

Vermont's Wildlife Action Plan

Taking Action: Implementing Vermont's First Wildlife Action Plan 2005-2015

Appendix E

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A Decade of Fish and Wildlife Conservation

When the State Wildlife Grants (SWG) program began in 2001, the program came with a mandate: In order for states to continue to receive funding after 2005, they must adopt a strategic plan for prioritizing the conservation of the state's fish and wildlife with a focus on Species of Greatest Conservation Need (SGCN)—wildlife with declining populations, those that are threatened or potentially threatened, or those about which we knew so little that we had no means to assess conservation status.

The 2005 Wildlife Action Plan identified 143 vertebrates, 191 invertebrates, and 577 plants as SGCN. In order to provide guidance for the protection of these species, the plan also identified problems faced by these SGCN. While diverse, the most common of these problems included:

- Information needs and data gaps
- Loss of habitat
- Impacts of roads and trails
- Pollution and sedimentation
- Invasive species
- Climate change

The plan went on to recommend strategies for aiding SGCN to survive and thrive in the face of the above problems.

Now it is 2015, and a decade has passed since the Wildlife Action Plan was adopted. Vermont has made great strides to implement its Action Plan, and this document attempts to capture some of the success Vermont has had in accomplishing the plan's goals.

State Wildlife Grant has been a major source of funding for the projects below, though certainly not the only source. If not otherwise noted, it can be assumed that these projects were completed using SWG funds.

Surveys, Monitoring, and Data Systems

If we don't know what we have, we don't know what to conserve. While our knowledge of species has improved substantially over time, the 2005 Wildlife Action Plan identified numerous information gaps that have prevented us from creating conservation plans or implementing management strategies for many groups of wildlife. We didn't know what threats some species face or have a good grasp of their population dynamics. Over the past decade, Vermont has worked to fill many of these holes through surveys of species abundance and distribution. In many cases, trained volunteers aided in data collection efforts, amplifying the quantity of data collected and providing opportunities for public awareness. Updated data management systems also helped us to compile information, much of which can now be accessed by planners, government entities, conservation organizations and, in some cases, interested citizens.

Invertebrates

Vermont Butterfly Atlas

The Vermont Butterfly Atlas (2002-2007) surveyed the entire state and analyzed historic records and collections to document the distribution of 103 butterfly species, including 12 species new to Vermont as well as giant silkworm moths. The project was collaboration between VFWD, the Vermont Center for Ecostudies, and the Vermont Institute of Natural Sciences with more than 200 citizen scientists participating. Assessing the conservation status of each species and establishing a baseline for understanding future changes was the principle goal of the Atlas. Fifteen species were listed as Species of Greatest Conservation Need representing three ecological groups—wetlands, grasslands, and hardwood forests. We also calculated the vulnerability to climate change for 14 butterfly SGCN currently found in Vermont. Three species were found to be extremely vulnerable to climate change, five were highly vulnerable, one moderately vulnerable, three presumed stable and two could likely increase in numbers in Vermont. We hope to see the Butterfly Atlas repeated in ~2027 as a comparison to this baseline. More information, including *The Vermont Butterfly Survey, 2002 - 2007: A Final Report*, can be found at <http://www.vermontbutterflysurvey.org/>.

Damselfly and Dragonfly Survey

From 2007-2009 the first statewide field surveys, focused on peatland and large river habitat, were conducted to detect the presence of dragonflies and damselflies (collectively known as odonates) including 27 Species of Greatest Conservation Need. The survey data when compiled with existing records resulted in a total count of 142 odonate species in the state—98 dragonflies and 44 damselflies. This effort provided vital species distribution and occurrence information which has broadened our understanding of rare habitat-specialist dragonfly and damselfly SGCN. Habitat data collected as part of the study provides a comparative baseline for future population trend monitoring. Among the investigation's results were: new encounters with *Gomphus abbreviatus* (very rare to rare) on two rivers and a moderate gain in the knowledge of *Ophiogomphus* spp. (four species), particularly on the White River; discovery of at least two previously unknown populations of *Neurocordulia yamaskinensis* (uncommon), a species that had been rarely encountered in Vermont; an expanded knowledge of *Somatochlora* spp. (seven species) distribution in and around peatlands, including *S. albicincta* (very rare), *S. cingulata* (very rare to rare) and *S. franklini* (very rare to rare), revealing that Silvio Conte National Wildlife Refuge and West Mountain Wildlife Management Area have some of the highest *Somatochlora* diversity in New England; and two new peatland sites for *Williamsonia fletcheri* (very rare to rare). Future efforts toward odonate SGCN conservation will continue to rely on the information resulting from this and future field studies.

Bumble Bee Survey

When public attention was brought to bumble bee declines in the last decade, the Vermont Center for Ecostudies worked with the Vermont Fish & Wildlife Department to document distribution and determine the status of bumble bee species in the state. With the help of citizen scientists a two-year survey amassed over 10,000 current bumblebee records from more than 1,500 locations, which were then compared to historic data. Twelve of the 17 species previously reported from Vermont were collected during this period. Three species appear to be more widespread than in the past, as well as the carpenter bee, which seems to have extended its range northward. This project enabled the Vermont Fish & Wildlife Department to assess the Natural Heritage conservation status of all of Vermont's bumble bee species in 2014, resulting in three species ranked as rare, one as uncommon, eight as common, three as having only historical records, and two species lacking information adequate to assign a rank. The three rare species were added to Vermont's Threatened and Endangered Species list in 2015: the Rusty-patched Bumble Bee (*Bombus affinis*) and Ashton Cuckoo Bumble Bee (*B. ashtoni*) are now listed as endangered, and the Yellow-banded Bumble Bee (*B. terricola*) is threatened. Harmful parasites accidentally imported from Europe and neonicotinoids, a class of pesticides toxic to bees and other insect pollinators, are believed to account for the bumble bee declines

Freshwater Mussels

Freshwater mussels are now recognized as the most endangered group of aquatic species in North America. In Vermont, ten of the eighteen native species are listed under the state endangered species law, one is federally endangered, and several others are considered rare. Between 2003 and 2010, surveys sought to describe the abundance, distribution, and habits of Vermont's freshwater mussel populations. Findings included a drastic decline in Brook Floater and a dramatic increase in Eastern Elliptio species in the West River. We now know more about fish hosts for Creek Heelsplitter and Fluted-shell, and have a better understanding of the distribution of Dwarf Wedgemussel and Elktoe. VFWD is in the process of developing a multi-species freshwater mussel recovery plan based on survey findings.

Vermont Invertebrate Database

The paucity of basic information such as species presence, geographic distribution, habitat associations, and life history has limited our ability to direct conservation actions for most groups of invertebrates. Some years ago, the Invertebrate Scientific Advisory Group to the Vermont Agency of Natural Resources' Endangered Species Committee recognized that a substantial amount of information already exists in past invertebrate collecting and research in Vermont, although it is scattered among various collections, government offices, research facilities, published works, gray literature, and other sources. The group recommended a centralized repository of invertebrate species data. What followed was the Vermont Invertebrate Database, an effort that beginning in 2006 compiled over 75,000 records representing over 400 species of invertebrate gathered from museum and private collections and literature. These data have been incorporated into the Vermont Atlas of Life, a database maintained by the Vermont Center for Ecostudies to provide a baseline of information for a broad spectrum of invertebrate taxa for future invertebrate conservation and research planning efforts.

Fish

Fish Surveys

Twenty-three percent of Vermont's native fish species are currently designated as rare, and many of these have experienced population declines due to habitat disturbance, overharvesting, pollutants, and the introduction of invasive species. Between 2004 and 2011, five Vermont water bodies were sampled to document abundance and distribution of some of these rare species (Lake Champlain, Holland Pond, Black River, Poultney River, and Missisquoi River). Surveys targeted Lake Sturgeon; Muskellunge; Shorthead, Greater, and Silver Redhorse; Eastern Sand and Channel Darter; Blackchin, Blacknose, and Bridle Shiner; Round Whitefish; and Stonecat. When Stonecat was discovered in a new location in 2004, fisheries biologists wondered if there may be additional, undiscovered populations, and rigorous additional effort was placed on locating new sites, to no avail. Sturgeon spawning was detected in three of the four rivers that had been known spawning sites in the past (Sturgeon spawning was detected in the Winooski, Lamoille, and Missisquoi Rivers), but not in the fourth, Otter Creek. The Sturgeon project also included genetic sampling of the Lake Champlain population, indicating that our local sturgeon is genetically distinct from other North American populations. Significant effort was placed on Muskellunge surveys not only to assess the current population but also to determine the potential to restore the species. Muskellunge were documented in Otter Creek (population established from a stocking program in the 1980's). None were captured in the Missisquoi River. The Missisquoi River between Swanton and Highgate dams is believed to have been the last known refuge population of "native" strain musky in the state but appears to have become extirpated following a chemical spill to the river during the 1970s.

Fish Historical Record Scanning

From the late 1800s to the 1960s, records of fish management activities and observations were documented in diverse paper formats and stored in several physical locations across the state. In recent years, much time and attention has been given to rare or endangered species, species in decline, fish and wildlife species distribution, fish and wildlife community changes and fish and wildlife species genetic composition, and yet the important historic data that could inform management strategies on these topics were difficult to access. For this project, over 2,000 documents were digitally scanned with text recognition software, and over 50 years of stocking records have been compiled into a digital database and made available through the Department's internal website. The digital format, text recognition capabilities and searchable databases have enhanced our ability to access these records to better understand historic species distribution and abundance, past management activities, and cultural impacts that may have influenced current fish and wildlife populations. This information is critical to making meaningful decisions for future conservation activities.

Amphibians and Reptiles

Town Surveys for Reptiles and Amphibians

First published in 1995, the Vermont Reptile and Amphibian Atlas relies heavily on volunteer citizen scientists to submit records of reptiles and amphibians throughout the state. The Atlas has greatly added to Vermont's knowledge of herp distribution and abundance, but one challenge with this type of volunteer-driven project is that some towns remain poorly surveyed. In these locations, knowledge of amphibian and reptile presence is very limited. In 2006, the Vermont Fish & Wildlife Department applied for a State Wildlife Grant to help fill some gaps by surveying three under-represented Vermont towns. In each town, 10-15 previously undocumented species were recorded.

North American Racers, Eastern Ribbonsnakes, and Common Five-lined Skinks—all rare species in Vermont—were also surveyed statewide, resulting in many new and confirmed reports from both new and previously-reported locations.

Rare Amphibian Surveys

When the Boreal Chorus Frog was listed as a state endangered species in 1987, the cause of the population decline was—and still is—unknown. By 2007, it was unclear whether the frog still remained on the landscape. While surveys followed over the next three years, the species was not detected, leaving us to suspect that the frog may either be extirpated from the state or no longer has any viable populations here. Fowler’s Toads were also subject to repeated, targeted surveys in 2008, and these also failed to produce any occurrences. This toad species was last documented in 2007, and it has now been added to the state’s endangered species list. Mudpuppy was also considered for threatened status in Vermont in 2011, but the decision was made against listing the species. This decision was based upon 2008-2010 surveys in which Vermont Fish & Wildlife Department refined a methodology to more effectively survey this difficult-to-detect species and thus learned more about mudpuppy population distribution. As part of this project, genetic sequencing across the state also revealed that Lake Champlain Mudpuppies show significant differentiation from those in the Connecticut River basin, which may have been introduced from outside the state.

Rare Snake Surveys

Timber Rattlesnakes, Eastern Ratsnakes and North American Racers are all restricted to just a few locations in Vermont. The rattlesnake is listed as state endangered and the ratsnake and racer are threatened. Traffic, mowing, and intentional kill all pose threats, as does human visitation to denning areas. In 2010, SWG funded a rattlesnake telemetry study to gain insight on home range and movements, parcel utilization, genetic analyses and some population demographic information, which provided a basis for developing the state’s 2015 Rattlesnake Recovery Plan. Essential to the project were staff of The Nature Conservancy, local citizen volunteers, the Herp Scientific Advisory Group, and Vermont Reptile and Amphibian Atlas staff and contributors. During the project, Snake Fungal Disease was confirmed in both of Vermont’s two rattlesnake populations. In 2012, a radio telemetry study was also completed for Eastern Ratsnakes to expand the knowledge base and known Vermont range for this species. North American Racers have been surveyed numerous times since 2006, with the latest two documented sightings surfacing in 2014. A Racer Habitat Improvement Project conducted from 2007-2014 in one Wildlife Management Area (WMA) has created new racer travel cover, several experimental hibernacula, foraging cover and egg-laying substrate.

Turtle Conservation, Planning, and Management

It is uncertain what the future holds for any of Vermont’s seven turtle species. The Spotted Turtle is state endangered, the Spiny Softshell is state threatened, Wood and Musk Turtles have been identified as SGCN, and even the remaining are vulnerable to boat traffic, human disturbance, egg predation, road mortality, collection, and habitat conversion. With the help of SWG, USDA Wildlife Services, many volunteers, the Friends of Northern Lake Champlain, ECHO Lake Aquarium and Science Center, Missisquoi National Wildlife Refuge, the Vermont Forests, Parks, and Recreation Department, Audubon Vermont, and Green Mountain Audubon, VFWD established a Spiny Softshell Turtle monitoring and management program to develop and implement conservation and recovery methods for softshell turtles in Vermont. Several large, communal nesting beaches are intensively managed for the Spiny Softshell, with Map, Snapping, Painted, and Musk turtles also benefiting. Initial monitoring not only enhanced knowledge of distribution but also made it clear

how to manage communal nesting areas to save eggs and hatchlings from predation, parasitic flies, and drowning. Additional turtle studies included a genetic analysis indicating that there is no female-mediated gene flow between the two Spiny Softshell subpopulations in the state and radio-tagging of Spotted Turtles to learn more about movements and habitat use. Invasive plants have been controlled at a Spotted Turtle Wetland.

Vernal Pool Mapping

Vernal pools are vital breeding habitat for a range of species, including several amphibians. A series of State Wildlife Grants helped in funding first a project that mapped potential vernal pools across the state using infrared photographs, and then to verify the mapped sites through field investigation. Work on this project is ongoing and relies on a large volunteer base as well as a partnership with Vermont Center for Ecostudies and Arrowwood Environmental. In all, some 2500 amphibian breeding sites were cataloged statewide. More information can be found at <http://vtcostudies.org/projects/forests/vernal-pool-conservation/vermont-vernal-pool-mapping-project/>.

Mammals

Rare Carnivores

For the most part, rare carnivore studies are limited to the collection and analysis of reported citizens' sighting information related to American Marten and Canada Lynx. Between 2005 and 2015, this involved reported sightings of 44 marten (27 confirmed) and 45 lynx (9 confirmed). For American Marten and Canada Lynx—species with known populations in the state—additional survey efforts to delineate presence include winter track surveys, remote cameras, and genetic analysis. A regional lynx survey—funded by USFWS's Endangered Species Program—was also conducted in cooperation with Silvio O. Conte National Wildlife Refuge and New Hampshire Fish & Game to test a remote camera-based protocol, and so far 16 lynx have been recorded. A similar remote camera protocol was used to detect marten, with 8 successful detections. Genetic samples of rare carnivores have also confirmed one wolf, 17 marten, and four lynx. Because lynx sightings have been increasing, VFWD is also implementing a Canada Lynx Response and Handling Protocol to guide staff in their response to cases of injured, sick, or otherwise incapacitated lynx. Most of this rare carnivore work is funded through the Wildlife Restoration Program. We also received 317 citizen reports of mountain lions (none confirmed) and 6 wolves (none confirmed).

Bat Conservation and Management

There are nine species of bat in Vermont, and all have been identified as important conservation targets. In 2003, VFWD established a Bat Conservation and Management Program to learn more about distribution, abundance, and effective conservation strategies for all nine species. When White Nose Syndrome appeared in the Northeast, monitoring efforts intensified, including spring, summer, and fall mist net surveys coupled with winter cave surveys of large hibernacula. These revealed population declines in excess of 90% between 2008 and 2010 at many sites, with a lower rate of decline by 2013. An outreach effort known as “Got Bats?” was also implemented to collect citizen reports of Big Brown and Little Brown Bats in structures such as barns, attics, and bat houses, mapping over 500 maternity colonies across the state. This revealed that Little Brown Bat maternity colonies, once widespread and abundant, are now found primarily in the Champlain Valley. Radio telemetry tracking of Indiana Bats further aided in the development of a publication, *Forest Management Guidelines for Indiana Bats*, that details a series of conservation strategies developed over the course of the project. The funding for this work has been shifting from SWG to Wildlife Restoration Program funds.

Small Mammals of Vermont Atlas

When the 2005 WAP identified a need to improve our understanding of the status and needs of many of Vermont's small mammals, the Small Mammals Atlas was developed in response. In addition to compiling historic documents and museum collections, Small Mammals Atlas project staff conducted field surveys documenting 2,844 small mammal captures from 47 sites. This allowed for the construction of distribution maps for all 23 small mammal species in Vermont.

Birds

Breeding Bird Atlas

First published in 1985 using survey information from 1977-1981, a new Breeding Bird Atlas (<http://www.vermontbirds.org/>) was completed using surveys from 2003-2007, allowing for comparisons in bird distribution over time. This time, 200 bird species were documented—with accompanying range maps—including 17 species that were added since the first atlas and 14 species from the 1985 version that could not be confirmed as breeding in the state in 2007. Over 300 bird-savvy volunteers contributed expertise and nearly 30,000 hours for this Atlas. Vermont Center for Ecostudies handled project coordination with help from Audubon Vermont and its chapters, the University of Vermont, the National Wildlife Federation, and the VFW. Additional funding from the World Climate Research Program helped make this possible. A website maintained by Patuxent Wildlife Research Center makes Vermont's breeding bird data accessible, at http://www.pwrc.usgs.gov/bba/index.cfm?fa=explore.ProjectHome&BBA_ID=vt2003.

Threats to Vermont's Mountain Birds

Bicknell's Thrush, Blackpoll Warbler, Swainson's Thrush, and several other bird species require the dense shrub thicket found only on Vermont's highest peaks as nesting habitat. This habitat type is not common, which limits the number of nests the birds can build and is often also correlated with low nesting success. Between 2007 and 2011, the Vermont Fish & Wildlife Department supported scientists at the Vermont Center for Ecostudies with the revision of the Mountain Bird Watch monitoring protocol to improve the estimating power of species abundance, distribution, and habitat preferences. This baseline information will allow the monitoring of population and habitat changes associated with climate change, habitat conversion/alteration, and pollution. A report of this study, commonly called "Birdwatch 2.0" can be found at <http://vtecostudies.org/wp-content/uploads/2014/09/VCE-MBW-USFWS-report-2013.pdf>.

Plants and Natural Communities

Rare, Threatened, and Endangered Plant Monitoring

Each year, New England Wild Flower Society and Vermont Fish & Wildlife Department train volunteers to monitor populations of regionally rare plants. In addition to locating and monitoring populations, there is currently a focus on seed collection of New England's rarest plants and identification of high priority sites for management. Vermont Fish & Wildlife Department conducts additional, regular monitoring of the endangered Northeast Bulrush and Jesup's Milk-vetch. Just this year, four new plant species were listed as endangered in Vermont: the Dwarf Birch, Tulip Tree, Whorled Milkweed, and Green Mountain Quillwort. Funding for the federally listed plant species comes, in part, from USFWS's Endangered Species Program; other funding is from Vermont's general fund.

Natural Community Inventories

Natural community inventories are a primary tool for identifying conservation targets, refining the natural community classification, and identifying important wildlife associations with natural communities. In the past decade, Vermont Fish & Wildlife Department has sought to fill data gaps by conducting inventories of Dwarf Shrub Bogs, Poor Fens, Limestone Bluff-Cedar Pine Forests, all types of softwood swamps, and Montane Spruce-Fir Forests. The Department is currently completing a statewide inventory of oak-pine-northern hardwood forest types. Results from these projects include identification of state-significant examples of natural communities that are added to the Natural Heritage Database and providing recommendations to private landowners on how best to manage the natural communities they own. State-significant examples of natural communities are considered high priority for conservation on both public and private land. Natural community inventory work remains a priority of the Department and will continue in years to come.

Invasive Species

Housed by the Vermont office of The Nature Conservancy, the iMap Invasives database tracks invasive species infestations, management activities to control them, and documentation of post-management population changes. Ongoing trainings by the Vermont Fish & Wildlife Department and The Nature Conservancy aid volunteers in correctly identifying invasive species and properly using the database. The Vermont Agency of Transportation has also partnered on the project to locate and document invasive plants along interstate highways. This work is supported via a contract with Florida State University, and the site can be found at www.vtinvasives.org. It follows up on previous work conducted in partnership with the New England Wildflower Society to train volunteers to conduct invasive plant surveys for the Invasive Plant Atlas of New England.

Herbarium Records

New England Wild Flower Society's 2003 Herbarium Recovery Project documented and annotated more than 18,600 specimens of regionally rare plants housed in 42 herbaria, and more than 90% of the data of interest to Vermont from this project has now been entered in Vermont's Natural Heritage Database. Additional specimen data from Vermont's own herbarium records has also been updated, and Vermont's Pringle Herbarium records are being scanned into the Consortium of Northeast Herbaria portal (<http://portal.neherbaria.org/portal/>) to make them more widely available. This project is paid for through Vermont's general fund.

Revision of Natural Community Ranking Specifications

Natural Community ranking specifications provide a means to consistently and objectively compare the relative importance of each occurrence of a particular natural community type across the state. New ranking specifications were developed for all 95 natural community types and a report on how to use these specifications is available for the public and consulting ecologists/biologists. The consistency in approach that is included in the natural community ranking specifications and the resulting Natural Heritage Database of state-significant natural communities has been the basis for including natural communities in recent revisions to two rules and land use provisions in Vermont: the Vermont Wetland Rules now includes significant wetland natural communities as a protected function, and Vermont's Use Value Appraisal program now allows for significant natural communities to be enrolled as Ecologically Significant Treatment Areas. Plant rarity ranks were also revised based on new records.

General Natural Heritage

Natural Heritage Inventory

Vermont's Natural Heritage Inventory documents the diversity of native plants, animals and natural communities in the state. The inventory is maintained using the "Biotics" software, which provides a common data management platform for members of the NatureServe network to achieve and maintain a unified taxonomy and consistent application of our shared data standards and methodology. The database tracks natural heritage elements including taxonomy, nomenclature, rarity ranks, habitat descriptions, threats, trends, and additional information for 1260 animal species, 1425 plant species, and 92 natural community types. In addition, there are over 10,000 populations documented, complete with GIS mapping. General information is available to the public for planning purposes through Vermont Center for Geographic Information (<http://www.vcgi.org/>) and the Agency of Natural Resources' online Atlas (<http://maps.anr.state.vt.us/ANRA/>). More detailed attribute data is made available to partners through data use agreements. NatureServe is a major partner and provides software support for Biotics and servers as a centralized repository for North American biodiversity information.

Structured Decision-making

The Vermont Fish & Wildlife Department, in partnership with the University of Vermont, developed a system for managing, archiving, sharing and analyzing wildlife data and information. This new system, known as Resources of Vermont, or ROVER, is a comprehensive database for a wealth of wildlife data in Vermont that compliments the comprehensive Natural Heritage Database that addresses rare, threatened, and endangered species and significant natural communities. While it will continue to grow and evolve it currently supports data for many species of birds and mammals. It will be used in the future to guide conservation decisions by providing more effective access to data and greater abilities to analyze and interpret information.

Wildlife Management Area Inventories

Whenever possible, Vermont uses Long Range Management Plans to guide activities in state-owned Wildlife Management Areas. Since 2004, the Vermont Fish and Wildlife Department routinely inventories bats, breeding birds, reptiles, and amphibians in state Wildlife Management Areas, to aid in the creation of well-informed management plans.

Research

The 2005 Wildlife Action Plan identified gaps not only in our knowledge of species abundance and distribution but also in potential threats species face, interactions with surrounding natural or human-altered landscapes, and the identification of conservation needs. The following are research projects seeking to answer questions that will inform the management of wildlife or their habitats.

Fishes

Lake Whitefish

In Vermont, Lake Whitefish occurs only in Lake Champlain where, prior to its closure in 1913, there was a substantial commercial seining whitefish fishery. Recent research conducted by the University of Vermont concluded the population is stable and unexploited but populations that once existed at two locations in the lake once supporting commercial harvest appear to be extirpated due to past

exploitation and/or degraded spawning habitat. The university is currently conducting research of the effects of man-made barriers (e.g. causeways) in limiting whitefish movements among bays within the lake and whether these are causing the formation of spatially separate and genetically differentiated sub-populations within the lake. This work was partially funded by a State Wildlife Grant awarded by Vermont Fish & Wildlife Department. Other possible threats to Lake Whitefish in Lake Champlain are competition with exotic species (e.g. Alewife) and Sea Lamprey parasitism.

Stream Temperature

Because of land clearing, dams, and other shifts in land use that remove shade from stream banks, some of Vermont's historic trout streams are now too warm to support healthy trout populations. With funding from the State Wildlife Grant program, the Vermont Fish and Wildlife Department conducted a series of case studies to model watershed temperature conditions and predict quality brook trout habitat. One study examined potential management scenarios on river temperatures, finding that increasing shade on just the upper 50% of the watershed has a high impact on the resulting downstream water temperatures. In a second study, metrics were developed that allow researchers to assess coldwater habitat suitability when only temperature data are available. This study produced recommendations which can guide decision making for the conservation of native salmonid populations.

Stream Morphology

Physical processes form habitat in a stream channel, such as movement of sediment or woody debris, formation of scour and depositional features, and dynamic riverbank changes. Combined with chemical constituents and biological interactions, physical habitat determines biological productivity and diversity and drives the aquatic ecosystem. By taking a detailed look at the habitat resulting from the physical processes taking place in a stream, it may be possible to understand how fluvial processes impact aquatic communities. The Vermont Agency of Natural Resources Reach Habitat Assessment has been created as an integral part of the existing Vermont Stream Geomorphic Assessment Protocols, although it is also available for stand-alone usage. It builds on previous habitat assessments by fundamentally being based on stream processes and their link to resultant channel, bank, and cover features. Indicators of key physical ecological attributes were identified for inclusion in the assessment that are necessary for aquatic organisms to carry out life cycle functions.

Fish Health & Predator-Prey Dynamics

For fisheries biologists to effectively manage wild fish, they must first understand a wide variety of ecosystem functions, including diseases, predator-prey relationships, and more. For example, whirling disease is a parasite that can be detrimental to trout and salmon populations. From 2006-2008, Brook Trout, Brown Trout, Rainbow Trout and Atlantic Salmon were tested for the disease, which was confirmed to be present in several Vermont streams. In a different study, fisheries personnel developed standard operating procedures for hydroacoustic surveys that quantify populations of forage fish in Lake Champlain. These surveys are used to monitor the prey base for larger, predatory fish so that fisheries can maintain the balance of fish species in the lake.

Landlocked Salmon Stocking

Landlocked Atlantic salmon were once abundant in Lake Champlain, but habitat degradation and over-fishing destroyed the native population by 1850. Since 1973, the Vermont Fish and Wildlife Department, along with New York and the U.S. Fish and Wildlife Service, have since committed to restoring the salmon population and fishery. This effort relies on a successful stocking program—

and there are several stocking methods that can be employed. The goal of this study was to evaluate one particular strategy to stock fry in tributaries to Lake Champlain. A rotary screw trap was employed to sample downstream migrating salmon smolts produced from fry stocking in the Huntington River, a tributary to the Winooski River and Lake Champlain. Results showed that significant numbers of smolts were produced, suggesting that fry stocking does indeed seem to be a promising restoration strategy.

Atlantic Salmon Genetics

Historically, anadromous Atlantic Salmon was native to the Connecticut River watershed but became extirpated by the early 1800s following construction of the first dam on the river in 1798 near present-day Turners Falls, Massachusetts. During the latter half of the 19th Century unsuccessful attempts to restore salmon to the river were undertaken. The most current restoration effort was initiated in 1965 and continued until 2012, when the U.S. Fish & Wildlife Service and other basin state fisheries agencies (New Hampshire, Massachusetts and Connecticut) withdrew from the program. Annual stocking of hatchery produced salmon fry continued through 2013 but since then no juvenile salmon have been released into Vermont waters, and smolt outmigration is expected to end after the spring of 2016. Even though salmon restoration has ended for the foreseeable future, its anticipated that adult salmon will return to the Connecticut River in small numbers and, therefore, will be provided upstream passage by dams at Holyoke and Turners Falls, Massachusetts and Vernon, Vermont as part of the power utilities commitment to providing fish passage for other anadromous fishes (e.g. American Shad). Given these recent events, anadromous Atlantic Salmon will in all likelihood remain an extirpated species in Vermont. In 2011, prior to termination of the salmon program, a State Wildlife Grant funded project was undertaken to test for genetic variation in smolt production and adult returns to determine smolt and adult return production from each stocked Connecticut River tributary. Genetic testing of samples has been completed, even though with termination of the restoration program this information probably will not be used to adaptively manage stocking efforts.

Lake Trout Genetics

Although Lake Trout are indigenous to most of Vermont's larger and deeper lakes, the status of the native populations was in question due to more than a century of stocking at all these lakes using lake trout sources from outside Vermont. A decade ago the lake trout populations in several Northeast Kingdom (NEK) lakes were supported entirely or predominantly by natural reproduction despite annual stocking. This study sought to determine the degree to which a century of lake trout stocking had genetically influenced these populations. Results irrefutably show that stocking has influenced all the contemporary populations, with the demonstrable degree of influence varying from one lake to another. However, the suite of genetics tests included in the study also reveals evidence that elements of the indigenous genomes persist. Unfortunately, in the absence of comprehensive historical documentation of lake trout stocking in Vermont accompanied by genetic material from the various source populations, it is impossible to describe the *family trees* of contemporary wild lake trout at the several NEK lakes. Lake trout stocking was discontinued in 2006 at most of the lakes, and the naturally reproducing populations continue to be monitored periodically.

Mammals

Indiana Bat

In 1973 the Indiana Bat was one of the first bats recognized as endangered under the federal Endangered Species Act. Populations then continued to drop through much of the species' range, although Vermont's summer populations have remained robust. Biologists recently began to suspect the decline's primary culprit to be the loss of summer habitat—particularly the roost trees where females form maternity colonies, give birth, and raise their young—but the recipe for attractive Indiana Bat habitat remained mysterious prior to this study. University of Vermont researchers worked with Vermont Fish & Wildlife Department staff to evaluate minimum habitat and maternity site requirements for the Champlain Valley and developed a tool to predict maternal nest sites and prioritize sites for conservation.

Bobcat Movement and Habitat Use

Animals with large home ranges can be tricky to study and manage, because their territories include a network of many different habitat types. The Bobcat is no exception, and prior to this study there were a number of gaps in our knowledge of Bobcat habitat needs. To get a better sense of home range requirements, University of Vermont researchers and Vermont Fish & Wildlife Department staff captured Bobcats across a landscape that spanned urban, agricultural, and forested settings and outfitted them with GPS collars that recorded each individual's location over a 3-4 month period. This study provided critical information about how Bobcats travel through a landscape by staying under shrub cover as much as possible, allowed an estimation of minimum home range resource requirements for breeding females, and provided information to use in habitat suitability mapping and home range requirements for Bobcat conservation and landscape-scale management.

Habitat Blocks and Critical Crossings

Black Bear, Fisher, Marten, Lynx, and River Otter are among the species that rely both on large blocks of contiguous forest and secure means of crossing roads and human-impacted landscapes between these forest blocks. Although total forest cover in Vermont increased over the past century, it has again begun to decline, and it is breaking up into an increasing number of smaller blocks as a result of residential development and road construction. Because we still have a limited ability to prioritize conservation of these blocks and forest connectors, the Habitat Block project identified and mapped 4,055 habitat blocks, then evaluated them for biological and physical diversity and potential threat. Considerable work has been done to map and rank likely wildlife road crossing areas. Structural connectivity models showing potential road crossings have been developed and refined in partnership with the Agency of Transportation, and the Staying Connected Initiative is working with partners on several fronts toward a better understanding of functional connectivity. The Critical Paths project involved field-checking road crossings for signs of wildlife use, potential threat, and conservation priority, as well as several photo-monitoring projects that are capturing pictures of wildlife use of transportation infrastructure. Forest block and road crossing data has been made available to the public via the Vermont Agency of Natural Resources' online Atlas (<http://anrmaps.vermont.gov/websites/anra/>).

Birds

Bicknell's Thrush in Northeastern Vermont

Large-scale wind energy developments have recently been installed or proposed for a number of Vermont's peaks, and their arrival brought to the surface questions about the interplay between wind farms and the wildlife that inhabits Vermont's highest elevations. Because the peaks that developers believe are best suited for wind energy are largely covered by montane spruce-fir forest, this project studied possible effects from these developments on the rare Bicknell's Thrush that relies on this habitat. The wind project did not go forward, so the study was unable to ascertain the effects of building the towers. In their final report, biologists from Vermont Center for Ecostudies say that while Bicknell Thrush ecology is too complex to make a specific prediction of development impacts, both short- and long-term effects are possible, and they may differ as initial impacts give way to succession. The report includes maps showing the location and size of current and potential Bicknell's habitat in the Northeast Highlands of Vermont, to be used to assess future wind development and conservation priorities. In addition to funding from State Wildlife Grants, the Nature Conservancy, Vermont Institute of Natural Science and Vermont Center for Ecostudies each provided aid.

Black Throated Blue Warbler Abundance and Nesting Productivity

Habitat quality—a phrase used extensively in conservation and land use planning—is often gauged by wildlife population counts. However, as habitats become modified for human uses and low-quality habitats become more dominant, wildlife may be using environmental cues that no longer relate to better reproductive success, causing them to make poor habitat choices. Indeed, results of this study indicate that for Black Throated Blue Warblers, preferred habitats did not correlate to the highest fitness levels in terms of daily nest survival or annual fecundity. It seems that predation and cowbird parasitism kept “popular” habitats from being as successful as some of the less-preferred habitats.

Landscape Conservation

Shoreline and Development Surveys for Vermont's Lakes

Lakeshores in Vermont provide vital habitat for a variety of SGCN, and until recently there was no regulation to protect them. This project compared the SGCN present in undeveloped and developed lakeshore areas, finding that with the exception of aquatic plants, there were significantly fewer SGCN species present at the developed sites than the undeveloped shorelines. The study then used reserve design methodology to identify lakeshore areas that are most likely to support SGCN, producing a map that could be used to help prioritize lakeshore conservation efforts. The findings of this project also aided in efforts to get the Vermont legislature, governor, and the public to support lakeshore regulation, and in July of 2014, the Shoreland Protection Act was established.

Species Recovery

Over the past decade, 20 species (9 plants and 11 animals) were added to the state's Endangered Species list and are now receiving the additional protections that come with the listing. Because the ultimate goal of the endangered species program is recovery, some of these species have been targeted for additional action. A successful recovery restores a once endangered or threatened species to a point where protection is no longer needed, because the species can sustain itself as a natural part of its ecosystem. Creating a recovery plan is generally the first step, which might include protection or restoration of habitat, species or habitat management activities, or even translocation

of individuals from an outside population. The following are recovery projects that Vermont has undertaken in the past decade. All have been guided by the 2005 Wildlife Action Plan.

Invertebrate Recovery

The Cobblestone Tiger Beetle, the Hairy-necked Tiger Beetle, and several species of freshwater mussel are state-threatened in Vermont. After several years of surveying known populations of these invertebrates, Vermont Fish & Wildlife is in the process of completing recovery plans for the two tiger beetles and a multi-species recovery plan for freshwater mussel species, several of which are in rapid decline due to the invasion of the invasive Zebra Mussel.

Bat Recovery

Vermont Fish and Wildlife Department staff were in the process of creating a statewide bat conservation and recovery plan when two occurrences arose. First, proposals to expand wind energy facilities in Vermont brought up questions about the potential threat of wind development to bats, which needed to be better studied. In the winter of 2008, White Nose Syndrome (WNS) then appeared in Vermont, which has been detrimental to the bat population. Substantial efforts since then have gone toward research on the causes, threats, and spread of the disease. Now that the effects of both wind facilities and WNS are better studied and understood, a revised bat conservation and recovery plan can be developed, most likely within the next few years.

Bird Recovery

The past decade can claim several success stories among bird recovery efforts. Common Loon, Peregrine Falcon, and Osprey were all delisted from state-endangered status in 2005, and their recovery goals have been met. Common Tern is very close to its recovery goals and is being considered for downlisting, while the known nesting population of Bald Eagles in Vermont has grown from zero in 2007 to 18 nesting pairs with 17 fledglings in 2014. These species all continue to be monitored, with the help of Audubon Vermont, Vermont Center for Ecostudies and citizen volunteers. Other ongoing bird surveys include Black-backed Woodpecker, Whip-poor-will, Golden-winged Warbler, Grasshopper Sparrow, and a suite of wetland bird species. In addition, we are evaluating the results of Spruce Grouse Translocation efforts. Once down to just a single population of 150-300 birds, two State Wildlife Grants allowed a total of 134 birds to be captured in Maine and Quebec and then released in a small portion of the bird's former range in Victory, Vermont, twenty of which were fitted with radio transmitters to track movements. If the translocation efforts are successful, the establishment of this second sub-population will be a significant step toward downlisting the species.

Other Recovery Projects

Vermont's Rattlesnake Recovery Plan was adopted in 2015 after substantial research on the status of Vermont's two populations. The Vermont Eastern Spiny Softshell Turtle Recovery Plan was also approved and adopted in July of 2009. A draft restoration plan for Lake Sturgeon in Vermont was released in August, 2015. Federal recovery plans were developed for the Jessup's Milk-vetch and Northeastern Bulrush which are found in Vermont. The New England Wildflower Society has developed conservation plans for many high priority plant species in the region with some technical support from VFWD for species found in Vermont.

Policy, Planning, and Land Acquisition

In some cases, the 2005 Wildlife Action Plan identified that Species of Greatest Conservation Need would benefit most from statewide policies, long-range planning, or the protection of additional habitat important at a statewide regional scale.

Vermont Conservation Design

Fish, wildlife and other elements of biological diversity rely on both landscape-level features such as forest blocks, connectivity, and riparian areas, and finer-scale elements of natural communities, specific habitats, and species. In 2015, Vermont Fish & Wildlife Department, Vermont Land Trust, Vermont Forests, Parks, & Recreation, The Nature Conservancy, Northwood Stewardship Center and others produced “Vermont Conservation Design: Maintaining and Enhancing an Ecologically Functional Landscape.” This report identifies coarse-filter conservation targets for landscape scale features including forest blocks, riparian areas, surface waters, wildlife and landscape connectivity, and physical landscape diversity that are necessary to ensure the conservation of many finer scale conservation elements in the face of climate change and habitat loss. This is a significant addition to conservation planning in Vermont. Phase 2 of this project will focus on natural communities, habitats, SGCN, and rare species.

Getting the Lead Out

Lead is known to be toxic to many wildlife. The Common Loon is particularly sensitive to it, and lead toxicosis contributes to the mortality of the loon and at least 23 other species in North America. Research in the northeastern United States and Canada has documented that poisoning from lead sinkers and jigs is the leading cause of observed loon deaths and can account for 10 to 50 percent of dead adult loons found. In 2006, Vermont Fish & Wildlife Department assisted in a successful campaign to ban the sale and use of lead sinkers for fishing.

Helping Landowners Protect Ecologically Sensitive Lands

Approximately two million acres of Vermont’s forestland is enrolled in the Use Value Appraisal program, which requires active management of enrolled land. In 2009, changes to the Use Value Appraisal program allowed forest areas to be enrolled as “Ecologically Sensitive Treatment Areas,” meaning that instead of being managed exclusively for timber, they can be managed for their values as significant natural communities. At the same time, the Use Value Appraisal program was also revised to allow for enrollment and management for significant wildlife habitat. To qualify, Vermont Fish & Wildlife staff review and approve proposals based on the Department’s standards of significance for natural communities and wildlife habitat.

Land Acquisition

From 2005-2013, the Vermont Fish & Wildlife Department acquired 41 separate parcels in fee totaling 4,141 acres, either to be added to existing Wildlife Management Areas or to create new ones. The Department also acquired 2,322 acres under conservation easement during the same period. Conservation activities have focused on a few key criteria: 1) the purchase of key inholdings and lands adjacent to existing Wildlife Management Areas; 2) ecologically-significant lands such as habitat for rare, threatened or endangered species and critical wildlife habitat; and 3) public access for wildlife-dependent recreation.

Technical Assistance and Public Awareness

With over 80% of Vermont's land in private ownership and the majority of land use and development decisions made at the local or regional level, the conservation of Vermont's wildlife relies heavily on private landowners, municipal governments, regional planning groups, and coordination among state agencies and conservation organizations. In order to fulfill the goals of the Wildlife Action Plan, Vermont has therefore allocated substantial resources toward working with all scales of stakeholders in Vermont.

Community Wildlife Program

In Vermont, land use and development decisions are made at the local or regional level, through municipal or regional plans and zoning bylaws. Distributing information to municipalities and regional decision-makers is therefore a critical piece of the state's natural resources planning process. After publishing *Conserving Vermont's Natural Heritage: A Guide to Community-Based Planning for the Conservation of Vermont's Fish, Wildlife, and Biological Diversity* in 2004, Vermont Fish & Wildlife Department created the Community Wildlife Program to provide additional support and technical assistance to interested towns, regional planning commissions, and others in incorporating the latest information and strategizing for the conservation of fish and wildlife. Since 2003, the program has provided technical assistance to all 14 of Vermont's Regional Planning Commissions and more than 150 towns, created a web guide to technical assistance opportunities available in the state, expanded Vermont Fish & Wildlife Department's work with partner organizations in several landscape-level conservation projects, and has been instrumental in providing resources and guidance for grassroots regional planning projects. From 2008-2010, this work was further supported by a partnership with the Vermont Natural Resources Council, who conducted a review of every Vermont town plan and bylaw that pertains to fish and wildlife species and habitat protections. This updates a similar assessment from 2000, enabling a review of progress over the past decade. While trends are noticeably in the direction of increased attention to wildlife conservation—with 87% of all municipalities recommending the protection of wildlife habitat in town plans—the report found a sharp disconnect between municipal plan recommendations and the implementation of those recommendations through bylaws. This report has aided Community Wildlife Program staff and other state-level planners in appropriately targeting technical assistance to municipalities. For more information on the Community Wildlife Program, see

http://www.vtfishandwildlife.com/get_involved/partner_in_conservation/community_wildlife_program.

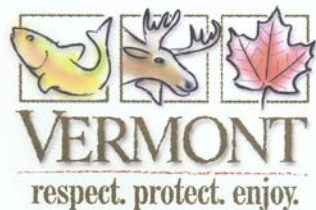
Helping Private Landowners Help Wildlife

Because conservation in Vermont relies heavily on private landowners, VFWD has partnered with Vermont Coverts several times in the past decade to conduct landowner outreach. In addition to 23 workshops focused on protecting SGCN, a landowner orientation video and four publications were developed and distributed to 500 forest landowners. The partnership also reached out to new landowners by creating and distributing 100 “Welcome Wagon Kits”—buckets containing materials about land stewardship and wildlife conservation in Vermont. Two additional publications have targeted landowners; first, VFWD worked with the Center for Northern Woodlands Education to publish and distribute ~20,000 copies of *The Place You Call Home: A Guide to Caring for Your Land*, a magazine compiling formerly-published articles relating to land stewardship with an emphasis on technical forest management skills. Secondly, *Wildlife Habitat Management for Lands In Vermont* provides tips on recognizing wildlife habitat and then managing it to benefit wildlife in tandem with other management goals such as timber or hiking trails. This publication was the result of a partnership with the Vermont Department of Forests, Parks and Recreation and the USDA Natural

Resources Conservation Service. Using non-SWG funding, VFWD works with the same partners to aid landowners through additional means, such as by helping landowners to incorporate wildlife habitat management and conservation considerations into forest management plans submitted to the Vermont Use Value Appraisal Program.

Public Opinion Survey

While surveys show that most Vermonters support the conservation of wildlife, an average of 6500 acres of wildlife habitat are lost in the state every year through the development of land. Prior to this study, it was unclear what messages and/or actions most effectively motivated the public to support



specific conservation programs, and so data were collected to document public attitudes towards a variety of conservation strategies. In addition to creating a baseline against which we can monitor changes in public attitudes, these data aided in the development of a state communications plan and conservation message, including the “Respect. Protect. Enjoy” logo and tagline now used by the Vermont Fish & Wildlife Department.

Species of Greatest Conservation Need

The Vermont Fish & Wildlife Department provides technical support and guidance to protect Species of Greatest Conservation Need (SGCN) to those who work directly with these species and their habitats. Beginning in 2012, a State Wildlife Grant aided VFWD staff in providing technical assistance to other Vermont Agency of Natural Resources departments, private land managers and NGOs, interagency programs, and scientist researchers. Additional technical support is provided to the Vermont Endangered Species Committee and several Scientific Advisory Groups. A second State Wildlife Grant provided support at the municipal level, striving to connect citizens with the SGCN occurring in town forests and other municipally owned lands. This project worked through town partnerships to provide educational materials and technical assistance with municipal planning efforts in eight target communities.

Orange County Headwaters Project

In the summer of 2007 two University of Vermont graduate students undertook an inventory of wetlands and vernal pools in the towns of Washington and Corinth. A State Wildlife Grant, along with Connecticut River Mitigation and Enhancement Funds and Orange County Headwaters Project operating funds, provided additional support for identifying high priority areas for conservation and conducting outreach to community members. This included directing citizens to available conservation resources and researching recommendations for protecting vernal pools and wetlands while continuing active management for forest products. The program’s efforts resulted in the permanent protection of 24 parcels through conservation easements as well as enrollment of four landowners in Audubon Vermont’s Forest Bird Initiative program—a program that conducts habitat inventories and provides specific recommendations for the enhancement of forest bird habitat—and an equal number in NRCS’s Wildlife Habitat Incentives Program.

Baitfish Workshop

The harvest, transport and use of baitfish has long been identified as a high-risk vector for the spread of aquatic invasive species and fish pathogens. Wild harvested baitfish are frequently moved to and used in other waterbodies or watersheds, and anglers tend to release unused live bait when

done fishing. This workshop used the Hazard Analysis and Critical Control Point (HACCP) concept to teach risk identification and analysis to over 40 participants from Vermont's baitfish industry and state government. Presentations focused on managing the risk of inadvertently spreading invasives during day-to-day activities in their fields.

The Fishes of Vermont

Vermont supports the greatest freshwater fish diversity in New England, and the publication *The Fishes of Vermont*, a field guide to the fish species of Vermont, explains why. Researched and written by Rich Langdon (Vermont Department of Environmental Conservation) and Vermont Fish & Wildlife Department's Mark Ferguson and Ken Cox, the book describes glaciers and other forces that determined fish distribution while presenting a Vermont-specific identification key that maps and describes the life histories of all 92 fish species in the state. Fishermen, natural history buffs, conservationists and natural resource managers will all find this book useful. Its publication was funded by the Wildlife Conservation and Restoration Program—a precursor to State Wildlife Grants.

Bats On Private Land

Suitable summer roosting habitat is extremely limited for the federally endangered Indiana Bat, and much of what exists in Vermont is on private land. Vermont Fish & Wildlife staff provided technical assistance to private landowners interested in managing for Indiana Bats, which included assessing parcels for potential roost trees and desirable habitat characteristics and, when appropriate, connecting interested landowners with habitat incentives programs such as the Natural Resources Conservation Services' WHIP and EQIP.

Natural Communities and the Plant Stewardship Project

In Vermont, many significant natural communities and rare, threatened, and endangered species are located on private land. To support landowners and land managers the Vermont Fish & Wildlife Department has conducted outreach to identify these sites, map them, and then assess population levels, threats, and management needs. These visits and associated landowner communications were made possible thanks to funding from the Landowner Incentives Program over much of the past decade. Unfortunately, that federal program has been discontinued, and with it much of VFWD's financial capacity to carry on the program.

Management

In order for some species to thrive in Vermont, the 2005 Wildlife Action Plan identified a need for changes in species or habitat management. In some cases, habitats have been restored or expanded. In others, projects were implemented to mitigate conflicts between wildlife needs and human activities. Included below are some of the specific management efforts undertaken for the benefit of Species of Greatest Conservation Need.

Aquatic Organism Passage

Fish and other aquatic organisms need to move freely within stream networks to meet daily and seasonal life cycle needs. During the development of transportation systems in Vermont, numerous barriers to the movement of these populations have been created from the construction of culverts at road/stream crossings. An assessment of aquatic organism passage (AOP) at over 3000 culverts throughout the state found less than 6% were rated fully passable. Through this project we developed technical guidelines for designing AOP at road/stream crossings; conducted technical

trainings on these techniques for state, federal and municipal transportation managers, engineers, regulators and biologists; refined culvert assessment protocols and screening tools to better utilize assessment data; produced outreach materials (Stream Crossing Handbook) and worked with partners to identify, design and implement AOP enhancements at existing stream crossings. These efforts have also served to inform regulatory improvements for design and performance standards for culvert replacement and repair projects. In addition to State Wildlife Grants, this work was funded through Sportfish Restoration Programs.

Prevention of Fish Disease

Preventing the introduction of diseases to fish culture stations and to natural fish populations can be a daunting challenge. To accomplish disease prevention goals, VFWD employs a comprehensive fish health program that follows strict biosecurity practices. Specifically, these biosecurity practices seek to reduce the risk of fish pathogen introduction into fish populations and minimize the risk of pathogen spread. Examples of the tools implemented include but are not limited to: strict fish importation permit program, regulations prohibiting the live transfer of fish from one body of water to another, the use of water filtration and disinfection equipment for fish culture station water source(s), regular use of disinfectants at fish culture stations and pathological examinations of both naturally produced fish and fish produced at fish culture stations.

Amphibian Crossings

On warm, rainy nights in spring, many roads in Vermont experience an inundation of frogs and salamanders attempting to reach the vernal pools, wetlands, and ponds where they breed. When these amphibian travel routes cross roads heavily traveled by human vehicles, mortality can be extremely high. In 2011 and 2012, funding was secured from State Wildlife Grants, Vermont Agency of Transportation's Transportation Enhancement Grant, private donors, and several smaller grants to build two wildlife crossing structures at one well-used amphibian crossing site in the Town of Monkton. General monitoring of this crossing dates back to 1997 and monitoring specific to planned crossing structures began in 2011—prior to the structure's construction—to allow for future comparisons of road mortality. The crossing is expected to be built during the summer of 2015. Local partners and key supporters include the Town of Monkton Select Board, Monkton Conservation Commission, Lewis Creek Association, many volunteers, and many individuals who have financially supported the project.

Beaver Baffles

Wetlands created by Beaver are ecologically important and provide critical habitats for many Species of Greatest Conservation Need. However, Beaver wetlands also jeopardize—or are perceived to jeopardize—roads, dwellings, timber, homes, and water supplies. Beaver baffles are water control structures installed to alleviate flooding caused by beaver and satisfy the concerns of the landowner or town while maintaining as much wetland habitat as possible. From 2006-2010, 206 structures were installed and 1,785 wetland acres conserved as a result of this program, funded through State Wildlife Grants, the U.S. Fish & Wildlife Service Partners in Wildlife Program, the Duck Stamp Fund, and Vermont Agency of Transportation.

Grassland Birds At Airports

As a group, grassland birds have been on the decline, in large part because much of the area of grassland habitat has reverted from farmland to forest and woody shrub habitat. In an ongoing

project, Vermont Fish & Wildlife Department works with Vermont Agency of Transportation to develop airport plans that include the consideration of grassland birds in their mowing schedule.

Golden-winged Warbler

To find a nesting Golden-winged Warbler, you would want to look in old fields with sparse trees or shrubs with a grassy understory close to mature forest. In Vermont this type of habitat is becoming increasingly rare as forests mature, and you may have a difficult time finding one. Through funding from the NRCS's Wildlife Habitat Incentives Program (WHIP) and Conservation Innovation Grant (CIG), Vermont Audubon surveyed a transmission line corridor to prioritize suitable Golden-Winged Warbler habitat. Vermont Fish & Wildlife Department then worked with Audubon and private landowners on six high-priority sites to enhance habitat for the Golden-winged Warbler and other shrubland birds. In 2014—just six months after management activities—monitoring visits found hybrid Blue-winged/Golden-winged Warblers. While no true Golden-winged Warblers have yet been found at the treatment areas, monitoring will continue on these sites for the next 3-5 years.

Double-crested Cormorant Control

Wildlife management increasingly involves mitigating unwanted wildlife impacts, and Double-crested Cormorants have recently been the target of such efforts in order to restore island habitats and protect rare bird species. New to our area, cormorants remove leaves and sticks to use as nesting material, and their acidic guano accumulates near nesting sites, eventually killing trees and shrubs—vegetation that provides important nesting habitat for other species. In 1999, VFWD began applying corn oil to cormorant eggs and, in 2004, culling adult birds to limit reproduction. These methods eliminated the nesting cormorant population on the state-owned islands by 2008. The objective of this project was to use an adaptive management approach in order to restore the former islands' habitats, and it was found that the strategy of egg-oiling and culling, in combination with habitat restoration plantings of grasses, shrubs and trees as the cormorant and gull numbers declined, was indeed the most efficient strategy. The USDA/APHIS/Wildlife Services was an integral partner in controlling cormorants on the islands, and funding was provided by VFWD license funds. Habitat restoration was further funded by the Wildlife Restoration Program.

Partnerships with Natural Resources Conservation Service

The former Wildlife Habitat Incentives Program (WHIP) and the Environmental Quality Incentives Program (EQIP) are administered and funded by the National Resources Conservation Service (NRCS) with technical aid from Vermont Fish & Wildlife Department. These programs help private landowners with the resources and expertise needed to manage their land for the benefit of fish, wildlife and overall environmental quality—be it by releasing mast or apple trees for wildlife, creating early successional habitat for nesting song birds, or controlling invasive species, these programs have helped Vermonters manage their land for wildlife. When the Wildlife Action Plan was adopted in 2005, the Vermont NRCS office quickly adopted it as a guide for its work on these programs. Over the last 10 years of this agreement, Department staff have worked with landowners on approximately 986 WHIP projects and over 220 EQIP projects throughout Vermont. This agreement is ongoing and the continued partnership is improving habitat throughout Vermont.

Regional Partnerships

Because wildlife do not recognize political boundaries, we have found a need to go beyond our own and collaborate with our neighbors. Below are a few examples of Vermont's participation in regional conservation efforts.

Regional Conservation Needs Grant Program

Since 2007, the Vermont and the other twelve Northeast states and the District of Columbia have worked together as Northeast Association of Fish & Wildlife Agencies (NEAFWA) to implement landscape-scale wildlife conservation actions identified in their collective Wildlife Action Plans through the Regional Conservation Needs Grant Program. Partner states contribute 4% of their annual State Wildlife Grants Program allocations to this fund. Through the RCN program states develop, coordinate, and implement conservation actions that are regional or sub-regional in scope; build upon the multiple regional initiatives that already exist and compliment ongoing work in individual states. Each year, NEAFWA states contribute roughly a half million dollars of State Wildlife Grant funds, leveraging another half million dollars or more from the Wildlife Management Institute and grantees. This is a substantial investment in regional scale conservation. Details about the RCS program can be found at <http://www.rcngrants.org>.

The Staying Connected Initiative

Encompassing a region of five Northeast States and three Canadian provinces, the Staying Connected Initiative is a collaborative of NGOs and local, state, and provincial agencies working to protect connectivity, with a focus on wide-ranging mammals such as moose, black bear, fisher, bobcat, lynx, and marten. The Initiative brings a landscape scale vision but tailors actions to the needs of local communities, with approaches including conservation science, land protection, technical assistance to communities, land use planning, transportation mitigation, and policy development. Since the Initiative began in 2009, region-wide accomplishments include the protection of over 300,000 acres of land, technical assistance on land use planning and policies for over 40 municipalities and several regional planning agencies, numerous GIS models for conservation planning, the identification of priority road segments, the development of best practices for mitigating road impacts to wildlife, the creation and distribution of numerous tools and reports to aid with the implementation of connectivity actions, and assistance or outreach to local groups through workshops, field trips, citizen science opportunities, and other community engagement measures. While funding for the Staying Connective Initiative includes substantial contributions from all of its partners, the Competitive State Wildlife Grants program, the Wildlife Conservation Society's Wildlife Action Opportunities Fund, and the Jessie B. Cox Charitable Fund, funding from Vermont's State Wildlife Grants program specifically targeted one wildlife linkage area between the Worcester Range and the state's Northeastern Highlands. Associated technical assistance included the hiring of a local coordinator to act as a liaison between partner organizations and the community, and the publication of an outreach guide entitled "An Enduring Place" (<http://216.92.98.160/assets/enduringplacefinal.pdf>). This guide is a celebration of place, weaving together the cultural and natural landscape in the region and calling out the regional importance of habitat connectivity. More information can be found at <http://stayingconnectedinitiative.org/>.

For the Future

In reality, the above list of projects and accomplishments represents only a fraction of the work undertaken in Vermont that has aided in the implementation of the Wildlife Action Plan. While this

list captures the efforts of Vermont Fish & Wildlife Department and a few prominent partners—with a primary focus on projects funded through State Wildlife Grants—the true efforts have been diverse, accomplished not only by multiple state agencies but by Vermont’s extensive network of conservation organizations, municipalities, regional groups, interest groups, and individuals. In the future, we would like to find a way to capture these collective efforts, in order to better represent Vermont’s progress toward conserving wildlife on our landscape.