WCE/WMA Compliance Monitoring

WCE Name	Activity	Town	Acres
Alford Springs WCE	Deed & Road Research for Abutter Access	Alford	10
Meadow Brook WCE	Trail Permitting	Plainfield	10
Westfield Water WCE	Forest Stewardship Planning	Montgomery	1200
Windsor Brook WCE	Fee-owner Wood Products Harvest	Dalton	50
Total			**1270**

Table 5. FY2019 DCR Harvest Proposal Reviews.

Property	Parcel	Town	Acres
Myles Standish State Forest	Norway Spruce Lot	Carver & Plymouth	62
October Mountain State Forest	Washington Lot	Washington	15
Savoy Mountain State Forest	Shear Pin Lot	Savoy	86
Templeton State Forest	Hadley Aiken Lot	Templeton	176
Townsend State Forest	Barker Hill Lot	Townsend	90
Windsor State Forest	Two Cubs Lot	Windsor/Savoy	132
Total			**561**

statewide, and expanded into WMZ's 10-12 in 2012. A total of 231 wild turkeys were harvested, which is slightly higher than previous years and the highest since 1999. Harvest in the 1st fall season of 1990 was 329.

There were 104 male and 127 female (55.0%) wild turkeys harvested during the 2018 fall hunting season. The proportion of females harvested in 2018 was comparable, but slightly higher to most years over the past decade (average of 50.8%). In the fall, sex identification of juvenile turkeys can be challenging to untrained hunters, so it is possible there is some bias where hunters report female harvests when actually they have harvested a juvenile male.

Archery hunters (including crossbow under special permit) continued to contribute a significant portion of the total harvest, accounting for approximately 30.7% of the total fall harvest; spring season archery hunters typically account for 7-8% of the total harvest. A large portion of this archery harvest can likely be attributed to archery deer hunters who are opportunistically harvesting turkeys. 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.

Hunter participation, weather conditions, and food availability may all influence the fall turkey harvest. Turkey population size, distribution, and particularly poult production and survival during the preceding summer months are factors that also greatly influence fall wild turkey harvest. However, archery deer season hunters appear to be opportunistically harvesting turkeys when the seasons overlap each fall. That said, overall fall hunter participation remains relatively unknown and is generally considered to be low relative to the number of total turkey permit holders. Further, sexing and aging of harvested fall turkeys is hampered by the inexperience or disinterest on the part of cooperating check station operators, many of which collected unusable or incomplete feather samples and inaccurate biological measurements.

Spring 2019 Harvest:

The 4 week spring wild turkey hunting season occurred from 29 April – 25 May 2019. A total of 2740 wild turkeys were harvested during the regular spring season, representing the lowest spring total harvest since 2015 but comparable to the recent long term average (average of 2810 over the past 10 years). An estimated 17.8% of permitted hunters were successful in harvesting at least one turkey during the spring hunting season. Approximately 4.3% of permitted spring turkey hunters harvested a season limit of 2 bearded wild turkeys. Based on hunter surveys, about 60% of turkey permit buyers actually hunt during the spring season.

Bearded hens accounted for less than 1% of the total spring 2019 wild turkey harvest. In fact, only 5 total hens were reported during the spring season indicated the potential for some substantial reporting bias, primarily associated with online reporting in all likelihood. Bearded hens have comprised <1% of the total spring wild turkey harvest over the past decade. Approximately 3.45 adults turkeys (77%) were harvested per juvenile males (22.4%). The ratio of adult males to immature males was lower than in 2018 (4.2), but higher than in previous years (2.38-2.73 from 2014-2017). It is likely that the high adult:immature ratio is due to hunter preference but also indicative of strong juvenile recruitment.

In 2019, harvest was highest in Worcester (n = 679), Franklin (n = 425), and Berkshire (n = 293) counties. Suffolk County (4 towns) is nominally within the open zone but is heavily urbanized and many areas are closed to hunting and firearm discharge by local ordinances. Spring turkey hunting season is now open for 4 weeks statewide, except for Nantucket which lacks evidence of wild turkeys and is closed to spring turkey hunting. Generally, western counties are showing reduced spring harvest while eastern counties are showing increasing turkey harvest. Again, the distribution of hunter effort may be greatly influencing this trend, however it is also quite possible that as habitat in western portions of the state are less productive and turkey abundance/turkey hunting interest is declining.

A near record proportion of spring turkey hunters (8.5%) harvested turkeys with archery equipment in 2019; 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.

2019 Spring Youth Turkey Hunt:

The annual mentored youth wild turkey hunt was held on 27 April 2019, on the Saturday immediately preceding the opening date of the spring hunting season. In order to participate, youths (ages 12-17) were required to complete a standardized training program and field exercise (pre-hunt workshop) conducted by participating sportsmen clubs and National Wild Turkey Federation chapters. Youths aged 12-14 were 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.

An estimated 249 youths received permits for the youth

turkey hunt day. Youths harvested a total of 61 turkeys (20 immature, 41 adult) on youth day, representing a success rate of approximately 24%. Youth success rates are typically greater than regular spring season hunter success.

Ruffed Grouse:

Drumming Surveys: In 2019, 18 of 29 random drumming survey routes established statewide were active and 11 were in constant zero status. Constant zero routes are ones where no grouse had been recorded in 5 consecutive years. All routes were surveyed between 15 April – 5 May. All but one (Route #3 Ashfield) constant zero route occurred in either the Northeast, Southeast, or Central wildlife district.

Overall, the average number of drums heard per stop (ANDS) per route on all random routes statewide in 2019 has been stable at 0.07 since 2016, but lower than previous years 2007-2015 (0.20-0.34). The ANDS per route in the Western District in 2019 improved to 0.16 representing the second year ANDS has increased. ANDS decreased slightly in the Ct. Valley and Central district compared to previous years. 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 2019 was 0.31, which is slightly lower than in 2017 and 2018 (0.40 and 0.49 respectively). However, the 3 year average has been stable the past three years (0.39-0.41). Grouse continue to be detected on a subjective route in the Southeast District (Route 41) and a new Subjective route in 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 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 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, may also be affecting grouse abundance during years with high West Nile Virus prevalence.

American Woodcock:

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

Currently, there are 19 randomized singing-ground survey routes in Massachusetts. Of those 11 were active in 2019. The average number of woodcock heard peenting per route (including constant zero routes) in 2019 was 1.26, below the long term 10 year average of 1.65. On the 11 active surveyed routes, a total of 24 woodcock were heard peenting, or 2.18 per non-constant zero route.

USFWS estimates harvest for woodcock through the Harvest Information Program (HIP). A sharp increase in hunter numbers and number of woodcock bagged occurred in 2011 coinciding with a 50% season length expansion. However, the estimated number of hunters and harvest has variable but slightly increasing 2012-2017 (approximately 1020 hunters and harvest of 2100). In 2018, HIP estimates resulted in a substantial increase in harvest (3500 birds) and hunter numbers (1400). Woodcock harvest appears to be slightly increasing in Massachusetts over the past 10 years.

New England Cottontail/Eastern Cottontail:

Pellet Surveys and Trapping:

DNA analyses were conducted on over 700 fecal pellet samples collected on >50 sites across areas of Barnstable, Plymouth, and Berkshire counties. All plots were surveyed from early January through April 2019. Plots were surveyed 1-2 times with 0-20 samples collected per plot. Results of the 2019 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 505 samples collected during the winter of 2018, 334 were from eastern cottontail, 151 were from New England cottontail, 14 were from snowshoe hare, and 1 was from a white-tailed deer. Five samples were not able to be processed successfully to yield a viable species identification. 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 New England cottontail pellet samples, with 137 NEC positive samples occurring in areas of Sandwich, Falmouth, Mashpee, Barnstable, and Bourne.

Live trapping of rabbits occurred at several properties on Cape Cod. Live trapping of rabbits occurred during January-February 2019 and again in March 2019. Several adult New England cottontail were trapped and successfully transported to Roger Williams Park Zoo for inclusion in re-

gional captive breeding efforts to enhance and augment imperiled cottontail populations in Maine, New Hampshire, and Rhode Island. Additional trapping in March was conducted to facilitate the stocking of New England cottontail on Noman's Island National Wildlife Refuge. Over 3 weeks, 20 rabbits were trapped on Cape Cod, all but 2 were New England cottontail. Four female and seven male New England cottontail adult rabbits were trapped and eventually stocked onto Noman's NWR. The status of the stocked rabbits is currently unknown.

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 2017-18 was relatively mild and wood ducks and hooded mergansers began nesting earlier than normal. However, similar to the last two years, there was a cold snap the first week of April and pre-incubated eggs were subject to addling. Eggs were left with longitudinal cracks indicative of freezing. Some entire clutches were abandoned. Some clutches with a few eggs laid after the freeze hatched leaving many addled eggs behind.

Wood duck nesting attempts declined with only 237 nest starts compared to 274 last year, 275 in 2016 and well below the 297 in 2014 and 321 in 2013. There were 201 hatches compared to 217 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 both the Western and Connecticut Valley study sites. Hooded mergansers, a species that had increased substantially over the past two decades, had 108 nest starts, down from 112 nest attempts last year, with 84 hatches, similar to last year's 88 hatches. Overall box use was 69% compared to 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 67 sites in 61 cities and towns in Massachusetts. The state total included 413 goslings and 387 adults. Crews also captured an additional 191 previously banded geese.

For the 2018 airboating season we made a strong attempt to reach the elusive goal of banding 1000 birds by nightlighting, an accomplishment achieved only 5 times in 48 years of airboating. We scheduled 20 nights of boating on 17 sites. That would have been the greatest number of trips since 1998 when we managed to boat on 24 nights. (We boated 13 sites in 17 nights last year and only 9 nights of boating 8 sites in 2016.) We ended up banding 826 birds by airboating nightlighting and captured 66 previously banded ducks but were thwarted in part by damaging the airboat engine cage on our last night out and were unable to band at the Ipswich River Sanctuary in Topsfield on our last planned night. We last boated the area in 2015 but during the previous 10 years had always captured between 90 and 160 ducks and had high hopes for 2018. We banded an additional 140 mallards by use of a tub launcher during 23 attempts at 21 sites where ducks were being fed for a total of 967 birds. Among birds banded, there were 672 Wood Ducks, 276 Mallards, 12 Green-winged Teal, 3American wigeon blue-winged teal, 1 hooded merganser, and 1 Virginia rail.

During the period of September 4-21, Massachusetts conducted a state-wide 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 50 days with a three-bird bag limit in the Berkshire zone for Atlantic Population (AP) geese.

During the period January 15—February 5, 2019, Massachusetts held a late, resident Canada Goose season in both the Central Zone and the North Coastal Zone with a five-bird daily bag in each zone.

Postseason banding of wintering Black Ducks continued as part of an experiment to determine if two-season Black Duck banding efforts can improve the precision for Black Duck survival rates. Also of interest was the increase in the black duck bag limit from 1 to 2 after 35 years. All Mallards and Mallard x Black Duck hybrids could be banded and broken down into five plumage types. Bait-trapping was carried out at 14 coastal sites in 7 towns from the New Hampshire to the Rhode Island borders. Trapping was carried out in January and February 2018. The winter of 2018-19 was warmer than normal with higher rain fall and less snow than average. There were two brief periods of extreme cold but each was followed after a couple of days by mild temperatures reaching into the 50s. Black duck banding was restricted to the Southeast Wildlife Management District. Totals of 411 American Black Ducks, 15 black-plumaged hybrids, 3 intermediate type, 1 Mallard-plumaged hybrid were banded. In addition, there were 90 previously banded birds captured.

In addition to Black Duck focused banding we also put emphasis on winter banding mallards in light of the move to reduce the mallard bag limit from 4 to 2 due to declining breeding populations in the Atlantic Flyway. While some mallards were banded incidental to black duck banding, this year we targeted mallards wintering at sites where they

were artificially fed, an important component to wintering habitat for mallards in the Northeast. We used a bait trap at one site but primarily used a tub launcher loaned by the Wildlife Services section of the USDA's APHIS program. The tub launcher was used at 13 sites. A total of 314 mallards were banded by all methods.

During April and May, we participated in the Northeastern states' waterfowl breeding survey, which is based on sampling randomly selected 1-kilometer-square plots. This year's Massachusetts' survey was incomplete as we were unable to check some offshore plots due to being unable to schedule flying time. We were able to check by boat two of the 7 plots normally flown. For the flyway, 1,307 plots were checked in this year's survey. Eleven states participated in the 2019 breeding pair survey for waterfowl. The population estimate for mallards was 267,566 pairs+ 41,262. The estimate for black ducks was up substantially at 25,222 pairs +10,100; wood ducks, 191,801 pairs + 35,008 and Canada geese, 363,086 pairs + 52,120. 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 assistant of a volunteer boat operator. We banded 20 hens on Tenpound Island in Gloucester, 1 on Eagle and 14 on Cat Island both in Salem. An additional 14 were banded on Penikese in Buzzards Bay where 7 previously banded hens were also captured.

Massachusetts issues individual egg-addling permits for resident Canada goose control under a federal program begun in March 2007. In 2018, we issued 57 such permits, all but 4 of which were returned. The permittees reported addling 1,356 eggs in 304 nests, while USDA/APHIS Wildlife Services addled 472 eggs in 104 nests under their statewide permit.

This year, Massachusetts hosted the summer meeting of the Atlantic Flyway Council technical and council meeting in Plymouth, September 24-28 and the project leader also attended the winter meeting of the Technical Section held in Kittyhawk, North Carolina February 24-28. The project leader is a member on the Mallard, Black Duck, and Canada goose committees as well as voting representative for Massachusetts.

Black Bear Program
Dave Wattles, Black Bear Program Leader

Black Bear Distribution and Harvest Investigations:

A near record total of 15,005 bear-hunting permits were issued for the 2018 hunting season. A total of 204 bears were taken during the 48-day season, including 152 during the 17-day September segment, 19 during the 18-day November segment, and 33 during the 12-day deer shotgun season segment. One hundred and one males, 101 females and 2 unknown were taken in Berkshire (n=78), Franklin (n=41), Hampden (n=47), Hampshire (n=22), Worcester (n=13), and Middlesex (n=3) counties. Eighty two percent of bears were reported through the online system in 2018, compared to, 70% in 2017, 76% in 2016, 66% in 2015, 74% in 2014, and 69% in 2013. Results from the 2018 Annual Hunter Survey showed that 29% of respondents reported that they purchased a bear hunting permit in 2018 and 22.1% reported they hunted bear during the 2018 season. Of hunters that reported hunting bear, 66.9% did so while hunting other game and 33.1% specifically targeted bear. Thirty four percent of bear hunters hunted during the September bear only season, 69% 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 7.7% of those hunters only targeting bear. There were 80 additional confirmed mortalities in CY 2018. These mortality records are collected by Massachusetts Division of Fisheries and Wildlife staff and through Environmental Police call logs and included: 59 road-kills; 11 bear taken under M.G.L. Ch. 131, Sec. 37; 3 euthanized due to injuries; 3 public safety kills; 2 illegal kills; 1 disease; and 1 of unknown cause. MassWildlife received 367 bear calls and the Massachusetts Environmental Police received 399 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 three bears were harvested during the new deer shotgun season in 2017 (93 in 2017, 47 in 2016, and 59 in 2015).

Black Bear Research:

The Massachusetts Division of Fisheries and Wildlife continues to monitor collared female black bears as part of a cooperative research project with the Massachusetts Cooperative Fish and Wildlife Research Unit and the University of Massachusetts Amherst. The primary objectives of this research project are as follows: (1) to refine the population model for evaluating population trends of bears in Massachusetts; (2) to document black bear habitat use and movements in a fragmented landscape and to determine the effects of human-associated food sources on bears, (3) to assess the public's attitudes and perceptions of the bear population and bear management options, (4) to develop a comprehensive bear management plan to guide black bear management in Massachusetts. As of June 30, 2019, 19 female bears were being monitored with GPS collars and another 22 females with VHF collars. To date, 53 female bears have been monitored with GPS collars, of which most have been monitored for at least 2 reproductive seasons. Additionally, 4 male bears have been monitored with GPS

collars. In 2017 we began collaring bears in our Western Wildlife Management District. MassWildlife monitored cub production/yearling survival at all successful winter dens or through encounters with sows/yearlings. In May 2019 we initiated a new project to estimate the bear population and calculate bear densities throughout the state using hair snares and genetics. To accomplish this we deployed 122 hair snares throughout western and central Massachusetts and as of June 30, 2019 had collected 610 hair samples at the snares.

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 1,755 furbearers were tagged at MassWildlife check stations during the 2018-19 season. The harvest (a combination of hunted, trapped, and/or salvaged) of tagged species included 567 beaver, 109 bobcat, 759 coyote, 109 fisher, 32 gray fox, 18 mink, 35 river otter, and 114 red fox. Trapper survey results indicated that a minimum of 97 raccoons, 32 muskrat, 23 skunks, 20 opossum, and 2 weasel were trapped during the 2018-19 season.

Division staff conducted a hunter survey of a random sample of license buyers that provided an email address in 2018. Coyote is the most popular furbearer that is hunted. Twenty-five percent of respondents indicated that they hunted coyote, and 39.3% of those respondents specifically targeted coyotes. Six percent of all respondents hunted fox, 5.3% hunted bobcat, 2.4% hunted raccoon, and 2.4 % hunted opossum. Bobcat, coyote, and fisher sighting questions were added to our annual hunter survey in order to calculate sightability rates by town and wildlife management zone. Results of those data indicate that coyote are common throughout the state, bobcat numbers appear to be increasing and expanding into more developed eastern zones (9, 10, and 11), and fisher appear well adapted to suburban areas, with our highest sighting rates currently occurring in the eastern WMZs.

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

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

Wetland/Beaver Management:

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

Licensed trappers tagged 567 trapped beaver during the 2018-19 trapping season, of which 125 were reported as

taken under emergency permits. PAC Agents reported taking 187 beaver outside the trapping season (April 15, 2017 - October 31, 2017) and 101 beaver during the trapping season under emergency permit. Licensed trappers reported through the voluntary trapper survey that 246 beaver were taken under the local Board of Health 10-day Emergency Permit, which includes beaver taken outside the season (n=169) and only beaver taken during the season that were not sealed at a MassWildlife check station (n=77). In total, a minimum of 356 beaver were taken outside of the trapping season as nuisance animals. A minimum of 433 beaver were taken under emergency permits (either inside or outside the trapping season) for which conibear traps are legal to use and are the preferred trap type for beaver trapping.

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

Furbearer Depredation and Damage:

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

Deer Management Program
David Stainbrook, Deer and Moose Program Leader

Harvest and Population:

The statewide 2018 harvest of 14,551 deer represents the highest harvest ever reported in Massachusetts (Fig. 1). The 2018 total harvest was about 9% higher than the 2017 hunting season and 24% higher than the previous 5-year average. The record breaking harvest was attributed to rising deer numbers, a rise in shotgun season harvests, and great hunting conditions with snow cover during much of the shotgun and primitive seasons. We have also kept antlerless deer permits low for about 10 years in zones 1-8 to allow deer numbers to slowly rise, which they have. We are now making adjustments in many of these zones to increase antlerless deer permits to stabilize deer numbers. 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 50 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

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

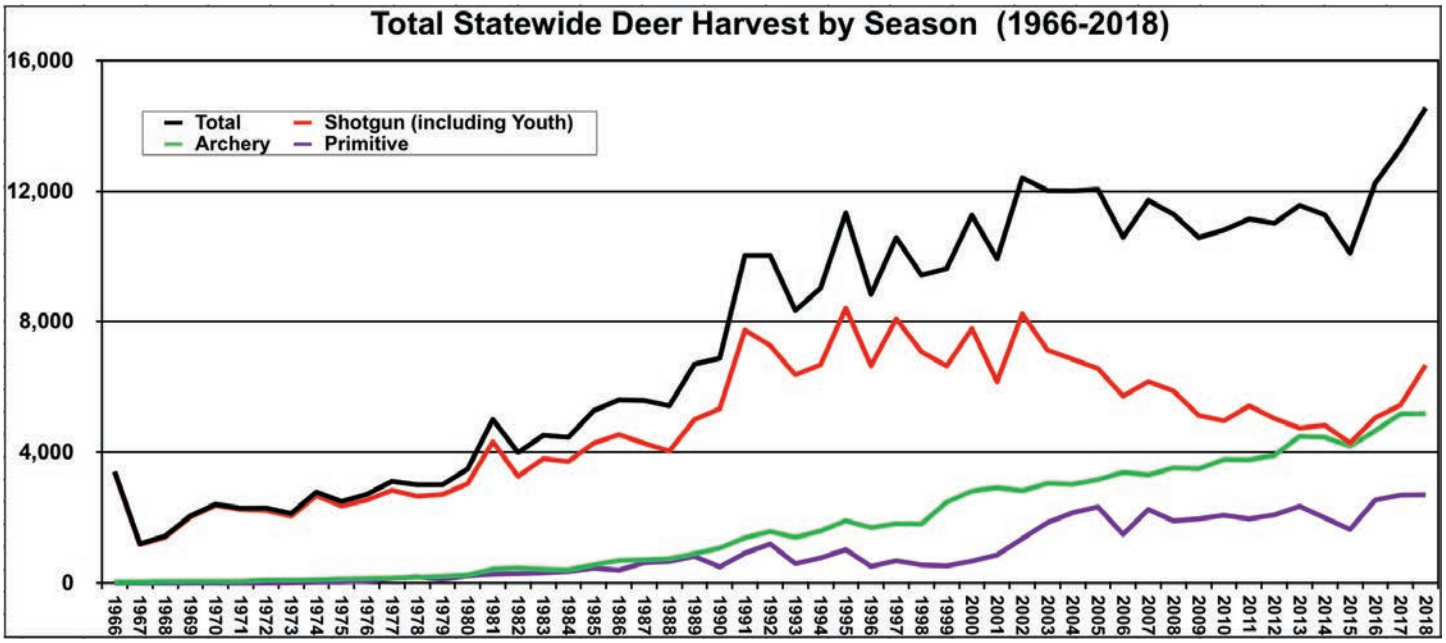


Table 6. The 2018 white-tailed deer harvest by season and sex/age class in Massachusetts, including Quabbin harvest.

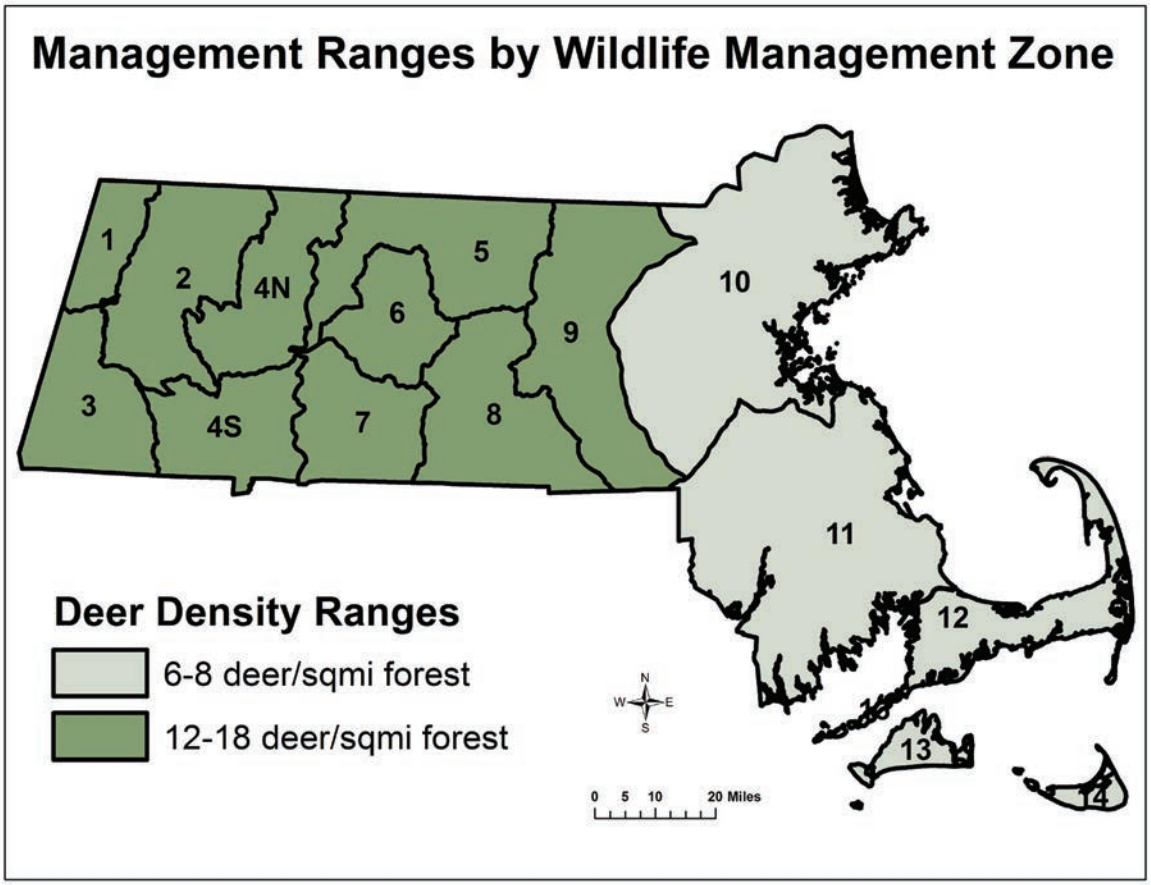
Season	Adult Male	Female	Button Buck	Total	Percent Harvest
Paraplegic/Youth	53	75	13	141	1%
Archery	3,242	1,638	303	5,183	36%
Shotgun	3,641	2,285	570	6,496	45%
Primitive	1,243	1,239	214	2,696	18%
State	**8,199**	**5,247**	**1,105**	**14,551**	**100%**

Table 7. The 2018 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	2018 Allocation	2018 Issued
1	304	85	14	403	Stabilize	500	488
2	438	97	6	541	Stabilize	250	246
3	462	180	28	670	Stabilize	1,400	1,419
4N	456	154	16	626	Stabilize	500	519
4S	298	68	11	377	Stabilize	400	427
5	487	186	31	704	Stabilize	1,250	1,241
6	111	34	2	147	Increase/Stabilize	300	295
7	411	251	47	709	Stabilize	2,250	2,136
8	596	250	40	886	Increase/Stabilize	2,500	2,502
9	787	557	114	1,458	Reduce/Stabilize	4,800	4,690
10	1,220	1,193	238	2,651	Reduce*	12,000	11,845
11	1,774	1,292	296	3,362	Reduce	12,000	11,863
12	181	101	17	299	Stabilize	1,000	1,002
13	355	426	119	900	Reduce*	2,700	2,000
14	299	363	121	783	Reduce*	2,700	1,550
Statewide	**8,179**	**5,237**	**1,100**	**14,516**		**44,550**	**42,223**

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

Figure 2. The 2018 map depicting management ranges for the 15 Wildlife Management Zones (WMZs) in Massachusetts, which satisfy the statewide deer management goal of keeping deer densities below the level where major impacts are seen to the habitat, but in balance with social desires/tolerance. *NOTE: in May 2019, the fish and wildlife board approved a management range of 12-18 deer/sqmi forest in all WMZs.



to harvest an antlerless deer in any deer season. The ADP system regulates female harvest across all Wildlife Management Zones (WMZ; Fig. 2). Overall, we've met or are very close to our deer density management ranges in the western and central parts of the state (Figs. 2 and 3). However, some areas in the central WMZs appear to be on the lower end of our management range, so antlerless permit allocation has remained at a low level to stabilize or increase numbers, which led to fewer deer being harvested in those zones (Fig. 1 and Table 2). Conversely, deer densities in the eastern part of the state are still above our management range, so antlerless permit allocations have remained high in an effort to increase the harvest of females. However, challenges still remain in eastern MA because of the lack of hunter-access, which limits our ability to reduce deer numbers.

The ADP allocation for 2018 was 44,550 permits. However, 42,223 permits (95% of allocated) were actually purchased/issued in 2018 (Table 2). 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 play and pay than in previous years. Prior to 2012, we were typically issuing above 95% of the allocated permits in most zones. The decided solution, beginning in 2014, was to adjust the antlerless permit allocation model to compensate for the significant proportion of applicants that do not come back to play and pay 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 play and pay.

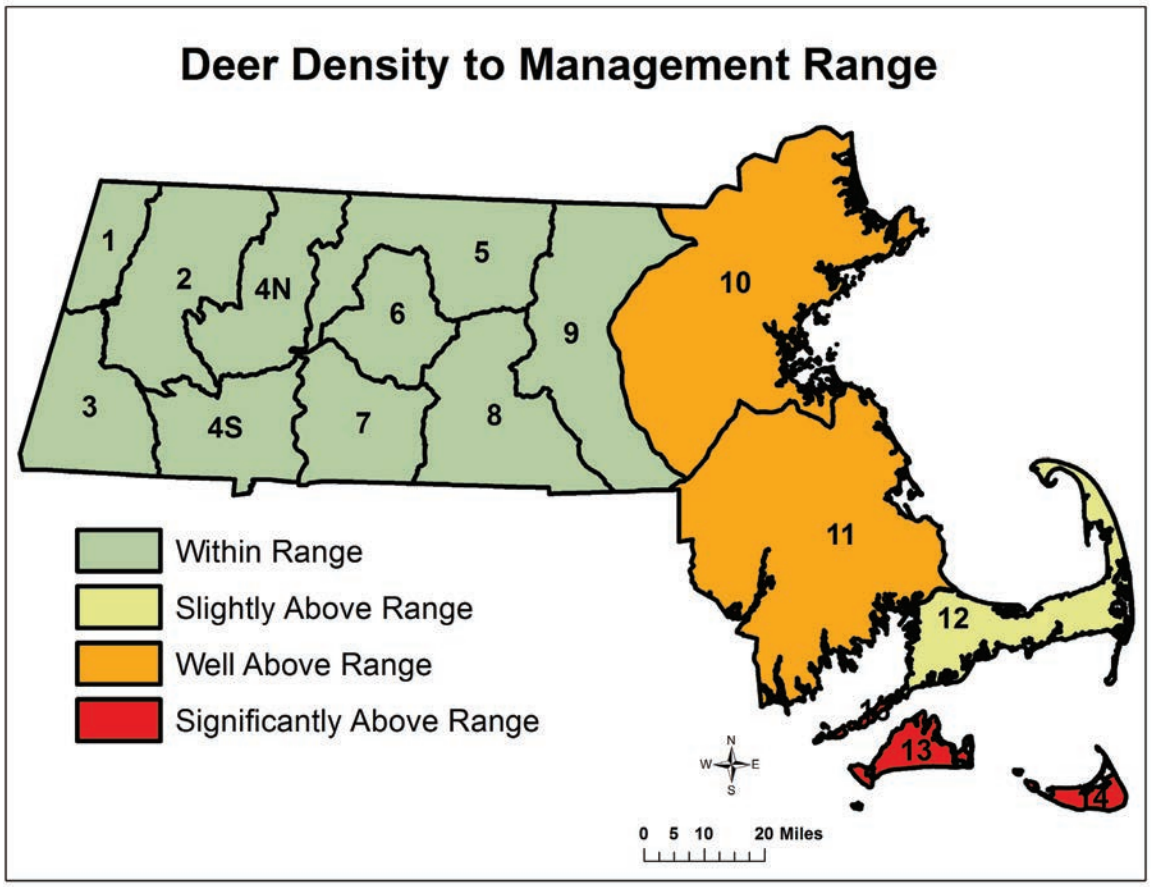
Research:

No deer-related research projects occurred in FY 18/19.

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 MA in 2018. Fewer than 10 disease suspect samples were taken and tested in 2018, 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.

Figure 3. Map depicting how the current deer densities relate to the management ranges for the 15 Wildlife Management Zones in Massachusetts. *NOTE: in May 2019, the fish and wildlife board approved a management range of 12-18 deer/sqmi forest in all WMZs, which means that zone 12 is now within the range.



Moose Program (David Stainbrook, Deer and Moose Program Leader)

Traditionally, MassWildlife has collected reported data of moose-vehicle accidents (MVA). In 2018, 27 MVAs were reported. However, MVAs are not always reported to MassWildlife or to the MA 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 Fig. 4; reporting rate is likely low in 2007-2009). Nonetheless, these indices can be useful for biologists to use, along with other population trends, to monitor moose relative abundance and trends in Massachusetts. The number of reports per town can be useful when making decisions about areas to focus on with signage on highways (Figure 5). 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 1000 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 (Fig. 6). The two maps (Figs. 5 & 6) were created from completely independent sources of information, yet show very similar spatial trends, thus providing more confidence in these methods.

Figure 4. Total moose-vehicle accidents reported per year from 1980 to 2018 in Massachusetts.

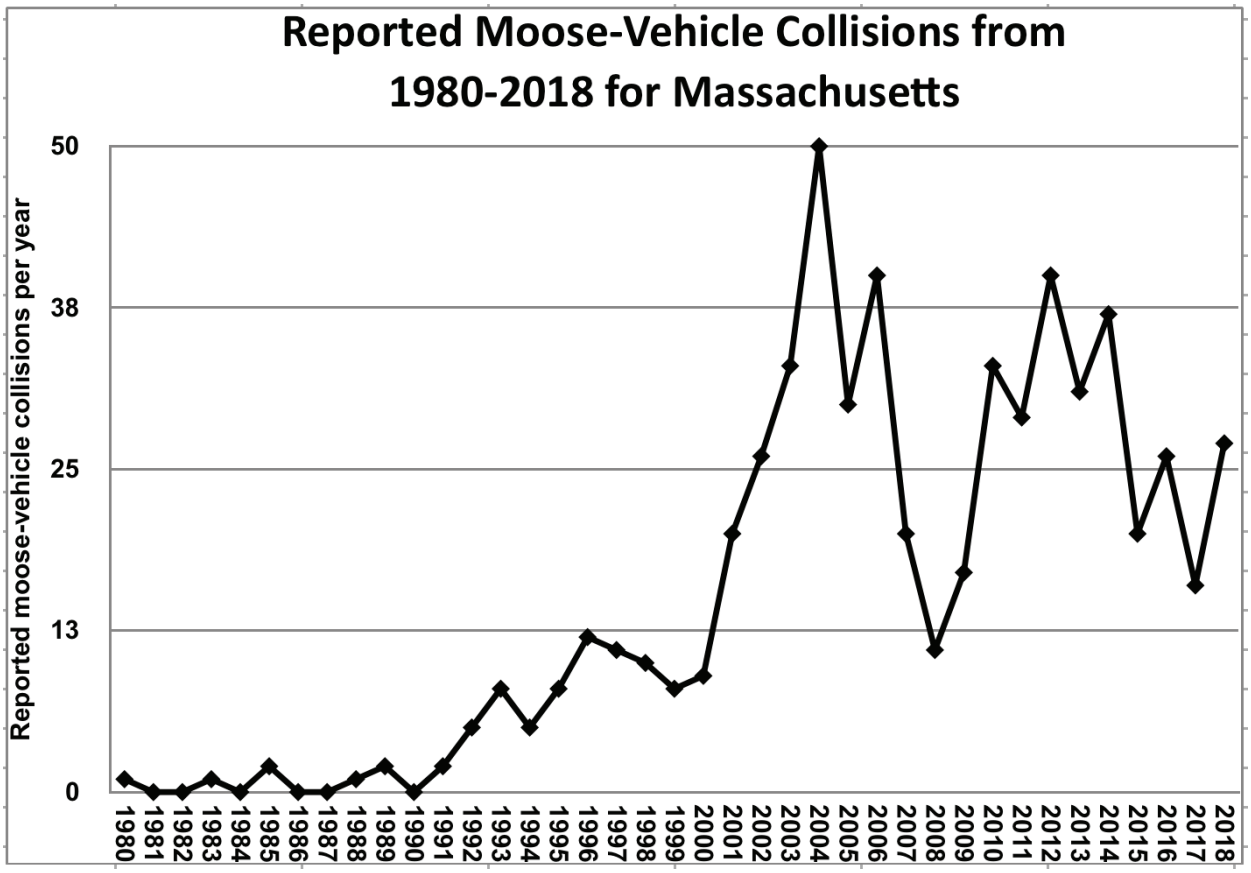


Figure 5. Total moose-vehicle accidents reported by town from 1980 to 2018 in Massachusetts.

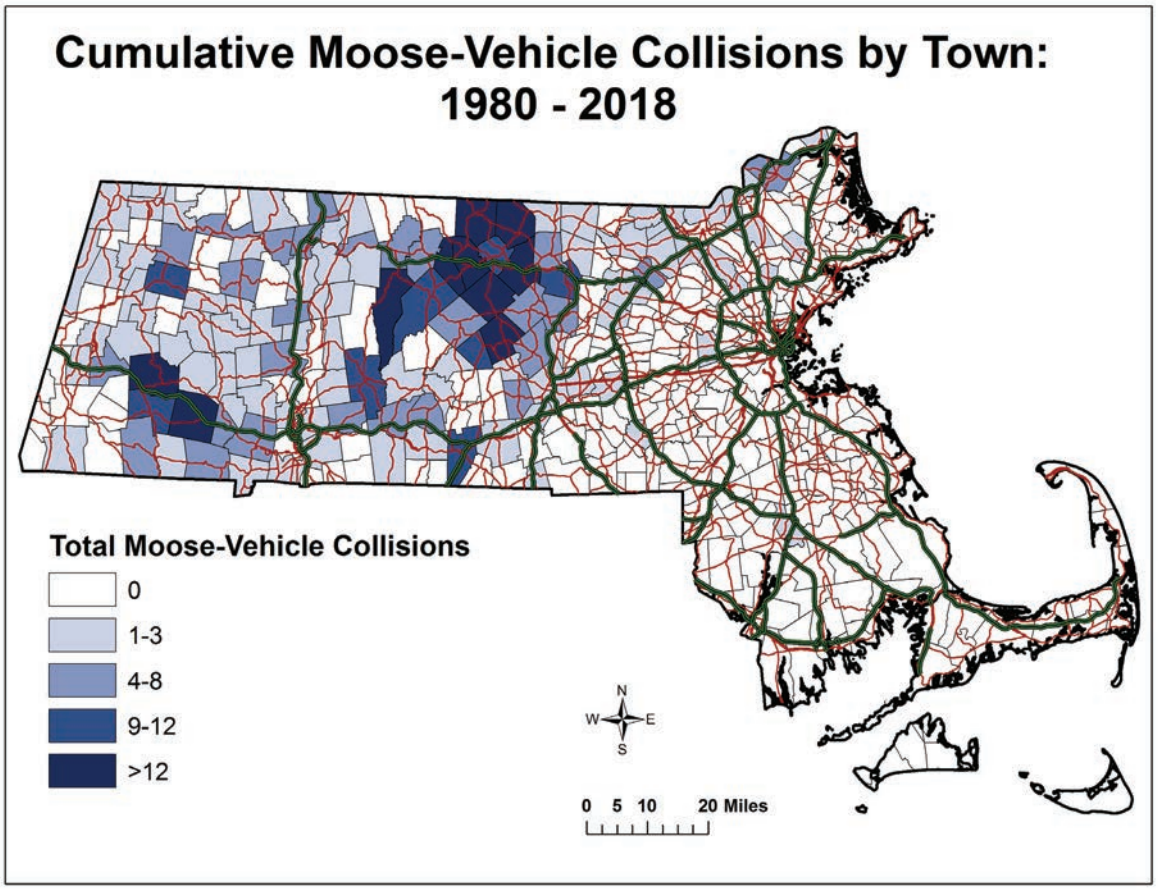
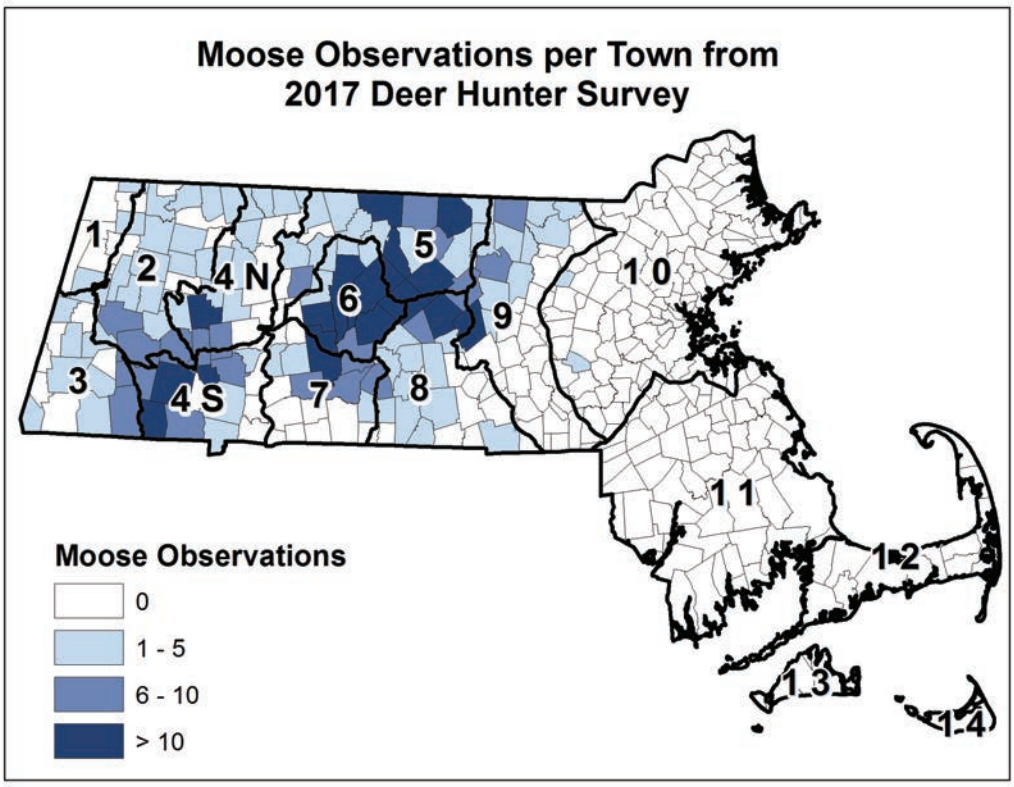


Figure 6. Observations of moose by town reported in the 2017 hunter survey in Massachusetts. The 2018 moose sighting data from the hunter survey had not been analyzed at time of publication.



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 Animal Report Form. The data collected include; date, species, town, and report type (sick or injured animal, aggressive animal, property damage, depredation, etc.). Reports come in the form of phone calls and emails from the general public. Reports are recorded as given by the individual therefore, are not considered accurate with regards to species identification or the circumstances of the incident. In other words, the data collected are meant to represent the public's perception of a conflict or interaction with wildlife. In 2015 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 unso-

licited 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 308 of 351 towns across Massachusetts, amounting to 2,091 total reports submitted from July 1, 2018 through June 30, 2019 (Fig. 1). Ninety-nine percent of records (2,077) contained one or more species (9 reports contained more than one species recorded), 99% (2,078) contained a report type, 88% (1,839) contained a concern type other than "no concern", and 94% (1,965) contained a town.

We received reports of 47 different species, of which 12 made up 85% of all reports (Fig. 2). We received more reports in June (341, 16%) than any other month followed by May (255, 12%), July (249, 12%), and August (234, 11%) (Fig. 3). Of the 2,078 reports containing a report type, the highest number of reports were animal sightings and/or requests for general information (1,481, 71%), the second highest number of reports were of wildlife using and/or damaging property (1,181, 57%), and the least number of reports were those regarding public safety (87, 4%). Reports regarding threats to public safety included: wildlife approaching humans and/or pets on a leash, aggression toward humans, and human attacks. Of the 87 reports of threats to public safety, 2 were reported as human attacks involving a coyote (1) and a raptor (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

Figure 7. Map depicting total reports of human-wildlife interactions per square kilometer throughout Massachusetts.

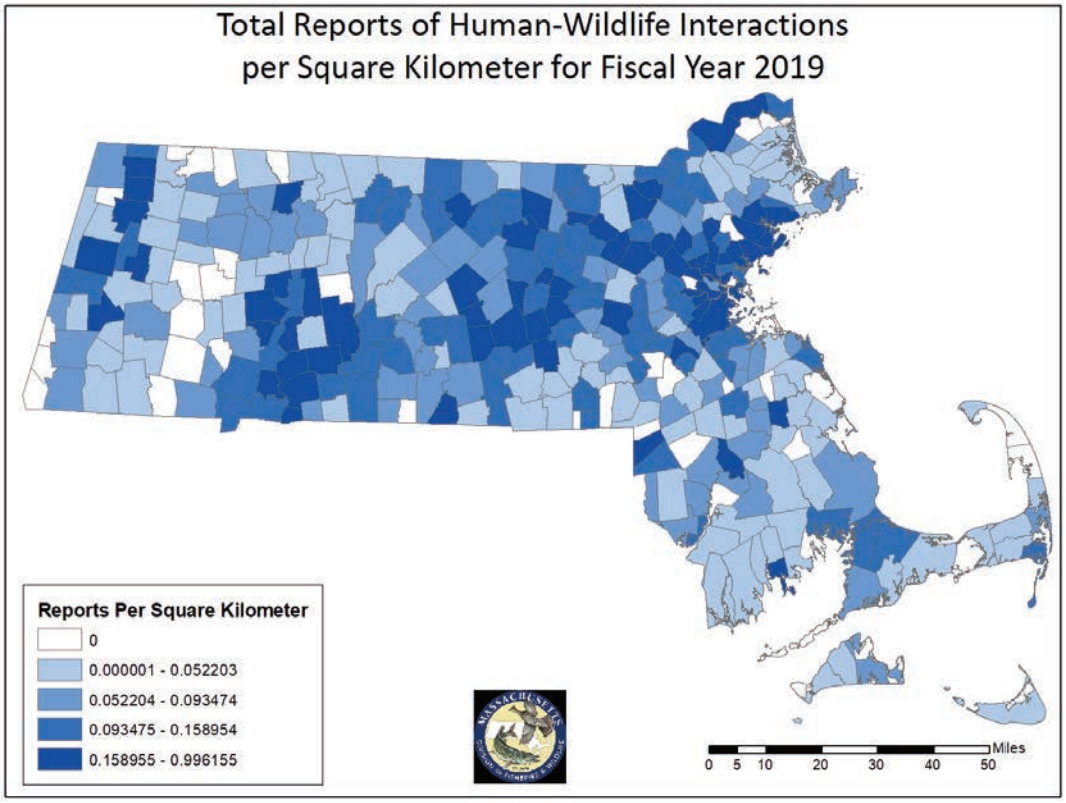


Figure 8. Top 12 species that were reported to MassWildlife offices as being involved in human-wildlife interactions in Massachusetts between July1, 2018 and June 30, 2019.

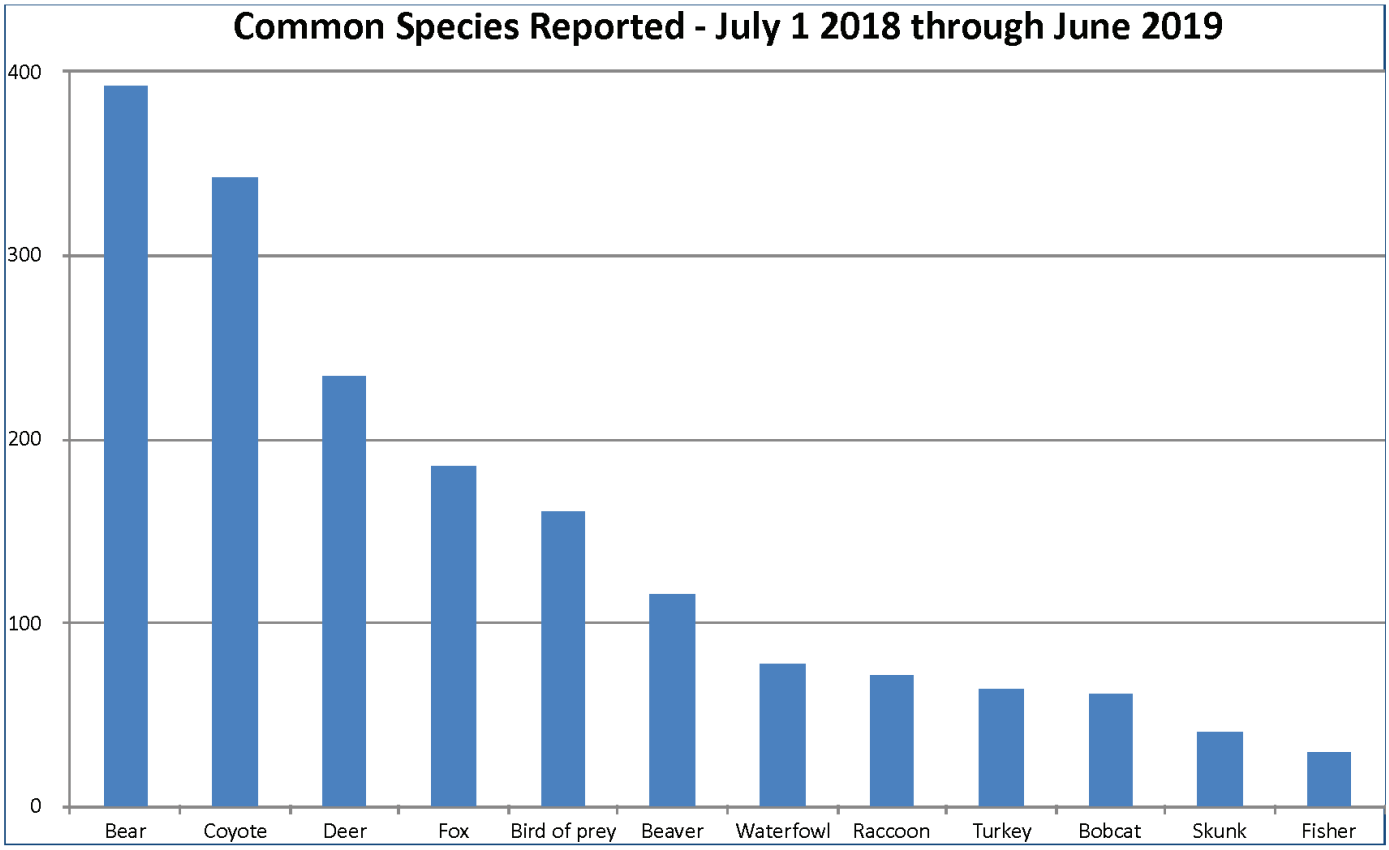
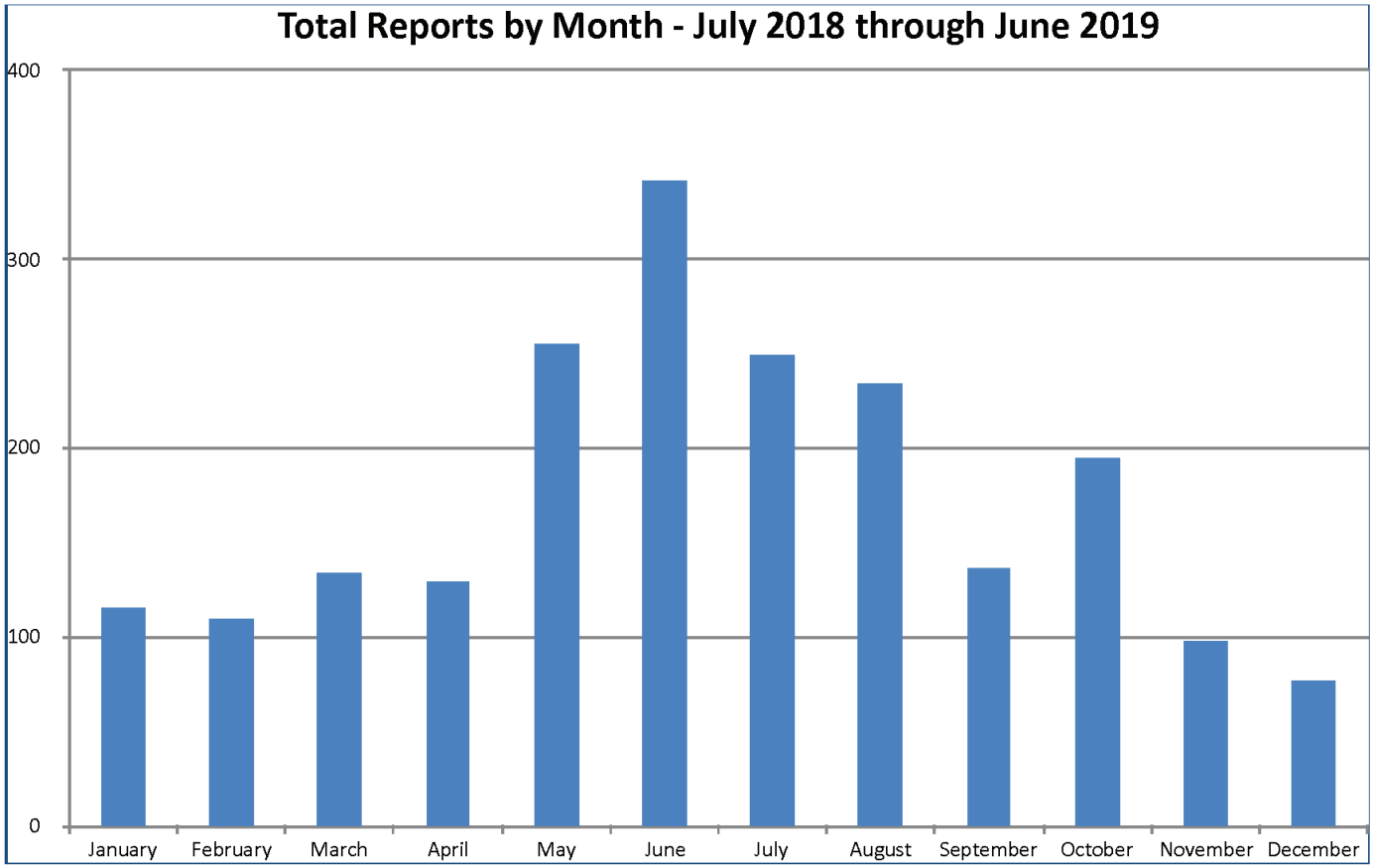


Figure 9. Total reports of human-wildlife interactions by month in Massachusetts between July1, 2018 and June 30, 2019.



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 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 are 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 Report
Andrew Vitz, State Ornithologist, Ph.D.

American Kestrel Project

The DFW and partners continued the American Kestrel project that was initiated in 2013 in hopes of reversing their rapid decline in the state. Kestrels nest across Massachusetts and are most common in the Connecticut River Valley and other areas with extensive agriculture. 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, MA Department of Transportation, MA Department of Conservation and Recreation, The Trustees of Reservation, Essex County Ornithological Club, East Quabbin Land Trust, Grafton Land Trust, The 300 Committee, the University of Massachusetts, and a few dedicated volunteers (e.g., Ron Rancatti, Ed Neumuth).

In 2019, MassWildlife and partners maintained and monitored 160 kestrel nesting boxes. Although we are waiting to get results from a few collaborators, we documented that 32/111 (30%) were used by kestrels for nesting. Nest boxes in cranberry bogs in southeast Massachusetts had a 23% (7/30) occupancy rate (Joanne Mason – Keeping Company with Kestrels), CT Valley boxes had a 43% (13/30) occupancy rate, and 27% (9/33) of boxes in central Massachusetts were occupied by nesting kestrels. As in prior years, occupancy rates remained low in northeastern Massachusetts (3/18) but successful boxes were located at the Strawberry Hill reservation (Ipswich), Newburyport, and an agricultural property in Dracut.

In addition to monitoring nesting success, we banded chicks prior to fledging from boxes. During 2019, 61 nestlings were banded in the state with MassWildlife staff banding 21 chicks. Licensed kestrel banders Anthony Hill (27) and Joanne Mason (13) banded kestrel chicks in the Connecticut River Valley and southeast Massachusetts, respectively. 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.

Young Forest/Songbird Project

We initiated a project to examine the bird community using young forest habitat created through forestry practices during the nesting and post-fledging periods. Five young forest sites created through forestry were sampled for the project in July-August of 2018. All sites were located in Worcester County and were at least 5 acres in size. Sites included the Muddy Brook Wildlife Management Area (Hardwick), three sites owned and managed by the city of Worcester (2 in Holden, 1 in Paxton), and a private parcel (Winchendon). At each site, 9 mist-nets were established 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 net, 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 (taking a ratio young-of-the-year/ adult birds).

In total, 899 unbanded birds of 49 species were captured

with the most commonly captured species being Gray Catbird (173), Baltimore Oriole (72), Chestnut-sided Warbler (69), Common Yellowthroat (67), and Cedar Waxwing (60). In addition, we recorded 128 recaptures of previously banded birds from this project. One surprising result was the capture of four Tennessee Warblers, a boreal forest nester with the closest portion of their breeding range in northern New Hampshire. As all of these individuals were actively molting their flight feathers, it is suspected that they were undergoing a molt-migration where they initiate an early migration only to stop to molt south of the breeding grounds. This pattern is well supported in songbirds in the western United States but is not well documented in the eastern portion of the country. In general, an impressive diversity of early and late successional species were 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.

Avian Response to Brimfield Tornado

In June 2017, we participated in shrubland bird surveys in young forest habitat created by the 2011 tornado that moved in a linear path from Westfield to Sturbridge. Early successional forests have become increasingly scarce in Massachusetts (<4% of forest habitat), and many of the bird species that rely on this type of habitat are declining and are listed as species of conservation concern under our State Wildlife Action Plan. To better understand avian response to the natural disturbance caused by the tornado, automated audio-recorders were deployed during the 2017 nesting period to document the breeding birds at sites within three treatment groups (tornado-impacted areas, tornado-impacted areas that were salvage-logged, adjacent mature forest not directly impacted by the tornado). These data (10 minute audio recording around dawn and dusk) will supplement the same type of data that was collected at the same points between 2012-2014.

During 2018, data was extracted from the audio recordings collected in 2017. Although data analysis on this project is ongoing, the basic summaries are informative. In the tornado impacted areas some of the common early successional species (e.g., Prairie Warbler, Indigo Bunting) that had shown stable occupancy between 2012-2014 were substantially less common by 2017. Interestingly, as some young forest species declined, the Eastern Whip-poor-will increased dramatically in tornado impacted areas in 2017 and was documented at over 80% of points. Also, most young forest nesting birds continued to increase (e.g., Field Sparrow, Chestnut-sided Warbler) or remain stable (e.g., Prairie Warbler) in the tornado impacted but salvage logged sites. As expected, all years of data demonstrate that the control areas were heavily dominated by mature forest nesting birds with very few or no detections of the young forest breeding birds. This was in contrast to the tornado impacted areas that had high occupancy rates of both young forest and mature forest nesting birds.

Wildlife Staff

Westborough Field Headquarters Staff

Michael Huguenin, Assistant Director of Wildlife
Erik Amati, Wildlife Biologist
Jonathan Brooks, Wildlife Population Ecologist
Fletcher Clark, Habitat Biologist
Patrick Conlin, Private Lands Habitat Biologist
Brain Hawthorne, Habitat Planning Coordinator
H Heusmann, Waterfowl Project Leader
Ben Mazzei, Habitat Biologist
Bridgett McAlice, Wildlife Biologist
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

An elusive bobcat caught by a camera trap.

Photo by Bill Byrne/MassWildlife

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 has a total of 31 staff members distributed primarily among three sections: Conservation Science, Information Management, and Regulatory Review. Conservation Science staff are responsible for determining the abundance and distribution of rare species in Massachusetts through field inventories and biological research and the planning and implementation of conservation efforts for rare species and their habitats. The Information Management Staff are responsible for the development and management of biological data in the NHESP's expansive tabular and spatial databases. The Regulatory Review staff assesses the potential impacts of proposed projects or activities to federally- and state-listed species and their habitats and provides guidance on avoidance, minimization, and mitigation measures. The NHESP's highest priority is protecting the native species that are listed as Endangered, Threatened, or of Special Concern in Massachusetts pursuant to the Massachusetts Endangered Species Act (MESA; M.G.L. c. 131A) and it's 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 (Special Concern ↔ Threatened ↔ Endangered). Needed changes are proposed on a species-by-species basis. The last update of the MESA list occurred on March 10, 2017. The process leading up 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 for the currently-proposed changes to the MESA list which are anticipated to occur late in 2019 began on November 1, 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 the Division. Between January and March 2018, staff biologists wrote a total of 15 list change proposals, consisting of seven listing proposals, five delisting proposals, and three proposals for a change in listing status. Three additional proposals to list three bird species were received from the Massachusetts Audubon Society (MassAudubon). By March 31, 2018, all 18 proposals had been sent to external reviewers (three or four reviewers for each proposal) for assessment and comments. All external reviews were completed and returned to the Division 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 Division Senior Staff for comment and input. A second meeting was held in June 2018 to resolve any outstanding issues and finalize decisions regarding the Division's recommended changes to the MESA list. It was decided that the Division 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 & Endangered Species Advisory Committee, along with copies of all comments and other information provided by the 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 the Division. Regarding the American Kestrel, the Advisory Committee vote was evenly split, with two votes to support Mass Audubon's 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 & Wildlife Board, along with the recommendations of both the Division and the Advisory Committee, the only difference in the recommendations being the split vote of the Advisory Committee regarding the American Kestrel. The Fisheries & Wildlife Board voted to proceed, at future Board meetings on dates yet to be determined, with both a Public Hearing and a vote of the Board on the proposed changes to the MESA list.

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 FY19, 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 the Division 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 FY19, 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 successfully planned and cohosted the 2018 Northeast Transportation and Wildlife Conference with MassDOT at the University of Massachusetts (September 9-12, 2018). Nearly 270 people attended the 4 day conference from over 20 states, 3 Canadian provinces, and Europe. During the conference participants attended workshops, talks, panel discussions, poster sessions, and scheduled field trips. The conference created a community of practice where biologists, engineers, planners, and advocates came together to discuss landscape connectivity, road ecology, and ways to design more resilient infrastructure/landscapes. Both agencies received the 2018 NETWC Achievement Award for the partnership and Linking Landscapes.

2018 Field Season Summary

Birds

Piping Plover; Federally Threatened

Observers reported breeding pairs of Piping Plovers present at 157 sites; 175 additional sites were surveyed at least once, but no breeding pairs were detected at them. The population increased 5.7% relative to 2017. The Index Count (statewide census conducted June1-9) was 669 pairs, and the Adjusted Total Count (estimated total number of breeding pairs statewide for the entire 2018 breeding season) was 688 pairs. A total of 893 chicks were reported fledged in 2018 for an overall productivity of 1.30 fledglings per pair, based on data from 99.6% of pairs.

American Oystercatcher

MassWildlife coordinated annual monitoring and protection efforts for American Oystercatchers conducted by a coastwide network of cooperators. Approximately 200 sites were surveyed during May and early June 2018. Preliminary results indicate that Massachusetts supported an estimated 205 breeding pairs of oystercatchers in 2018.

Terns, Laughing Gulls, and Black Skimmers

Cooperators in Massachusetts surveyed approximately 140 coastal sites in 2018 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 8,293 pairs of Roseate and Common Terns on Bird, Ram, and Penikese Islands in 2018, which was very similar to 2017 numbers (8,221 pairs). These islands supported 2,246 "peak season" pairs of Roseate Terns (vs. 2,240 in 2017; +0.3%), the highest number of Roseate Terns that we have ever recorded nesting in Buzzards Bay by a slight margin over 2017. The islands supported 6,047 "peak season" pairs of Common Terns (vs. 5,981; +1.1%).

Bird Island

Tern populations dipped in 2017 following island restoration work but returned to expected levels in 2018. Whereas flooding events related to construction issues affected reproductive performance of terns in 2017, the island was capped with permeable fill in April 2018 to reduce saturation at the surface. Both Common and Roseate terns nested later on Bird than on Ram, a reversal of the typical order, suggesting hesitance to nest on the new fill, but egg-laying was less delayed than in 2017. We planted 1,500 seaside goldenrod plugs on the new fill in September 2018.

Common Tern numbers increased 26% to 2,079 pairs (vs. 1,652 pairs in 2017). Productivity was poor (0.61 fledglings/nest vs. 1.00), possibly due to lack of vegetation on the new fill. Whereas chicks typically shelter in vegetation near the nest, lack of vegetation increased chick mobility, separating chicks from their parents and subjecting them to attacks by other territorial adults. Roseate Terns increased dramatically (49%; 1,175 vs. 595 pairs), returning to pre-restoration levels. Productivity was good (1.04 fledglings/pair vs. 0.6), reflecting adequate food resources. While a snowy owl depredated several adult terns in early May, predation was otherwise minimal throughout the season.

Ram Island

Common Tern numbers on Ram I. decreased 14% to 3,053 pairs (vs. 3,545 in 2017), and productivity was fair (0.81 fledglings/nest vs. 1.21). Roseate Terns decreased 42% to 1,093 nests (vs. 1,555 in 2017) suggesting that some of the population shifted back to Bird I. following restoration work. Food appeared to be adequate for Roseates, and productivity was good (0.98 fledglings/pair vs. 1.16). Although we discovered rat burrows and droppings in early May, we found no further evidence of rats, and predation was minimal throughout the season.

Penikese Island

A 70-acre prescribed burn was conducted on Penikese on 22 April. Common Tern numbers increased 28% (1,004 pairs vs. 784 in 2017) presumably because of successful predator control efforts in 2016 – 2017. Nesting began a week later than usual: the presumed first clutches were initiated when staff arrived on island on May 23. There may have been an early predation event that caused terns to abandon the site temporarily, as has occurred a couple of times over the past two decades when Peregrine Falcons have been present. Clutch sizes were also small, possibly reflecting inadequate food resources. Productivity was affected by gull depredation, particularly in the South Point sub-colony, which was in close proximity to nesting gulls. Productivity was still good at 1.07 – 1.14 fledglings/nest (vs. 1.85 – 2.16). Roseate Terns decreased to 12 pairs (vs. 90), and productivity was very good at 1.10 fledglings/nest (vs. 1.29). One Arctic Tern nested with a Common Tern, producing two hybrid chicks.

Common Loon

State-wide monitoring of nesting loons was a collaborative effort among staff at the Massachusetts Division of Fisheries and Wildlife (MassWildlife), Massachusetts Department of Conservation and Recreation (DCR), and Biodiversity Research Institute (BRI). Prior to the nesting season, MassWildlife staff deployed nesting rafts at Buckley Dunton Lake (Becket) and 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 2018 nesting season, 44 territorial pairs of loons were documented on 21 waterbodeies. Reproductive success was relatively high and exceeded the level required to

support a sustainable population. The majority of the loon population in the state nest on the Quabbin (21 territorial pairs) and Wachusett Reservoirs (4 territorial pairs), and these birds are monitored by DCR staff (Table 1). Nests were documented for 15/21 pairs on the Quabbin, and these nests produced 16 hatchlings, with 14 surviving to fledging. On the Wachusett Reservoir, nests were documented for 3 pairs, and these produced 6 hatchlings and 5 fledglings. MassWildlife and BRI staff monitored loon pairs on 18 waterbodies not managed by DCR and primarily located on lakes, ponds, and reservoirs in central Massachusetts. Of these, nesting was documented at 11 sites, producing at least 7 hatchlings and 4 fledglings (Table 1).

Table 1. Nesting data on loons at the Quabbin Reservoir, Wachusett Reservoir, Hycrest Pond and sites monitored by MassWildlife and Biodiversity Research Institute staff in 2018.

Site	# Territorial Pair	# Nesting Pairs	# Hatchlings	# Presumed fledglings
Quabbin Reservoir (DCR)	21	15	16	14
Wachusett Reservoir (DCR)	4	3	6	5
Bickford Pond	1	1	0	0
Buckley Dunton/ Yokum Pond	0	0	0	0
Cleveland Brook Reservoir	1	1	1	1
Crystal Lake	1	1	2	1
Fallbrook Reservoir	1	0	0	0
Fitchburg Reservoir	1	1	0	0
Great Quittacas Pond	1	0	0	0
Haynes Reservoir	1	0	0	0
Hycrest Pond (DCR)	1	1	0	0
Littleville Lake	1	0	0	0
Mare Meadow Reservoir	2	2	0	0
Meetinghouse Pond	1	0	0	0
Moosehorn Pond	0	0	0	0
Notown Reservoir	1	1	2	0
Pine Hill Reservoir	1	1	1	1
Springfield Reservoir	1	1	1	1
Stockbridge Bowl	0	0	0	0
Stodge Meadow Pond	1	1	0	0
Upper Naukeag Lake	1	1	0	0
Lake Wampanoag	1	0	0	0
Wachusett Lake	1	1	0	0
Total	44	31	29	23

Bald Eagle

During the summer of 2018, there were 77 known territorial pairs of Bald Eagles in Massachusetts. This is 9 more pairs than in 2017. The highest concentrations of eagles were along the Connecticut River (14 territories) and Quabbin Reservoir (11 territories). The Merrimack River, Westfield River, and the Assawompset Pond Complex also had multiple pairs of nesting eagles. Single nests were reported from numerous waterbodies throughout the state. New nests were documented in West Brookfield, Hardwick, Hadley, Beltchertown, Petersham, Plymouth, Southwick, Pembroke, Haverhill, and Greenfield. In total, 36 successful nests fledged 63 eagle chicks of which 42 were banded with a USGS federal band and a field readable color band uniquely identifying each individual. This is the 30th year that Bald Eagles have raised young in Massachusetts since their restoration. During these 30 years, at least 769 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 2018 Spring Nesting Eagle Survey took place on April 6, 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 2018 nesting season, 41 pairs of Peregrine Fal-

cons likely nested, but 10 pairs were not monitored closely enough to know their outcome. Of the 31 monitored pairs, 3 pairs failed, and 28 pairs successfully fledged at least 73 chicks. 49 chicks were banded (67%) from 17 nests. One banded chick is known to have died after fledging, and a second chick was found injured and later euthanized due to unrepairable shoulder/wing injury. Three unbanded adult females were also captured by hand at their nest and banded, so the total number of Peregrine Falcons banded was 51. Six chicks (1 of which was banded) are known to have died, and 1 injured chick was declared non-releasable.
This year had the largest number of chicks fledged in a single year to date. This is the 32nd year that Peregrine Falcons have raised young in Massachusetts since their restoration. During these 32 years, at least 720 wild-born chicks are known to have fledged.

Grassland Birds
During 2018 the Division collaborated with the Massachusetts Audubon Society to continue a citizen science based approach to collect data on the abundance of Eastern Meadowlark, Grasshopper Sparrow, and Bobolink at grassland sites in Massachusetts selected using aerial imagery in a geographic information system (GIS). This information was made publically available on the internet, and amateur and professional ornithologists signed up to conduct the surveys. During this citizen science effort, each site was surveyed three times between 15 May – 15 June with surveys at the same site were separated by at least 3 days. Surveys were conducted between 5:00-9:30 AM and consisted of a 10 minute passive sampling point count.

In total, 26 people participated in the 2nd year of this survey effort, resulting in sampling 63 sites throughout Massachusetts. Eastern Meadowlarks were only documented at 2 sites (3% of sites). This collaborative survey effort will continue in 2019 to further our understanding of meadowlark distribution in Massachusetts.

Eastern Whip-poor-will
The statewide nightjar survey project based on the Nightjar Survey Network's protocol continued into its eighth consecutive year. Over 20 survey routes were surveyed in 2019, with several new routes added. Surveys 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. 2019 was the second consecutive year that MassWildlife staff surveyed the islands of Quabbin Reservoir: a previously unidentified and relatively inaccessible core area for breeding whip-poor-wills. As has been the trend over the past several years, chuck-wills-widow was detected on the coast, but 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.

In addition to the volunteer based nightjar surveys, during May-June of 2018 (2nd year of project) we captured and deployed miniature GPS tags on Eastern Whip-poor-wills. In total we retrieved 6 geolocator units that were deployed in 2017. The data were downloaded from each geolocator, and Mexico was identified as a primary wintering location. Data processing is ongoing and additional details on migration timing and pathway are forthcoming.

We also deployed an additional 26 GPS tags on whip-poor-wills using the leg-loop harness attachment method. These were deployed at Bolton Flats Wildlife Management Area (12), Joint Base Cape Cod (7), and Montague Wildlife Management Area (7). Each unit was programmed to turn on and off 60 times throughout a 12 month period. To access these data the birds will need to be recaptured in 2019 so that devices can be removed in order to download the information. Eastern-Whip-poor-wills have been found to demonstrate strong site fidelity, and we anticipate recapturing approximately 25% of the originally tagged birds. These data will provide us with information on migratory timing and pathways as well as where nesting birds in Massachusetts overwinter. Identifying migratory connectivity for migratory birds will facilitate strategies for developing full life-cycle conservation plans for this species.

Colonial Waterbird Surveys
A colonial waterbird survey was conducted during May-June of 2018 and preliminary data has been entered into an electronic database. Surveyed species included Double-crested Cormorant (*Phalacrocorax auritus*), Great Egret (*Casmerodius albus*), Snowy Egret (*Egretta thula*), Little Blue Heron (*Egretta caerulea*), Cattle Egret (*Bubulcus ibis*), Black-crowned Night-Heron (*Nycticorax nycticorax*), Glossy Ibis (*Plegadis falcinellus*), Laughing Gull (*Larus atricilla*), Herring Gull (*L. argentatus*), and Great Black-backed Gull (*L. marinus*). In total, 93 sites with known or potential colonies were surveyed during May or June in 2018, including all significant colony sites that were surveyed in prior comprehensive surveys (1994-1995, 2006-2008). We did not systematically survey rooftops for nesting gulls as part of the 2018 survey but will work with USDA-Wildlife Services to obtain some information on roof top nesting gulls. Surveys at most colonies consisted of total nest counts made by observers on the ground. At small rocky islands that were too steep for safe landings, counts of nests or nesting adults were made by observers in a small boat that slowly circled each island. Whenever possible, surveys at each site were conducted using the same methodologies for all three survey periods so that results would be directly comparable.

The results from the 2018 Colonial Waterbird Survey in Massachusetts is concerning as it reveals continued declines for

most of the species included in the survey. Numbers of pairs of Herring and Great Black-backed Gulls, Snowy Egret, and Black-crowned Night Heron all demonstrated strong, long-term declines across the state. Glossy Ibis numbers dropped from the 2013 survey but remained at higher numbers than the 1994 survey. The only species demonstrating a population increase were the Double-crested Cormorant and Laughing Gull, both continuing this trend reported in the 2013 survey.

The highest numbers of nesting Herring Gull pairs were documented on Penikese Island (1405) and North Monomoy Island (586). The top sites for Great Black-backed Gull pairs were North Monomoy Island (616) and Coskata-Coatue (435). One caveat for the gull numbers (primarily Herring Gull) is that roof tops were not systematically surveyed for nesting and many roof nesting gulls would not be reflected in our totals. Pairs of Double-crested Cormorants were highest at Weepecket Island (1837) and Nomans Land NWR (1465). Laughing Gull pairs were only documented at a single location with 3,272 pairs at Monomoy NWR. Nesting Great Egrets were found at 15 sites with highest numbers at Kettle Island (194) and Sarah Island (85). Snowy Egrets were documented at 10 sites with approximately a third of the population on Kettle Island (99 pairs). Forteen sites host Black-crowned Night-herons with the most numbers of pairs on North Monomoy Island (225) and Sarah Island (190). Finally, Glossy Ibis were detected at 5 sites with Children's Island (30) hosting the highest number of nesting pairs. (Table 2).

Reptiles and Amphibians

Northern Red-bellied Cooter; Federally Endangered

Continuing a major project that has run continuously for 34 years, MassWildlife and its partners made a dedicated effort to locate Northern Red-bellied Cooter (*Pseudemys rubriventris*) nests at known nesting areas adjacent to Federal Pond in Carver. The first nest was found on June 2nd, and the last nest was discovered on July 15th, which is on target with the typical start and end of the nesting season. The entire nesting season lasted 44 days. The nesting season was affected by record high air temperatures and ample ground fog resulting in record-breaking hatch out dates. A total of 69 nests were identified by contractor employee, John Crane in June and July of 2018. Wire cages were placed over the nests in order to protect them and prevent predation by red foxes, coyotes, raccoons, and skunks. These 69 nests produced a total of 946 eggs (13.71 per nest), which resulted in 760 viable hatchlings (11.01 per nest). Of these, a total of 113 hatchlings were retained for the 2018-2019 headstart program. The remaining live hatchlings were directly released back into Federal Pond.

A total of 113 hatchlings collected by John Crane, plus an additional six hatchlings collected from cranberry processing plants and six hatchlings from Crooked Pond, were headstarted by 23 cooperating schools, organizations, and individuals across Massachusetts. Due to a few mortalities, 123 headstarted turtles were released in May 2019 to six separate waterbodies. From 1984 to 2019, a total of 4,457 headstarted Northern Red-bellied Cooters have been released by MassWildlife and partners after nine months of headstarting.

Bog Turtle

MassWildlife biologists conducted formal Bog Turtle population monitoring with TNC and other partners throughout 2018 at the two known extant sites. At the northern Bog Turtle site, three beaver deceiver/flow devices were maintained by MassWildlife Western District staff and NHESP staff, and beavers were trapped in spring and fall to reduce ongoing flooding pressure on sensitive fen habitats. One beaver deceiver was reinstalled by MassWildlife and TNC to improve the hydrological conditions of the fen. Significant progress has been made managing water levels and controlling invasive plants. MassWildlife also contracted a full population assessment of both remaining populations, which included radio telemetry and was conducted by contractor Jason Tesau-

Table 2. Summary of changes in abundance of nesting pairs for 8 species of coastal colonial waterbirds in Massachusetts based on 1994-95, 2006-08, 2013, and 2018 surveys using comparable methods. Results for 2018 remain preliminary.

Species	1994-95	2006-08	2013	2018
Double-crested Cormorant	7,822	5,963	8,105	8,183
Herring Gull	15,666	9,294	6,924	6,287
Great Black-backed Gull	14,746	8,823	4,580	3,658
Laughing Gull	868	1,585	1,863	3,272
Great Egret	69	228	386	451
Snowy Egret	746	456	325	308
Black-crowned Night-Heron	1,496	746	625	581
Glossy Ibis	47	144	70	58

ro. Additionally, MassWildlife continued to work collaboratively with state wildlife agencies in Connecticut, New York, and other Northeastern states through a Competitive State Wildlife Grant (CSWG) to conduct distributional surveys and habitat management for Bog Turtles, and participated in regional conservation planning decisions throughout 2018. We provided critical feedback and contributions to a regional Conservation Plan for Bog Turtles, which was completed early in 2019.

Wood Turtle

MassWildlife completed work with seven partner states and numerous non-state partners on a Conservation Plan for the Wood Turtle in the Northeastern United States, funded by a CSWG. MassWildlife was the host agency for this four-year initiative. As part of this effort, a rangewide genetics study provided the basis for genetic assignment of confiscated Wood Turtle specimens. The Conservation Plan identified "Focal Core Areas" throughout Massachusetts, within which we conducted technical assistance and outreach to key landowners. We expanded a partnership with the University of Massachusetts to assess Wood Turtle populations in the Connecticut Valley that were first studied in 2004. Further, we initiated a major new partnership with Zoo New England to study, restore, and manage impaired Wood Turtle populations in the lower Merrimack, Nashua, and Concord River basins. Research conducted by MassWildlife on Wood Turtle populations in Lancaster was published in the journal Herpetological Conservation and Biology.

Eastern Box Turtle

MassWildlife expanded a partnership with Zoo New England to better document the distribution of Eastern Box Turtles in northeastern Massachusetts, where they are known to occur at low densities in association with sandy outwash soils. A relatively large and robust population of Box Turtles is now well-documented to occur near the New Hampshire border. Nearly 20 box turtles were found and radio tracked by our partner, contractor Julie Lisk, at a site in northern Middlesex County near the New Hampshire border. MassWildlife also worked closely with TNC to facilitate habitat protection efforts for this species that are supported through mitigation funds for offsite conservation established through MESA Conservation and Management Permits.

Northern Diamondback Terrapin

MassWildlife played a coordinating role in terrapin research from Cape Cod to Buzzards Bay to the Taunton Watershed, the three primary areas of terrapin occurrence in Massachusetts. Partners moved closer to a standardized approach to PIT-tagging and surveys. Research funded by MassWildlife on terrapin detections was published by Patricia Levasseur et al. in the journal Diversity.

Timber Rattlesnake

As is now well-known, Massachusetts rattlesnake populations have dwindled to five isolated populations, several of which appear to be in decline. MassWildlife completed a five-year, multistate partnership with Northeastern and Midwestern states, funded by the CSWG program, to assess the population-level effects of a pathogen, *Ophidiomyces ophiodiicola* (Snake Fungal Disease or "SFD"). Additionally, MassWildlife 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). In 2018, MassWildlife and the other New England states finalized a conservation and monitoring strategy for New England rattlesnake populations, as well as a genetic management plan for the species (funded by the Regional Conservation Needs or RCN program). For the second year, MassWildlife also established a contract with Tom Tyning, professor at Berkshire Community College, to monitor one of the most threatened rattlesnake populations in Hampden County and to implement conservation actions there. 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.

Copperhead

In 2018, 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

We continued implementation of Year 3 of a 5-year, statewide monitoring plan for Eastern Spadefoot during July–November 2018. 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 both 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 and 2018. Those observations provide encouraging data on the effectiveness of tadpole rescue as a last-resort management option when impaired pools dry prematurely. At the Southwick WMA, where we are attempting to establish a new, self-sustaining local population of the species, we observed one juvenile spadefoot during a nocturnal survey in October. The individual was in approximately the same location as the two juveniles observed the previous year, but its size precluded firm judgment on whether it was from the 2017 or 2018 cohort of introduced eggs, tadpoles, and metamorphs. Additional spadefoot work during summer/

fall 2018 included implementation of the second phase of a breeding-pool restoration project in Wayland, treating seedlings and re-sprouts of previously cleared non-native invasive shrubs and vines (glossy buckthorn, common buckthorn, multiflora rose, oriental bittersweet). Only a light herbicide treatment was needed, as the site is revegetating nicely with sedges, grasses, forbs, and brambles.

During April–June 2019, we began implementation of Year 4 of the statewide monitoring plan with the help of volunteer monitors. The night of April 20th marked the third consecutive year in which spadefoots bred at multiple sites across the state (following the 2014–2016 drought years), and we once again documented breeding activity in/at Westfield, Plum Island, Wayland, and Rehoboth. For the 4th consecutive year, we visited a historic site in East Longmeadow, where several spadefoots had been observed calling from atypical habitat in 2018 but were not believed to have bred (last breeding observation in 1993). The original breeding pool was long thought to have been damaged beyond repair, as landscaping alterations in the 1990s divided it into two small sub-basins that, subsequently, seldom held much water. However, two spadefoots were observed calling from the southern sub-basin after midnight on April 21st, and follow-up surveys confirmed the presence of tadpoles in both sub-basins. In Hadley, spadefoot tadpoles were documented in a historic breeding pool for the first time since 1990, and adults were documented calling in another area a little over a mile away for the first time ever (though monitors had encountered an adult there in August 2016). Our surveys documented mature tadpoles nearing or undergoing metamorphosis at the Westfield, East Longmeadow (northern sub-basin only), Hadley, and Wayland sites, and so successful reproduction was concluded at each location. Surprisingly, spadefoot breeding was not detected at sites monitored in/at Taunton, Westport, Sandy Neck, and Martha's Vineyard.

We continue to be encouraged by the success of habitat restoration work at the Wayland site, which could not happen without the support of private landowners. One of the Rehoboth pools, which is believed to have been altered (via filling) sometime within the past couple of decades, could also benefit from management work. Our monitoring has revealed that the pool routinely dries early and that tadpoles are growing more slowly in the pool than in any other monitored across the state. Even in the wet spring of 2019, intervention was needed to ensure some reproductive success. We worked with the Rehoboth Land Trust (RLT) and the former owner of the property to help finalize transfer of ownership of the pool to the RLT in summer 2018. We now plan to engage the RLT and an abutter in discussions to develop a potential management prescription to reduce shading and restore a portion of the original basin area. Other management work during spring 2019 included the successful introduction of spadefoot tadpoles to the Southwick WMA for the third consecutive year. We followed the same monitoring and collection strategy as in the previous 2 years, again relying on the Westfield site as a donor population. However, since it appeared there would finally be some successful metamorphosis at the Westfield pool this spring (despite its usual early drying), we did not conduct a mass rescue-and-transfer of tadpoles to Southwick but, rather, relied exclusively on a small collection of eggs for captive-rearing by students at Bristol County Agricultural High School. We ultimately released 243 captive-reared tadpoles to one of the constructed pools at Southwick, and we observed metamorphs under cover around the pool soon thereafter. In Sunderland, we determined that spadefoots have yet to colonize the pool where we worked with Kestrel Land Trust in August 2016 to construct supplemental breeding habitat. To help facilitate its adoption by the local spadefoot population, we translocated 100 tadpoles from the Hadley pool (considered part of the same metapopulation) just prior to metamorphosis. Our hope is that the surviving metamorphs have "imprinted" on the pool and, therefore, will reside in the immediate vicinity into adulthood. Conceivably, when males reach sexual maturity, their calling behavior from the pool could be a catalyst to advertise its availability to the broader spadefoot population.

One challenge we encountered with constructed pools this year is that most filled with water late last summer and did not dry out prior to spring 2019. Consequently, the pools supported successful dragonfly reproduction, which is not desired because dragonfly larvae (which spend up to a year or more in the water) are effective tadpole predators. Eastern Spadefoot generally avoids breeding in pools that support dragonfly reproduction, and we believe we observed negative behavioral responses of tadpoles introduced to constructed pools this year. At one pool, we believe tadpoles initiated metamorphosis immediately and subsequently exited the pool smaller than they would have otherwise. We suspect a similar phenomenon occurred at constructed pools during spring 2018. Ensuring that pools remain sufficiently dry into the fall to preclude presence of dragonfly larvae the following spring will be a focal subject of our management work during the coming year(s).

Marbled Salamander

Most of Massachusetts experienced unusually frequent rains in July and August 2018, with many vernal pool habitats filling with water prior to the Marbled Salamander breeding season (late August through October). In our experience and that of others, Marbled Salamanders appear to breed only in small numbers (or not at all) under those conditions, as adults become unusually difficult to find during the fall, and larval abundance is very low the following spring. Therefore, we skipped our regular survey effort for Marbled Salamander during the 2018 breeding season.

Jefferson Salamander / Blue-spotted Salamander Complex
During winter and early spring 2019, we designed and implemented Year 1 of a new research project to investigate wetland habitat use by Blue-spotted Salamander. Massachusetts populations of the species consist of varying proportions of genetically "pure" individuals versus "unisexual" forms derived from an ancient, hybrid lineage. For unknown reasons, unisexuals appear to predominate at some sites but not others. Conceivably, differential habitat selection (or reproductive success among habitat types) between the pure and unisexual forms could explain why pure individuals sometimes persist at relatively high abundance. Blue-spotted Salamanders are known to breed in isolated woodland ponds, extensive shrub swamps, marshy river floodplains, and other wetlands, but the degree to which each habitat is used by pure versus unisexual forms is not known. As part of a continuing effort to better understand the genetic structures and presumed viabilities of local populations of Blue-spotted Salamander throughout Massachusetts, we launched a pilot investigation of potential differences in breeding habitat use between the pure and unisexual forms. We sampled adult salamander populations at 3 sites via aquatic funnel-trapping during the breeding season (March–April) in an effort to compare use of relatively small, isolated, and fishless ponds versus relatively large swamps and marshes where presence of fish was presumed. DNA samples have yet to be analyzed, but preliminary results based on morphological measures at 2 of the 3 sites suggested strongly that unisexuals were predominant in fishless ponds while pure individuals were predominant in swamps and marshes containing fish. We hope to evaluate at least 2 additional sites in similar fashion during 2020. This work is expected to result in significant improvements to the criteria used for ranking habitat quality and local population viability. It will also increase 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.
Other work during winter and early spring 2019 consisted of exploratory surveys for Blue-spotted Salamander in Bristol County. Populations in southeastern Massachusetts are not influenced by the unisexual lineages found elsewhere in the state and, therefore, distinct from those in other regions of the state where they contain mixes of pure and unisexual forms. Pure populations are very rare; accordingly, the NHESP has prioritized exploratory surveys in southeastern Massachusetts to find the last remaining undocumented sites. Our surveys in 2019 resulted in discovery of one previously undocumented population in Norton, plus confirmation of a poorly-documented population suspected from Rehoboth during the mid-1980s. The two finds increase our current count of pure populations of Blue-spotted Salamander to 10 extant populations, representing over half of those known from the eastern United States. However, one of our populations (North Attleboro) has not been observed since 1994, and so it will no longer be classified as extant if it is not reconfirmed by 2020 (intensive surveys at the site last year failed to detect the species).

Spring Salamander
In June 2019, we launched what is expected to be a 2-year rapid assessment of Spring Salamander populations in Massachusetts. The project consists of rock-turning surveys at streams where the species has been documented previously and at "exploratory" sites where there is potential for its occurrence. The survey area covers Berkshire, Franklin, Hampden, Hampshire, and Worcester counties. Surveys are being conducted by NHESP staff, members of an informal amphibian conservation partner group ("Rara Amphibia"), and citizen scientists recruited from the general public. The project implements a standard survey protocol that aims to allow for coarse comparisons of relative abundance among sites and, therefore, establish baseline data for monitoring population trends over time. In addition to updating the current conservation status of Spring Salamander in Massachusetts (not assessed since MESA de-listing in 2006), the project will contribute toward MassWildlife's broader goal of evaluating responses of the Commonwealth's wildlife to climate change. The project will also provide Brook Trout occurrence data to the Fisheries Section of MassWildlife. As of the end of June, Spring Salamander was documented at 4 of 6 historic sites surveyed.

Tiger Beetles

Northeastern Beach Tiger Beetle
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/MassWildlife staff and occasional volunteers. In 2018, 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 912 individuals in 2018. This was the fifth year in a row that the estimated total population has declined. This decline has occurred only at the largest of the three subpopulations, which inhabits the beach along the southwest shore of Aquinnah. Although large storm events both destroy and create habitat by erosion and accretion, in recent years available habitat has been shrinking at Aquinnah, and this seems the most likely explanation for the decline of this sub-population. In contrast, the population of Northeastern Beach Tiger Beetle introduced to Monomoy National Wildlife Refuge in the early 2000s continues to thrive, with an estimated total population of > 10,000 adults in recent years.

Cobblestone Tiger Beetle (*Cicindela marginipennis*) surveys
The Cobblestone Tiger Beetle has not been observed at its single known site since 2007, despite surveys conducted

there in 2012, 2013, 2014, and 2017. In 2018, an approximately 11 km stretch of the Deerfield River was surveyed for this species by Mike Nelson (NHESP/MassWildlife 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.

Puritan Tiger Beetle
Massachusetts NHESP participation in the Cooperative Recovery Initiative (CRI) led by the U.S. Fish & Wildlife Service (USFWS) for the Puritan Tiger Beetle was continued. Captive propagation of beetles at the Silvio O. Conte National Fish & Wildlife Refuge in Sunderland, Massachusetts, produced sufficient larvae for reintroduction at several sites in Connecticut. Although the USFWS no longer considers long-term persistence at the Rainbow Beach site in Massachusetts an explicit recovery goal due to adverse, artificial hydrology over the past decade at this site, "excess" larvae not needed at the Connecticut sites were released at Rainbow Beach in 2018. Summer counts of adult beetles at Rainbow Beach remain low, and population supplementation may be the only hope for continuous persistence of Puritan Tiger Beetle at Rainbow Beach unless adverse hydrology (frequency and extent of beach inundation due to daily dam releases from late June through early September) is attenuated.

Butterflies and Bees

Hessel's Hairstreak
In 2018, field surveys for Hessel's Hairstreak butterfly were conducted by Mike Nelson (NHESP/MassWildlife Invertebrate Zoologist). Five separate sites (cedar swamps), each with no record of Hessel's Hairstreak in 20 or more years, were surveyed during the spring adult activity period of this species. No Hessel's Hairstreaks were documented. While it is possible that Hessel's Hairstreak no longer occurs at some of the sites surveyed, a more likely explanation is that this species is often too difficult to observe at any single site without a multi-year effort. Hessel's Hairstreak butterflies spend most of their time in tree canopies, including the Atlantic White Cedar (Chamaecyparis thyoides) which serves as their sole larval host. Butterflies in the canopy can rarely be seen (let alone reliably identified) from ground level, and they descend only occasionally (usually during warm, sunny weather) to nectar at flowers. All of the sites visited in 2018 were dominated by large Atlantic White Cedars, with few small trees or evidence of regeneration, a potentially negative situation for Hessel's Hairstreak over the long term. Additionally, all of the sites exhibited a dearth of canopy openings with heaths and other spring-blooming flowers that are typically more abundant in high-quality Hessel's Hairstreak habitat. Canopy closure by Atlantic White cedar and other associated tree species may be negatively affecting Hessel's Hairstreak at these sites by reducing the abundance of nectar sources; in addition, the same factor is almost certainly making observation of any Hessel's Hairstreaks that may be present more difficult.

Bee (Anthophila)
In 2018, pilot field surveys for bees were conducted as part of the Pollinator Habitat RCN Grant. Bee bowl sampling was conducted in June and September at Frances A. Crane WMA and Southeast Pine Barrens WMA. Fourteen native bee species were documented at Crane WMA, while only 4 native bee species were documented at Southeast Pine Barrens WMA. This paucity of bees is likely due in part to the habitat at Southeast Pine Barrens WMA having been relatively recently restored by clearing of dense, fire-suppressed pine barrens and pitch pine forest, which as of 2018 still had a low diversity and abundance of wild flowers. Interestingly, the bee bowls at Southeast Pine Barrens WMA caught far more deer flies and horse flies (family Tabanidae) than bees, likely indicative of local deer abundance, the relatively intensive equestrian use of adjacent Myles Standish State Forest, or both. Although a few of the bee species documented by these pilot surveys are considered "uncommon" in Massachusetts, none of them are particularly rare in the state (Michael Veit, pers. comm.).

Plants

Rare Plant Inventory
During the 2018 field season, the State Botanist and Plant Conservation Biologist searched for or discovered 372 plant population occurrences. Six-hundred-thirty-eight rare plant observations were reviewed, mapped as needed, and accepted into the Biotics database by the two botanists. In each of the last three years, the number of plant records accepted in the database has increased by just over 100 records each year.

New Plant Occurrences of Note: A Federally Endangered species relocated after 53 years

In early July, Doug McGrady, a botanist from Rhode Island, made an incredible discovery on Cape Cod when he came across American chaffseed (*Schwalbea americana*), a federally endangered plant that hasn't been seen in Massachusetts since 1965. MassWildlife staff visited the site shortly after to confirm the discovery, where they delineated the area and counted over 2,600 stems. American chaffseed will be added as "endangered" to the MESA list. New of this discovery reverberated around the botanical community all around the east coast where notes of astonishment were sent from South Carolina to Maine. There are only a few large populations of this size left in the entire world, and most are on the decline.

Another plant that was thought to be extirpated from all of New England was rediscovered by a local botanist in a bog in northern Worcester County. The Carolina club moss (*Pseudolycopodiella caroliniana*) is a tiny plant that creeps along floating bog mats. The state botanist confirmed the find in early April. The plant is also endangered in New York state and is found in coastal states from New Jersey to Texas.

Finally, the state-endangered crane-fly orchid (Tipularia discolor), which had previously been known only from Martha's Vineyard, was discovered by a local botanist in a state-owned forest on the mainland on the coast of Bristol County. It was also confirmed by the state botanist in April of 2018. This new population greatly reduces the risk of this rare plant becoming extirpated from Massachusetts.

Special Projects

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

Sandplain Gerardia: Population censuses or sampling procedures were conducted at seven sites, three locations on Martha's Vineyard and four on Cape Cod. There was an explosion of the population, no doubt thanks to prescribed fire, at Francis Crane WMA, where over 50,000 plants were counted and estimated. Population sizes of this annual plant at the four sites on Martha's Vineyard were 8506, 91, 152 and 7. The other three sites on Cape Cod the numbers were 14, 238, and 1153. Additionally a large new population was discovered in Barnstable with an estimated count of 100,000 plants.

Small Whorled Pogonia: The numbers at the previously known sites were similar to past years. A total of 45 plants were counted at three survey sites (8 subpopulations within three general locations).

Northeastern Bulrush: Surveys of both populations in Franklin County were conducted. One population has 254 plants and the other had none.

General Habitat Management Projects

The Program continued its emphasis on Habitat Management Projects for rare plants during 2018. 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.

Success has continued with the installation of small deer exclosures that are now protecting state-endangered species in the Blue Hills Reservation (for Lesser Snakeroot - *Ageratina aromatica*) and at the Quabbin for Purple Milkweed (*Asclepias purpuracens*). 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 first 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 of Reservations, 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.

Hardy Kiwi (*Actinidia arguta*) has been an aggressive invasive species in Lenox, causing significant damage to forest canopy and carpeting the forest floor preventing the growth of other plant species. NHESP's Plant Conservation Botanist worked with the Town of Lenox and staff from Mass Audubon to control this species in areas of rare plant populations on Mass Audubon's Pleasant Valley Sanctuary.

Other Botanical Notes

After reviewing and proposing a number of changes to the plant list for the MESA list updates, a final review process submitted three plants to be added to the list, and two to be removed from the list. This represents many days of work for the State Botanist and Plant Conservation Biologist. The list review process is generally once every four years.

Aquatic Species

Aquatic Species Distribution and Status Assessments
During the 2018 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 Districts. Surveys included updating or recording new observations of:

Crustaceans
- Agassizi's Clam Shrimp – a new population of this State Endangered crustacean was discovered
- Dragonflies & Damselflies
- Harpoon Clubtail – State Endangered Dragonfly - Up-

dated 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 three ponds.

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 on a regional grant to New Hampshire Audubon to evaluate the presence and habitat needs of 5 species of rare northeastern damselflies.

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

The following table summarizes the environmental reviews conducted during FY19:

Table 3

Review Type	Count
CMP - Application Received	9
Forest Cutting Plan	78
MESA Info. Request/Data Releases	286
MEPA Reviews	85
MESA Project Reviews	644
Notices of Intent	506
Scientific Collection Permits	100
Other	105
Total	1813

Data Management and Data Products

In FY19, NHESP processed a total of 226 new rare species, natural community, and certified vernal pool records, and updated 756 existing records. The data processed were in the following categories:

Table 4

FY19 Totals	New Records	Updates to Existing Records
Vertebrates	57	276
Invertebrates	15	62
Plants	85	410
Communities	0	0
CVPs	69	8
Total	226	756

**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.

Vernal Pool and Rare Species Information System (VPRS)

For the FY19 alone, 204 new people signed up for VPRS and a total of 1950 observation reports were submitted, including 140 vernal pool certification forms, 633 plant observation forms, and 1177 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 6 large reports for Common Loon, Piping Plover, Timber Rattlesnake and Copperhead, and a report on a variety of herps.

Other Data Projects

For FY19, 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 also been 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. Lastly, the NHESP has completed phase one of a project with EEA-IT, nCourt, and the Comptroller's office to allow online donations to the Program.

Land Protection

In FY 19, MassWildlife spent about $6.2 million to protect 2,428 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
Protection of 37 acres on The Throne in Pepperell and 35 acres near the Parker River in Groveland and Georgetown help conserve habitat for Threatened Blanding's Turtles.

Southeast District
In Middleborough, protection of 99 acres on the Nemasket River just upstream of its confluence with the Taunton River helps conserve habitat for two Special Concern freshwater mussels, Tidewater Mucket and Eastern Pondmussel.

Central District
In Templeton, an EOEEA Landscape Partnership Grant assisted MassWildlife in acquiring 465 acres along Norcross and Beaver Brooks, including habitat for American Bittern (Endangered) and Eastern Whip-poor-will (Special Concern).

Valley District
The Great Swamp in Whately, a Black Gum-Pink Oak-Swamp White Oak Perched Swamp, is partly protected by MassWildlife's Great Swamp WMA. This year, an additional 29 acres of this Priority Natural Community were protected on the east side of the wetland. In Southwick, MassWildlife helped the Town of Southwick protect 61 acres between the Southwick WMA and North Pond. Part of this acquisition will be managed as sandplain grassland, adding to the restored grassland on the WMA and expanding habitat for Grasshopper Sparrows (Threatened) and Eastern Whip-poor-wills (Special Concern).

Western District
Six acquisitions in Worthington, Middlefield, and Chester, totaling over 600 acres, all help protect the watershed of the Middle Branch of the Westfield River. A National Wild and Scenic River, the Middle Branch supports four species of MESA-listed dragonflies: Rapids Clubtail, Harpoon Clubtail, Riffle Snaketail, and Ocellated Darner.

Natural Heritage and Endangered Species Program Advisory Committee

Full members are: Kathleen Anderson (Chair, part year), Mark Mello (Vice Chair/Acting Chair, part year), Thomas Rawinski (Secretary, part year), Gwilym Jones (part year), Joseph Larson, Wayne Petersen, Timothy Flanagan (part year), William Brumback (part year)

Associate members are: William Brumback (part year), Andy Finton, Timothy Flanagan (part year), Mark Pokras (part year), Kevin Powers, Dave Small, Bryan Windmiller, Russ Hopping (part year)

Staff Publications/Awards/Professional Presentations/ Outreach

Mike Jones:
Publications
- Jones, M.T., H.P. Roberts, and L.L. Willey. 2018. Conservation Plan for the Wood Turtle in the Northeastern United States. Report to the Massachusetts Division of Fisheries & Wildlife and the U.S. Fish & Wildlife Service. 259 pp.
- Jones, M.T., L.L. Willey, A.M. Richmond, and P.R. Sievert. 2091. Reassessment of Agassiz's Wood Turtle Collections Reveals Significant Change in Body Size and Growth Rates. Herpetological Conservation and Biology 14:41-50.
- Professional Presentations
- October 2018: Presented on Wood Turtle Conservation Plan to the Wildlife Society Meeting in Cleveland, Ohio; 70 people in attendance
- August 2018: Presented at NEPARC 20th Meeting on the Wood Turtle Conservation Plan and MassWildlife-hosted Competitive SWG; 120 people in attendance
- Jake Kubel:
- Publication
- Charney, N.D., J.E. Kubel, C.S. Eiseman, J.A. Blyth, J.

Castorino, and J.H. Malone. 2019. Distinguishing egg masses of unisexual and Jefferson Salamanders. Herpetological Conservation and Biology 14:250–260.

Mike Nelson:

- Publication: Goldstein, P.Z., M.W. Nelson, T. Simmons, and L. Raleigh. 2018. Historical and ecological insights from a relictual sandplain: reexamining the insular moth fauna (Lepidoptera) of Martha's Vineyard, Dukes County, Massachusetts, USA. Proceedings of the Entomological Society of Washington 120(1): 76-133.

Dave Paulson:

Award:

- 2018 Northeast Transportation and Wildlife Conference Achievement Award for the MassWildlife & MassDOT Partnership: Linking Landscapes for Massachusetts Wildlife (accepted by Dave Paulson, MassWildlife and Tim Dexter, MassDOT)

Professional Presentation:

- "Linking Landscapes for Massachusetts Wildlife," New England Chapter of the Wildlife Society Spring Workshop, 4/23/19 (20 attendees)

Staff Outreach Presentations

Lauren Glorioso:

- "Protecting Resource Areas/Wildlife Habitat along Electric Transmission Rights-of-Way" Massachusetts Association of Conservation Commissions, co-presented with Matt Waldrip from Eversource. (March 2019) Approx. 80 attendees
- Utility Turtle Training, June 2019, Approx. 90 attendees

Tara Huguenin:

- MassWildlife Information Table, Westminster Farmer's Market , July 2018, Approx. 150 people
- Children's Activity and MassWildlife display, Ecotarium, April 2019, Approx. 250 people

Chris Buelow:

- Myles Standish State Forest Stakeholder Meeting (for large-scale restoration proposal), 12-05-18, 35 people
- Myles Standish State Forest Public Hearing (for large-scale restoration proposal), 12-05-18, 50 people
- Myles Standish State Forest Public Site Walk (for large-scale restoration proposal), 02-08-19, 25 people
- UMASS Forest Ecology lecture, 04-17-19, 20 people
- Nashua River Watershed Tour of Bolton Flats Restoration, 05-21-19, 35 people
- Friends of Myles Standish State Forest presentation (for large-scale restoration at their annual meeting), 05-22-19, 60 people

Rebekah Zimmerer:

- Logger Workshop for DCR District 3 with DCR Service Forester Laura Dooley, Pepperell Library, 6/11/19, Approx. 15 loggers from MA and NH
- Logger Workshop for DCR District 9 with DCR Service Forester Sean Libbey, Deerfield Polish American Club, 6/12/19, Approx. 50 loggers from MA (and NH?)
- Logger Workshop for DCR District 4 with DCR Service Forester Mike Downey, Lunenburg Library, 6/19/19, Approx. 25 loggers from MA (and NH?)

Dave Paulson:

- "Partnering for Resilient Infrastructure and Ecosystems In MA," "Bats, Birds, and Fish Oh My! Endangered Species Act and Migratory Bird Treaty Act Updates and Ongoings," "Profiling Road Segments: Building a basic understanding of how wildlife are impacted by roads," and "Where the River Meets the Road: MassDOT Training Program for Using Fluvial Geomorphology to Enhance Infrastructure Resiliency." Northeast Transportation and Wildlife Conference, 9/9-9/12/2018 (100 attendees at conference)
- "Linking Landscapes for Massachusetts Wildlife," MA Fisheries & Wildlife Board, 1/10/19 (25 attendees)
- "Massachusetts Endangered Species Act and Game Species Management," Lecture at Bridgewater State College, 2/6/19 (20)
- "MassDOT/Wildlife: Agency Coordination and Partnerships," MassDOT Innovation Working Group, 2/14/19 (50)
- "Partnering for Resilient Infrastructure and Ecosystems In MA," NHESP Advisory Committee, 3/21/19 (20 attendees)
- "Massachusetts Endangered Species Act," MACC Young Professionals Working Group, 3/21/19 (20 attendees)
- "Linking Landscapes: Citizen Science Data and Management," Suffolk University, 3/28/19
- "MA Peregrine Falcon Conservation," Zoo New England, 3/28/19 (30 attendees)
- "Linking Landscapes for Massachusetts Wildlife," New England Chapter of the Wildlife Society Spring Workshop, 4/23/19 (20 attendees)
- MassDOT Wood Turtle Training, 5/15/19 (15 attendees)
- Eversource Turtle Utility Training, 5/31/19 (100 attendees)

Jake Kubel:

- Massachusetts Outdoor Heritage Foundation Amphibian & Reptile Fund: 2018 Projects Update. 17 December 2018. Massachusetts Outdoor Heritage Foundation Board Meeting. Westborough, Massachusetts.

Jennifer Longsdorf:

- Wildlife Weekend at Apex Orchards, Bat display, 9/22/18
- "All About Bats" presentation, Norcross Wildlife Sanctuary, 10/27/18, Approx. 60 attendees
- "All About Bats" presentation, Athol Bird & Nature Club, 4/10/19 Approx. 60 attendees
- National Bat Appreciation Day at Franklin Park Zoo, Bat display, 4/17/2019, Approx. 5,500 attendees
- "All About Bats" presentation, Hampden Garden Club, 5/16/2019, Approx. 20 attendees

Mike Jones:

- July 2018: Hosted and planned the 1st meeting of the Massachusetts Partners in Amphibian and Reptile Conservation (MassPARC) in Amherst, Mass. July 31, 2018; 75 people in attendance (see Photo)
- August 2018: Hosted and planned the 20th meeting of Northeast Partners in Amphibian and Reptile Conservation (NEPARC) in Amherst, Mass. Aug 1-3 2018; 120 people in attendance from Maine to Virginia
- July 2018: Swift River Valley Historical Society; Reptiles of Massachusetts
- July 2018: USFWS Hadley Regional Office: Wood Turtle Conservation Plan
- September 2018: NRCS and New Hampshire Fish and Game meeting at Westborough FHQ, technical assistance meeting; 5 people in attendance
- November 2018: Bristol County Agricultural High School, train students on PIT tagging and blood draws for turtles; 25 students
- February 2019: Bristol County Agricultural High School, train students on PIT tagging and blood draws for turtles; 25 students
- March 2019: Turtle Rescue League in Southbridge, Mass. I presented on the evolution and conservation of North American Box Turtles; 50 people
- March 2019: Pub Science Night at Honest Weight in Orange, Mass. I presented on Blanding's Turtles; maybe 60 people.
- April 2019: Fort River Division, Conte NWR, Wood Turtle Training for USFWS; 20 people
- April 2019: Felix Neck Wildlife Sanctuary on Martha's Vineyard – Spotted Turtle technical assistance; 5 people
- May 2019: Wellfleet Bay Wildlife Sanctuary, Turtles and Law Enforcement training with Mass Environmental Police; 30 people
- June 2019: Presentation on the Red-bellied Cooter Status to the Natural Heritage Advisory Board; 15 people

Peter Hazelton:

- Presented public outreach talks on freshwater mussels to two audiences (Athol Bird & Nature Club, Carlisle Conservation Foundation)
- Presented a lecture on Freshwater Mussel Sampling to UMass Amherst's Aquatic Ecology class
- Coordinated and presented in the zoology section of the 2018 meeting of the Northeast Natural Heritage Programs

Natural Heritage and Endangered Species Program Staff

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

Photos by Troy Gipps/MassWildlife

*In early July, Doug McGrady, a botanist from Rhode Island, made an incredible discovery on Cape Cod when he came across American chaffseed (*Schwalbea americana*), a federally endangered plant that hasn't been seen in Massachusetts since 1965. MassWildlife staff visited the site shortly after to confirm the discovery, where they delineated the area and counted over 2,600 stems. American chaffseed will be added as "endangered" to the MESA list. New of this discovery reverberated around the botanical community all around the east coast where notes of astonishment were sent from South Carolina to Maine. There are only a few large populations of this size left in the entire world, and most are on the decline. MassWildlife staff visited the site shortly after to confirm the discovery, where they counted over 2,600 stems. Because of this discovery, American chaffseed will be added as "endangered" to the Massachusetts Endangered Species Act list.*

Information & Education

Marion E. Larson
Chief, Information and Education

Overview

The Information and Education (I&E) Section has the responsibility and challenge of keeping sportsmen, conservation groups, municipal officials, environmental consultants, naturalists and other constituents apprised of regulations, laws, and recreational opportunities related to wildlife. It also provides basic information about and science-based explanations of wildlife-related issues, in order to enhance public understanding of wildlife management and compliance with laws and regulations. The Section also maintains an active program of educational and promotional outreach, to instill and foster public appreciation for fish and wildlife and related conservation and recreation.

Communications
Emily Stolarski, Communications Specialist

Website Analytics

Before the web migration in FY18, MassWildlife web content could be evaluated separately from other Mass.gov pages. Initially, the new Drupal system did not allow web analytics to be viewed by individual agencies. In January 2019, Mass.gov started allowing organizations to tag their web pages in order to analyze content in groups. Thanks to this new ability, we can now learn about user behavior on MassWildlife pages. All pages have been labeled with a MassWildlife tag, and Natural Heritage and Endangered Species Program pages have been marked with an additional tag to allow that content to be evaluated independently if needed. Using this new capacity, the Communications Coordinator produced a report showing general user behavior, and web traffic for all sections of the agency from January 1, 2019 to July 15, 2019 (see figure on page 99). This report was distributed to Senior Staff with the goal of soliciting feedback and questions from sections or district. Web traffic (which can be read as popularity) is a useful indicator for knowing what the public is interested in and can also be helpful when prioritizing tasks related to creating and revising web content. Additional new website features now allow web editors easy access to web users' feedback along with a list of high-priority pages with high-traffic and low quality scores. These enhancements have allowed the Communications Coordinator to make decisions based on analytics and real-time customer feedback.

Cross-Domain Tracking

We asked Aspira, our vendor for MassFishHunt, to insert a Google Tag Manager code into the MassFishHunt website, and with technical assistance from the Mass.gov team, we can now see trends in user behavior as customers navigate back and forth between agency Mass.gov pages and MassFishHunt pages. The new analytics structure allows us to view traffic that travels between Mass.gov and MassFishHunt (ma.wildlifelicense.com) as a single session, despite being on separate domains. In many cases, customers move back and forth between Mass.gov and MassFishHunt when they learn about and consider buying a license, when they actually buy a license, stamp, or permit and when they report a harvest, make a donation, or buy a magazine subscription. Now that cross-domain tracking is enabled, we can determine where customers might be having problems and what resources customers are finding helpful. This capability is especially useful in relation to marketing and outreach efforts since we can report on user engagement (time on page, bounce rate, page depth) seamlessly throughout this process. Cross-domain tracking capabilities will be invaluable for any external app that is used by the agency and is a priority for adding to the NHESP donation portal.

Web Maps

MassWildlife currently offers several web maps to serve the public. Starting this fiscal year, more emphasis has been placed on developing and refining web maps. Part of that emphasis is out of necessity; the current platform used by the agency for maps and sortable lists, Google Fusion Tables, will no longer be available as of December 2019. A new solution is needed. Another reason for increased attention on web mapping is that MassWildlife and the Department of Fish and Game, whose staff create web maps and assist with maintenance, have expanded access to software (ArcGIS online) that allows for relatively easy web-map creation.

New maps were created to display contact information for Problem Animal Control agents and Wildlife Rehabilitators. These new maps help the public quickly find local licensed professionals to help with their wildlife problems. The web maps also help MassWildlife staff quickly respond to calls or social media messages from the public. Work was also done to prepare the MassWildlife Lands Viewer to be moved to this new platform.

In response to a request from the EEA Secretary, GIS staff at the Department of Fish and Game began work on a digital outdoor recreation map. Since MassWildlife already has a web map showing lands open to the public, emphasis was placed on fishing opportunities in the state. The Communi-

MassWildlife Website Report

January 1 - July 15, 2019

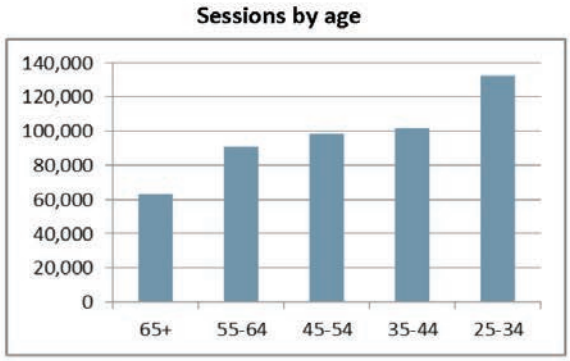
Traffic overview	
Unique pageviews	3,027,229
Unique users	790585
Pages per session	2.2
Ave. session duration	2:47

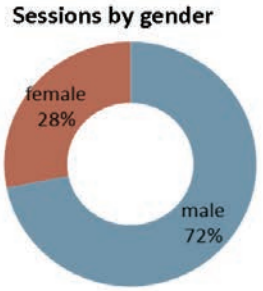
A user is a person who visits the website. A user can visit more than one page in a session. A user can have more than one session over time.

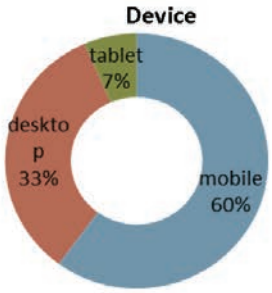
Page and document inventory			
	Total	MassWildlife	NHESP
Documents	946	255	691
Pages	497	438	59

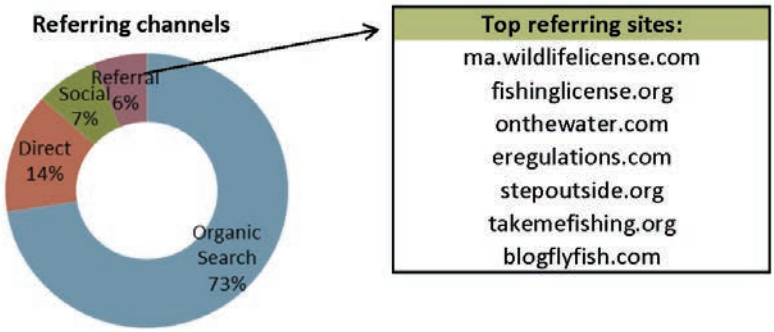
Pages means webpages. Documents are pdfs. Things like natural

Pages means webpages. Documents are pdfs. Things like natural
community fact sheets or crossbow permit applications.









cations Coordinator, along with I&E and Fisheries staff, collaborated with the Department to plan, execute, and test the fishing map. While creating the digital map was fairly routine, the methods used to evaluate the usability of the map were more sophisticated than anything the agency has done in the past. Using resources and guidance from the user-testing team at Mass.gov, the Communications Coordinator and DFG's Web and Social Media Coordinator developed a plan to gather input about the map. An internal test was conducted in November 2018 to refine the interview questions and procedures. Public user testing was completed at Cabela's in January 2019. Participants were asked to complete a series of tasks using the fishing map while Division and Department staff observed and scored the degree and quality with which each task was completed. Results from the user testing led to substantial changes in the fishing map. As resources allow, this type of user testing should be repeated with new web maps and new versions of web maps in the future.

Mass.gov Partnership

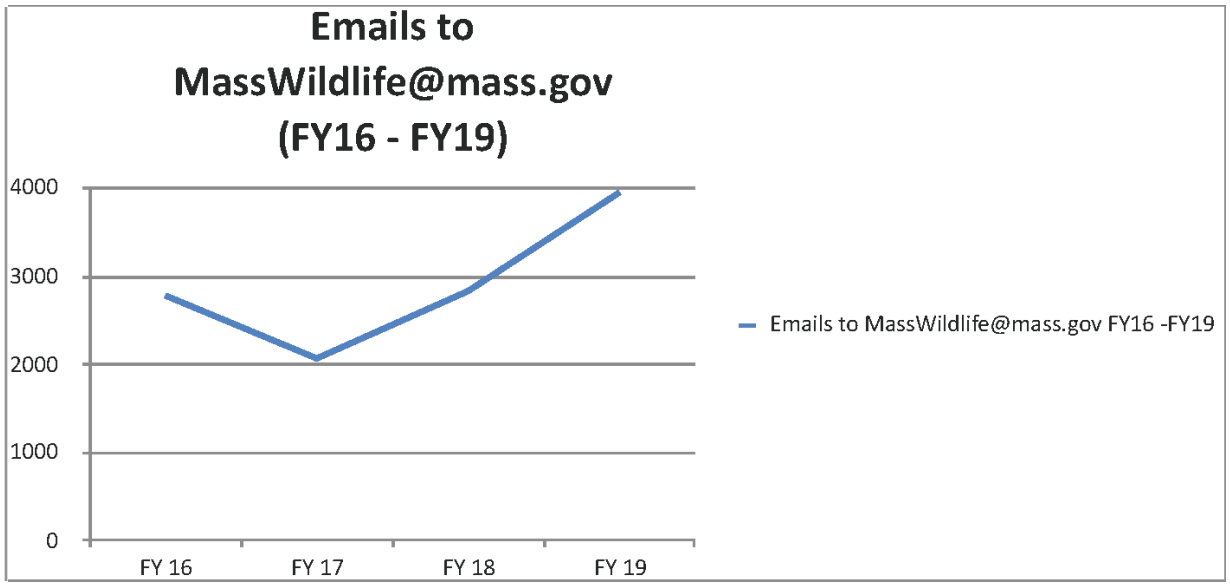
Since the web migration, the Communications Coordinator has worked closely with the Executive Office of Technology Services and Security's Mass.gov team on several projects. The Mass.gov team recognizes MassWildlife's unique approach (among state agencies) to customer service and often asks the agency to pilot new web features. In addition, MassWildlife often has complex web analytics needs that Mass.gov is to provide assistance.

MassWildlife and the Mass.gov team have partnered to (1) implement and evaluate cross domain tracking on MassFishHunt, (2) properly implement pixels to collect marketing success analytics, (3) design user testing protocols for web map evaluation, and (4) pilot new web analytics tools and page types. The Communications Coordinator presented to two Mass.gov user group meetings (September 2018 and June 2019).

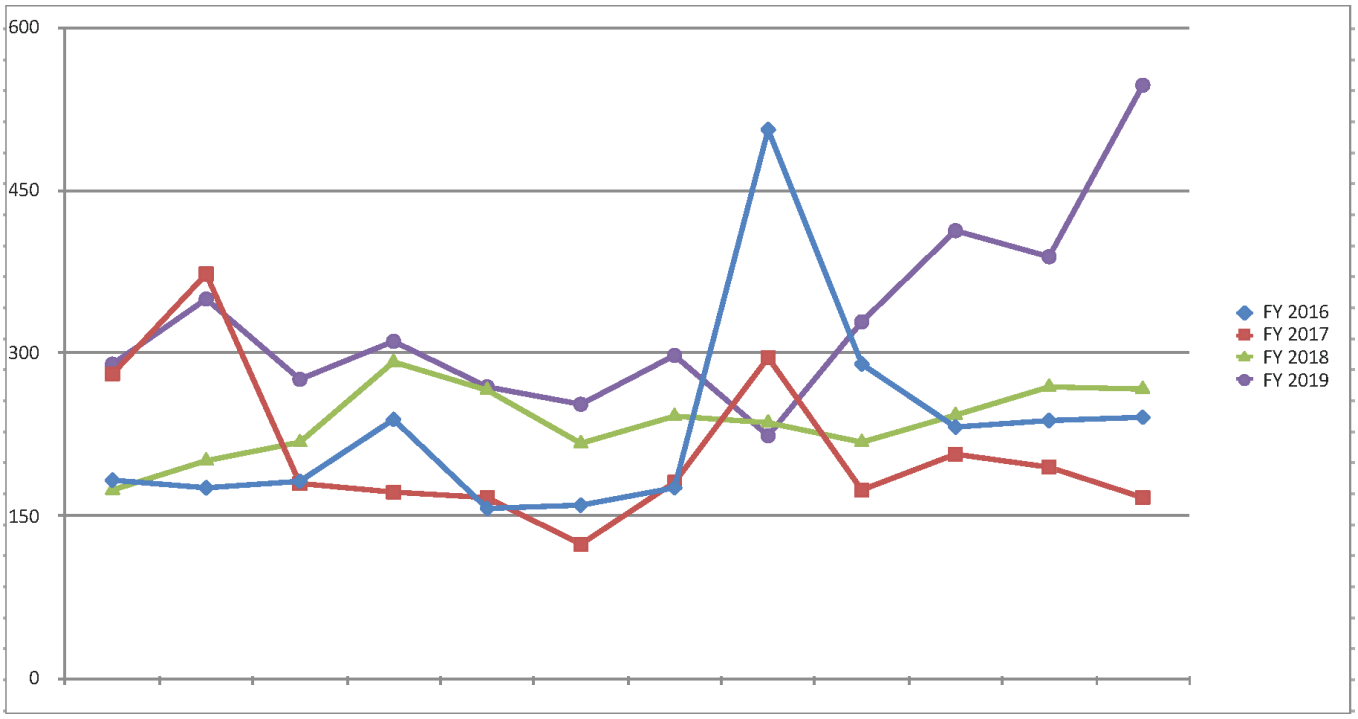
MassWildlife E-newsletter and Advisories

Emily Stolarski (Communications Coordinator) and Nicole McSweeney (Outreach and Marketing Manager) collaborate to publish the monthly e-newsletter called "MassWildlife Monthly." Outreach Specialist Elaine Brewer also contributes an article about the NHESP program to each monthly issue. Twelve issues of the electronic newsletter were published this fiscal year around the first of the month. Over the past year, the number of subscribers receiving the newsletter grew substantially; in July 2018, 44,447 received the newsletter each month, and by June 2019, that number had risen to 54,173. Sign-up tools like a check box to subscribe on MassFishHunt, links to subscribe on the MassWildlife website and social media, as well as signage at fairs and shows have increased the number of subscribers.

Emails to MassWildlife FY 16—FY 19



Monthly Agency Email Trends FY 16—FY 19



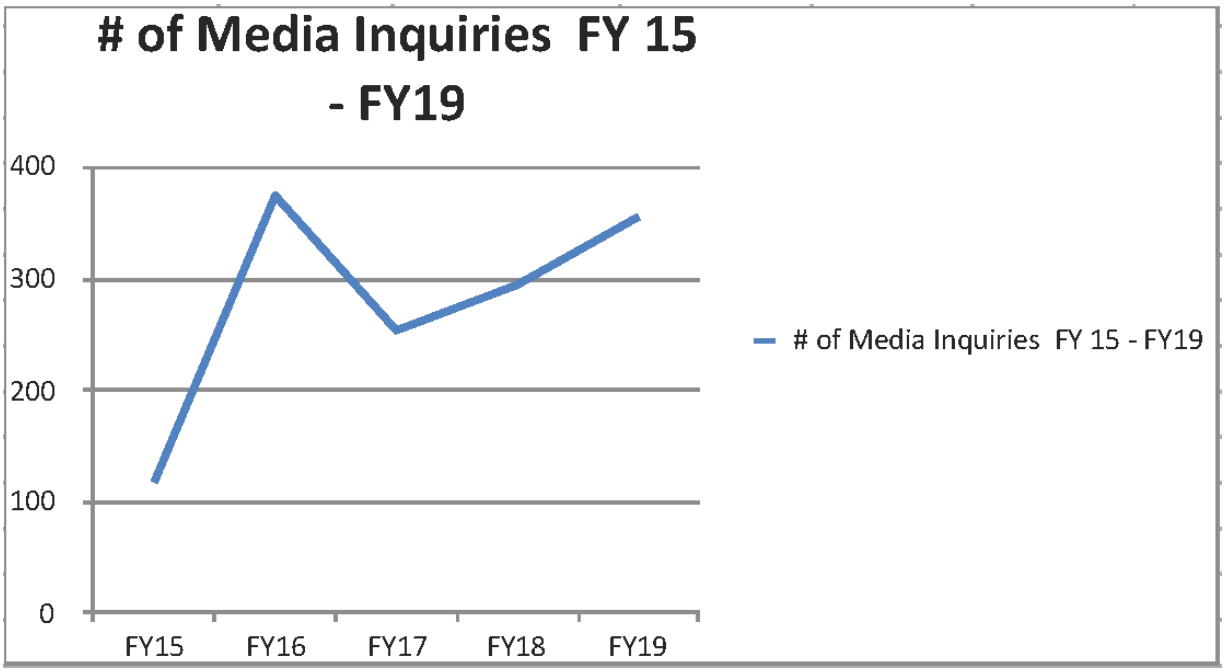
The newsletter is sent using Constant Contact, an email marketing service. On average, 33% of subscribers open the MassWildlife Monthly email, which is considered an "above industry average" open rate, compared to other businesses and organizations using Constant Contact (18%). Press releases to media and advisories alerting subscribers and license holders of new regulations, special events, public meetings, and hearings were also sent out through Constant Contact.

Agency Emails

Email messages to the agency rose significantly this year. A total of 3,949 (2,831 FY 18) agency email messages were managed by Biologist Bridgett McAlice, who is assigned to the Wildlife Section. Several hundred emails in the spring were the result of comments from the public regarding Coyote Contest Listening sessions held from April – June of 2019. Summary of emails by month FY 19: July 2018– 290; August –350; Sept– 276, Oct–311; Nov –269; Dec –253; Jan 2019 –298; Feb –224; Mar – 329; Apr – 413; May – 389; June 2019–547.

With the agency's heightened outreach to the public regarding new regulations in the last year or so, the agency email address is increasingly used as a means to receive public comment. In the graph shown above, FY 2016 spike

Monthly Agency Email Trends FY 16—FY 19



Monthly Agency Email Trends FY 16—FY 19

Inquiries by Media Type				
	FY19	FY18	FY17	FY 16
Newspaper	174	167	135	211
Television	98	80	72	92
Radio	56	28	28	40
Magazine	11	7	7	16
On line Outlets	9	4	4	14
News Service	2	2	5	0
Other	6	1	1	0
Total	356	289	252	373
Unique Media Outlets	106	95	87	61

in emails can be traced to emails regarding the rattlesnake conservation proposals.

MEDIA RELATIONS

Media Inquiries

This year media protocol procedural changes were made by the Executive Office of Energy and Environmental Affairs (EEA) press office. In January, EEA Press encouraged agency communications members to be pro-active with the media, pitch stories, and notify EEA press of all media inquiries and topics. EEA Press advised that sensitive topics should be brought their attention before speaking with the media. This has resulted in increased ability to respond in a timely and thorough manner to most media inquiries.

In FY 19, the agency received 356 media inquiries from 106 different media outlets. Of the 356 inquiries, the vast majority of inquiries still come from newspapers with 174 inquiries; 98 inquiries came from television; 56 from radio; 11 from magazines; and 9 online media sites.

In general, media inquiries to the agency have increased over time. (See # of Media Inquiries table) Spikes in media interest occur when there is a topic of general public interest. In 2019 there was a flurry of media interest related

to the coyote contest controversy on Cape Cod. A spike of media inquiries in FY 2016 can be attributed to public interest in the first Blue Hills Reservation Deer Hunt in the fall of 2015 and the proposal to headstart rattlesnakes at Quabbin Reservoir covered February through March of 2016.

There have also been changes over time relating to the different types of media outlets contacting MassWildlife. Although the overall number of unique media outlets contacting the agency has risen in the past four years, there have been some losses. Newspaper consolidation over the years has affected subscriber levels which have dropped. Overall there is less local coverage in the smaller and mid-size publications which are left. In the last 4 years, several long time outdoor writers who have had a history of utilizing MassWildlife newsletter articles and events have either been laid off or retired without being replaced. A bright spot is the increase in radio inquiries—most of which have been from public radio stations.

Print Media Coverage

As in past years, MassWildlife utilized a newspaper-clipping service to collect all articles in Massachusetts newspapers that mention the Division by name. The clipping service reports on print news sources and has started to provide more on related online outlets and television. This year, online media presence and audience reach increased though the number of articles were lower than FY 18. In FY 19 articles mentioning MassWildlife totaled 1,765 (1,167 print, 998 online) for an average of 147 articles per month. These articles reached 211,056,427 people and are valued at $8,712,228. In FY 18, articles mentioning MassWildlife totaled 1847 (1278 print, 569 online) for an average of 154 articles per month. These articles reached 156,198,956 people and are valued at $7,562,314.

Outreach and Marketing
Nicole McSweeney, Outreach and Marketing Manager

Social Media

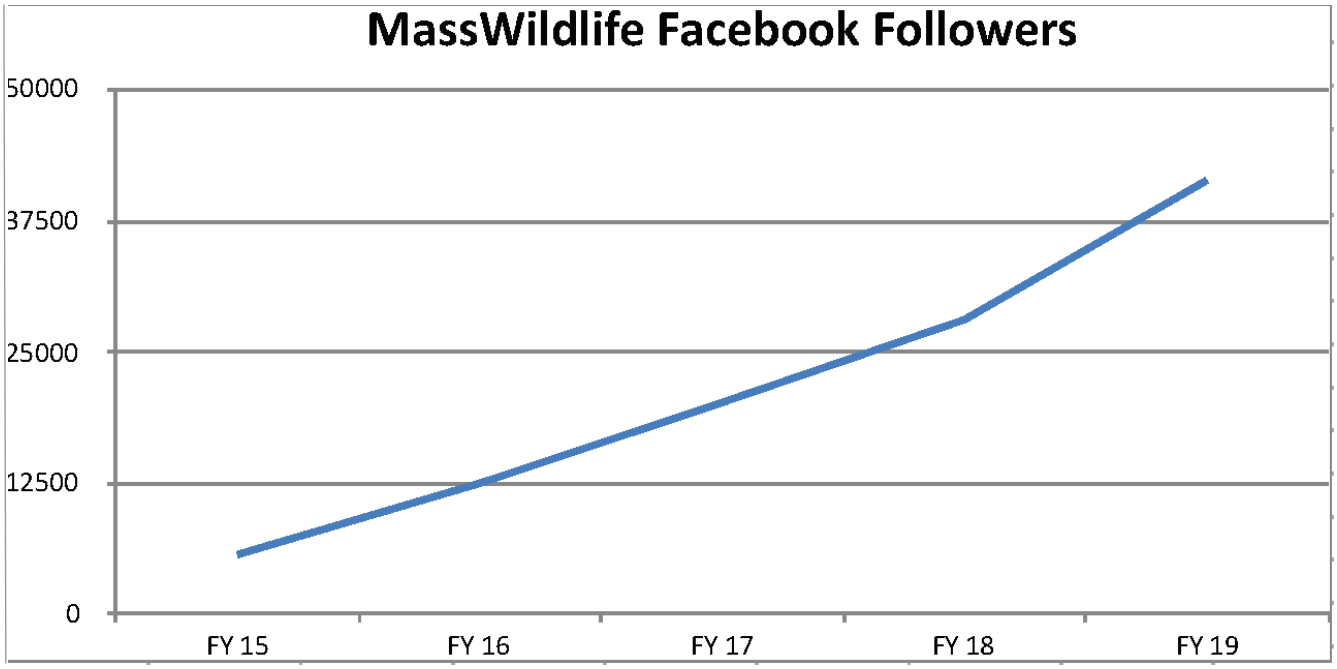
Facebook

In FY 19, 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; promote agency events, programs, job openings, and donation opportunities; listen to what constituents are saying; and engage with the public by responding to their comments and questions. MassWildlife typically posts to its Facebook page daily with a variety of content. In July of FY 19, a MassWildlife post "went viral"; it showed a Cooper's hawk perched on a revolving sprinkler as it enjoyed a cool bath on a warm summer day. This single post reached over 4.43 million people and generated 7,000 reactions, 921 comments, and 48,000 shares. Overall, MassWildlife had a substantial increase in its number of Facebook followers in FY 19, closing the year with over 41,375 followers. (See graph below)

Instagram

MassWildlife initiated an Instagram account (@mass.wildlife) on September 15, 2018. By the end of FY 18, Mass-

MassWildlife Facebook Followers



Wildlife accrued 2,800 followers. The number of followers on the agency grew to 9,578 followers by the end of FY 19. Instagram was chosen over other social media platforms for its robust growth and use. It is also attractive to a younger demographic. Every few months, Instagram invents new ways for accounts to reach their constituents. At every opportunity, MassWildlife uses these additions (such as stories, rating, carousels, and IGTV).

In July 2019, Instagram maintained 1 billion active monthly users. Outside of direct text messaging applications, this social media platform recently rose to the second most popular social media platform in the world (after Facebook—2.32 billion monthly active users—which is also used by MassWildlife). MassWildlife's Outreach Specialist uses the feed, stories, and IGTV interfaces on the platform.

Videos

I&E staff continue to create and edit video content for the Division. Hunter Education Specialist Jesse St. Andre has also been filming and creating videos. A film student from Fitchburg State, Liam Griffin, joined I&E for a summer 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. New videos created in FY 19 include topics like fishing and hunting promotion, wildlife tips for residents, bear research, New England cottontail release on Nomans Land Island, LART relocations, rare species research, and trout, pike, and landlocked salmon stocking.

Wildlife Management Area Signage

With goals for improving visibility of MassWildlife properties, standardizing signage among Districts, and differentiating Wildlife Management Areas from other state-owned properties like state parks and state forests, work began this fiscal year to update property name signs. I&E staff worked cooperatively with the Assistant Director of Operations and District Managers to develop a design. It was decided that "MassWildlife Blue" would replace brown that has historically been used on agency land signs—as well as many other state-owned property signs. This decision was in line with the MassWildlife brand standards and serves to visually set our properties apart. A new computer numerical control (CNC) router machine was purchased to produce the new signs. This equipment allows for the creation of large signs and can create our agency fonts. Guidelines to standardize the sizes, fonts, and installation procedures were being finalized at the close of FY19; installation, starting with high-trafficked areas will begin in FY20. In general, new WMA signs will be larger and more prominent than the existing signs. Work to establish content and a template for WMA kiosks began in FY19. I&E and District Managers worked to create a list of universal content that will be included in WMA kiosk template. Kiosk work will continue in FY20.

OUTREACH EFFORTS AND EVENTS

Fairs and Trade Shows

In FY 19, MassWildlife exhibited at two fairs: the Marshfield and Franklin County (Greenfield) fairs; and three trade shows: the New England Fishing and Outdoor Expo (Boxborough), the Springfield Sportsmen's Show (West Springfield), and the Boston Flower and Garden Show. 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 shows and the Boston Flower Show, MassWildlife 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.

Staff Outreach Participation

Agency staff led or otherwise participated in public events as workloads and time permit. Some events are generated by the agency, others are events to which the agency is invited to participate. I&E staff consulted with Division 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.

MassWildlife hosted and/or participated in at least 25 meetings and conferences: Northeast Association of Fish and Wildlife Agencies Conference, Northeast Trackers Conference (hosted), 2018 Regulatory Meetings of the Atlantic Flyway Council and Technical Sections and the Atlantic Coast Joint Venture (hosted), 84th North American Wildlife and Natural Resources Conference, Directors Meeting, Northeast Association of Fish & Wildlife Agencies (hosted) New England Chapter of The Wildlife Society meeting, Annual Roseate Tern Recovery Team Meeting, Northeastern Transportation and Wildlife Conference, American Sportfishing Association's 2018 Sportfishing Summit , 2018 Berkshire Natural History Conference, Northeast Association of Fish and Wildlife Agencies R3 Committee Meeting, Western and Midwestern Association of Fish and Wildlife Agencies Conference, Mass Audubon Birders Meeting, Northeast Partners in Amphibian and Reptile Conservation (PARC) Annual Meeting, MA Digital Government Summit, Hoosic River Watershed Association's 2019 State of the River Conference, Association of Massachusetts Bird Clubs Meeting, 2019 Massachusetts Poultry Enhancement Council Meeting , Western and Midwestern Association of Fish and Wildlife Agencies Conference, National R3 Webinar (hosted), Mass.gov User Group Meeting, MA Green Careers Conference,

New England Outdoor Writers Association monthly meeting, and an Interagency Stewardship Retreat.

Division staff set up and worked at outreach booths at over a dozen events including: MACC 2019 Annual Environmental Conference, Worcester; 2018 Berkshire Natural History Conference in Sheffield; Marshfield Fair; Springfield Sportsmen's Show in West Springfield; New England Fishing Expo, Boxborough; Massachusetts Association of Health, Physical Education, Recreation, and Dance Convention in Worcester; Brewster Conservation Day; Boston Flower and Garden Show; Donker Farm Arts and Agricultural Festival, Worcester; and Groton Greenway Riverfest in Groton.

In addition, agency staff gave at least 23 presentations on the following topics: Living with Coyotes (Scituate, Groveland, Swampscott, Saugus), Bear Awareness (Lanesborough, Holden, Ayer) Bald Eagle Biology & Behavior, The Impacts of the 2011 Tornado to Forests and Birds, Life and Times of Lake Trout at Quabbin and Wachusett Reservoir, Peregrine Falcons Photo Exhibit Reception, Wild Brook Trout Streams of Cape Cod and Southeastern Massachusetts, MassWildlife at Work in the North Quabbin Area, Decline and Recovery of Peregrine Falcons in Massachusetts, Presentation to Controlled Hunt Permit Holders, Deer Presentation (Marshfield, Westborough, and Sherborn), Chronic Wasting Disease, and Watershed management.

MassWildlife staff also offered college and university guest lectures at UMass-Amherst, Cape Cod Community College, Elms College, Westfield State University, Suffolk University, and Framingham State University. And finally, MassWildlife staff led habitat walks in Orange, Southwick, Myles Standish State Forest in Plymouth, Worthington, Montague, Groton, and Rockport.

NHESP Outreach

Elaine Brewer, Outreach Specialist, created information packets to increase awareness for the Natural Heritage and Endangered Species Program Fund tax check off. Each packet included a letter to the tax preparer, a fact sheet about the Program, and four posters highlighting charismatic species that are protected by the Massachusetts Endangered Species Act. Packets went out to 153 tax preparers throughout Massachusetts. Articles about the tax check off option (under volunteer contributions on the Massachusetts personal income tax form) were included in the MassWildlife Monthly eNewsletter in February, March, and April. Information about the tax check off was posted on social media in February and March.

Website pages for rare species in Massachusetts are in the process of being built. In FY 19, pages for peregrine falcon, bald eagle, northern red-bellied cooter, piping plover, and roseate tern were created. Pages will be released for the remaining species; however there is no timeline for completion.

A Living with Bats fact sheet was created and a press release about a wood turtle project partnership with Zoo New England was sent out to media and posted on social media. Twenty-two articles (22) based on NHESP were written for the MassWildlife Monthly eNewsletter in FY 19. The Outreach Specialist also is lead on an informational page about the joint Myles Standish Complex habitat management project that involves both MassWildlife and the Department of Conservation and Recreation.

In FY 19, the Outreach Specialist was assigned to be co-chair to lead MassWildlife's Relevancy initiative. Thus far, the working group was established and has met. The co-chairs also held meetings with staff from each of the districts and hatcheries, including the Boston office to explain the agency's view on Relevancy and to gather staff insights. A draft of the agency's Relevance Strategy is scheduled to be completed in December 2019.

Other projects that were initiated in FY 19 include: an update to the Homeowner's Guide to Bats, which includes a new section that has instructions to build a four-chamber bat house; initial steps to having an online platform to gather donations for the NHESP Fund; initial designs for a conservation-focused newsletter that will be delivered twice annually; and assistance with the initial iNaturalist projects focused on cataloging biodiversity on MassWildlife Wildlife Management Areas. Events and field world that the Outreach Specialist attended include: MassPARC in July; a fire management field trip to Montague Plains WMA in August; NETWC and MA Digital Government Summit in September; Northeast Regional Heritage Meeting in Pennsylvania in October; CLfT workshop in Illinois in February; trout stocking with the Governor in April; peregrine falcon banding at Marriott Vacation Club Pulse at Custom House and 177 Huntington Ave in Boston in May; bald eagle banding on Lake Quinsigamond in June; northern red-bellied cooter turn-in event in May; and swallowwort management in June.

PUBLICATIONS

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 21,000 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, 2018 – Number 2, 2019) covering a wide variety of fisheries, wildlife, and outdoor-related subjects, including

wildlife research, rare and endangered species, general nature interest, and "how-to" articles for the hunter, angler, and nature observer.

Continuing a long tradition of producing articles that will be useful as references on particular subjects for many years to come, this year's feature articles included:

Issue Number 3, 2018:

- Little Hunters (Northern Saw-whet Owl) by Brandi Van Roo
- Celebrating a Century of Migratory Bird Protection by H W Heusmann (MW staff)
- Hamant Brook: Restoring a Landscape for Trout and Turtles by Caleb Slater (MW staff)
- Duck Season Science by H W Heusmann (MW staff)

Issue Number 4, 2018:

- Quabbin Lake Trout (population study) by Jason Stolarski (MW staff)
- Deep Woods Gray (squirrel hunting) by Troy Gipps (MW staff)
- Canada Lynx Genome by Tanya Lama
- When a Moose is on the Loose (Large Animal Response Team) by Tara Carlow

Issue Number 1, 2019:

- Making Tigers (Tiger Trout) by Kenneth Simmons (MW staff)
- Asian Long-horned Beetle: 10 Years Later by Felicia Hubacz and Joshua Bruckner
- Angling Dilemmas by Jim Lagacy (MW staff)
- A Life Aloft: A Tree Climber's Perspective by Matthew Shreiner

Issue Number 2, 2019:

- Marvelous Milkweeds by Robert Wernerehl (MW staff)
- Photo Essay: Nightlighting Ducks by H. Heusmman and Troy Gipps (MW staff)
- Journal of a Frog Hunter by Troy Gipps (MW staff)
- A Good Man. A Good Hunt. By Dan Hayner
- Catching Tigers (Tiger Trout) by Kenneth Kordana

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, 2018 showed 19,808 subscribers for the magazine. By June 30, 2019 there were 21,810 magazine subscribers. One year subscriptions account for 66% of the total, 34% of subscriptions are for two years.

Promotion Efforts by Infonet:

Subscription Renewals—During FY 2019, four renewal effort mailings were sent out to 14,618 subscribers whose subscriptions were about to expire. Total cost of these mailings was $5,335 and resulted in revenue of $22,864 from 2,355 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 to 16,184 subscribers at a cost of $5,619. This resulted in 3,592 renewal orders, $23,936 in revenue, and 2,382 nominee names.

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 19, 7,720 cash acknowledgements were sent out at a cost of $2,817. There were 1,330 1-year subscribers who "stepped up" resulting in revenue of $9,310.

Gift Subscription Promotions—A gift subscription renewal effort mailing of 9,513 pieces to 2,424 donors who have given gifts, at a cost of $3,472 resulted in revenue of $28,285. A much less successful promotional mailing at a cost of $2,404 went out to 6,589 subscribers who did not have a history of giving gift subscriptions. The results were 276 orders for only $1,746 in revenue.

Hunting and Fishing License Holders—In the fall, a new business solicitation utilizing the MassFishHunt data, included a segment of hunting and fishing license holders and some expired subscribers. 26,878 pieces were sent out at a cost of $9,079. There were only 734 responses with revenue of $7,340; a disappointing outcome.

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

Publications Orders FY 16—FY 19

Inland Fish and Game (Books)	FY16 Quantity	FY17 Quantity	FY18 Quantity	FY19 Quantity
Birds of Massachusetts: A Check-list	29	19	27	25
Critters of Massachusetts	90	28	41	56
Field Guide to MA Amphibians	79	3	3	2
Massachusetts Homeowner's Guide to Bats	8	9	13	11
Massachusetts Snake Guide	29	N/A	N/A	N/A
Field Guide to MA Reptiles	92	22	26	8
Field Guide to MA Amphibians and Reptiles of MA		89	113	78
Field Guide to Amp. and Reptiles of MA (bulk order 25 or more)		25	50	50
The Wild Turkey in Massachusetts	10	2	3	
Magazine Issue (Back issues)	79	54	59	61
PAC Study Guide	49	44	60	62
Massachusetts Natural Heritage Atlas 13th Edition (CD)	3	N/A	N/A	N/A
Massachusetts Natural Heritage Atlas 13th Edition, Individual Town Map (2008)	7	15		12
BioMap 2 report	7	91		13
BioMap 2 poster	5	4		2
Field Guide to MA Dragonflies & Damselfies	39	58		72
Dragonflies & Damselfies (bulk order of 25 or more)				41
Guide to Invasive Plants in MA	75	68		102
Guide to Invasive Plants (bulk order of 25 or more)	325			30
Field Guide to Animals of Vernal Pools	213	139		166
Field Guide Vernal Pools (bulk order of 25 or more)		125		130
- An Introduction to the Threatened Turtles of Massachusetts: Why they need our help (DVD)	12	5		5
Turtles of Massachusetts (poster)	10	2		1
- Vascular Plants of Massachusetts (CD)	6	1		1
Vernal Pool Life: A Race Against Dryness (poster)	20	14	N/A	N/A

of agency publications.

During FY2019, 199 1-year subscriptions and 852 2-year subscriptions were sold through the MassFish Hunt system. (FY 18—934 1-year subscriptions purchased, 768 2-year subscriptions ordered)

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, the Hunter Education program committed to distribute magazines through the Hunter Education courses beginning in FY2020. This effort alone will reach about 5000 students annually.

The Guide to Hunting, Freshwater Fishing, and Trapping
The 2019 Guide to Hunting, Freshwater Fishing and Trapping was again produced in cooperation with J. F. Griffin Publishing Co., as part of a multi-year contract with this publisher. The full-color, glossy-stock, 56-page booklet includes a digest presentation of the fishing- and hunting-related laws and regulations and other information of interest to sportsmen. Publications Manager Troy Gipps and I & E Chief Marion Larson contributed much of their respective time to the production of the Guide. 183,000 copies were printed, representing1% drop in copies from last year due to left overs at the end of the year. This is the fourth year that guide printing numbers were reduced (FY17 196,000). Unfortunately there were several season date errors discovered after printing. Corrections were made to the website locations, but reminders are being sent out to license holders, in the newsletter and on social media. A system of season date checking has been revived to prevent future problems. To address some well researched evidence that many new hunters and anglers are confused by regulations, an effort is underway to simplify and reformat the information presented in the guide. Taking a cue from an effort on the agency website over a year ago, a similar format will be prepared for hunting regulations in the 2020 guide.

Publications 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 2019 represents the second year for tracking popularity. (See table on page 90)

PHOTOGRAPHY
Troy Gipps, Editor and Publications Manager

Since the death of MassWildlife photographer Bill Byrne, Troy Gipps 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 images.

Troy's photo shoots included:

- Pollinator planting, butterflies, Wayne McCallum Wildlife Management Area, Westborough
- American Chaffseed (Schwalbea amaricana) discovery on Cape Cod
- Massachusetts Junior Conservation Camp (week 1 activities)
- Hamant Brook, stream restoration
- Airboating/Nightlighting/Banding Waterfowl
- Portrait, new director
- River Raft, fisheries sampling, Deerfield River
- Blue-spotted salamander, Wayne McCallum Wildlife Management Area
- Yellow-billed Cuckoo, Wayne McCallum Wildlife Management Area
- Tiger Trout spawning process, Sandwich Hatchery
- Trout Unlimited Award, Adam Kautza/TU Staff
- PIT tagging Quabbin lake trout
- Coopers Hawk feeding on a ring-necked pheasant
- Asian Longhorned beetle; tree climbers, entomological collection, West Boylston/Worcester
- Tiger Trout stocking/underwater trout photography/ Fly fishing angler, Sandwich Hatchery and Peters Pond
- Freshwater Sportfishing Award Program annual awards ceremony
- Trout Stocking, "Schools Out; Stock Trout," Lake Quinsigamond
- Electroshock Fishing, fish identification, Chauncey Lake
- Camping and Fishing Marketing Campaign, various DCR locations
- Surfcasting, Plum Island
- American Kestrels, hatchlings
- Milkweed, common
- Frog hunting

Education Programs

Staff members of the I&E Section offer programs to civic, school, community, conservation, and sportsmen's groups on a variety of wildlife-related topics throughout the year, for both youth and adult audiences. Through our wildlife education programs (general wildlife, wildlife in the backyard, wildlife in the schoolyard, endangered species, tracking, living with wildlife, wildlife and habitats), public appearances at conferences, and workshops, we reach out to urban youth, scouts, early childhood educators and administrators, pre-service teachers, undergraduate and graduate college students, formal and non-formal educators, and other adult audiences.

General wildlife education programs were presented y the Education Coordinator to 1,354 youth in grades pre-K-12. (856 in FY 2018)

Formal or School-based Education Programs
Pam Landry, Education Coordinator

Educational programs by Education Coordinator Pam Landry focus on groups of educators, students, and youth gatherings, but were also highlighted at other public events.

Project WILD & Aquatic WILD

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. It is based on the premise that young people and educators have a vital interest in learning about our natural world. 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. This results in the making of informed decisions, responsible behavior, and constructive action concerning wildlife and the environment. In Massachusetts, Project WILD is sponsored by MassWildlife and the Association of Fish and Wildlife Agencies, with support from the Massachusetts Sportsmen's Council.

Growing Up WILD: Exploring Nature with Young Children

This early-childhood (ages 3-7 years) education program 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 is a tool for helping fish and wildlife agencies meet their conservation goals by recognizing that children start developing attitudes towards wildlife and nature at an early age, providing knowledge and skills to early childhood educators so they may teach about nature, providing suggestions for outdoor nature-based recreation, providing conservation suggestions for each activity, providing activities that families can do together, and laying the foundation for acquiring increased scientific knowledge and problem-solving skills. There was a continued strong focus on connecting Growing Up WILD to Science, Technology, Engineering, & Math (STEM).

15 Project WILD & Growing Up WILD facilitators, contributed 987 volunteer hours, and offered 15 workshops (11 GUW, 3 WILD/Aquatic WILD, 1 Aquatic) attended by 281 pre-K-Grade 12 educators.

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 281 educators reached through Project WILD would ultimately educate 21,000 youth/year.

21 Project WILD facilitators attended the annual facilitator gathering. A presentation focused on The Wildness of Stone Walls was given by Professor Robert Thorson from the College of Liberal Arts and Sciences at the University of Connecticut who is an author, journalist, speaker, and consultant on the deep time environmental history of New England. Eleven educators attended a three day Growing Up WILD facilitator training.

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 include: 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
Students in grades K-12 from across the Commonwealth submitted 241 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 Division of Fisheries & Wildlife Field Headquarters, Westborough. The acrylic painting of Canada Geese by Michelle Gong, Apple-Leaf Studio was selected as Best of Show and represented Massachusetts at the National Competition finishing in the top 15. Nearly 200 people (student artists, families, judges, supporters and teachers) attended the awards ceremony held at the Field Headquarters. Combinations of the top 100 pieces of art were part of a statewide traveling exhibit appearing at eleven venues. 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 & 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.

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 Wildlife Education Specialist 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. Several other Division staff played roles in this important program by volunteering in various capacities on the competition day in May. The Chief attended quarterly meetings of the Massachusetts Envirothon Council. Its purpose is to provide support for the event operation in coordination with the Mass. Commission on Soil, Water and Related Resources. The Angler Education Program also lends a hand on the Envirothon Competition Day. The 2019 Envirothon was held in on a rainy day in May at Sholan Farms in Leominster with 32 teams participating.

Massachusetts Junior Conservation Camp
In August 2018, the Conservation Camp held its 2-week session at Boy Scout Camp Moses in Russell. Facilities at this location are an improvement from the past location. 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. She offered a Fish and Wildlife Careers program on one of those evenings.

Recruitment, Retention and Re-Activation (R3)
Astrid Huseby, Hunting Recruitment and Retention Reactivation (R3) Coordinator

The R3 Coordinator is charged with designing and coordinating an overall plan to promote hunting in Massachusetts by enhancing current programs, as well as through the de-

velopment and implementation of new programs through a Hunting and Angling R3 Plan for Massachusetts.

Marketing Efforts to Promote Fishing (Nicole McSweeney)
A significant effort was undertaken in FY 19 to continue to promote fishing through digital marketing by Nicole McSweeney (Outreach and Marketing Manager), Emily Stolarski (Communications Coordinator), and Jody Simoes (Human Dimensions Coordinator).

In early FY 19, MassWildlife wrapped up its 2018 spring/summer fishing marketing campaign. Using Google search advertisements, social media advertisements, postcards, and emails, MassWildlife recruited new anglers, retained current anglers, and reactivated lapsed participants. These efforts ultimately increased participation in fishing and increased license sales. Campaign analysis continued into the fall in FY 19. Emails were sent to over 56,500 lapsed anglers and postcards were sent to over 13,000 lapsed anglers; both methods showed a statistically significant increase in sales over control groups that were sent no communications. We measured $642,000 in license sales attributed to our postcard and email efforts. When we compared these sales against our control groups, we found we generated additional revenue of over $55,000 that we would not have received if we hadn't sent any communications. Additionally, between $270,369 and $529,563 was generated in license revenue from digital ads on social media and Google. Marketing efforts on Google Ads generated 235K impressions, 25K clicks, a 10.8% click-through-rate, and 59.6% conversion rate. We lowered our average cost-per-click on Google by 30% from our spring 2017 campaign. The social media campaign resulted in 2.54M impressions, 438K reached, 67K clicks, and a 2.62% click-through-rate. We lowered our cost-per-landing-page-view on social 74% from 2017. Due to the success of this campaign, Nicole McSweeney was invited to present the results of this campaign for various audiences in FY 19, including the Recreational Boating and Fishing Foundation (RBFF)'s Annual State Marketing Workshop (December), the NEAFWA R3 Committee Meeting (November), the North American Wildlife and Natural Resources Conference (March), Mass.gov (November), and the Fisheries and Wildlife Board (December). Nicole was also invited by RBFF to host a webinar in February, where over 90 fish and wildlife professionals tuned in to learn about fishing license marketing efforts in Massachusetts.

Over the winter in FY 19, Emily Stolarski and Nicole McSweeney collaborated with the MassFishHunt vendor, Aspira, to make improvements to the design and functionality of the licensing site's homepage. These improvements streamline the log-in process, offer an improved design consistent with other MassWildlife webpages, and provide customers with more information before prompting them to log in. Improvements were based on web analytics and user feedback. These improvements should result in increased sales for the spring 2019 campaign and sales throughout the year. Emily and Nicole also attended professional development training in January 2019 to learn more about how to utilize and evaluate Google ads to promote fishing and other outdoor recreation. This training was very important to ensure success for future marketing campaigns.

In spring of FY 19, 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. Human Dimensions Coordinator Jody Simoes provided Conventures with updated customer information to ensure the campaign reached the appropriate target audiences. 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 will run through the end of July 2019. Initial feedback suggests these marketing efforts were extremely successful in increasing participation and fishing license sales.

R3 Plan Development
Workgroups were formed to further R3 plan development. A number of staff attended national/regional R3 related conferences including the RBFF State Marketing Workshop in December, American Sportfishing Association Summit in October, and NEAFWA R3 Committee meetings in November and April.

Industry partnership efforts
As part of the Partner as Payer program, Thompson Center Arms released a video on their Facebook page on MassWildlife's prescribed burn efforts in August. There were two 2-hour workshop sessions on decoy placement and gear for deer hunting held at Cabela's in Berlin in the fall. Cabela's donated a cooking grill that was given away as a prize for submitting deer hunting and game bird hunting logs. The I & E Chief participated in an industry Partner as a Payer tour in February at the Smith and Wesson manufacturing facility in Springfield. In March, as part of Bass Pro's Spring Fishing Days events, the Angler Education Coordinator staffed an agency table for a day. In the spring, Cabela's donated gift cards that were used as give a ways for the spring fishing digital marketing campaign. In June, Bass Pro and Cabela's donated a total of 100 new and "gently used" rods to the Angler Education Program. A low key donation event was held at BassPro and publicized on the MassWildlife Facebook page.

Youth Skills and Recruitment Programs

National Archery in the Schools Program in Massachusetts
This program offers international-style target archery train-

ing 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 19, four (4) new schools received teacher training in NASP with a total of 117 schools participating in the program. Some schools provided their own funding; others used the new loaner kits that were created this fiscal year.

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 2018 Youth Pheasant Hunt Participating Clubs

Club	Number of Participating Youth
Carver	12
Essex	2
Falmouth Georgetown	5 4
Lee	7
Norco	14
Walpole	5
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 Recruitment and Retention Specialist coordinates the Youth Turkey Hunt.

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

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

In FY 19, a 1-day mentored Youth Turkey Hunt was held on April 29, 2019, the Saturday preceding the opening of the spring season. A total of 74 new students (sponsored by 10 clubs) completed the pre-hunt training and participated in the field exercise. 247 youth total obtained permits.

The following sportsmen's clubs participated in the program, in cooperation with the NWTF state chapter (Table 3).

Table 3. FY 2019 Youth Turkey Hunt Participating Clubs

Club	Number of Participating Youth
Barre	9
Carver	9
Cheshire	3
Conway	25
Falmouth	8
Fitchburg	5
Norco	2
Stockbridge	5
Worthington	6
Wrentham	2

Total # New Youth Hunters	74

Learn to Hunt Program
The Learn to Hunt Turkeys and Deer Program were designed for new hunter education graduates who want more information/experience before feeling comfortable enough to hunt.

Learn to Hunt Turkey Program: The learn to hunt turkey program was started in 2015 with one 3-day mentored turkey hunt and two single day workshops, we have slightly adjusted the classes each year based on survey feedback. In FY19 we conducted:

- 1 single day workshop with 22 participants
- 1 two-day program with mentored hunt with 24 participants

Learn to Hunt Deer Program: The learn to hunt deer program was started in 2015 with one 3-day deer program and two single day workshops, we have slightly adjusted the classes each year depending on the survey results. In FY19 we had:

- One two-day program with 22 participants
- Two half-day workshops, scouting with 12 and field dressing and processing with 26 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. Two seminars and mentored hunts were held for new female hunting participants in cooperation with Fort Devens military base. This year, the Women in the Outdoors (WITO) event organized by the Central MA Chapter of the National Wild Turkey Federation which had been ongoing for 5 years was not held.

Table 4. BOW workshops held in FY 19.

Date	Title of Program and Location	Number of Participants
October, 2018	Deer Hunting Seminar, Devens	24
December, 2018	Deer Hunt, Devens	20
April, 2019	Turkey Hunt Seminar, Devens	20
May, 2019	Turkey Hunt, Devens	20
Total Participation		84

Angler Education Program
Jim Lagacy, Angler Education Coordinator

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.

The Angler Education Program is in part a volunteer-run operation. 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.

102 volunteer instructors.
Approximately 71% were active during FY 19.

Family Fishing Events
Our 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.
Conducted 24 family fishing events.
Total estimated participation was 4,131 people.

Family Fishing Clinics
Our 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 two to three hours long, involving a short lecture on fish, fishing, safety, and ethics, followed by casting instruction and a healthy dose of fishing. Fishing educational handouts are generally provided and clinic participation is kept small enough to allow the instructors to work with participants one-on-one.

72 fishing clinics
Approximately 1,704 participants

Fishing Classes
A few specialty fishing classes are conducted each year, such as fly tying, or pilot adult-only "Learn to Fish" classes.

- *Conducted 15 fishing classes:*
- *5 fly tying classes,*

Communications Coordinator Emily Stolarski speaks with members of the public at the Boston Flower and Garden Show.

- *1 adult "learn to fish" classes,*
- *8 in-school classes Auburn High School Physical Education Fishing Program classes,*
- *1 basic fresh water fishing class, Hardwick Elementary School.*
- *Total number of participants – 234.*

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 spincasting rods, spinning rods, salt water rods, as well as fly rods and fly tying equipment and even ice fishing gear. Equipment was loaned to various groups and agencies, including the Massachusetts Department of Conservation and Recreation (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.

Equipment loaned on 31 separate occasions utilizing 904 pieces of equipment.

Massachusetts Junior Conservation Camp – The Angler Education Program has always lent a hand to this camp, teaching both the fishing and the fisheries sections, as well as contributing fishing equipment, education materials, and extra manpower.

12 sessions taught: 6 sessions of basic fishing and 6 sessions of fisheries management to approximately 110 campers.

Cooperative Programs
Trout Stocking Programs – These programs are performed in the spring (April and May) and for the most part with various school groups around the state. These are more promotional than educational. We occasionally link them to fishing clinics and in-class presentations, but for the most part the groups show up, are given a short lecture about the agency and our fish stocking programs, after which they help MassWildlife staff stock a given pond, lake, or river.

12 trout stocking programs for approximately 551 people.

Massachusetts Envirothon – The Massachusetts Envirothon is a statewide environmental education program for high school students and their advisors. The Angler Education Program has been involved in various capacities over the years and this year was at the Sholan Farms site in Leominster with other Division staff.

I & E Staff Recognition/Presentations FY 2019

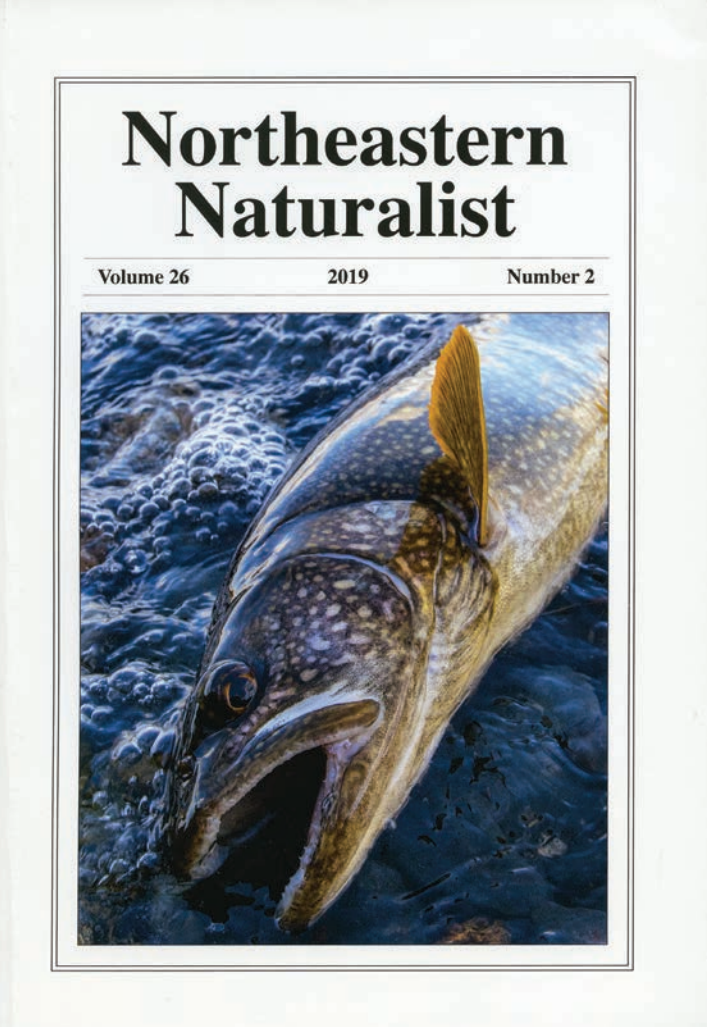
Astrid Huseby, Recruitment, Retention and Reactivation Coordinator, was honored by the Worcester County League of Sportmens Club at their Annual Appreciation Banquet with the 2019 Mentor of the Year Award in recognition of her work providing information and education to youths through the National Archery in the Schools Program (NASP). She also received recognition citations from the House of Representatives and the State Senate for her NASP effort during the WCLS Annual Banquet.

Nicole McSweeney was invited to present the results of the highly successful Fishing License campaign to: Recreational Boating and Fishing Foundation (RBFF)'s Annual State Marketing Workshop (December), the NEAFWA R3 Committee Meeting (November), the North American Wildlife and Natural Resources Conference (March). In addition, she was invited by RBFF to host a webinar in February, where over 90 fish and wildlife professionals tuned in to the webinar.

A lake trout image taken by Magazine Editor Troy Gipps graced the cover of the Northeastern Naturalist journal in the April 2019 Volume 26 Number 2 issue. This tied into a lake trout paper published by MassWildlife Fisheries Biologist Jason Stolarski; Observations on the Growth, Condition, and Ecology of Lake Trout in Quabbin Reservoir, Massachusetts

Information & Education Staff

Marion E. Larson, Chief Information and Education
Elaine Brewer, Natural Heritage Outreach Coordinator
Troy Gipps, Magazine Editor and Publication Manager
Astrid Huseby, Hunting R3 Coordinator
Jim Lagacy, Angler Education Coordinator
Pam Landry, Education Coordinator
Nicole McSweeney, Outreach and Marketing Coordinator
Jody Simoes, Human Dimensions Project Leader
Emily Stolarski, Communications Coordinator



Troy Gipps' photograph of a Massachusetts lake trout was selected as the cover of the Volume 26, Number 2, 2019 issue of Northeastern Naturalist.

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 the MDFW, 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 to the participants.

Courses

In FY19, four of the six 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. A total of 3,758students participated in the Hunter Education Program. Although lower than FY18 totals, participation levels are comparable with the five-year average of 4,477 students. Students are asked to volunteer information on age, gender, and ethnic background on course forms. The following is a summary of course offerings and statistics on student participation in FY19.

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. Seventy-six courses were offered in FY19. A total of 2,941 students participated and 2,684 successfully completed the course. Students are asked to provide information on age, gender and ethnic background. Of those responding, 715 students were minors (under 18 years of age), 247 were minorities and 509 of the respondents were female.

Trapper Education

The Trapper Education curriculum standards were revised in May 2018 by the IHEA in cooperation with the Association of Fish and Wildlife Agencies. Trapper Education is mandatory in Massachusetts for Problem Animal Control (PAC) agents and first-time trappers 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. Three courses were offered, with a total of 192 participants. One hundred and sixty-nine participants successfully completed the course including 6 minors (under 18 years of age), 10 minorities and 13 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. Seventeen courses were conducted. A total of 451 students participated and 441 successfully completed the course including 75 minors (under 18 years of age), 45 minorities and 60 women.

Waterfowl Identification and Hunting

This course teaches the identification of migratory waterfowl. It emphasizes the importance of distinguishing water-

Photo by Troy Gipps/MassWildlife

fowl in flight and includes identifying fall and winter plumage patterns and the size, shape, and flight characteristics of the birds. This course also covers hunting safely from boats and blinds and waterfowl hunting techniques. This course was not offered in FY19.

Black Powder (Muzzleloader) Education

This course was suspended in 2016 for review and revision. It was revised and tested in FY2018. The course includes the identification and selection of hunting equipment, state laws and regulations regarding muzzleloader hunting and the safe handling of muzzleloaders. A live-fire segment has also been added. Two pilot courses were conducted in FY18. Adjustments will be made and additional pilot courses will be conducted in FY20.

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. Eight courses were conducted (two in Pittsfield and six in Westminster). One Hundred and Seventy Four students participated and 167 successfully completed the course.

Shooting Range Development and Enhancement

It is DFW'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. The Division 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

District Reports

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 who meet the DFW do so through one of the agency's five Wildlife Districts. The District offices are this agency's field stations: administering wildlife lands, conducting on-site management, enhancing recreational opportunities, and addressing the wildlife issues pertinent to their regions.

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.

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 education and deal with a large number of bear complaints, deer damage complaints, questions about coyotes, and other issues dealing with the impact of wildlife on human activities, and vice versa. They also assist officers from the Office of Law Enforcement (OLE) to ensure public adherence to wildlife laws and regulations.

District staff also participate in a wide variety of survey and monitoring programs initiated by the DFW'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, banding of ducks, Canada Geese, Bald Eagles, and Peregrine Falcons, 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. They 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 checkstations, 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 encroachment 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 DFW 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 is very pleased to introduce Chalis Bird, our new Wildlife Biologist. Chalis comes to us from South Dakota Fish & Game where she worked with big game animals. Our Stewardship Biologist Jennifer Jones transferred to the Connecticut River District Office to fill the same vacant position. Assistant Director Moruzzi joined in on several NED staff meetings. New Board member Bob Durand paid a visit to meet District staff. There were no serious injuries or illnesses among the staff.

Migration onto the network was completed with access to the Westborough w:\drive, and individual p:\drives with daily back-ups. The septic system serving the Wildlife Technician/Biologists offices was invaded by an aggressively growing tree root which caused back-ups in the bathroom and work sink.

Many meetings were attended including: Senior staff, District Manager, Stewardship Biologist, R3, Agency Relevancy, Lands Committee, coyote listening sessions in Barnstable and Westford, Essex County League of Sportsmen, Norfolk County Sportsmen, drone use, Coastal Waterbird Cooperator's, turkey review, Mt. Watatic Advisory Committee meetings, fish ID, deer aging, sequestration, TTOR salt marsh remediation, and Active Shooter Training. Hunt Plan and impoundment meetings were attended as part of the Parker River National Wildlife Refuge CCP (Comprehensive Conservation Plan) process. Staff attended First Aid/CPR training. District Manager Huckery attended a workshop in D.C. entitled "Debate and Communicate Effectively About Hunting."

OSHA compliance was of primary importance with updates to trout stocking vehicles and practices, ladder use training, and safety updates to shop equipment. District staff were joined by the Office of Fishing and Boating and Moruzzi to clean-out the hatch house at the Ayer Game Farm.

A Kubota tractor was purchased along with a sickle mower. The deer scale was replaced.

Stewardship and Management

Following is a sample of stewardship projects handled throughout the year:

- John C. Philips Wildlife Sanctuary – Stewardship Biologist Jenn Jones met with Boxford town officials about proper kiosk installation being conducted by an Eagle Scout. Jones held a conservation planning meeting with Essex County Greenbelt Association to discuss trail access needs to their properties located in the interior of the Sanctuary. District and Realty staff conducted a site visit with trail experts and the Boxford Conservation Agent to determine potential work impacts upon wetlands from relocation of the Bay Circuit Trail.
- Dunstable Brook WMA – A 2nd year of herbicide treatment of swallow wort was completed by NHESP's Dan Bove.
- Crane Pond WMA – Additional federal taking research was completed. The Boudreau house trespass progressed through the Attorney General's office, with BVW delineation and survey lines drawn by staff.
- Squannacook River WMA – A MEPA comment letter was submitted on the Squannacook River Rail Trail. Survey lines were checked. Documentation of a large trespass (in-ground pool, cabana, fencing, land clearing, teepee, and OHV trails) was conducted.
- Flint Pond WMA – Wildlife Technicians installed snow fencing and signage at a tree harvest trespass in Tyngsborough to delineate the property boundary and future habitat restoration area. Conservation Commission and Selectmen meetings were attended regarding the Flint Pond Dam removal.
- Long Sought for Pond access – Jones reviewed Rt. 40 upgrades and determined the proposed project would provide safer access.
- Salisbury Marsh WMA – Cable gates were installed at Ferry Road and Sweet Apple Tree Lane.
- Nissitissit River WMA – Staff was joined by Pepperell Conservation Agent Paula Terrasi to clean up a dump site of used baby diapers.
- Groton Town Forest WCE - NHESP's Jesse Leddick returned to treat a patch of knotweed. District staff and CR Coordinator Newlands met with the Groton Forest Committee to review terms of the CR.
- Martin Burns WMA – Staff researched mine closure options for closing silver mine shaft openings. Management plan research was initiated, with all staff participating. A hearing on the Newbury Golf Center project was attended to protect DFW interests. Many Newbury Zoning Board of Appeals hearings were attended regarding a development off Pearson Drive impacting vernal pools, wildlife habitat and wildlife-dependent recreation. A kiosk was replaced at the target range. A trapping effort was undertaken for beaver flooding the powerline ROW that runs through the center of the WMA.
- Elbow Meadow WMA – Contract boundary work was completed and verified.

- Delaney WMA – Staff responded to a monarch butterfly concern regarding the mowing regime in the fields. A change to the mowing contract was agreed to by MA Department of Conservation & Recreation, keeping the Stow Conservation Commission in the loop on the actions taken.

- Ashby WMA – Staff responded quickly to a report about roadwork on Ashby WMA off Whitney Road, only to discover confusing Land Court decisions about ownership of the road.

- Surrenden Farm WCE – A Forest Cutting Plan was reviewed and approved.

Stewardship Biologist Jones and Huckery reviewed many NOI, ENF, and ZBA notices. A new shipment of property signs was received, and a new branded sign for the District office was installed. Wildlife Lands Viewer write-ups were finished. Staff was trained on the Managed Area Inventory database. The Pantry Brook WMA dam was checked for active beaver sign. Staff responded to a damaged tree near the Ayer Game Farm.

Research and Conservation

Wildlife

The Northeast District joined the urban black bear study with Wildlife Biologist Chalis Bird leading the trapping effort. Three males were trapped and tagged with one weighing in at an estimated 450 pounds. It was a tight squeeze in the trap for that big male taking several staff to pull him out. Staff also assisted with set-up of bear hair snares statewide.

Staff participated in a June LART training in Westborough. District staff assisted the Environmental Police with LART calls regarding black bear in Arlington and Amesbury. Interestingly, the Arlington black bear was tagged in Shirley one week prior as part of the DFW urban bear study.

Finally, after several warm winters, winter ice was thick enough for staff to reach, check and repair wood duck boxes. It was a successful Canada goose banding season. After 7 years of participating in the American black duck project, the Northeast District abandoned the job due to the high degree of difficulty trapping birds in Plum Island Sound. A mallard study was initiated. Staff were instructed on the use of a tub launcher, and how to extract blood from a duck's leg. Fisheries Biologist John Sheedy joined waterfowl survey crews on the airboat at Great Meadows/Concord, Ipswich River/Topsfield, as well as other sites.

The Northeast District was able to join prescribed burn projects state-wide (Montague Plains, Crane WMA) with Wildlife Technician Jesse Caney assisting, as well as providing training.

Volunteer Lucas Ghilardi researched values and protections of downed woody debris in streams and rivers for use in determining potential impacts from a proposed canoe access project on the Squannacook River WMA. He also researched navigable waters.

After a decade of study, data collection and permitting, Kent's Island Bridge has been replaced! Tidal flow has been restored within Kent's Island Creek to 47 acres of salt marsh. This marks the completion of one of the last major NAWCA grant projects (North America Wetlands Conservation Act). Replacing the bridge provides access to Kent's Island to complete several habitat restoration plans, including a NAWCA shrubland enhancement project for nesting American black ducks, mallards, and other waterfowl. Pheasant stocking will also be improved. The Kent's Island NAWCA shrubland enhancement project changed from a whole tree harvest to155 acres of herbicide treatment. This was a necessary change to prevent the spread of exotic plants following forestry operations. A prescribed burn plan was also prepared for a section of Kent's Island. In-Lieu Fee funds were explored for additional salt marsh restoration projects at William Forward WMA.

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, Dunstable Brook WMA, and North Pool at Parker River National Wildlife Refuge, well as help with other Westborough-directed bird surveys.

Fisheries

Stream surveys were conducted in nearly every watershed in the Northeast District with a few interesting finds, including a new native brook trout stream in Ashby. On the flip side, dipping into a known native brook trout stream produced nothing. "You gain some, you lose some" says Fisheries Biologist John Sheedy. A total of eight watersheds were visited including 19 streams/rivers, and eight ponds (Pearl/Wrentham, Stiles/Boxford, Fitchburg Reservoir/Ashby, Knops Pond/Groton, Boon/Hudson/Stow, Baptist/Chelmsford, Baddacook/Groton, Field Pond/North Andover).

A fish kill occurred in the Merrimack River in Haverhill. Shallow water spawning beds were exceptionally warm in July which depleted oxygen levels causing the death of common carp. A fish kill investigation was conducted below Willowdale Dam on the Ipswich River where DEP collected water samples.

The updated aquatic plant management plan for Baddacook Pond in Groton was reviewed and approved with conditions.

Natural Heritage and Endangered Species
Wildlife Technician Jesse Caney assisted Dr. Tom French at peregrine falcon nests located in quarries, on cliff-sides and bridges throughout the state. Peregrine chicks from Fox Hall in Lowell were rescued multiple times during fledging.

Bald Eagle nest survey additions and changes included a Newbury nest behind the Olde Newbury Golf Course on the Parker River, the Milton pair made a 2nd nest on the same property, the Merrimac pair moved across the Merrimack River to West Newbury, and the Pepperell nest was not in use. Eleven viable nests were documented.

Nesting habitat for state-listed turtles at Upper Parker River WMA received an herbicide treatment by NHESP's Dan Bove, followed by hand-pulling by volunteers.

Wildlife Technicians Travis Drudi, Caney, and Gahagan assisted NHESP's Pete Hazelton with freshwater mussel surveys as required by Turner Dam removal permits.

One of the rarest bees in North America, Epeoloides pilosulus, was discovered at Martin Burns WMA.

Enhancement of Outdoor Recreation
Fall trout stocking began in late September with 13,000 trout released (12,000 rainbow trout and 1,000 brown trout). In the spring, 97,545 rainbow, brown, Eastern brook, and tiger trout were stocked.

Five-thousand pheasants were released into five WMAs and 11 open covers. There was no loss in the number of pheasant covers. 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 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. MA Environmental Police officers, and friends of MassWildlife assisted with stocking Kent's Island since the bridge was in poor condition and not yet accessible to stocking trucks.

Bird and Huckery assisted towns (Wayland, Concord, Carlisle), conservation commission, and other property owners with hunting information, with the goal of opening lands to hunting to protect the health of the forest from deer. DFW-held WCEs were reviewed with grantees for hunting openness.

Twelve deer check stations operated within the District. Two hunters took part in the paraplegic hunt held at Fort Devens, where deer were seen, but not harvested.

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

Outreach and Education
The annual Carlisle Conservation Breakfast was devoted primarily to discussing the town's first controlled deer hunt. Members of the Deer Committee gave a small presentation. It was noted that the Selectmen have to approve the 2019 hunt. The 3rd annual Vernal Pool Discovery Walk was held by MassWildlife on The Throne in Groton with over 35 attending. The 4th Annual Groton Conservation Summit was attended by District staff to highlight the new dog regulation. It was Wildlife Technician Josh Gahagan's 2nd year running the native snake exhibit at Riverfest held by the Nashua River Watershed Association.

Black bear presentations were giver in Ayer and Ashburnham. Eastern coyote talks were presented in Saugus at DCR's Breakheart Reservation in response to complaints, and in Groveland. A tracking workshop was given in Ayer by Wildlife Technician Caney. Huckery and Bird participated in UMass-sponsored beaver trainings for municipal staff. Huckery led a workshop on "Living with Wildlife" for a room full of kids at 4-H Winter Forum.

Earth Day trout stocking was held at Whitehall Reservoir in Hopkinton with NED's John Sheedy and Josh Gahagan distributing fish and greeting attendees.

Technical Assistance
Here are just a few of the wildlife calls staff addressed throughout the year:
Coyote and black bear calls were frequent, with people concerned about these animals being out during the day. Turkeys were at it again in the cities digging up flowers, pecking cars, and chasing people. Staff responded to a call about cormorants caught in fishing line, and a swan was transported for New Castle Disease testing. Over a dozen calls came in from Peabody about rabbits, coyotes, Canada geese, and fox.

There were a few concerns regarding trapping of woodchucks by farmers. A few s.37 calls were addressed. The town of Ashby requested help with a beaver issue emanating from DFW land in Ashby. Aggressive hawks were a concern for several people. A lone baby skunk was taken in by a kind person and then released so its mother could raise it. Staff helped rescue a barred owl from a warehouse.

A considerable amount of time was spent helping MCI/Concord deal with goose hunting complaints. Safety set-back signs were posted, and staff attended a Selectmen's meeting to talk about hunting access, safety, and importance – especially in protecting farmer's crops, and controlling deer populations

Southeast District:

Administration
There were no personnel changes in the Southeast District in FY19.

The District had to address a significant safety issue at the District Headquarters facility by working with the Barnstable County Sheriff's Office to serve a no trespass notice to an individual that had verbally and physically assaulted several agency staff. The situation was resolved following the issuance of the order.

The District also had to address a few other safety issues in FY19 including the installation of a new alarm system at our Red Brook Wildlife Management Area house following a break in, the correction of a significant electrical issue in our garage at the District office and the beginning of an effort to bring the agency into OSHA compliance following a new law requiring it for State agencies. Related to the new OSHA regulations, the District was involved in a comprehensive review of our trout stocking truck following a minor injury to a staff member while working on one of our large stocking trucks. The District Supervisor had to meet with the Division of Labor Safety multiple times and create a Job Hazard Analysis for trout stocking from trucks, which resulted in several changes to the truck itself and the establishment of a formal safety protocol. Although the effort took a considerable amount of time, the result, which is to be applied to all trout stocking trucks, will be an improvement in safety for staff completing this task.

The new WMA regulation pertaining to the use of dogs, that the District Supervisor was intimately involved with, went into effect in January of 2019. The agency coordinated a comprehensive public informational rollout plan to ensure that the public was made aware of the new regulation in advance of that date and worked closely with WMA users and law enforcement on education and enforcement efforts.

District staff played key roles in several agency initiatives including attendance at multiple R3 (recruitment, Retention and Reactivation) meetings. These meetings, and the overall R3 initiative, follow a nationwide focus on R3 with the intention of finding ways to continue to grow the number of people involved in hunting, fishing and shooting sports which are the backbone of conservation funding in the United States.

Several important land issues in the Southeast District were addressed in FY19 including the ongoing review and licensing, in compliance with the agency's Trails Policy, of segments of the Bay Circuit Trail that cross MassWildlife land holdings, the review and reissuance of a license agreement for the Penikese Island School to utilize buildings and land on our Penikese Island Wildlife Sanctuary, the modification of lease agreement with Beaton Cranberries to farm cranberry bogs at our Burrage Pond Wildlife Management Area and participation in meetings associated with a proposal to include part of the Myles Standish State Forest area as a National Historic Landmark.

The most important, controversial and time-consuming land issue that continued in FY19 was the ongoing review of the request by the Town of Barnstable (specifically the Village of Hyannis) to establish new drinking water supply wells on the Hyannis Ponds Wildlife management Area. The District Supervisor served as the agency lead on the review team, along with staff from Westborough, as well as outside organizations/agencies including MADEP, USGS, Marine Biological Laboratory and private consultants, to continue to evaluate whether proposed new wells would negatively impact the sensitive coastal plain pond habitats on the WMA and abutting lands. The issue progressed through several phases, with the Town being granted permission to test the water via existing monitoring wells on the WMA, as well as USGS developing comprehensive groundwater simulation models. The issue is far from resolved but has been progressing in a positive direction with good data being collected that will ensure that any decisions made will be based on the best possible available science.

Aaron Best, District Stewardship Biologist, was among a few agency fire crew personnel that were selected for the Massachusetts Wildfire crew and deployed in August 2018 to assist in fighting the Goldstone Fire on the border of Montana and Idaho. Aaron and the other firefighters worked in the field, under difficult conditions, to assist in building fire breaks for a total of 14 days. Aaron gained valuable wildfire experience that will greatly enhance his ability to work on prescribed fires, one of the agency's most important habitat management tools.

District staff attended several trainings in FY19 including all staff being certified in Basic First Aid and CPR, all prescribed fire crew taking the annual refresher course and fitness test and all field staff that operate tractors or other heavy machinery obtaining hoisting licenses. Further, Dan Fortier (Technician III) successfully completed the S390 wildfire course. District staff also attended the annual employee conference hosted at the Connecticut Valley District Office in Belchertown.

The District Supervisor and Steve Wright (Wildlife Biologist) were tasked with inspecting two facilities that house captive wildlife species for natural history educational purposes, the Thornton Burgess Society and the Cape Cod Museum of Natural History. Both facilities were closely inspected, checking on proper care/husbandry of all captive wildlife species, as well as checking up on record keeping, etc. Both facilities were found to be in compliance with all applicable standards and regulations, resulting in permits being reissued by our Boston office.

Multiple District staff participated in the review of coyote hunting regulations following public outcry related to a coyote hunting contest hosted by a private business on Cape Cod. Staff were involved in a comprehensive review of the issue and relevant regulations, the coordination/planning of two of the public listening sessions that were held and the development of a set of proposed new regulations that we anticipate will go to a public hearing sometime in early FY20.

District staff responded to two emergency situations in FY19. The first was when a snow and wind storm collapsed a large portion of our quail holding pen and close to 600 quail that were planned to be stocked out over the course of the last week of the hunting season escaped. Multiple staff responded outside of normal working hours, in the early mornings, late evenings and on weekends, to assist in repairing the damaged pen and set several traps to recapture escaped quail. Thanks in large part to their efforts, most of the quail were recaptured, saving the agency money and ensuring we had quail to stock for the reminder of the hunting season.

The second emergency was when the main flume at our Hartley reservoir WMA blew out following a major rain just before Memorial Day. The District received a call from the Rochester Fire Department reporting that the flume had failed and much of the WMA, which consists of a series of impoundments (former cranberry bogs), had drained almost completely and had deposited a significant amount of sediment into the Mattapoisett River. District staff immediately notified agency senior staff and responded to the scene. The flume, a nearly 100-year-old concrete structure, was found in complete disrepair and it was evident that it had to be replaced as soon as possible due to safety and environmental concerns. The District Supervisor contacted the DCR Office of Dam Safety, Rochester Conservation Commission and MADEP. It was determined that, because the abutting cranberry bog operator still occasionally utilizes water from the WMA, that the structure was exempt from both dam safety regulations and wetlands protection act regulations. The District Supervisor prepared a report, presented it to the Conservation Commission and worked with Kris McCarthy (Assistant Director of Finance) to get contracts in place with two companies to replace the structure. The project was completed in less than two weeks, avoiding any significant damage to the upstream or downstream aquatic habitats and eliminating a major public safety hazard.

Research and Conservation

Wildlife

Southeast District staff completed multiple annual spring surveys including 3 ruffed grouse drumming surveys (Attleboro, Joint Base Cape Cod, Myles Standish State Forest), 1 nightjar survey (Mashpee/Falmouth), 8 breeding waterfowl plot surveys (Eastham, Barnstable, Chatham, Truro, Falmouth, Joint Base Cape Cod) and 1 woodcock peenting survey (Martha's Vineyard). District staff also conducted annual winter American black duck trapping and banding, successfully banding a total of 477 ducks throughout Plymouth, Bristol, and Barnstable counties.

Nesting boxes for wood ducks and Eastern bluebirds were monitored, maintained and replaced on DFW lands and other public and private lands. A total of 126 wood duck nest boxes were checked and maintained at 33 different sites across the District.

District staff conducted a site visit at our Taunton River WMA with biologists from Westborough to develop a plan for management of existing hayfields on the property to benefit grassland nesting birds and migrating waterfowl. As a result, the license agreement with the farmer was modified slightly.

The District Supervisor worked closely with the US Army Corps of Engineers to permit past and future emergent wetland restoration projects at the Burrage Pond WMA. This permitting effort will pave the way for additional pit-and-mound grading within the former cranberry bog units which has been shown to create a mosaic of microhabitat features that benefits a wide range of game and non-game wildlife species.

In June 2019 SEWD worked with DFW waterfowl project leader and biologists from MassWildlife Field Headquarters to capture and band 200 resident Canada Geese. 50 were banded from 5 sites in Barnstable County, 77 from 9 sites in Plymouth County and 73 from 8 sites in Bristol County. District staff also conducted pre-season summer mallard banding at a number of sites using baited traps and/or baited tub launcher sets. A total of 55 mallards were banded including 12 from two sites in Barnstable County, 13 from four sites in Plymouth County and 30 from three sites in Bristol County.

Former cranberry bogs on our 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 May 2019, along with H. Heusmann and other Westborough staff. Eiders were surveyed for and banded on offshore islands including Penikese and Bird Islands.

As part of a multi-state collaborative effort to restore New England Cottontails to historical ranges SEWD spent 11 days to live-trap 10 New England Cottontails from three areas in Sandwich and Mashpee. A subset of the rabbits were provided to the Roger Williams Zoo for a captive breeding program as part of this project. John Garofoli, Technician II, lead this effort and participated in a major NEC project by working with the USFWS to release some of the captive reared rabbits onto Noman's Land National Wildlife Refuge, which is intended to be a sanctuary for a new population and a source for future restoration efforts.

District staff assisted with two black bear projects in FY19. Staff attended several winter den visits as part of ongoing research being coordinated by David Wattles to look at cub production, food habits and other factors as the bear population continues to expand and move eastward. Several District staff also assisted with a graduate student's project by installing a number of bear hair snare traps across central Massachusetts. The study is intended to provide a better estimate of the bear population.

District staff also investigated numerous reports of wildlife that were sick, injured or dead 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. District staff spent a few days at Manchester reservoir in Attleboro attempting to locate a distressed common loon that was entangled in a balloon ribbon. Staff successfully located and freed the loon from the ribbon and released it unharmed. Staff also successfully captured a Canada goose in Fall River that had been shot with a crossbow and transported it to a local wildlife rehabilitation center where it was treated and eventually released.

District staff also operated many game check stations during the deer and turkey seasons, collecting biological data used in management of these 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 for 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 FY19 in consultation with the Fisheries Section in Westborough including Red Brook, Santuit River, Coonamesset River, Jones River, Quashnet River, Herring Brook – Falmouth, Fresh Pond, Williams Pond, Stetson Pond among others. Several of these surveys were coordinated with other agencies or organizations to collect additional data such as the USGS, Massachusetts Institute of Technology, DMF and DEP.

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

The District Fisheries Biologist continued our efforts to monitor stream temperature in many southeastern Massachusetts systems including Quashnet River, Mashpee River, Santuit River, Coonamesset River, Red Brook, Weir River, Indianhead River, Childs River, Jones River, Eel River, Wellingsley Brook, Town Brook, Marshfield Fairgrounds Brook, Beaver Dam Brook, Third Herring Brook, Phillips Brook, Furnace Brook, Pocasset River, Rattlesnake Brook, Iron Mine Brook, Marstons Mills River in order to better manage these systems, warn of dangers or issues, and provide a baseline set of data. Technical assistance in data analysis for stream temperatures was given to the Falmouth Rod and Gun Club for the Childs River, to the Sea Run Brook Trout Coalition for the Mill River in West Tisbury and to Trout Unlimited for Red Brook and streams in Westport.

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 sum-

mer camp, as well as the Tidal Quest summer camp and Falmouth High School AP Environmental science class.

A natural fish kill was investigated at Silver Lake, water supply for the city of Brockton.

Students from UMaine were assisted in collection of mosquitofish, *Gambusia affinis* from the Quashnet River for a temperature tolerance study.

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. Substantial numbers of brook trout were sampled and PIT tagged in the Spring of 2019 in the mainstem of Third Herring Brook at the old Tack Factory Dam site (removed in 2016-2017).

A poster session for the Environmental Monitoring class at Massachusetts Maritime Academy was attended and feedback was given on posters concerning Red Brook and Century Bog.

Restoration of the lower bogs and a dam removal on the lower Coonamessett River was monitored and technical assistance was provided to the town of Falmouth. The southeast District Fisheries Manager has been involved in the Coonamessett River Restoration plans for over 20 years.

A summer intern assisted in fisheries field activities and a winter intern from the Mass Maritime Academy assisted in field activities and data analysis.

The White Island Pond dam was monitored 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. Further, the fisheries manager worked with district staff to stabilize eroding sections of the Red Brook channel with a combination of stone and biodegradable erosion control matting. Plantings completed in late FY18 were monitored and watered regularly in early FY19 to assist in their successful establishment along the banks of the stream channel.

Land Stewardship

The District Stewardship Biologist completed annual monitoring visits and reports on all District Wildlife Conservation Easements (WCE) that were his responsibility in FY19.

Boundary marking efforts continued in FY19, with both in-house and contracted boundary marking work being completed on many properties. The Stewardship Biologist marked boundaries at the Taunton River WMA, Haskell Swamp WMA, Copicut WMA, Hockomock Swamp WMA, SE Pine Barrens WMA and Camp Cachalot WCE, among other lands. Contractors worked on marking boundaries at the Hyannis Ponds WMA and at Camp Edwards. The Camp Edwards boundary project is part of a larger boundary security project being coordinated by the District Supervisor in conjunction with the Massachusetts Army National Guard and Environmental Management Commission that also includes informational signage, gates and security cameras.

FY19 was not, thankfully, a very busy year in terms of encroachments, however we did locate and address two new encroachments and continue to work on an ongoing encroachment issue. New encroachments were identified at the Red Brook WMA and Quashnet River WMA. The Red Brook WMA encroachment consisted of an abutter to Bartlett Pond cutting shrubs, mowing herbaceous vegetation and storing materials (boat, chairs, etc.) along the shoreline of the pond on the WMA. Bartlett Pond is a coastal plain pond and the shoreline is host to several State-listed rare plants. The Stewardship Biologist contacted the landowner, but also got in touch with both MassWildlife's Natural Heritage & Endangered Species program and the Town Conservation Commission as there were violations of relevant regulations. A meeting was held with all parties and the situation was quickly resolved. The encroachment at our Quashnet River WMA consisted of some minor fencing, a portion of a chicken coop and dumping of yard waste/debris. The individual was contacted, met with and the encroachment was removed. Finally, the ongoing encroachment consists of fencing and a significant amount of illegal brush dumping on the Frances A. Crane WMA by an abutting landowner that has been very uncooperative with the agency. MassWildlife has had extensive title and deed research completed and a formal attorney's affidavit recorded in the Registry of Deeds confirming the boundary line shown and/or described in various surveys and deeds. In FY20, a letter, including the affidavit and all relevant survey plans and deeds, will be formally served to the abutter via the Barnstable County Sheriff's Department as a next step in attempting to address the encroachment.

Routine custodial functions continued in FY19 with trash/dumping issues addressed at all properties. Most significant dumping areas in FY19 included 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.

A new sign, in line with the agency's recent rebranding effort, was installed at the District Headquarters. Signs were also erected and/or maintained at several other properties including the Haskell Swamp WMA, Agawam Mill Pond Access, Atwood Reservoir WMA and a second District HQ sign

at the end of Bournedale Road. All new or repainted signs are being converted to our new standard brand colors of blue with white lettering. New kiosks or informational signs were also installed at the Weymouth Back River WMA in Hingham and at the Camp Cachalot WCE.

Parking areas and roadways were maintained at all WMAs and Access sites in the District. Significant improvement projects were completed at the Red Brook WMA (new formal parking area created, two gates and 30 boulders installed), Frances A. Crane WMA (16 loads of gravel used to improve 6 different parking areas), Noquochoke WMA (2 loads of gravel used to improve parking area) and Tispaquin Pond Access (2 loads of gravel used to improve parking area). The roadway leading to our parking area in Hanson at the Burrage Pond WMA, as well as the interior roadway leading to the Burrage Pond WMA house (that OLE utilizes under license agreement as their inland east HQ) were graded and maintained multiple times over the course of FY19. Further, all interior dikes and roadway edges were mowed in FY19. The roadway at the Old Sandwich game Farm WMA was graded and filled multiple times as well. Further, illegal OHV access was controlled with the installation of boulders at Red Brook WMA, Rocky Gutter WMA and Hockomock Swamp WMA.

Fire breaks were created and/or maintained at Camp Cachalot WCE, Frances A. Crane WMA and Southeast Pine Barrens WMA in support of planned prescribed fire management actions at those properties. Further, snags within a specified distance from fire breaks were cut down in accordance with the approved burn plans for each site. Prescribed fires were supported by District staff at several properties in FY19 including Frances A. Crane WMA, Camp Edwards WMA, Leyden WMA and Muddy Brook WMA. Research plots, designed to evaluate the effects of a variety of habitat treatments including fire, were created and/or maintained at the Frances A. Crane WMA.

Invasive plants were controlled at several WMAs through hand pulling and/or herbicide applications at the Halfway Pond WMA, Burrage Pond WMA (phragmites, gray willow) and Frances A. Crane WMA (spotted knapweed).

The Stewardship Biologist and District Supervisor coordinated with MADCR to address concerns expressed by the Boy Scouts (fee owner at Camp Cachalot WCE) related to horseback riding by the general public on the property. MassWildlife biologists from the District and Westboro evaluated the impacts of the activity, particularly on several sensitive coastal plain pondshore communities on the WCE and were in favor of prohibiting the use. Further, the Boy Scouts expressed concerns related to safety of scouts participating in programs that had had multiple instances of people on horses riding right through the program areas and near children. MassWildlife worked with DCR, who co-holds the WCE to officially endorse the request of the Boy Scouts to prohibit horseback riding on the WCE for both ecological and public safety reasons.

Two ongoing restoration projects were worked on in FY19. The District worked closely with DER to continue to study Mill Brook Bogs WMA in coordination with a private consulting firm. The Stewardship Biologist removed the boards from all water control structures on the WMA to allow the consultant to gain a better understanding of the natural hydrology of the site to aid in a full redesign of the restoration plan. Further, the District Supervisor completed the Notice of Intent filing for the restoration of the former Dyer property within the Taunton River WMA in accordance with the USEPA order. The permit filing will be completed in early FY20.

Natural Heritage and Endangered Species Program

The District cooperated with the Natural Heritage & Endangered Species Program (NHESP) staff on a variety of projects this fiscal year. District staff continued with our increased involvement in coastal shorebird monitoring and management, participating in planning meetings and training sessions, monitoring various plover, tern and American oystercatcher sites, installing and maintaining symbolic fencing and signs and interacting with the public and beach managers on a variety of issues related to shorebird management. Coastal shorebirds were monitored by District staff at Long Island and the South Shore Marshes WMA in Fairhaven, Brandt Island Causeway, Strawberry Point and Angelica Point in Mattapoisett, Fox Island WMA in Wellfleet, Planting Island in Marion and at 10 locations on the Elizabeth Islands.

In spring 2019 SEWD monitored 11 known/active Bald Eagle nesting locations within Bristol, Plymouth and Barnstable Counties and banded a total of 9 chicks from four of the nests. (Table 1.)

Two new nests were located in FY19 including one on the North River in Marshfield and one at the landfill/transfer station in Brewster. The latter one, although it did not produce any chicks, is of particular significance as it represents the first confirmed active nest on Cape Cod since the last nest in all of Massachusetts (pre-reintroduction) existed on Snake Pond in Sandwich in 1905! The District also participated in the annual Spring Bald Eagle Survey.

In a continued effort to monitor habitat use and identify key nesting areas of Blandings Turtles within the Hockomock Swamp WMA, District staff assisted biologists from MassWildlife's Field Headquarters by conducting radio-telemetry of tagged individuals.

Table 1.

TOWN	LOCATION	RESULTS
Lakeville	Anuxanon Island	Nest failure
Middleboro	Pocksha Pond	3 chicks banded
Plymouth	Halfway Pond	2 chicks banded
Plymouth	Billington Sea	3 chicks banded
Carver	Sampson Pond	2 chicks fledged
Pembroke	Silver Lake	Nest failure
Fall River	North Watuppa Reservoir	No eagle activity at nest
Marshfield	North River	2 chicks fledged
Brewster	Transfer Station	Housekeeping only
Dighton	Bristol Agricultural High School	1 chick banded
Westport	Westport River	Nest tree gone (fell over)

Coastal Plain Pond plant surveys were completed at several sites including Camp Cachalot WCE, Maple Springs WMA, Plymouth Grassy Pond and several Cape Cod locations.

District staff monitored our five known peregrine nesting sites in Fall River, New Bedford, Brockton, Taunton and Sandwich/Bourne and assisted NHESP staff with banding efforts. Kestrel nesting boxes were installed and/or monitored and maintained at Burrage Pond, Taunton River, Frances A. Crane, Maple Springs and Erwin Wilder WMAs.

The District continued supporting the tern project in FY19, assisting with a wide variety of projects over the course of the year including storing and transporting boats and equipment, the annual tern surveys and habitat improvement projects. District staff assisted with clearing of vegetation on Bird and Ram Island in May.

The District continued implementing the water level management plan at Cooks Pond WMA in Plymouth to support/enhance coastal plain pondshore habitat.

District staff assisted with rare plant and animal surveys in FY19 including rare plant surveys at several coastal plain ponds and along the North River, roseate tern surveys in April, establishment and collecting data from rare plant monitoring plots at Frances A. Crane WMA and rare water bird surveys at several WMAs and on private lands.

District staff were also involved in responding to the public and taking media inquiries related to concerns raised by a number of individuals related to the lethal removal of foxes from Duxbury Beach to protect piping plovers.

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

Enhancement of Outdoor Recreation

District staff stocked its fall 2018 allocation of 12,000 trout into 25 ponds and stocked its spring 2019 allocation of 78,795 trout into 52 ponds and 27 streams.

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 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 Correlus State Forest and Katama Farm are stocked on Martha's Vineyard and 8 locations are stocked on Nantucket.

In addition to Pheasants, staff also stocked 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 DFW's Club Bird Program. The District also provided pheasants to the Carver Sportsmen's Club and the Falmouth Rod and Gun Club for use in the DFW's Young Adult Pheasant Hunt, and assisted with the operation of the hunts at both clubs.

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. A total of 54 deer and 13 turkeys were taken during the 2018 deer and 2019 turkey seasons, respectively. Further, the District worked closely with base personnel to offer the Division's annual paraplegic deer hunt, with three participants all seeing deer. The District also worked with base staff to again provide very successful youth deer and youth turkey hunting programs. District staff also supported the implementation of the Blue Hills Reservation Deer Management Plan by assisting with the second segment of the controlled deer hunt.

The District Supervisor issued permits for a total of 63 special winter game bird hunts, 19 at the Erwin Wilder WMA and 44 at the Frances A. Crane WMA. A total of 136 pheasant and 1,803 bobwhite quail were stocked during these hunts. Four field dog trials were reviewed and permitted by the District Supervisor at the Frances A. Crane WMA.

The National Archery in the Schools Program training kit was again delivered and loaned to the Old Rochester Regional School so that they can teach archery as part of their physical education curriculum.

Several land projects were completed that greatly benefit public access and outdoor recreation including the acquisition of the ~100-acre Jigerjian property along the Nemasket River in Middleborough, which is a major addition to our Taunton River WMA and provides excellent public access and outdoor recreational opportunities. The District also began locating the boundaries of a small lot we have owned for a number of years on the Nemasket River and is working with the Office of Fishing and Boating Access on a potential car-top fishing and boating access. The District also met again with the Popponesset Beach Association, Office of Fishing and Boating Access and the MA Environmental Police to ensure angler access to the MassWildlife fishing access lot on Popponesset beach is maintained.

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. The Johns Pond Boat Ramp was brush cut and a large amount of accumulated leaves and debris were removed, which improved parking and access for the public. Most fields and access trails at the Myles Standish State Forest WMA were mowed and/or maintained by hand cutting.

Outreach and Education

District personnel continued to provide information and educate the general public, as well as a wide variety of other agencies and organizations, through publications and presentations and by attending meetings and events throughout the region. 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, the Waquoit Bay National Estuarine Research Reserve Watershed Block Party, the Falmouth Rod and Gun Club's Youth Day and several other environmental career days and youth events.

The District Supervisor gave a talk on the American bald eagle put on by the Harwich Conservation Trust and on coyotes at the Scituate Public Safety Complex. 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 talks on black bears at the Raynham Senior Center and the Wankinquoah Rod & Gun Club. The Fisheries Biologist gave talks on brook trout and/or fisheries management to the Cape Cod Chapter of Trout Unlimited and at Cape Cod Community College.

The District Supervisor participated in a workshop put on by Astrid Huseby in Westborough to provide newer hunters with experience and information on field dressing and butchering deer and donated a recently harvested deer so that participants could each bring home some fresh venison to try.

The District Fisheries Manager participated in the Earth Day Trout Stocking Event, stocking fish at Little and Long Ponds in Plymouth and giving a brief presentation on trout stocking and fisheries management to the public in attendance.

The Fisheries Manager also attended regular meetings of the River Herring Network, Eastern Brook Trout Joint Venture and Sea Run Brook Trout Coalition.

The District Supervisor attended monthly meetings of the Barnstable, Bristol, and Plymouth county leagues of sportsmen, providing them with information on DFW 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 during FY19 in the District.

In FY19 SEWD staff again responded to numerous reports of aggressive hawks, which appears to be an ever-increasing issue in the District. Site visits were conducted in Centerville, Mansfield, Middleborough, Plymouth and two locations in Sandwich. In all cases, the species involved was either Red-shouldered or Broad-winged Hawks. In most cases, the birds were far enough along to deal with the issue by simply preaching temporary tolerance until the birds fledged. In one case, young chicks were removed from the nest and transported o the Blue Hills Trailside Museum where Norman Smith was prepared to foster them into a new nest. In three cases, District staff removed nests and cut supporting branches for the homeowners after chicks had fledged in an attempt to discourage future nesting attempts in their yards.

In addition to the coyote contest issue, coyotes were a big issue in the District in FY19. District staff were involved in four different situations where coyotes were reportedly being very bold/aggressive, two of which involved reported bites to humans. A significant amount of effort was put towards investigating all four situations, educating the public and working with local officials to address the problems. In Scituate, where significant bold/aggressive behavior has been reported for a couple years, we identified a location where a homeowner was deliberately feeding coyotes in their yard, and we worked with the Town and homeowner to curb the situation. We also investigated the two coyote attack incidents, one in Norwell and one in Hingham, and worked with public safety officials in both cases.

The Fisheries Manager conducted a site visit to the Boston Golf Club in Hingham following reports of cutting close to a coldwater stream and assisted the conservation commission and golf course staff in addressing the situation. He also assisted with the review and ongoing coordination of the Elm Street dam removal project on the Jones River, working with Town officials and the Jones River Watershed Association.

The District Supervisor worked with several local concerned citizens, Town officials and the US Sportsmen's Alliance on a proposed ordinance in Attleboro that would seriously impact hunting opportunities and, consequently, wildlife management, in the City.
Dan Fortier (Technician III) assisted staff at Joint Base Cape Cod in teaching the S-130 wildland firefighter course.

The District had staff that served as the MassWildlife representative on a variety of management teams and efforts including the Santuit Pond Preserve Management Team, the Assawompset Pond Complex Management Team, the Lyman Reserve/Red Brook Management Team, the Buzzards Bay Restoration Committee, the Southeastern Massachusetts Bioreserve Management Team and the Mashpee National Wildlife Refuge Management Team. The Fisheries Biologist was actively involved in monitoring the Massachusetts Military Reserve (MMR) cleanup activities as a member of the Plume Containment Team.

Central District:

Administration
Central District staffing was stable through FY19 with no personnel changes to report.

The District Supervisor and the District Biologists provided input to DFW Lands Committee on potential land acquisition projects, focusing on wildlife habitat and recreational opportunities. One acquisition is particularly notable; the agency closed on Norcross Hill WMA in Templeton on June 24th, 2019 and added this 465 acre parcel to our stewardship holdings. In addition to our acquisition activities the District Stewardship Biologist and Wildlife Technicians monitored Conservation Easements throughout the District.

License agreements were issued by the District for agricultural leases on WMAs. During FY19 the District managed 34 agreements. The language and terms of License Agreements issued in FY19 were updated to include clarification of the ground nesting bird blackout period, and moved lease payment due dates up to facilitate re-bidding if necessary. These agreements benefit wildlife by maintaining open habitats, often in places that would otherwise not be actively managed due to staff, equipment, and time constraints.

The District also entered into two scientific research study License Agreements. One with a Tufts researcher studying bumble bees, and another with NOAA and NASA who've 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.

Staff participated in professional development and training including: Large Animal Response and Safe Capture Training, continuing education to maintain Hoisting Licenses and a Forest Carbon sequestration seminar. We also attended the NE Transportation and Wildlife Conference and gained insight into road crossing infrastructure and mortality mitigation for fish and wildlife passage.

Wildlife

District staff monitored 13 active bald eagle nests. Ten of these pairs successfully reproduced a total of 18 chicks. We banded 4 of these chicks at two nest sites. An attempt to band was made at a third nesting site on the Quabbin Reservoir however the two chicks found were too small at the time of the site visit. Both these chicks were subsequently observed as juveniles and appear to have successfully fledged.

Two research bear trapping sites were operated with no female bears captured. One male was captured and released. A total of seven collared research bears were monitored during FY19, and we conducted five bear den site visits during the winter to assess the health of the bears and cubs they produced.

A total of 126 wood duck boxes were checked and maintained at 28 sites throughout the District. 10 new boxes were erected. An early thaw prevented further planned installation work. Efforts will be redoubled next season.

We stocked 12,904 adult pheasants at 19 properties (16 WMA & 3 DCR). Heavy rain and flooding was an issue during the 2018 season. The District was unable to stock one of our traditional coverts, Bolton Flats WMA, and we were forced to suspend stocking at Barre Falls WMA mid-season as well. The birds planned for those locations were stocked elsewhere in the district. There were nine sporting clubs and two Department of Corrections locations participating in the club bird program. These locations were delivered 5,448 pheasant chicks that were reared and subsequently released onto publically huntable grounds throughout the district.

In June of 2019 we banded 150 Canada Geese at 15 sites within the District. A total of 20 birds were banded recaptures from previous seasons.

Central District personnel collected biological data at 9 deer check stations in the district. We also provided staffing, along with the Department of Conservation and Recreation, at the District Office location on Saturdays during the month of December to capture data from the newly established Wachussett Reservoir controlled hunt. This hunt was implemented to help control the deer population on watershed land near the reservoir. District staff oversaw the operation of 8 turkey check stations, 6 coyote check stations, and 2 bear check stations during the respective seasons as well.
Our staff also assisted in conducting waterfowl breeding plot surveys, Ruffed Grouse drumming surveys, Woodcock surveys, and White-Tailed Deer pellet count surveys.

Fisheries

District staff surveyed 45 sites on the Millers, Nashua, Concord, French and Chicopee watersheds during the months of July, August and September. The surveys were conducted using electro shocking equipment, and gathered information on fish species and length. Dissolved oxygen, Ph, conductivity & temperature data were also collected.

We surveyed 7 waterbodies for warmwater species - East Wauschacum & West Wauschacum Ponds in Sterling, Wampanoag Lake in Gardner & Ashburnham, Lashaway Lake in East Brookfield, Moosehorn Pond in Hubbardston, Tully Lake in Royalston and Little Pond in Bolton.

We surveyed 3 waterbodies for both coldwater & warmwater species – Webster Lake in Webster, Quinsigamond Lake in Worcester and Wachusett Reservoir in Boylston and West Boylston.

District staff conducted lake trout sampling on Quabbin and Wachusett Reservoirs by live capture gillnet. Data was collected for age and growth rate.

Trout were stocked with approved spring & fall allotment numbers. A total of 81 waterbodies received trout with 39 ponds, lakes, and reservoirs, 22 rivers and 20 streams. Overall 95,430 trout were released with six staff members working full time on this effort from 3/12/19 - 5/30 2019. Hatcheries in Belchertown, Sunderland, Montague and Sandwich supplied the trout.
District staff conducted monitoring efforts for a Westminster Business Park & MBTA proposed layover station which may impact two unnamed tributaries that flow to the Whitman River in Westminster. Water flow devices that record temperature, dissolved oxygen and conductivity are monitored to assess conditions for fish survival.

We continued oversight at Bartlett Pond in Lancaster to reintroduce wild eastern brook trout into the lower section of Wekepeke Brook to the Nashua River.

Land Stewardship

Habitat maintenance was conducted on 22 Wildlife Management Areas including mowing, invasive species spraying, timber cutting, and prescribed burning. Open space reclamation work in overgrown fields was completed at High Ridge, Birch Hill, and Winimussett WMAs.

District staff utilized land Access Grant funding to rebuild the parking lot at Whortleberry Hill WMA. The job entailed two days of prep and bulldozer work and 300 tons of gravel. With funding, we hope to do more parking improvements on WMAs in the coming years.

Ongoing boundary marking work often uncovers illegal encroachments and dumping on MDFW lands. This fiscal year stewardship and boundary marking work revealed over a dozen encroachment issues and a similar number of illegal dump sites. These range from a neighbor's shed being built on WMA land to a contractor using a WMA as a staging area for a bridge reconstruction project. In each case the District Land Stewardship Biologist makes contact and ensures mitigation and, if necessary, proper remediation work is completed. Additionally, two illegal encampments we found and removed.

We compiled agricultural lease maps and bid packages for four properties that were up for bid in FY19. The information was sent out to our mailing list of potential farmers and we received successful bids on all properties. This important program helps the agency maintain land and gives our farmer partners access to affordable agricultural land.

District staff installed new signs and improved the parking and boat ramp area at Leadmine Pond access in Sturbridge. We will be partnering with the Office of Fishing and Boating Access to make further improvements there in the future.

We replaced a damaged gate at the Westborough Field Headquarters building leading onto the MacCallum WMA. This gate was the first that was built in house using steel materials purchased with Access Grant funds mentioned earlier. Additional gate installations are planned for next year.

Central District staff assisted with the dam removal project at Welsh Pond in the Merrill Ponds WMA system in Sutton. Dam maintenance (vegetation and beaver control) continues at Cusky Pond, Williamsville Dam, Wine Brook, Birch Hill, and Adams Pond.

Outreach and Education

The District Supervisor attended the monthly meetings of the Worcester County League of Sportsmen providing highlights of district activities and interacting with meeting participants. A monthly report of these activities was also generated and distributed.

We also assisted with the head start Red Bellied Cooter turtle project by supplying holding tanks for the collection and liberation events at FHQ.

District staff conducted a presentation on Black Bears at the Holden library, and a presentation on Furbearers at the Boston Science Museum.

We continue to assist the public with the new lands viewer maps. Office visitors enjoy the local knowledge of the District and ability to get a map printed of specific area in any WMA.

We 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.

We also conducted trout stocking events with local interest groups including N.E. Flytyers, Cub Scouts, Boy Scouts, local High School students, and a daycare facility in Phillipston.

Connecticut Valley District:

Administration

The Connecticut Valley District remains fully staffed despite some changes during FY19. Long time district manager Ralph Taylor retired in June of 2018 as reported in the FY18 report. His vacant position was filled by Joseph Rogers who was hired in July 2018 to as the Connecticut Valley District Manager.

Jennifer Jones was hired to fill the Stewardship Specialist position after the position was vacated in June of 2019. Although Jennifer is new to the district she has been working in the Northeast District of the Division of Fisheries and Wildlife as the Stewardship Specialist for nearly 5 years. Jen has nearly a decade of experience in rare species field research, habitat management, and conservation land stewardship. She is proving to be a valuable addition to the Connecticut Valley District Staff.

The District Manager served as local representative on the DFW Lands Committee again this year providing guidance and input on 9 new land acquisition projects. These acquisitions will serve to protect critical wildlife habitat and provide recreation opportunities for outdoorsmen and women throughout the district. This year a total of 509 acres of new property were acquired to either expand existing Wildlife Management Areas (WMAs) or create new ones.

Agricultural licensing agreements were issued on three Wildlife Management Areas (WMAs) in FY18. 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), Valley District staff sold 2,177 Quabbin One Day Fishing Licenses. These licenses were issued at the three boat launch areas on the Quabbin Reservoir and totaled $10,885 this fiscal year.

The Swift River primitive camping area continues to be a draw for campers in the area. This fiscal year 35 Swift River Camping permits were issued. This is one less than last year but more than expected given the a wet spring and higher than usual number of cancellations.
There were three Field Trial permits and one Special Pheasant Hunt permit issued for upland hunting events at Herm Covey WMA this year. This is slightly more than last year despite cancellations due to weather. Several of the field trial users commented in favor of the invasives management on the property, saying that the habitat work had improved their events substantially. The invasive management work has been an ongoing project in coordination with FHQ habitat staff.

In April 2019 the district hosted a joint fire crew training with DCR and other nearby forest fire and prescribed fire crews. The training was held at the District Headquarters in Belchertown, MA.

Valley District staff participated in professional development and training throughout the year including: prescribed fire certifications, pesticide applicator's license, boater safety training, Large Animal Response and Safe Capture training and attended workshops and conferences.

Research and Conservation

Wildlife
Valley District staff completed 7 Ruffed Grouse drumming survey routes, 5 deer pellet transects and contributed to the Wild Turkey brood survey. Staff also banded 100 Canada Geese at seven sites. A total of 119 Wood Duck boxes were checked and maintained at 40 sites. Blue Bird and Kestrel nesting boxes were maintained at several WMAs as well. Staff assisted in erecting bear hair snares for a new genetic and bear density study.

Valley District staff monitored the survival and reproduction of 18 radio-collared female black bears during this reporting period. One collared adult reproducing female was harvested during the hunting season. Attempts were made to capture 13 collared females in their dens to determine reproductive success and first-year cub survival, but only 7 of the females were captured. It was determined that 7 females had newborn cubs, 5 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 6 females bears with GPS collars that malfunctioned and to add new females to GPS radio-collared female sample size. Twenty three bears were captured during 45 days of trapping (12 males, 11 females), two males and one female were captured twice during this period. Four of females with malfunctioned GPS collars were captured and had their collars replaced.. During the fall of 2018, 1 GPS collared females made an unusual movement outside her normal home range traveling 45 miles south into Connecticut. Three years of defoliation of oaks by gypsy moths and a widespread failure in acorn production may have caused her to search for food outside her home range.

The Valley District office in Belchertown continues to be staffed to check all harvested game species that require reporting. 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.

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

Approximately 127 acres of fields were mowed at six WMAs (33 acres at Southwick WMA, 23 acres at Southampton WMA, 38 acres at Herm Covey WMA, 3 acres at Poland Brook WMA, 5 at Montague Plains, and 25 acres at Leyden WMA). Several firebreaks were mowed and/or maintained at Montague Plains WMA, Southwick WMA, Herm Covey, and Leyden WMA for prescribed fire management on those properties. Two district staff members certified to work on controlled burns assisted with prescribed fires throughout the state, including 4 within the Valley District. In total 306 acres of grassland, scrublands, or woodland were burned with prescribed fire (138 acres at Southwick WMA, 117 acres at Montague Plains WMA, 36 acres at Herm Covey WMA, and 15 acres at Leyden WMA). District staffed assisted in cut stem herbicide treatment of invasive woody plants on a total of 12 acres at 3 WMAs. Six acres at Leyden WMA and 1 acre at Herm Covey WMA were treated to release approximately 60 apple trees. Five acres at Palmer WMA were treated to improve rare species habitat.

Valley District staff continues to clear and maintain the 1.25 miles of access trails to four duck blinds for the annual Ludlow WMA controlled duck hunt.

Valley District staff stocked 10,000 pheasant on 10 agency owned WMAs, 6 government properties, and 12 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 Whateley Great Swamp WMA. Tully Mountain WMA was also stocked this year by local clubs as part of the districts Club Bird Program. Towns stocked within the district included: Amherst, Belchertown, Brimfield, Conway, Deerfield, Gill, Hadley, Hatfield, Holland, Brimfield, Leverett, Leyden, Montague, Northfield, Northampton, Orange, South Hadley, Southampton, Southwick and Whately. A complete list of pheasant stocked properties within the district can be found on MassWildlife's website at: https://www.mass.gov/service-details/pheasant-stocking-connecticut-valley-district.

Fisheries

The Valley District continued its involvement in a number of region-specific fisheries projects on the Connecticut and Swift Rivers, as well as the Quabbin Reservoir. These include the Connecticut River Juvenile Shad Project, a modified Swift River Rainbow Trout mark-recapture project, and the Quabbin Reservoir Lake Trout netting project. Additionally district staff worked closely with biologists from field headquarters and several outside agencies and institutions 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 2018 and 2019 field seasons are included in this document.

The second year of the Connecticut River juvenile American Shad assessment project was completed between summer and fall of 2018. Sampling effort was increased substantially from the previous year with the addition of a second MassWildlife boat, allowing district and Westborough staff, as well as U.S. Fish & Wildlife Staff, to sample different regions of the river simultaneously. Sampling in the 2018 field season ran from August 8 and concluded November 1, totaling 217 individual electrofishing runs and sampling 4,130 juvenile American Shad. Catch rates are compared and used to estimate juvenile shad abundance in a variety of different temporal and geographic strata. Additionally every fish was measured and weighed to help compare changes and differences in fish condition. Findings from this dataset were presented at the Connecticut River Atlantic Salmon Commission (CRASC) biennial meeting, as well as the summer meeting of Southern New England Chapter of the American Fisheries Society. The full text of the 2018 Report, as well as the previous 2017 report, can be found on the Connecticut River Fish and Wildlife Conservation Office's website at: https://www.fws.gov/r5crc/.

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 5 separate nights between 11/01 and 11/20/2018. 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 2018 field season, crews captured 147 Lake Trout, 39 of which were recaptures from previous years. Additionally 55 Landlocked Salmon were sampled in the gillnets. Of note, an especially large individual was recaptured and weighed in at 26 pounds.

Another year of a simple mark-recapture study was initiated on the Swift River after assessing some of the pitfalls of the previous year's efforts. The summer 2019 program was expanded to include a much more thorough marking and recapture protocol. In the previous fiscal year, two different stocking groups of Rainbow Trout were differentially marked just prior to their release. Fish stocked above Route 9 in both July and October 2018 were differentially marked and resampled at 1 week, 1 month, and 3 month intervals after their initial release. In the summer 2019 stocking load, all fish stocked in the river were differentially marked to distinguish them from fish stocked during the normal spring 2019 season, which were all unmarked. All Rainbow Trout were marked with an adipose fin clip, and a subset received an additional caudal fin hole punch on July 1 and 2, 2019. The double marked trout were stocked above Route 9 in the fly-fishing-only catch and release area, and the remaining single marked adipose clipped fish were stocked in the reaches of the river downstream of the Route 9 Bridge. Similar to last year, a 1 week, 1 month, 3 month recapture protocol was initiated after the fish were stocked, which will run into the 2020 annual report due to the timing at the end of the fiscal year.

In addition to the larger scale research projects outlined in the sections above, the district staff also completed numerous smaller scale electrofishing surveys. Several large river systems were sampled in multiple reaches with both backpack and boat electrofishing in FY19, these included the Millers River (3 surveys), Fort River (7 surveys), Swift River, Quinebaug River (3 surveys), Mill River (5 surveys), and the Connecticut River (7 surveys, not including juvenile Shad work). Three smaller pond surveys were also completed at Forest Lake, Bowen's Pond, and Peppermill Pond. Three small streams were backpack electrofished outside the locations mentioned above. District staff and equipment were deployed to a considerable number of waters year-round with in this reporting period; both leading and assisting with a variety of new and exciting projects.

Trout Stocking

Trout stocking in the fall 2018 season began on 10/01 and was completed on 10/15/2018. In total 12,911 trout were stocked across district waters, weighing 13,411 pounds. 32 waters; 26 ponds and 6 rivers, were stocked with 14 inch Rainbow Trout from McLaughlin Hatchery. The Millers River received a special load of Brown Trout from the Bitzer Hatchery, stocked in cooperative with Trout Unlimited.

Spring trout stocking began on 3/27 and ended on 5/31/2019, however the established out-of-season additional stocking on the Swift River took place on 07/01 and 07/02/2019. In this time period staff stocked 92,195 trout, totaling 77,515 pounds, across district waters. Trout were sourced from McLaughlin, Bitzer, Sunderland, Reed, and Sandwich Hatcheries. 99 different water bodies were stocked, 31 pond and lakes, and 68 rivers and brooks. 75% of all stocked trout were greater than 12 inches in average length, 42% of the total allocation was comprised of 14inch size class Rainbow Trout form the McLaughlin Hatchery. Spring stocking was accomplished through the use of two district 2½-ton fish stocking trucks, with some additional assistance from hatchery staff and vehicles.

Land Stewardship

Boundary marking of WMAs continues to be a priority throughout the district. This year in the Connecticut Valley District a total of 34 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, Herm Covey WMA, Satan's Kingdom WMA, Montague Plains WMA, and Herman Covey 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.

Despite a late start this year, annual monitoring visits and reports were conducted on 35 Wildlife Conservation Easements (WCE) throughout the district in FY19. 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 come along for the site visits provided a good perspective on the land's history and current use, as well as, a chance to build relationships with these landowners.

Under the agency's current Walking Trails Policy, proposed trails and maintenance of existing trails must undergo and in-depth application and approval process. The Valley District has been working with Appalachian Mountain Club (AMC), the Town of Amherst, 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.

Natural Heritage and Endangered Species Program

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 and Whip-poor-will surveys within the district.

The Valley District staff continues its efforts to monitor and band eagle census covering Hampshire, Hampden and Franklin Counties. District staff identified and monitored 31 breeding Bald Eagle territories and banded eaglets in trees that could be safely climbed.

Enhancement of Outdoor Recreation

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 will be released on properties open to public hunting during the regular hunting season for sportsmen and sportswomen to enjoy.

Valley District staff administered the annual controlled waterfowl hunt at Ludlow WMA. Five groups of hunters applied for this year's raffle style permits and all five were drawn to participate in the hunt.

Outreach and Education

Valley District participated in the Franklin County Fair again this year by manning a MassWildlife display over the four-day event. Field Headquarters staff (FHQ) assisted and provided river fish shocked at the Oxbow on the Connecticut River for the Fish and Game buildings display tanks.

Valley District staff also provided a presence at the Springfield Sportsmen's Show in West Springfield, selling licenses, stamps, and permits and answering questions from the visiting public.

During the spring trout stocking season, Valley District staff participated in several public stocking events, including events with several new partners. The majority of these events took place during the week of spring break when children are out of school and available for events, which coincidences with Earth Week.

In mid-April, Valley District Staff worked collaboratively with West Springfield's Park and Recreation Department to stock Piper Brook Pond in West Springfield as part of a fishing derby hosted by the town.

MassWildlife advertised an informal stocking event during Earth Week in each of the 5 districts. The Valley District hosted this year's stocking event at Hampton Ponds in Westfield. The time and location of the stocking was posted both online and in print a few weeks prior to the event, and the public was encouraged to attend. Attendees helped district staff stock two different age classes of Brown Trout from the Sunderland Hatchery into the pond. This was the third year of this event, and was by far the most heavily attended, the large parking area and boat ramp allowed for a great staging area for such a large event.

Another small stocking event took place at Dragon Brook in Shelburne. Children and their parents helped stock Brook Trout and were given a brief presentation about our stocking program and fisheries in general.

The Eagle Brook School of Deerfield visited the McLaughlin Hatchery for a spring fieldtrip and helped stock the Swift River with district staff. Students learned about water ecology and had a chance to release some large Brown Trout from the Bitzer Hatchery into the Swift River. Students took advantage of the practical location of the Valley District field office and stocked the Swift from the grounds that border the river.

The district fisheries biologist also presented information to various sportsmen's and scientific groups. A talk was given at the Pioneer Valley Boat and Surf Club in Agawam regarding trout stocking and an overview of fisheries research projects within the district. Additionally, the findings associated with the Connecticut River Juvenile Shad Assessment project were presented at both the Connecticut River Atlantic Salmon Commission meeting, as well as the Southern New England American Fisheries Society meeting.

The District Supervisor attended regular meetings of the Hampden County Sportsmen's Council, the Hampshire County League of Sportsmen, and the Franklin County League of Sportsmen 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
The most significant change in the Western District was the loss of conservation champion George "Gige" Darey, who passed away December 21st, 2018. Gige's contributions throughout Massachusetts have been well documented and described. For the Western District staff he was a mentor, advocate, and defender. His support over the years was greatly appreciated and he will continue to be an inspiration.

The Western District operated on limited staffing throughout FY19. Two wildlife technicians were out for the entire Fiscal Year with injuries. This made labor intensive operations such as trout stocking, pheasant stocking, deer check, and stewardship difficult. Staff performed well to ensure that Agency programs were executed. In March 2019, we added a seasonal technician (Adam Burt) to assist us with field work.

The Western District completed a project improving access to Three Mile Pond and the adjoining waterway. This was the culmination of a collaborative effort between MassWildlife, Ducks Unlimited, Office of Fishing and Boating Access, and the Massachusetts Outdoor Heritage Foundation. The improvement will allow increased access for wildlife dependent recreation. The opening of this access was celebrated with and event including the DFG commissioner, the Fisheries and Wildlife Board and the Outdoor Heritage Foundation. (Figure 1)

The District Manager participated in the land acquisition process by attending two parcel meetings, touring and assessing land projects, and assisting in project coordination. Fifteen projects totaling more than 1000 acres, across 10 towns were protected in the Western District. It was another excellent effort by Western District Land Agent Peter Milanesi and the rest of the acquisition team.

Staff participated in professional development and training including Wildland Fire refresher, deer aging, active shooter training and Large Animal Response training.

Improvements to the district office include a new asphalt shingle roof.

The Western District responded to numerous wildlife situations in FY19. We picked up multiple hawks and owls over the course of the year. Most of these birds were young, in-

jured, sick or otherwise unable to fly. Typically they were transported to a raptor rehabilitator. Other wildlife calls included boa constrictors, bats, turkey, and bald eagles. Many of the towns in the western district have animal control officers that work on a part time basis and are often unavailable for response. As a result, District Staff help fill the gap providing assistance with wildlife issues.

Large Animal Response Team (LART) cases in FY19 included immobilization and relocation of a young bull moose from the town of Adams where it was trapped along a section of the Ashuwilticook Rail trail and a public safety hazard. Western Staff also relocated a doe from Pittsfield where it had no escape route. Both events were successful and done in cooperation with the Massachusetts Environmental police.

Research and Conservation

Wildlife

Annual surveys for Woodcock (1), Ruffed Grouse (5) and waterfowl indicated pair surveys (5) were conducted in the district. Staff also cleaned, constructed and installed nesting boxes for Wood Ducks (132), Bluebirds (91) and Kestrels (10).

Western District personnel provided support for Wildlife Project Leaders through game check stations, kill-card data entry, goose banding (100 bands over 10 sites), and habitat work. Rabbit pellet collecting efforts continued in FY19. Samples were collected in six plots in January and February of 2019 as part of the search for New England Cottontail.

Western District personnel implemented multiple habitat projects including brush mowing over 300 acres across 13 different WMAs. More than 20 apple trees were pruned at Stafford Hill WMA and Hinsdale Flats WMA. District staff also created more than 2 acres of early successional habitat at Hinsdale Flats WMA using the District skids steer forestry cutter.

The District deployed a loon raft at Cleveland Reservoir in Hinsdale. The Cleveland raft was used successfully for the second consecutive year.

The District had continued success with the bear trapping and collaring program. We collared 5 new sows bringing the total number of monitored bears to 11. District staff also set up and helped take down 22 bear hair snare traps in coordination with the UMass Coop Unit as part of a research project.

We continued to see undersized yearling bears in numer-

Photo © A. Sears Photography

ous locations throughout the district in the Spring of 2019. These small yearlings attracted attention in a number of locations. One yearling bear had to be captured in Adams and brought to tufts veterinary school for rehabilitation and release.

The District Manager and Wildlife Biologist investigated the killing of a miniature horse in Hinsdale. The horse had been fed upon by coyotes but was likely killed in its stall by a black bear and dragged across the property

Fisheries
A total of 21 fisheries surveys were conducted on 18 rivers and streams in the Western District from July to September 2018. All the surveys were conducted utilized backpack electrofishing gear. Five new Coldwater Fisheries Resources were identified as a result of FY19 sampling;

Due to lack of staff availability and other district duties, only 1 pond survey was conducted in 2019. Shaw Pond in Becket was surveyed on June 19, 2019. Five sampling runs were completed, shocking the perimeter of the waterbody. All fish were identified and measured to the nearest millimeter before being returned to the water.

The District Fisheries Biologist and technicians continued to monitor for the presence of *Didymosphenia geminata* (a.k.a Didymo) in two river systems in the Western District.

The District manager and Fisheries Biologist assisted the Fisheries Section in adipose clipping of brown trout for stocking in the Deerfield River. Clipping will help identify between stocked fish and wild reproduction.

We continued a program to remove invasive water chestnut (*Trapa natans*) from Three Mile Pond in FY19. The shallow, eutrophic nature of the pond makes it particularly susceptible to water chestnut which would have deleterious impacts on rare species and recreation. A noticeable decrease in water chestnut indicates that our efforts have been productive.

District personnel provided support for the Fisheries Section by providing technical information, consulting on environmental review, responding to fish kills, and participating in meetings.

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 48 miles of boundaries were marked in FY19, in combined efforts between district staff and contractors. Property surveys were conducted on 4 Western District WMAs. These surveys were important in establishing boundary lines and determining clear ownership.

The Stewardship Biologist completed 28 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 District office is currently in process on attempting to resolve 5 encroachments from abutting landowners onto Wildlife Management Areas.

We eliminated a campsite and blocked off Road Vehicle access at Tekoa WMA. We collected and disposed of 20 yards worth of trash and debris dumped on WMAs throughout the District.

District Staff maintained parking areas at 12 WMAs. With stewardship funding from the realty section, we were able to secure 264 tons of stone to stabilize parking areas and control access. This was an important addition to parking areas throughout the district and beneficial to public use.

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. The District Manager and Fisheries Manager have been involved in review of the lake and pond drawdown activities in the Western District. We plan to continue to work with NHESP and the Fisheries Section on this effort.

District staff participated in the Bald Eagle Nesting Survey. There are 7 active nests known in the Western District: Russell, Pittsfield, Lee, Monterey, Buckland, Richmond, and Otis. Chicks were banded at the nests in Richmond and Russell.

We conducted winter bat hibernaculum surveys at 4 locations. The District manager worked with franklin Land Trust on a grant to protect a hibernaculum on FLT land.

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.

Enhancement of Outdoor Recreation
Enhancement of outdoor recreation is a core function of the District office.

Fall trout stocking ran from September 27 – October 10, 2018. Sixteen lakes and ponds and 2 rivers (Deerfield River, Westfield River East Branch). A total of 12,346 trout (from Bitzer, McLaughlin and Sunderland hatcheries) were stocked

in Western District waters during the FY19 fall season.

FY19 Spring trout stocking commenced on March 28, 2019 and concluded on May 31, 2019, for a total of 45 stocking days. Seventy–seven waterbodies were stocked during the spring season; 23 lakes and ponds, 54 rivers and streams. The total number of fish stocked in the spring was 91,401 from all five Division hatcheries: Bitzer, McLaughlin, Sandwich, Sunderland and Roger Reed. Rainbow Trout in the 14+ category from McLaughlin Hatchery were the most frequently stocked.
Trout stocking is the primary activity for District staff through the spring months. The District Staff greatly appreciates the effort of the Hatchery staff is assisting with distribution of fish.

Pheasant were stocked 3 days per week throughout the season. The Western District distributes 4,000 birds, released on nine WMAs: Stafford Hill (Cheshire), Eugene Moran (Windsor), George Darey Housatonic Valley (Lenox), Hop Brook (Lee), Knightville (Huntington), Hinsdale Flats (Hinsdale), Three Mile Pond (Sheffield), Flat Brook (West Stockbridge), and Peru (Peru) and 13 covers across the towns of Ashfield, Lee, Lenox, Williamstown, Hawley, Great Barrington and Pittsfield. Overall, Pheasant stocking requires about 40 personnel days to complete each year. Pheasant chicks were provided to the Lee and Ashfield sportsmen's clubs in early FY19.

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.

Outreach and Education
District field staff interacts with the public on a daily basis, 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.
The District Supervisor attended monthly meetings and provided updates to the Berkshire County League of Sportsmen and to the Hampshire County League of Sportsmen's Clubs when the meetings occurred in the Western District. He also presented at and information meeting with Franklin Land Trust, the Berkshire Natural History Conference and the Hoosic State of the River Conference.

The District Stewardship Biologist hosted a booth at the Berkshire Natural History Conference and attended the Massachusetts Land Trust Conference.

The Fisheries Biologist worked with Wahconah Regional High School on numerous occasions demonstrating trout stocking and fisheries survey techniques. She also attended meetings of the Westfield River Wild and Scenic Committee.

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. In addition to advising members of the public, District personnel were often called upon to provide technical assistance to other agencies or user groups.

Black bear management continued to be a major activity for District staff during the spring and summer months. Calls requesting assistance, information, or simply reporting activities were an almost daily occurrence. District personnel responded with a tiered approach ranging from over the phone advice to site visits and active response.

District Staff worked with the Pittsfield Board of Health to address intentional bear feeding in the city limits. We have had some success in reducing feeding in a particularly egregious case.

The District Wildlife Biologist participated in a regional municipal forum on beaver biology and management.

District Personnel:

Northeast Wildlife District
Patricia Huckery, District Supervisor
Chalis Bird, Wildlife Biologist
Jesse Caney, Wildlife Technician
Travis Drudi, Wildlife Technician
Anne Gagnon, Land Agent (DFG)
Joshua Gahagan, Wildlife Technician
Tim Mathews, Wildlife Technician
Sue Ostertag, Clerk
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
Alex Krofta, 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
Debra Lipa, Clerk
Derek McDermott, Wildlife Technician
Peter Milanesi, Land Agent (DFG)
Jacob Morris-Siegel, Land Stewardship Biologist
Leanda Fontaine Gagnon, Fisheries Biologist

Staff from the Central District and Field Headquarters Fisheries Section conduct fish sampling operations on Lake Chauncy in Westborough.

Wildlife Lands
Acquisition and Realty Stewardship

Elizabeth Wroblicka
Chief of Wildlife Lands

Overview

The Realty Section, with Elizabeth Wroblicka as Chief of Wildlife Lands, Christine Chisholm as Land Stewardship Coordinator, and Elizabeth Newlands as Conservation Restriction Coordinator, 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.

Stewardship

Boundaries

With funding assistance from the Executive Office of Energy and Environmental Affairs, MassWildlife engaged the services of five experienced contractors who marked in total over 110 miles of property boundaries at various Wildlife Management Areas (WMA) across the state. All of the Districts reported good progress toward the goal of marking all WMA boundaries to inform the public of what land is open for hunting, fishing, trapping, and wildlife viewing. Staff provided contractors with maps and deeds together with basic orientation. Contractors performed a diverse set of tasks including research, locating boundaries in the field, creating GPS track-logs, blazing and painting trees, and hanging MassWildlife signage.

Surveys

MassWildlife also hired several 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 and set boundary markers at 10 different properties across the state.

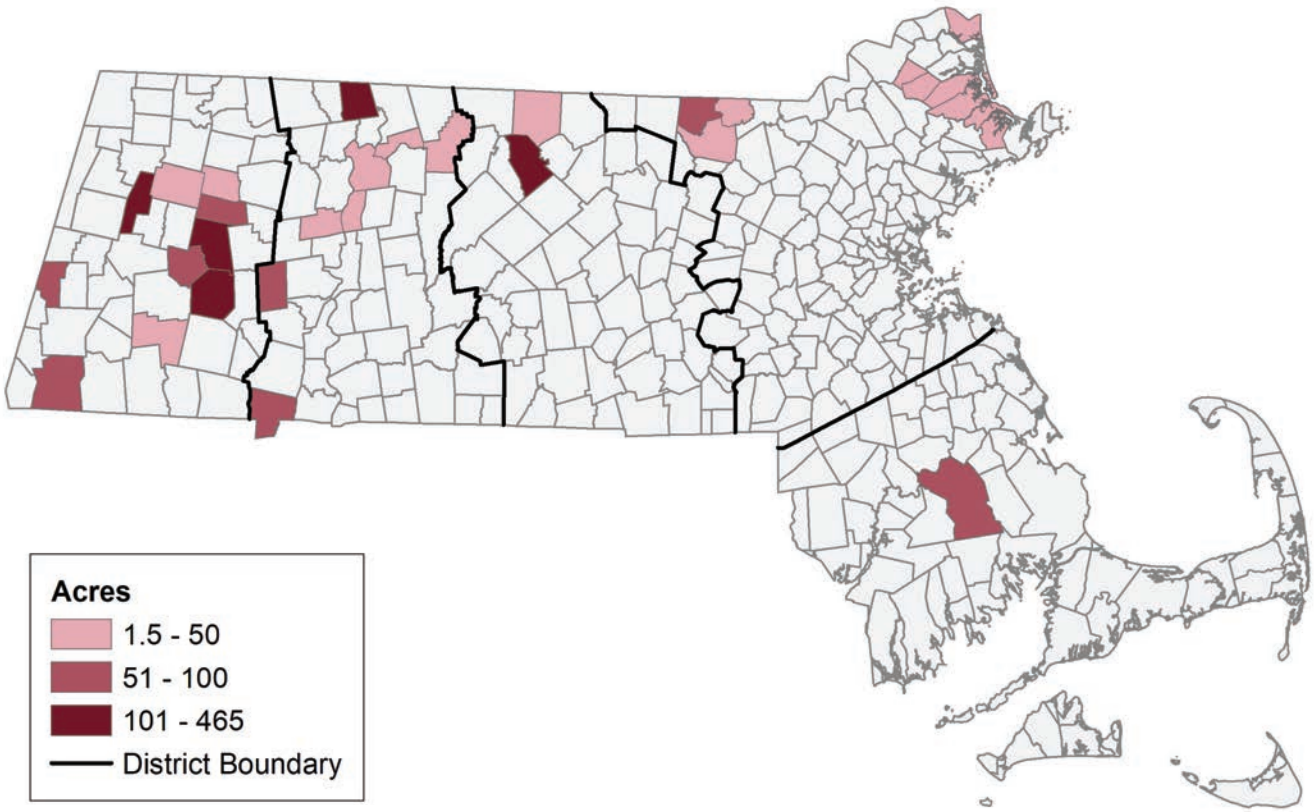
Conservation Restriction Baseline Documentation and Monitoring Efforts

Contractors working with Realty Section staff completed nine Baseline Documentation Reports (BDR) for MassWildlife's Conservation Restriction (CR) properties. With only one back-logged CR remaining, it is expected that all new CRs will have a BDR prepared within a year following acquisition. The BDR is an important component of CR stewardship as it establishes the condition of the property at the time the CR is put in place. Any subsequent changes on the ground are compared to the BDR to help establish whether the change is permitted or prohibited by the CR.

Members of the stewardship team communicate regularly with CR landowners, including municipalities and land trusts, to discuss the revitalized stewardship program, the agency's role in safeguarding the natural resources protected by the CR. Stewardship staff also work with landowners and other agency staff to seek opportunities to manage the property for wildlife and habitat improvements, for example through the Wildlife Habitat Management Grant Program. Realty and stewardship staff have also begun to focus on public enjoyment of the CR lands by posting boundary marking signs along CR road frontage to alert the public to the fact that the land is open to the public for wildlife-dependent recreation, by documenting parking, and updating property descriptions and limitations of public use on the MassWildlife Landsviewer.

District Stewardship Biologists and Realty Section staff conducted CR monitoring visits on over 180 of the agency's 204 CR land holdings. During these CR site visits, monitors walked the boundary, noted general conditions of the property, and documented issues and concerns as they relate to the recorded CR. Roughly 1/3 of these consisted of a "comprehensive" monitoring visit which includes an assessment of key natural resources protected by the CR such as vernal pools, rich mesic forests, rare species occurrences, and potential for management opportunities. We continue to refine and improve staff's capacity to collect and manage data and to produce and archive monitoring reports. At trainings, meetings in District Offices, and in the field, staff continues to refine and improve use of tablets, a web-based GIS program and the Land Information System (LIS) database. Monitoring reports have been archived in the intra-agency LIS, and were submitted to USFW and Forest Legacy Program as required.

FY19 Acquisitions by Town and Acreage



FY19 Wildlands Acreage Summary

	WESTERN	VALLEY	CENTRAL	NORTHEAST	SOUTHEAST	TOTAL
WMA	49,031	20,724	40,430	15,066	44,546	169,796
WCE	15,476	8,466	8726	2,160	11,434	46,262
Access	36	526	693	235	59	1,549
Sanctuary	428		368	552	79	1,426
WCR	69	2	746	127	38	983
Installation	2	579		106	114	802
Other				372	6	378
TOTAL	65,042	30,297	50,962	18,618	56,276	221,196

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.

Christine Chisholm, Land Stewardship Coordinator, marks a property boundary at a Wildlife Management Area.

Forest products harvesting continues to be the most common landowner activity that requires review and approval as required by the CR. Stewardship Biologists, the CR Stewardship Coordinator, and Habitat Biologists (as needed) review Forest Management Plans to ensure they are consistent with terms and conditions of the CR, and Forest Cutting Plans to ensure they are consistent with the Forest Management Plan. The review offers MassWildlife the opportunity to track and positively influence management with respect to sustainable forestry that benefits wildlife and wildlife habitat, and where appropriate and agreed to by the landowner, help the agency achieve its overall goals and objectives for increasing the acreage of young forest habitat in the landscape to benefit species in conservation need.

Acquisition

Land and Conservation Restriction Acquisitions in FY 2019
All of our work starts with protecting land from development. The land acquisition staff from both Department of Fish and Game (DFG) and the Division of Fisheries and Wildlife(MassWildlife) collaborated on 41 projects in FY 19 which protected a total of 2,429 acres of critical habitat, forests, grasslands, and inland water access points. These significant parcels will be added to MassWildlife's current holdings of 221,196 acres of land. Parcel by parcel the land acquisition team focuses on the most important land for hunting and fishing access, and biodiversity. Attributes such as wildlife corridors, flood water absorption, and climate change resiliency are also important factors considered when a parcel is targeted for acquisition. The total acquisition cost of $6.2 million to protect land will pay many dividends to all the citizens of Massachusetts now and in the future as we endeavor to save the many state-listed threatened and endangered species in the face of extreme weather events associated with a warming planet.

In FY2019, Central District land acquisition staff completed 2 projects protecting 475 acres of land at a cost of $1,409,000. In particular, acquisition of the former Walter E. Fernald Corporation land in Templeton provided MassWildlife with the opportunity to enhance landscape-level biodiversity and wildlife habitat protection across a conserved landscape of over 2,200 acres spanning from the Otter River State Forest in the north to the Templeton State Forest in the south. Acquisition of the 465-acre property created a new Wildlife Management Area: the Norcross Hill WMA. This new WMA protects over 5,300 feet of frontage on the Norcross Hill and Beaver Brooks, preserves and expands opportunities for active forest management and agricultural uses, and permanently secures public access for wildlife- dependent recreation including hunting and fishing. MassWildlife's ability to acquire the Norcross Hill WMA would not have been possible if it were not for the strong partnership with the North County Land Trust and Mount Grace Land Conservation Trust which participated in the successful application to the Massachusetts Landscape Partnership Program. The LPP awarded NCLT, MGLCT and MassWildlife with a grant in March, providing critical financial support toward project costs.

The Southeast District completed a pivotal acquisition project on the Nemasket River in Middleboro. Many groups have been trying to acquire the Jigerjian property for open space for 30 years. The District considers the "Jigerjian" 99 acre property to be the single most important property to be protected along the Nemasket River. The property has 1 ½ miles of scenic river frontage, rare species habitat, excellent public access and is a key link to other still unprotected

parcels along the Nemasket River. Much of the property can be hunted and offers opportunities for passive recreation both on the river and on the land. The Nemasket River has one of the largest herring runs in Southern New England and is major tributary to the federally-designated Wild and Scenic Taunton River.

The Northeast District protected 267 acres comprised of 14 projects ranging from 2.6 to 37 acres in 9 different towns. Although these projects cost $338,750 the value of the land protected is estimated at over $1,250,000 due to donations and other funding sources. A highlight is 29 acres of land on Town Farm Road in Ipswich, acquired with funding from the Army Corps of Engineers' In-Lieu-of-Fee program. While the majority of this parcel is salt marsh, it also includes an oak-covered island that provides excellent wildlife habitat and beautiful views. The parcel also has a small parking area. Another highlight is a 37-acre parcel in Pepperell on the Groton border. While this parcel will be part of the nearby Squannacook River WMA, it adjoins land protected by many different organizations totaling over 650 acres.

The Western District completed 15 land protection projects that added to eight different Wildlife Management Areas and conserved over 1,078 acres of land. Six of these projects, totaling approximately 624 acres, were added to Fox Den Wildlife Management Area (WMA) in the Towns of Worthington, Middlefield and Chester. The Fox Den WMA, one of the premier upland game areas in the state, features the Middle Branch of the Westfield River, an excellent cold water stream, its tributaries and the large interior forest blocks that make up most of its watershed. The biggest addition to the Fox Den WMA is 315 acres of land along Starkweather Hill Road in Worthington. This acquisition added protection to an additional 950 feet of frontage along the Middle Branch of the Westfield River, a top trout fishery, included two major tributaries to the Middle Branch and a large forest core habitat area. In addition, other Western District acquisitions in the town of West Stockbridge protected approximately 9,000 feet of frontage along the Williams River, another outstanding coldwater fishery, while adding acreage to both the Williams River WMA and the Maple Hill WMA.

Nine projects were completed in the Connecticut River Valley District protecting 863 acres at a cost of $1,092,220. One important acquisition is a 61-acre Conservation Restriction on North Pond, with 1,500 feet of frontage on the pond and adjacent to the Southwick Wildlife Management Area. North Pond is a very high risk area for residential development; this project conserves the only remaining undeveloped waterfront on the three contiguous ponds in Southwick, referred to as the Congamond Lakes. The project was a cooperative effort with the Franklin Land Trust and the Town of Southwick.

To see a map of all of our protected properties visit mass.gov/dfw/wildlife-lands.

Realty Staff:

Elizabeth Wroblicka, Chief of Wildlife Lands
Elizabeth Newlands, CR Stewardship Coordinator
Christine Chisholm, Land Stewardship Coordinator

Summer mowing at the Wayne F. MacCallum Wildlife Management Area in Westborough.

Wildlife Lands FY19

Late autumn at the Wayne F. MacCallum Wildlife Management Area in Westborough.

Photo by Troy Gipps/MassWildlife

Row Labels	Sum of Report Acres
Central District	**50962.1899**
Access	**692.55**
Bare Hill Pond Access	1.45
Blackstone / West River Access	28
Cusky Pond Access	23
Five Mile River Access	178.52
Glen Echo Lake Access	1
Leadmine Pond Access	0.05
Moose Brook Access	20.13
Moosehorn Pond Access	9
Mossy Pond Access	17
Natty Brook Access	95.17
North Pond Access	0.18
Quag Pond Bog Access	31
Quinapoxet River Access	32
Quinsigamond Marsh Access	59
Quinsigamond River Access	18.6
Sevenmile River Access	77
South Meadow Pond Access	0.25
Sputtermill Pond Access	58.5
Tully River Access	1
Ware River Access - Barre	40
Webster Lake Access	1.7
Sanctuary	**367.91**
Mount Watatic Sanctuary	228
Susan B. Minns Sanctuary	139.91
WCE	**8725.5**
Benjamin Hill WCE	87.5
Breakneck Brook WCE	526
Burnshirt River WCE	100
Carter Pond WCE	300.5
Fish Brook WCE	75
Fitchburg Watershed WCE	1875
Hitchcock Mountain WCE	110.5
Lawrence Brook WCE	462.6
Leadmine Mountain WCE	826.37
Long Pond WCE	8.85
McKinstry Brook WCE	31

Millers River WCE	194.22
Moose Brook WCE	125
Mt. Pisgah WCE	19.12
Muddy Brook WCE	575.69
Newton Reservoir WCE	622
Nineteenth Hill WCE	623.75
Potter Hill WCE	90.8
Quisset WCE	247
Savage Hill WCE	234
Secret Lake WCE	311.3
Slater Woods WCE	73.9
Stuart Pond WCE	28.7
Taft Hill WCE	394.6
Wekepeke WCE	564
Whitmanville WCE	118.1
Winimusset WCE	100
WCR	**746.41**
Breakneck Brook WCR	176
Five Mile River WCR	17.27
Hitchcock Mountain WCR	499.5
McKinstry Brook WCR	26
Raccoon Hill WCR	22
Williamsville Pond WCR	5.64
WMA	**40429.819923**
Barre Falls WMA	650.184923
Bennett WMA	281.2
Birch Hill WMA	4560.55
Bolton Flats WMA	1319.88
Breakneck Brook WMA	707
Chockalog Swamp WMA	52.5
Clinton Bluff WMA	42
Coy Hill WMA	1013.5
E. Kent Swift WMA	157
Fish Brook WMA	142.5
Four Chimneys WMA	200
High Ridge WMA	2240.87
Hitchcock Mountain WMA	268.41
Hubbardston WMA	361
Lackey Pond WMA	174.54
Lawrence Brook WMA	295.5
Leadmine WMA	826
Long Pond WMA	5.6

Martha Deering WMA	232.58
McKinstry Brook WMA	291.3
Merrill Pond WMA	1037.06
Millers River WMA	3749.76
Mine Brook WMA	1062.15
Moose Brook WMA	849.195
Moose Hill WMA	640.1
Mt. Pisgah WMA	88.8
Muddy Brook WMA	1842.68
Nineteenth Hill WMA	293.6
Norcross Hill WMA	464.93
Oakham WMA	911.2
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
Stone Bridge WMA	505.17
Sucker Brook WMA	102.6
Thayer Pond WMA	131
Ware River WMA	185.36
Wayne F. MacCallum WMA	894.58
West Hill WMA	350
Whortleberry Hill WMA	324.4
Winchendon Springs WMA	854.06
Winimusset WMA	670.17
Wolf Swamp WMA	1233.88
Row Labels	**Sum of Report Acres**
Connecticut Valley District	**30297.269**
Access	**526.01**
Connecticut River Access	94.8
Deerfield River Access	21
Lake Lorraine Access	0.26
Lake Quinsigamond Access	6.49
Lake Rohunta Access	2.49
Little Alum Pond Access	0.5

Mill River Access	14.15
Millers River Access	60.5
Packard Pond Access	0.54
Sawmill River Access	52
Tully Brook Access	154.88
Ware River Access	39
Westfield River Access	79.4
Installation	**579.22**
Bitzer Fish Hatchery	74.54
Reed Fish Hatchery	316
Sunderland Fish Hatchery	45.59
Wilbraham Nature and Cultural Center	143.09
WCE	**8465.51**
Amethyst Brook WCE	36.9
Brushy Mountain WCE	78
Chestnut Hill WCE	175.4
Facing Rock WCE	190
Flagg Mountain WCE	345
Great Swamp WCE	0.94
Honey Pot WCE	52.74
Lake Rohunta WCE	59
Little Tully Mountain WCE	461.38
Ludlow Reservoir WCE	1750
Orange WCE	877.97
Paul C. Jones Working Forest WCE	3486
Satan's Kingdom WCE	198
Southwick WCE	61.31
Tully Mountain WCE	692.87
WCR	**2.39**
Wendell WCR	2.39
WMA	**20724.139**
Bachelor Brook WMA	93.7
Bennett Meadows WMA	201
Brewer Brook WMA	456.69
Brushy Mountain WMA	181.38
Catamount WMA	413
Darwin Scott WMA	27.3
East Mountain WMA	604.45
Facing Rock WMA	1366.1
Flagg Mountain WMA	223.69

Great Swamp WMA	724.85
Green River WMA (Valley District)	507.85
Herman Covey WMA	1492.98
Honey Pot WMA	178.42
Lake Warner WMA	98
Leyden WMA	759
Montague Plains WMA	1977.589
Montague WMA	2004.29
Mt. Esther WMA	328.95
Mt. Toby WMA	724.1
Mt. Tom WMA	79.9
Orange WMA	388.5
Palmer WMA	1478.43
Pauchaug Brook WMA	161.3
Poland Brook WMA	707.53
Rainbow Beach WMA	45.9
Satan's Kingdom WMA	2194.6
Shattuck Brook WMA	178.8
Southampton WMA	170.6
Southwick WMA	348.28
Sunderland Islands WMA	15
Tully Mountain WMA	704
Wales WMA	207.15
Warwick WMA	379
Wendell WMA	591.19
Westfield WMA	234.03
Whately WMA	388.59
Williamsburg WMA	88
Row Labels	**Sum of Report Acres**
Northeast District	**18618.407**
Access	**234.94**
Baddacook Pond Access	0.16
Concord River Access	0.25
Flint Pond Access	89
Ipswich River Access	1.79
Knops Pond Access	0.6
Lake Attitash Access	6.03
Long Sought For Pond Access	1
Mascuppic Lake Access	0.25
Nashua River Access - Dunstable	15

Nashua River Access - Groton	10.1
Nashua River Access - Pepperell	11.2
Nashua River Access - Shirley	31.2
Sudbury River Access	51.86
Weymouth Back River Access	16.5
Installation	**106.42**
Ayer Game Farm	90.72
Northeast District HQ	15.7
Other	**371.7**
Gov. Thos. Dudley Park	4.5
King Phillip Woods	87.2
Mount Watatic Reservation	280
Sanctuary	**552.48**
Carr Island Sanctuary	110.5
Henry Cabot Lodge Bird Sanctuary (Egg Rock)	2
J. C. Phillips Sanctuary	390.98
Milk Island Sanctuary	29
Ram Island Sanctuary (North)	20
WCE	**2160.36**
Concord River WCE	18.9
Cow Pond Brook WCE	127
Devil's Den WCE	28
Great Meadows WCE	16
Great Swamp Brook WCE	106
Groton Town Forest WCE	513
Hunting Hills WCE	84.59
Martin H. Burns WCE	113.44
Meadow Pond WCE	81.9
Pepperell Springs WCE	255
Squannacook River WCE	299.33
Sucker Brook WCE	12
Surrenden Farm West WCE	169.7
Throne Hill WCE	177.5
William Forward WCE	10
Wright Ponds WCE	148
WCR	**127**
Mill Creek WCR	59
Squannacook River WCR	68
WMA	**15065.507**
Ashby WMA	946.76
Boxborough Station WMA	124.1
Castle Neck River WMA	54.67
Crane Pond WMA	2605.21
Delaney WMA	658
Dunstable Brook WMA	177.35
Eagle Island WMA	5
Elbow Meadow WMA	210.33
Fessenden Hill WMA	21
Flagg Swamp WMA	54
Great Marsh North WMA	511.25
Hauk Swamp WMA	61
Hunting Hills WMA	430.02
Martin H. Burns WMA	1576.7
Mulpus Brook WMA	496.43
Nissitissit River WMA	428.06
Pantry Brook WMA	449.95
Salisbury Salt Marsh WMA	865.87
Squannacook River WMA	1713.23
Townsend Hill WMA	658.82
Trapfall Brook WMA	45.38
Unkety Brook WMA	808.387
Upper Parker River WMA	198.1
Whittier WMA	42
William Forward WMA	1923.89
Row Labels	**Sum of Report Acres**
Southeast District	**56275.97**
Access	**59.41**
Agawam Mill Pond Access	1.4
Bakers Pond Access	1.75
Barnstable Harbor Access	2.78
Big Sandy Pond Access	0.2
Childs River Access	0.25
Cook Pond Access	3
Dogfish Bar Beach Access	2.4
Great Herring Pond Access	1.06
Johns Pond Access	0.52
Mashpee-Wakeby Pond Access	25
Nemasket River Access	0.46
Popponesset Beach Access	1.5
Robbins Pond Access	1
Scorton Creek Access	5.48

Shubael Pond Access	0.35
Snipatuit Pond Access	0.5
South Watuppa Pond Access	5.26
Spectacle Pond Access	0.5
Tispaquin Pond Access	6
Installation	**114.36**
Lobster Hatchery	14.8
Sandwich Fish Hatchery	69.76
Southeast District HQ	29.8
Other	**5.94**
SE Massachusetts Bioreserve	5.94
Sanctuary	**78.5**
Billingsgate Island Sanctuary	12
Penikese Island Sanctuary	60
Ram Island Sanctuary (South)	2
Tarpaulin Cove Sanctuary	4.5
WCE	**11434.14**
Acushnet River WCE	30.2
Agawam Mill Pond Access WCE	0.5
Agawam River WCE	3.98
Angeline Brook WCE	100.7
Assawompsett Pond Complex WCE	3065
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
Copicut WCE	486.22
Halfway Pond WCE	28
Lake Nippenicket WCE	8.35
Maple Springs WCE	156.25
Pickerel Cove WCE	78.3
Pilgrim Springs WCE	17.05
Plymouth Pine Hill WCE	240.7
Plymouth Town Forest WCE	296
Poor Meadow Brook WCE	101
Quashnet River WCE	14.1
Santuit Pond WCE	293
Sippican Woods WCE	390.14
South Triangle Pond WCE	47.5

Stump Brook Reservoir WCE	174
Taunton River WCE	290.07
Watuppa Reservation WCE	4300
Weweantic River WCE	10.08
WCR	37.9
Plymouth Grassy Pond WCR	33.9
Taunton River WCR	4
WMA	**44545.72**
Atwood Reservoir WMA	511.07
Bearse Pond WMA	5.8
Black Brook WMA	411.32
Blueberry Pond WMA	1.5
Brayton Point WMA	2.2
Burrage Pond WMA	1835.08
Camp Edwards WMA	15013.16
Canoe River WMA	116.6
Chase Garden Creek WMA	56.4
Clapps Pond WMA	68.35
Cooks Pond WMA	69.18
Copicut WMA	3992.56
Dartmoor Farm WMA	473
Dennis Grassy Pond WMA	7.24
Eastham Salt Marsh WMA	7.44
English Salt Marsh WMA	288.5
Erwin S. Wilder WMA	540.95
Fisk Forestdale WMA	235
Fox Island WMA	71.1
Frances A. Crane WMA	2170.31
Gosnold WMA	3.45
Halfway Pond WMA	122.64
Hartley Reservoir WMA	70
Haskell Swamp WMA	3111.22
Head Of The Plains WMA	2
Hockomock Swamp WMA	4552.54
Hog Ponds WMA	24.5
Hyannis Ponds WMA	365
Katama Plains WMA	18.57
Maple Springs WMA	774.57
Marconi WMA	1211
Mashpee Pine Barrens WMA	198.35
Mashpee River WMA	55.8
Mattapoisett River WMA	163

Meetinghouse Swamp WMA	123
Miacomet Heath WMA	3.83
Mill Brook Bogs WMA	584.52
Muddy Pond WMA	72
Noquochoke WMA	204.5
North Attleborough WMA	36.46
Old Sandwich Game Farm WMA	93.13
Olivers Pond WMA	12
Peterson Swamp WMA	250
Pickerel Cove WMA	15.9
Plymouth Grassy Pond WMA	25.5
Poor Meadow Brook WMA	161.61
Provincetown Corridor WMA	122
Purchade Brook WMA	106
Quashnet River WMA	51.54
Quashnet Woods State Reservation & WMA	360
Red Brook WMA	683.2
Rocky Gutter WMA	3142.89
Sandwich Hollows WMA	224.2
SE Pine Barrens WMA	436.84
Sly Pond WMA	192
South Shore Marshes WMA	22.4
Taunton River WMA	649.42
Triangle Pond WMA	92.16
Wasque Point WMA	99.5
West Meadows WMA	231.72
Row Labels	**Sum of Report Acres**
Western District	**65042.044**
Access	**35.82**
Deerfield River Access - Charlemont	0.62
Hoosic River Access	5.9
Housatonic River Access	17
Konkapot River Access	8.8
Westfield River Access - Chester	3.5
Installation	**2.35**
Western District - Old HQ	2.35
Sanctuary	**427.5**
E. Howe Forbush Sanctuary	365.5
Grace A. Robson Sanctuary	62
WCE	**15476.35**
Abbott Brook WCE	1782
Alford Spring WCE	889.82
Allen Mountain WCE	208
Boulders WCE	642.53
Cold Brook WCE	405
Cole Meadow WCE	101
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
Meadow Brook WCE	126.04
Mt. Darby WCE	319.29
Mt. Plantain WCE	1337.44
North Egremont WCE	21.5
North River West Branch WCE	96.2
Rockhouse Mountain WCE	78
Scout Pond WCE	175.9
Shales Brook WCE	5.6
Silver Brook WCE	162
Stage Brook WCE	581
Steadman Pond WCE	1170.95
Thorpe Brook WCE	266.2
Umpachene River WCE	239
Westfield Watershed WCE	2300
Widow White's Peak WCE	85
Windsor Brook WCE	3284.43
WCR	69.4
Windsor Brook WCR	69.4
WMA	**49030.624**
Abbott Brook WMA	18
Agawam Lake WMA	785.75
Ashfield Hawley WMA	284
Barton's Ledge WMA	88.6
Bullock Ledge WMA	15.5
Chalet WMA	7614.48
Cummington WMA	288.97

Day Mountain WMA	382.45
Dolomite Ledges WMA	389.87
Eugene D. Moran WMA	1870.427
Fairfield Brook WMA	164.9
Farmington River WMA	1901.1
Fisk Meadows WMA	638.17
Flat Brook WMA	273.15
Fox Den WMA	5686.946
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	27.5
Hubbard Brook WMA	195.93
John J. Kelly WMA	342
Jug End Fen WMA	112.54
Jug End State Reservation and WMA	1169.8
Jug End WMA	20
Kampoosa Fen WMA	72
Knightville Dam WMA	0
Lilly Pond WMA	350.7
Long Mountain WMA	958.84
Maple Hill WMA	643.85
Maxwell Brook WMA	36.4
Misery Mountain WMA	1336.04
North Egremont WMA	25.96
Oak Hill WMA	712.3
Peru WMA	5013.47
Powell Brook WMA	404.58
Ram Hill WMA	468.83
Richmond Fen WMA	22.9
Savoy WMA	1883.34
Shales Brook WMA	234
Shaw Brook WMA	153.33
Stafford Hill WMA	904.6
Stage Brook WMA	148.3
Swift River WMA	845.271
Tekoa Mountain WMA	1383.3
Three Mile Pond WMA	1141.82
Tower Brook WMA	298.61
Tracy Pond WMA	225.07
Upper Westfield River WMA	328.72
Walnut Hill WMA	988.7
Williams River WMA	60.5
Grand Total	**221195.8799**


Photo © Troy Gipps

Archivist

James E. Cardoza, CWB®
Wildlife Biologist
Contract Librarian and Archivist

I have made significant progress of the backlog of boxed and stored archival material which was aggregated during the move from the former Overlook Field Headquarters in 2012 and have processed all which I personally boxed and stored. I have also processed all of the antique realty files which were transferred to me by realty staff. Other sections periodically provide material to me which they had stored and are now going through for current access or long-term storage.

I am now working with the I&E Section on sorting and cataloguing the substantial array of transparencies, black-and-white negatives and photographs, and motion picture footage. I have completed the cataloguing of antique glass slides, except for one box containing slides in very fragile envelopes. I do not wish to handle these until we can acquire and transfer them to archival slide envelopes, to avoid damage to the existing envelopes and loss of the information on them. I have now completed the initial cataloging of motion picture footage, except for those reels for which the original labels have been lost. This footage will need to be viewed (or scanned on a splicer or like device) in order to ascertain what is shown on them. I have begun sorting and cataloging the many (~10) boxes of black-and-white prints. Each box contains smaller boxes labeled by topic, which sometimes contain several identical prints. I have discarded the surplus or poorer prints and grouped the others by subject and placed them in archival glassine sleeves and then into numbered manila folders. This has substantially reduced the volume of prints as originally stored. The negatives probably also exist among the many boxes still in storage. Some appropriate filing cabinets may be necessary to store and provide access to negatives and small prints. I am working with Robert Morley to provide on-line access to the archival database, in like manner as has been done for library materials.

The backlog of library materials has been catalogued and processed. I continue to receive occasional books, gray literature, and theses which are processed and catalogued as they become available. I keep a list of desirable books to acquire for the library and am in occasional contact with the Assistant Directors as to the library needs and desires to their staff and the process for book acquisition.

Photo by Troy Gipps/MassWildlife

Federal Aid Program Administration

Mike Sawyers
Federal Aid Coordinator

Overview
The Federal Aid Coordinator, acting through the Deputy Director, 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 apportionment of Federal Aid in Wildlife Restoration funds, $6,775,277, 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)
The State's Federal Aid in Sport Fish Restoration Act apportionment of $3,703,967 represents an increase over 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 $555,595 (15%); and the balance of $3,148,372 was equally divided between the Division of Marine Fisheries and MassWildlife ($1,574,186 each).

Two projects were obligated with the OFBA and MassWildlife shares of the FY 19 Dingell-Johnson and Wallop-Breaux funds. The OFBA, in cooperation with MassWildlife, had eleven boat accommodation grants active in FY 19. MassWildlife activities reimbursed under the Sport Fish Restoration Program include aquatic resources education, program coordination, hatchery operations, hatchery maintenance, fish distribution, and anadromous fish coordination and technical assistance.

State Wildlife Grant Program (SWG)
MassWildlife's State Wildlife Grant apportionment of $760,421 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 10, FY 11, FY 13, and FY 14 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 will be completed during FY20.

MassWildlife served as the lead state and was awarded $269,955 through the FY 14 national State Wildlife Grant Competitive program to fund Conservation Planning and Implementation for the Wood Turtle. MassWildlife is partnering with Maine, New Hampshire, Connecticut, Pennsylvania, New Jersey, Maryland, and Virginia. This cooperative project was completed in FY 19.

MassWildlife was awarded $20,000 through the FY 15 national State Wildlife Grant competitive program to fund the Multistate Recovery Actions for the Bog Turtle and Associated Headwater Wetland Species of Greatest Conservation Need. MassWildlife is partnering with Pennsylvania, Maryland, New Jersey, and Connecticut. This cooperative project was completed in FY 19.

MassWildlife served as the lead state and was awarded $402,545 through the FY 16 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 22.

Also in FY 16, 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 16. Implementation of the Blanding's Turtle grant will continue through FY 20.

MassWildlife was awarded $40,000.00 through the FY 17 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 through FY 21.

The Endangered Species Act (Section 6)
In FY 19, MassWildlife received $50,590 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 15, the 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 has established partnerships with other state agencies, municipalities, conservation organizations, and private individuals to accomplish the goals of the project. Project implementation will continue through FY 20.

Regional Conservation Partnership Program
During FY 17, 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 through FY 20.

Audits
The office of the State Auditor conducts a state audit of the MassWildlife Federal Aid Program once every two years and the U.S. Department of Interior, Office of Inspector General, conducts a federal audit of the program once every 5 years. No audits were active in FY 19.

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 Personnel
Kris McCarthy, Associate Director of Administration & Finance
Mike Sawyers, Federal Aid Coordinator
Lori Cookman, Fiscal Program Coordinator
Debra Chamberlain, Assistant to the Federal Aid Coordinator
Debbie McGrath, Federal Aid Bookkeeper

Photo by Troy Gipps/MassWildlife

Personnel Report

Johanna Zabriskie
EEA Deputy Human Resources Director / Dept. of Fish and Game

New Hires - Employee			
Name	**Title**	**Action**	**Date of Action**
Bird, Chalis	District Game Biologist III	New Hire	September 4, 2018
Bove, Daniel	Restoration Ecologist Conservation Biologist III	New Hire	July 1, 2018
Hawkins, Tabatha	Hunter Education & Outdoor Skills Specialist-Game Biologist I	New Hire	December 9, 2018
Jones, Michael	Conservation Biologist IV	New Hire	January 13, 2019
Marsden, Christopher	Wildlife Technician II	New Hire	March 3, 2019
Rogers, Joseph	District Manager – Environmental Analyst V	New Hire	July 8, 2018
Wroblicka, Elizabeth	Chief of Wildlands – Environmental Analyst V	New Hire	July 8, 2018
Seasonals & Interns Hires			
Name	**Title**	**Action**	**Date of Action**
Asta-Ferrero, Joseph	Fisheries Technician-Connecticut	Contract Seasonal	March 31, 2019
Averka, Jacob	Laborer I – Angler Education	Seasonal Hire	April 7, 2019
Burt, Adam	Wildlife Technician I	Seasonal Hire	March 3, 2019
Callahan, Michael	Predator Control Technician	Contract Seasonal	May 1, 2019
Danielson, Lord	Fisheries Technician-Merrimac	Contract Seasonal	May 5, 2019
Grasso, Kyle D.	Fisheries Technician	Contract Seasonal	September 24, 2018
Harmon, Nicole	Fisheries Technician-Connecticut	Contract Seasonal	March 31, 2019
Holly, David	Tern Colony Manager	Contract Seasonal	April 21, 2019
Lagacy, Eli	Fisheries Technician-Connecticut	Contract Seasonal	March 31, 2019
Liljesthrom, Marcela	Tern Colony Manager	Contract Seasonal	April 21, 2019
Morgan, Campbell	Fisheries Technician-Merrimac	Contract Seasonal	April 21, 2019
Pszybysz, Tara	Fisheries Technician-Merrimac	Contract Seasonal	April 14, 2019
Rawinski, Peter T.	Fisheries Technician	Contract Seasonal	June 9, 2019
Siener, Hillary	Wildlife Technician	Contract Seasonal	February 17, 2019
Stanmyer, Elise	Wildlife Technician	Contract Seasonal	February 17, 2019
Tawa, Samuel	Fisheries Technician-Merrimac	Contract Seasonal	April 14, 2019
Upham, Megan	Wildlife Technician	Contract Seasonal	February 17, 2019
New/Rehires - Contractors			
Name	**Title**	**Action**	**Date of Action**
French, Thomas	NHESP Technical Expert	Post Retirement	April 14, 2019
Walker, Kiah	Waterbird Specialist	Contract Employee	December 9, 2018

Terminations – Employee			
Name	**Title**	**Action**	**Date**
Kielbasa, Christopher	Wildlife Technician II	Retired	October 3, 2018
Krofta, Alex	Game Biologist III	Resigned	May 4, 2019
Pellegri Jr., Arthur	Fish Culturist II	Retired	May 29, 2019
Pratt, Cynthia	Office Support Specialist I	Resigned	March 30, 2019
Zima, Gary	Aquatic Biologist III	Retired	July 28, 2018
French, Thomas W	Program Manager VI – Asst. Director of NHESP	Retired	February 23, 2019
Jones, Michael	Conservation Biologist IV	Resigned	November 24, 2018
Terminations - Contractors			
Name	**Title**	**Action**	**Date**
n/a			
Transfers			
Name	**Title**	**Action**	**Date of Action**
Jones, Jennifer	Game Biologist I	Transfer to Central	June 9, 2019
Schluter, Everose	Program Manager VI – Assistant Director / Natural Heritage and Endangered Species Program	Promotion / Transfer from Executive Office of Energy and Environmental Affairs	May 12, 2019

Promotions			
Name	**Title**	**Action**	**Date**
Clark, Michael	Wildlife Technician II	Promotion	February 17, 2019
Hazelton, Peter	Chief of Conservation Science, Environmental Analyst V	Promotion	December 23, 2018
McSweeney, Nicole	Outreach & Marketing Mgr. Aquatic Biologist IV	Promotion	June 23, 2019
Regosin, Jonathan	Dep. Dir. Fisheries & Wildlife Program Manager VIII	Promotion	November 12, 2018
Reclassifications			
Name	**Professional Titles**	**Action**	**Effective Date**
n/a			

Financial Report

Kris McCarthy
Associate Director of Administration & Finance

SUMMARY		
REVENUE AND FUND EQUITY		
INLAND FISH/GAME FUND		
07/01/2018-06/30/2019		
DEPARTMENTAL REVENUES:		
Fishing,Hunting, and Trapping Licenses	$	5,174,321.70
Archery Stamps	$	171,859.40
Primitive Firearm Stamps	$	183,224.50
Waterfowl Stamps	$	53,669.50
Wildlands Stamps	$	962,810.00
Trap Registrations	$	3,015.00
Antlerless Deer Permits	$	216,950.00
Bear Permits	$	74,815.00
Turkey Permits	$	124,030.00
Special Licenses,Tags and Posters	$	39,482.00
Magazine Subscriptions	$	126,275.71
Timber Sales,Other	$	77,000.00
Fines and Penalties	$	3,350.00
Rents	$	53,647.08
Prior Year Refunds	$	-
Donations	$	30,924.56
Miscellaneous Income	$	24,188.36
PAC	$	32,864.00
NSF Charge/Debt. Collection	$	160.00
Total	**$**	**7,352,586.81**
FEDERAL AID REIMBURSEMENTS:		
Dingell-Johnson (Fisheries)	$	1,660,834.42
Pittman-Robertson (Wildlife)	$	7,659,101.92
Total	**$**	**9,319,936.34**
TAXES:		
Gasoline Tax Apportionment	$	1,010,815.74
OTHER FINANCIAL SOURCES:		
Reimbursement for Half-Price Licenses	$	197,139.25
Investment Earnings	$	27,070.97
Total	**$**	**224,210.22**
TOTAL REVENUE	**$**	**17,907,549.11**
FUND EQUITY AS OF JUNE 30, 2019	**$**	**10,369,477.80**

LICENSE AND STAMP SALES (07/01/2018-06/30/2019)				
Code	**Type of License**	Cost	Quantity	Amount
F1	Resident Citizen Fishing	22.50	110,318	2,482,155.00
F2	Resident Citizen Minor Fishing	FREE	6,913	0.00
F3	Resident Citizen Fishing (Age 65-69)	11.25	9,328	104,940.00
F4	Resident Cit. Fishing (Over 70)	FREE	15,075	0.00
F4	Resident Cit. Fishing (Disabled)	FREE	361	0.00
F6	Non-Res. Citizen/Alien Fishing	32.50	11,689	379,892.50
F7	Non-Res. Citizen/Alien Fishing (3 day)	18.50	3,313	61,290.50
F8	Resident Fishing (3 day)	7.50	2,505	18,787.50
F9	Non-Resident (Citizen) Minor Fishing	6.50	432	2,808.00
	Quabbin 1-Day Fishing	5.00	2,612	13,060.00
T1	Resident Citizen Trapping	30.50	656	20,008.00
T2	Resident Citizen Minor Trapping	6.50	2	13.00
T3	Resident Citizen Trapping (Age 65-69)	15.25	57	869.25
H1	Resident Citizen Hunting	22.50	14,442	324,945.00
H2	Resident Citizen Hunting (Age 65-69)	11.25	952	10,710.00
H3	Resident Citizen Hunting (Paraplegics)	FREE	3	0.00
H3	Non-Resident Citizen Hunting (Paraplegics)	FREE	2	0.00
H4	Resident Alien Hunting	22.50	158	3,555.00
H5	Non-Res. Cit./Alien Hunting (Big Game)	94.50	3,164	298,998.00
H6	Non-Res. Cit./Alien Hunting (Sm. Game)	60.50	1,307	79,073.50
H8	Resident (Citizen) Minor Hunting	6.50	1,159	7,533.50
S1	Resident Citizen Sporting	40.00	32,202	1,288,080.00
S2	Resident Citizen Sporting (Age 65-69)	20.00	4,031	80,620.00
S3	Resident Citizen Sporting (Over 70)	FREE	11,696	0.00
S4	Resident Sporting Paraplegic	FREE	42	0.00
	TOTAL LICENSE SALES (GROSS)		**232,419**	**5,177,338.75**
	Type of Stamp			
M1	Archery Stamps	5.10	33,702	171,880.20
M2	Waterfowl Stamps	5.00	10,736	53,680.00
M3	Primitive Firearm Stamps	5.10	35,931	183,248.10
W1	Wildlands Stamps	5.00	172,593	862,965.00
W2	Non-Resident Wildlands Stamps	5.00	19,969	99,845.00
	TOTAL STAMP SALES (GROSS)		**272,931**	**1,371,618.30**
	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			(401.40)
	Refunds			(2,670.55)
	TOTAL			**-3,071.95**
	TOTAL LICENSE/STAMP SALES (NET)			**6,545,885.10**

INLAND FISH AND GAME FUND EXPENDITURES (07/01/2018 - 06/30/2019)			
Administration:		**FY 2019**	
Administration	$	2,103,192.96	
Information-Education	$	1,302,128.11	
ISA DCAMM Field Headquarters	$	74,858.58	
Total	**$**	**3,480,179.66**	19%
Fisheries and Wildlife Programs:			
Hatcheries	$	2,633,121.91	
Game Bird Program	$	624,448.60	
Seasonals	$	123,395.60	
Cooperative Units	$	161,001.69	
Fisheries and Wildlife Management	$	6,058,870.92	
Total	**$**	**9,600,838.72**	52%
Other Programs:			
Land Acquisitions	$	1,346,628.00	
Waterfowl Management Program	$	42,944.00	
Hunter Safety Program	$	334,232.79	
Total	**$**	**1,723,804.79**	9%
Other Assessments:			
Payroll Taxes	$	177,184.79	
GI and Other Fringe Benefits	$	3,473,350.00	
Total	**$**	**3,650,534.79**	20%
TOTAL EXPENDITURES*	**$**	**18,455,357.96**	100%
Note: FY2019 $157,469 in reserve draw funding was transferred into the IFG Fund.			

SUMMARY		
REVENUES, EXPENDITURES AND FUND EQUITY		
NATURAL HERITAGE AND ENDANGERED SPECIES FUND		
07/01/2018 - 06/30/2019		
REVENUES:		
Natural Heritage and Endangered Species Tax Checkoff Donations		$ 281,139.01
Sales		$ 6,335.50
US Fish and Wildlife Service (ex. SWG, NAWCA)		$ 1,804,219.54
Natural Resouces and Conservation Services		$ 9,927.65
Regional Conservation Partnership Program (RCPP)		$ 30,067.90
Massachusetts Endangered Species Act Fees		$ 369,600.00
Contracts		$ 3,000.00
Direct Donations		$ 8,031.72
Interest		$ 2,420.46
TOTAL REVENUES:		**$ 2,514,741.78**
EXPENDITURES:		
Natural Heritage and Endangered Species Program		**$ 2,547,199.69**
FUND EQUITY AS OF JUNE 30, 2019		**$ 2,386,119.65**

OTHER EXPENDITURES 07/01/2018 - 06/30/2019	
Capital Outlay Funds:	**FY 2019**
Land Protection : Habitat Management- CR Stewardship	$1,152,586.96
Staffing for Land and Infrastructure Programs	$437,704.22
Hatchery/District/Westborough Field Headquarters Repairs	$213,099.09
Habitat Grant Program	$300,654.73
Dam Safety and Repair	$903,033.77
Bird Island Restoration	$30,000.00
Hatchery Feasibility Study	$250,000.00
TOTAL CAPITAL EXPENDITURES	**$3,287,078.77**
Interdepartmental Service Agreements	
Massachusetts Highway Department (MassDOT)	$ 138,933.95
Department of Conservation and Recreation	$ 200,355.38
Executive Office of Energy and Environmental Affairs	$ 18,219.48
Division of Capital Asset and Management & Maintenance	$ 61,735.00
Total	**$ 419,243.81**
Division of Ecological Restoration (MOU)	**$ 75,000.00**
Natural Heritage and Endangered Species Line Item:	**$ 212,868.90**
Federal Grant Accounts	
New England Cottontail	**$ 75,416.91**
Other Trust Accounts	
Federal Duck Stamp (e-stamp)	**$ 106,954.00**

A Massachusetts waterfowl hunter takes his Labrador Retriever on its first duck hunt.