Interim Report
State Wildlife Grants
T-1-8

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Endangered, Threatened and Rare Wildlife Conservation Projects

Interim Report for Project Year
January 1, 2020 – December 31, 2020

NJ Department of Environmental Protection

DIVISION OF FISH AND WILDLIFE
ENDANGERED AND NONGAME SPECIES PROGRAM
P.O. BOX 420
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NEW JERSEY DIVISION OF
Fish and Wildlife

SPORT FISH & WILDLIFE RESTORATION

Project 1. SGCN Conservation and Management

Job A. Birds

Subjob A.1. Raptors (Activated in Grant W-70-R eff. 9/1/15)

Subjob A.2. Landbirds (non-raptors) (Activated in Grant W-70-R eff. 1/1/19)

Subjob A.3. Shore and Marsh Birds (Activated in Grant W-70-R eff. 9/1/15)

Job B. Mammals (Inactive job, presently covered by Grant W-71-R)

Job C. Reptiles and Amphibians

Subjob C.1. Turtles

Subjob C.2. Snakes

Subjob C.3. Amphibians

Job D. Invertebrates

Subjob D.1. Mollusks

Subjob D.2. Macroinvertebrates

Subjob D.3. Effects of Dam Removals

Job E. Marine Wildlife: Identify and Mitigate Threats to Sea Turtles in NJ Waters

Job F. Threat assessment: Emerging Diseases

Project 2. Habitat Management and Planning

A. Strategic Habitat Conservation

B. Habitat Management

B.1. Forest Habitat Management

B.2. Habitat Connectivity and Management

Performance Report

Project: **1. SGCN Research, Monitoring and Management**
Federal Aid Project: T-1-8 (State Wildlife Grants)
Segment dates: January 1, 2020 to December 31, 2020

JOB C. REPTILE AND AMPHIBIAN CONSERVATION
Subjob C.1. TURTLES

Project Leader: Brian Zarate

*Note, there was a limitation in our ability to carry out planned volunteer-based turtle surveys due to COVID-19 restrictions.

Bog Turtle Key Findings:

- Staff coordinated monitoring efforts of a site in central NJ where construction of an under-road tunnel system to safely pass turtles and other wildlife between two bisected areas was finalized in early 2019. Monitoring efforts in 2020 included radio-telemetry, road transect surveys, and "camera trapping," i.e., cameras placed inside the tunnels that capture an image of any animal passing through the field of view. A portion of the radio-telemetry monitoring was paid using these funds via a contract. The remainder of the monitoring was paid using non-federal funds. Results from the 2020 telemetry included:
  - Bog Turtles: Five tracked
    - Five bog turtles were tracked, including four females and one male. Three of the turtles remained throughout the season on the north side of the road and the other two turtles remained on the south side of the road.
  - Spotted Turtles (Additional spotted turtle activities will be reported below in SGCN Turtle Key Findings): Two tracked
    - One died during the study from a mower strike on the adjacent maintained uplands.
    - One had a transmitter failure right at the end of the monitoring period.
    - Neither crossed the road during tracking.
- Southern staff conducted group surveys at two core habitats and two potential sites in 2020. These surveys had assistance from NJ Audubon (NJA) and Conserve Wildlife Foundation of New Jersey (CWF) staff.
- Staff continued a partnership with NJA at a site in southern NJ. Phragmites was mowed in March and follow-up herbicide was applied later in the summer. Visual surveys and telemetry continued in the southern section of the property. USFWS has obtained a NJ Special Use Permit (SUP) for work to find and break up tile drains in the fields, strategically plug ditches coming off the field, and install check dams and weirs to control water flow in the agricultural ditch, and Service staff have filed for GP-16 and GP-4 permits.
- ENSP has partnered with NJA, CWF, NJ Conservation Foundation, and USFWS on a proposal for a Regional Conservation Partnership Program (RCPP) grant for habitat restoration, agricultural best management practices, and land acquisition opportunities that can benefit bog turtle populations, agricultural production, and the overall landscape of the Upper Salem watershed.

Wood Turtle Key Findings:

- Staff continued to participate in regional wood turtle monthly conference calls to stay engaged on efforts related to the active Regional Conservation Needs (RCN) grant for wood turtle and to continue working on actions identified in the conservation plan (funded by CSWG) (Jones et. al. 2018). Northeast state biologists are also awaiting a decision on funding award for a CSWG II for wood turtle conservation plan implementation.

- Staff coordinated and held two virtual wood turtle planning meetings on NJ's wood turtle conservation area network (CAN) sites and site planning. These meetings are steps to help staff create a NJ-specific wood turtle conservation plan (that will include elements of a status assessment and recovery plan).
    - The first meeting was held with key partners to review all of NJ's CAN sites and to hear updates on regional and state wood turtle conservation planning efforts.
    - The second meeting was targeted at partners working in a single CAN site within the professions of land protection, habitat restoration, and biological survey.

SGCN Turtle Key Findings:

- Additional turtle work this grant period focused on NJ's involvement with RCN/CSWG funded projects for the spotted turtle and box turtle, both species of special concern in NJ:
    - Spotted Turtle: Staff participated in monthly coordination calls and began review of products and deliverables associated with the active CSWG spotted turtle grant. NJ did not receive funding through the CSWG.
    - Box Turtle: Staff participated in monthly box turtle RCN committee calls to develop and refine the draft regional survey protocols. Staff coordinated all volunteer survey efforts for New Jersey. In addition, staff piloted plot-based surveys at three sites following guidance from the Eastern Box Turtle Population Monitoring Protocol (http://www.northeastturtles.org/uploads/3/0/4/3/30433006/ebt_survey_protocol.pdf).

Recommendations:

- Continue to apply standardized monitoring approaches for bog and wood turtle beyond the end of regional funding cycles, in addition to other standardized monitoring for other SGCN turtle species, such as spotted turtle and box turtle.
- Continue to coordinate with volunteers to monitor priority bog, wood, spotted, and box turtle areas. Utilize existing regional conservation plans to guide these surveys.
- Enlist additional, trained volunteers to assist with SGCN turtle monitoring.

Citations:

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

Subjob C.2. SNAKES

Project Leader: Kris Schantz

Key Findings:

- Due to COVID-19 related restrictions, the Endangered and Nongame Species Program (ENSP) did not recruit any new participants for the Venomous Snake Response Team (VSRT) or conduct any trainings in 2020 and many of our volunteers were unable to participate. However, the ENSP continued to work with trained personnel who were able to perform the duties of the VSRT as part of their job's responsibilities (e.g., animal control officers, police officers, etc.) and a few select volunteers.
    - Of the 46 active team members in 2020, 44 submitted information regarding their snake responses and time and mileage incurred at the time this report was prepared. Eleven responders had responded to 32 venomous snake calls including 26 Timber Rattlesnakes and three Northern Copperheads. Two rattlesnakes and one of the copperheads were dead on the roads and removed for public safety. One rattlesnake was fatally injured and died after attempted medical care. Another rattlesnake was seriously wounded during a suspected wanton killing attempt but was rescued, treated at Woodlands Wildlife Refuge with the help of Dr. Chadd Tindall, DVM and released less than two months later. Two of the three copperheads were in courtship but could not be found upon the responders' arrival; a video confirmed their presence and courtship behavior. One additional snake could not be found upon

the responder's arrival nor could its identification be confirmed. As such, it is excluded from the venomous snake "count." ENSP is working to obtain the official sighting report forms from responders for submission and entry into NJ DEP's Biotics database (Biotics).

- ENSP personnel fielded approximately 120 snake complaints from residents via telephone calls coming through our offices and/or the DEP Emergency Hotline. Only 13 of these reports were confirmed as venomous snakes (less than 10% of these calls; the remaining were non-venomous, native snakes). Note these figures exclude requests for assistance from residents who have had venomous snakes on their properties multiple times in past years and as such, are able to contact the ENSP biologist directly.
- ENSP personnel continued to reduce a backlog of rare snake observation data for entry into the Biotics database. This included compiling, formatting, reviewing data obtained by the ENSP personnel, consultants, academics and private researchers, and when necessary, seeking clarification and/or corrections regarding the data from the original observers. A backlog of data remains.
- Due to COVID-19 related restrictions, the ENSP's Pinelands Snake Research Team was unable to conduct surveys in the Pine Barrens.
- In 2020, the ENSP continued to partner with Robert Zappalorti (Herpetological Associates), Dr. Howard Reinert (The College of New Jersey), and the Pinelands Commission on a multi-objective Corn Snake (*Pantherophis guttatus*) study involving radio-telemetry, traplines and cover boards, and head-starting. The ENSP provided the necessary supplies for the study using a combination of funds from the SWG and other non-federal sources. In 2020, purchased pit-tags (for non-hatchlings) and DNA sampling supplies.
    - Seventy-four (74) non-hatchling corn snakes were pit-tagged in 2020; 52 tagged individuals (tagged between 2016 and 2020) were recaptured at least once during the 2020 field season.
    - The research partners have recruited Lauretta Bushar, Acadia University, to assist with DNA analyses of corn snake samples. Analyses will begin in 2021.
    - Noteworthy observations made by the ENSP's research partner, Robert Zappalorti, include the discovery of three previously undocumented corn snake nesting areas in western Berkeley Township including a communal nest under a decaying pine log, eggs under a shelter board, and a third site with an open, sunny mound of tree stumps and sand.
- No progress was made on the Northern Pine Snake Species Status Assessment update or recovery plan or the Timber Rattlesnakes' Species Status Assessment.
- Using information the ENSP compiled from literature and field assessments in 2019, the ENSP developed standardized protocols for northern pine snake drift fence/trapline surveys that are required as part of land use permit-application processes to ensure more uniform survey efforts and more successful methods are implemented among environmental consultants to trap all age classes of northern pine snakes and potentially, other rare snakes including but not limited to corn snakes (also referred to as red ratsnakes, *Pantherophis guttatus*), eastern kingsnakes (*Lampropeltis getula*) and northern scarlet snakes (*Cemophora coccinea copei*) to determine their presence in the landscape.
- Law enforcement continued to monitor known snake collection hot spots. No suspicious activity was observed at the sites in 2020.
- ENSP personnel prepared and submitted land management review packages for two projects to be conducted by research partners on state lands and assisted partners in obtaining the necessary state lands special use permits.
- ENSP personnel worked with a northern copperhead researcher to develop a potential study regarding activity range, habitat use, and survey methods.
- In 2019 and 2020, five snakes were reported to the ENSP that were entangled and dead in exposed soil erosion control blanket photo-degradable netting including two eastern king snakes (species of special concern). The material was used on conserved state land that is inhabited by three state endangered and threatened species, in addition to one species of special concern (eastern king snake) and one regional priority species (northern black racer). This raised questions within the ENSP as to why wildlife-friendly products were not being implemented on the state's conserved lands. Due to the likelihood of wildlife entanglement, snakes, ENSP personnel began investigating the use of soil erosion control products that incorporate netting made of plastics and other synthetic materials:

- Internal meetings in 2020 revealed that all lands, including state conserved lands, must follow soil erosion control standards outlined by the NJ Dept. of Agriculture's Soil Conservation Districts (SCD). Any desire to change those standards requires the SCD's participation, approval and acceptance.
- Conducted a literature review regarding snake entanglement in such products and began drafting a guidance document for New Jersey as a tool for future discussions.
- Virtually attended a three-day, multi-state, multi-organization peer exchange regarding plastics in the environment that focused on soil erosion control products to learn how other states have been shifting from these products to 100% biodegradable products, research they've conducted, and legal and legislative efforts they had to/are trying to overcome.
- Began coordination with ENSP staff, NJ Dept. of Transportation and the NJ Dept. of Agriculture's Soil Conservation Districts to discuss concerns regarding these products, other states' research and progress we learned from the aforementioned peer exchange, and how New Jersey might shift State standards to require the use of wildlife-friendly products where possible (e.g., project areas with steep slopes would likely be excluded from such a requirement as might other scenarios that may warrant longer-lived products).

- ENSP personnel is seeking input from the NJ Division of Fish and Wildlife's in-house educational staff regarding additional educational/outreach efforts that could be deployed to educate residents and/or reach a larger audience regarding the venomous snakes of NJ. Once identified, the ENSP will pursue sharing and coordinating such efforts with the northeast region's venomous snake state biologists as agreed upon by the region's biologists.
- ENSP personnel began a literature review of the impacts of off-road vehicle activities on snakes in preparation for a collaborative northeast region-based white paper.
- ENSP personnel led the effort with the northeast regional snake biologists to develop snake-focused pre-proposals for the Northeast Regional Conservation Needs Program (RCN) grant.

Conclusions:

- Venomous Snake Response Team (VSRT):
  - The VSRT is a valuable human resource for interceding in human-snake interactions. We need to expand it with new, trained team members in areas important for venomous snakes.
  - Obtaining VSRT members' time/mileage and response reports continues to be difficult, often requiring multiple requests for information and even then, not all team members responding. However, the volunteers provide a much-needed service to New Jersey residents and added protection for the snakes.
- Residents are very unaware of snake identification and New Jersey's snake species; education regarding snake identification is lacking in New Jersey.
- A rare snake sighting data backlog continues to exist. Although the backlog from previous years has been significantly decreased, each year new information is submitted, adding to the task.
- It is unclear what effect law enforcement's presence at the 2016-identified snake collection hot spots has had on illegal activities at this time. No violations have been recorded or summonses issued, but their attention to the issue may be a deterrent to poaching activities.
- Research partnerships are proving to be an effective means of obtaining important data with limited resources.

Recommendations:

- The VSRT will continue in 2021 as ENSP continues to consider possible methods to maintain and expand the team while decreasing the ENSP's responsibilities and time required.
  - If deemed safe (with regard to COVID-19), the ENSP must pursue the two local police departments that expressed interest in training in 2019 for recruitment as their communities are within venomous snake territories where we lack trained personnel.
  - If deemed safe (with regard to COVID-19), the ENSP needs to recruit and train new personnel statewide to build the VSRT to ensure adequate coverage for NJ residents.

    - The ENSP must continue to work with the team members so they understand (and fulfill) what is required of them as official volunteers and as team members not covered under NJ Division of Fish and Wildlife (DFW) insurance.
- The ENSP will reach out to non-government snake researchers for input on how public snake education could be improved.
- Continue revisions on the 2009 Northern Pine Snake Species Status Assessment and share the document with appropriate professionals for their review and input. Upon revisions and finalization, continue work on the Northern Pine Snake's draft recovery plan which had begun in 2014.
- The ENSP will determine potential rare snake projects to be contracted with funding assistance from a non-federal source.
- The ENSP will continue to partner with snake researchers on rare snake research to obtain important data and understanding of species' needs.
- The ENSP will work with other snake researchers to develop potential habitat management strategies that benefit snakes while minimizing the creation of sinks and/or attention from people.

Subjob C.3. AMPHIBIANS

Project Leader: William Pitts

Key findings

- Eastern tiger salamander surveys were conducted at known or potential breeding pools throughout the species range. Emphasis was placed on surveying potential new breeding pools.
- No new pools were constructed, or old pools modified. However, we began to identify areas to improve connectivity among known breeding pools. We also identified a new site for pool creation for newly acquired parcels.

Conclusions

- ENSP's survey efforts in 2020 emphasized monitoring viability of known eastern tiger salamander breeding populations.
- Survey efforts were largely conducted by the ENSP volunteers and Conserve Wildlife Foundation of NJ staff.
- Identification and remediation of threats to eastern tiger salamander populations remains important, especially regarding issues related to disease and habitat destruction due to off-road vehicles.

Recommendations

- Continue working with the NJ Division of Fish and Wildlife's (DFW) Bureau of Lands Management and the Conserve Wildlife Foundation of New Jersey on vernal pool construction on DFW's and other state lands.
- After suitable habitat is identified for management and/or new pool creation, locations will need to be ground-truthed for viability and accessibility.
- Develop a strategy to protect breeding pools from off-road vehicles, particularly on public lands. Work with DFW's Bureau of Law Enforcement on the use of surveillance equipment to protect known breeding pools from illegal off-road vehicle activity.
- Continue to work with partners and trusted volunteers to monitor pools and encourage amateur herpetologists to submit sightings, with a focus on the identification of new breeding populations.

JOB D. INVERTEBRATE CONSERVATION AND MANAGEMENT

Subjob D.1. Mollusks

Project Leader: Jeanette Bowers-Altman

Objective:

- To document occurrences, monitor populations, and create conservation strategies to aid in the recovery of listed freshwater mussel species throughout New Jersey. Listed species include the Dwarf wedgemussel, Brook floater, Green floater, Yellow lampmussel, Eastern lampmussel, Eastern pondmussel, Tidewater mucket and Triangle floater.

Key Findings:

- Endangered and Nongame Species Program (ENSP) staff were unable to conduct freshwater mussel surveys during the 2020 field season due to concerns relating to COVID-19 exposure, restrictions placed on field work by the State of NJ in response to the pandemic, and a 10-day State imposed furlough during optimum survey times.
- We contracted Biodrawversity LLC to conduct surveys in the Lamington River using a modified version of the Brook Floater Working Group's (BFWG) Rapid Assessment Protocol to determine presence of Brook floater (*Alasmidonta varicosa*) and other species and assess habitat in the river and select tributaries (Somerset County). New Jersey is now a supporting member of the working group. We are using the rapid assessment protocol wherever feasible to maintain consistency with regional surveys.
- Work in the Lamington River was severely curtailed in 2019 due to high water/low visibility issues caused by a continuous, 200 cfs water release by Round Valley Reservoir, which began in early September and lasted through mid-October. This season, Biodiversity completed surveys in the Lamington River and Lake Aeroflex, Sussex County. Once again, access proved to be very challenging due to private property and golf courses. Rather than focus solely on stream crossings (bridges), the 2020 work focused on a nearly 2,000-meter reach of the Lamington River that included areas upstream and downstream from Rattlesnake Bridge Road where access was possible. This focus on a large accessible river reach forced Biodrawversity to deviate from the *Rapid Assessment Protocol*, reverting to a more basic qualitative survey. Thousands of Eastern elliptio (*Elliptio complanata*), two Creeper (*Strophitus undulatus* - SC), and three Triangle floater (*Alasmidonta undulata*-T) were recorded. Brook floaters (*A. varicosa)* were not detected, but habitat appeared to be suitable throughout the areas that were surveyed.
- Biodrawversity LLC conducted a mussel survey in Lake Aeroflex (Sussex County) to attempt to verify the presence of state-listed mussels that may have been previously found in the lake, particularly the Dwarf wedgemussel (*Alasmidonta heterodon*). Three species were found: Eastern elliptio (*E. complanata*), Eastern floater (*Pyganodon cataracta*), and Eastern lampmussel (*Lampsilis radiata* – T). Mussels were numerous along the lakeshore, in water depths ranging from 1.0 to 10.0 ft. The high density of submerged aquatic vegetation impeded surveys to some extent, and the survey was confined to the relatively shallow edge of the lake. Eastern elliptio and Eastern floater both displayed some morphological variation that superficially resembled other species. Notably, young Eastern floater did have a somewhat "wedge-shaped" shell resembling the Dwarf wedgemussel, but biologists were not able to find any live or dead of the species. It should be noted that Dwarf wedgemussel have never been found in lakes but may occur in slow-flowing impoundments.
- Volunteers from Amy Greene Environmental Associates conducted qualitative, timed searches at one historic Brook floater (*A. varicosa*) site in the Stony Brook, Mercer County between Rosedale Park and Old Mill Road late in the season. Searches were supplemented with tactile methods including excavation in areas with softer substrates. Three species were found: Eastern elliptio (*E. complanata*), n = 234, Eastern floater (*P. cataracta*) n = 1, Creeper (*S. undulata* – SC), n = 1. No Brook floaters were found during the survey effort.
- Searches for the Chinese pond mussel in Wickecheoke Creek, Hunterdon County were temporarily suspended in 2020 due to COVID-19. In 2010, we documented the first North American occurrence of the

highly invasive Chinese pond mussel (*Sinanodonta woodiana*) from ponds owned by NJ Conservation Foundation (NJCF). The ponds had formerly been used as part of a fish farm operation for holding bighead carp and other fish species. Monitoring by the ENSP staff at six locations downstream of the source ponds to the Delaware River confluence continued during the project period. No live Chinese pond mussels or shells were found. In 2019, the NJCF, USFWS and other partners (including other bureaus from within the NJ Division of Fish and Wildlife; DFW) applied a series of molluscicide treatments to the ponds to eradicate the remaining Chinese pond mussel population.

- In 2019, we provided Urbani Fisheries LLC. with a detailed description of Brook floater habitat requirements and preferred stream characteristics to be applied to sections of a stream enhancement project in the Lamington River, Somerset Co. Urbani was contracted by a private organization that partnered with numerous local groups to create/enhance fish habitat along a 10,000 linear foot stretch of the river via instream enhancements, bank stabilizations and riparian plantings. The stream segment was devoid of freshwater mussels and approximately one mile upstream of brook floater occurrences. Biologists at Urbani agreed to create Brook floater and other mussel habitat in several key sections of the project area. We inspected the site on three separate occasions and are encouraged that the newly created habitat appears suitable for brook floaters and other rare species that occur downstream. Plans to inspect the newly created habitat were temporarily suspended in 2020 due to COVID-19 concerns and inability to access the project site.
- Listed and Special Concern freshwater mussels recorded during surveys covered in this report and others (e.g., private consultants, USGS, nonprofit organizations, etc.) have been/are in the process of being incorporated into the Biotics database. These locations will be included in the next Species Occurrence Area (SOA) file, which is used by DEP's Division of Land Resource Protection (*formerly* the Land Use Regulation Program) and other entities for environmental review purposes, as well as being incorporated into the next version of the Landscape Project Map to identify critical areas for listed mussel populations.

<u>Conclusions</u>:

- The prevalence of COVID-19 in NJ severely curtailed freshwater mussel survey efforts in 2020.
- Brook floater populations appear to be declining in the state. Despite efforts by Biodrawversity LLC and volunteers from Amy Greene Environmental Associates, no Brook floaters were found at or near historic occurrences. Habitat conditions at several historic Brook floater sites may warrant the use of stream/riparian restoration due to projected increases in flooding and extreme weather events. Brook floater declines in NJ may be attributed, in part, to the loss of stable habitat via transport downstream due to flooding and extreme events such as tropical storms Lee and Irene in 2011. Other threats include water quality degradation, habitat loss, dams and dam removal, warming water temperatures, and the prevalence of invasive species. The apparent lack of juvenile mussels at most occupied sites indicates that little reproduction is occurring within populations.
- Although eradication efforts at the NJCF ponds resulted in the mortality of numerous Chinese pond mussels, it is critical that monitoring of downstream and nearby sites continues. It is possible that 1) 100% mortality was not achieved during the molluscicide applications in the ponds, 2) there are privately owned ponds in the system that may be harboring additional populations, and 3) there may have been individuals that were undetected during previous monitoring efforts. The impacts of a Chinese pond mussel invasion in the Delaware River to native freshwater mussel populations in NJ and PA could be catastrophic.

<u>Recommendations</u>:

- Continue surveys for brook floaters in the Stony Brook, Lamington, Raritan and other areas in the northern half of the state. Draft the Brook floater species assessment and state recovery plan, and coordinate with BFWG to fill in data gaps and develop protective measures for critical areas. Determine suitable areas where Brook floaters may be re-established using hatchery-raised mussels.
- Continue surveys for listed species in previously unsurveyed suitable habitats to document distribution; monitor populations in known locations to determine trends.

- Continue surveys for Dwarf wedgemussels in the Pequest River watershed to document occurrences and establish population boundaries.
- Continue monitoring efforts for Chinese pond mussels in Wickecheoke Creek and tributaries.
- Conduct freshwater mussel surveys in the Lamington River to determine whether mussels have colonized habitat created by Urbani Fisheries. If no mussels are present, assess water quality parameters and determine whether a pilot study using caged common species to determine suitability for potential seeding is warranted.
- Publish results of predicative model developed in 2016. Develop protocol that will apply findings to stream restoration techniques to help manage for listed mussels and prepare for extreme weather impacts.
- Continue to identify and survey areas below and adjacent to golf courses and determine whether the development of BMP's specific to freshwater mussel protection is warranted.
- Investigate potential opportunities for habitat/mussel restoration within applicable areas.
- Solicit assistance from additional WCC volunteers; train volunteers to identify and survey for mussels; assign specific areas for survey work where data are lacking.

Subjob D.2. Macroinvertebrates

**Note, due to restrictions placed on field work by the State of NJ in response to the COVID-19 pandemic and a 10-day State-imposed furlough during the field season, there was limited macroinvertebrate project work completed during the 2020 field season.

Lepidoptera

Project Leader: Robert Somes

Key Findings:

- Surveys for early flying species such as Frosted and Hoary Elfin were unable to be completed due to COVID-19 restrictions.
- Northern Metalmark surveys were conducted at three known locations during three different surveys. One of those sites had a count of over 50 individuals and is one of the larger remaining populations. The other known sites had seven to ten individuals observed. The NJ Division of Fish and Wildlife (DFW) is partnering with the landowner of this site to implement management that will help support the colony. DFW staff held several meetings to review habitat management activities that could be conducted on several adjacent but historic sites.
- Leonard's Skipper surveys were conducted at three known sites with 5-11 individuals observed during three different surveys.
- Surveys for Bronze Copper were conducted during 14 surveys at two historic locations where a single individual and a maximum of six individuals were observed and at newly documented sites where a single individual and a maximum of five individuals were observed.
- Extensive survey efforts were conducted with the assistance of the USFWS for Arogos Skipper in NJ. All historic sites as well as numerous potential sites were surveyed for this species at over 20 locations but no Arogos Skippers were documented during the survey effort. Poor access during the peak flight season in the best-known sites limited survey efforts.
- Habitat management for pollinators in general continued with the planting of pollinator seed-mix plots at various locations throughout NJ. About 1200 plants of 20 different nectar source and butterfly foodplant species were propagated and planted at pollinator gardens and restoration sites throughout NJ.
- One hundred *Baptisia tinctoria* plants were propagated and planted at two known Frosted Elfin populations and a suitable site adjacent to a known population. These plants were to restore foodplants in damaged areas of the known sites and to potentially create suitable habitat on adjacent preserved land.

- Our partnership with the North American Butterfly Association-North Jersey Chapter and the South Jersey Butterfly Club has led to an increase in data collection for rare butterflies in NJ and has helped us to better document recently listed species.

Conclusions:
- The partnership with the NJ State Park Service and the NJ State Forest Service to propagate wildflowers and butterfly foodplant species and to create butterfly gardens and meadows continued to be a success and was expanded this year to include a greater variety of nectar plants and butterfly host plants. This year over 14 state parks, Wildlife Management Areas and county parks hosted plantings.
- The DFW Bureau of Land Management actively manages hundreds of acres of land each year including extensive mowing and seeding. By working together, we are improving large sections of Wildlife Management Areas for the benefit of rare butterflies and pollinators by delaying mowing until after September 30, and by changing the seed mixes used for planting to include more plants suitable as foodplants and as nectar sources for native butterflies and pollinators.
- Surveys of potential rare butterfly species habitat continued to yield discoveries of new colonies for several species; large areas of unsurveyed but suitable habitat exist within NJ for many species.
- Surveys for Frosted Elfin should be a high priority due to our inability to survey during the 2020 flight season.
- Northern Metalmark populations appear to be struggling at several historic sites and invasive plant species control needs to be expanded at several sites. The eruptive nature of this species makes it challenging to understand their population structure.

Recommendations:
- An extensive survey effort needs to target the butterfly species that were recently added to New Jersey's rare species list. Very limited data exist for many of these species in New Jersey, therefore it is critical that we develop a better understanding of their distribution, life history requirements, and threats.
- The milkweed propagation and butterfly garden/meadow creation project should be expanded within the NJ State Park Service and the NJ State Forest Service and we should strive to expand the number of seedlings that we distribute throughout the State. This program should also be expanded to include a variety of nectar source plant species as well as butterfly foodplant species to support restoration projects.
- The partnership with the DFW, Bureau of Lands Management should be expanded to create larger areas of habitat suitable to our rare butterflies and native pollinators.
- Habitat management for Northern Metalmark should be expanded to ensure the persistence of our current colonies and allow them to expand into former sites that have become overgrown and unsuitable. Continue working with land managers to maintain existing Northern Metalmark habitats. Work to increase connectivity between sites by maintaining natural corridors and creating suitable habitat by thinning invasive shrubs and trees. Work together with the NJ State Park Service to develop a maintenance plan for Northern Metalmark sites found on Kittatinny Valley State Park.
- Continuing Frosted Elfin surveys should be a high priority in NJ. Frosted Elfin was petitioned for Federal listing, so additional data from NJ would inform the status review. New Jersey is a regional stronghold for the Frosted Elfin, but many sites appear to be declining and a greater management effort needs to be made.
- Surveys for Arogos Skipper should be a high priority in NJ. Arogos Skipper is being petitioned for Federal listing; therefore, NJ data would serve the state and regional understanding. This species has regional strongholds in NJ and is probably one of our most imperiled species.

Odonata

Project Leader: Robert Somes

Key Findings:
- Staff conducted limited surveys for Scarlet Bluet, Pine Barrens Bluet, and New England Bluet as part of a regional effort to address the conservation of these species because they are endemic to the Northeastern

United States. Scarlet and Pine Barrens Bluet were both documented at two historic locations, absent from one historic location and not observed at two potential sites.
- Surveys for other listed Odonata species were limited this season. However, a regional surveying effort was made in Mercer and Monmouth counties in central NJ. Odonata surveying efforts have historically been lacking in this region and data are sparse. Staff conducted baseline Odonata surveys at approximately 10 sites in the region but failed to document any listed species.

Conclusions/recommendations:
- Surveys of historic sites and potential new sites were successful for Odonata even if they failed to document any listed species. Several areas of potential habitat for listed Odonata species were documented and should be targeted for survey efforts during 2021. Follow-up surveys should be conducted at historic locations where listed species were absent during 2020 to determine if the species were just missed during the surveys.
- Survey potential Tiger Spiketail habitat in central and southern New Jersey to locate new colonies and fill in the range gap between Hunterdon and Camden counties.
- Surveys for Pine Barrens Bluet, Scarlet Bluet, and New England Bluet should be a high priority because these species are a high regional priority, with New Jersey considered a stronghold.
- Surveys for other listed Odonata species should continue and be expanded during 2021 to fill in knowledge gaps and gain a better understanding of their distribution in New Jersey. Efforts should be made to revisit known sites that have not been recently surveyed to determine if previously documented species are extant.
- Surveys should be conducted for Harpoon Clubtail along the Delaware River to determine the distribution in the watershed.

Hymenoptera (Pollinating Bees)
Project Leader: Robert Somes

Key Findings:
- New Jersey is a partner in a regional project assessing the impacts of management activities on Xeric Pollinating Bee populations. Surveys were conducted along several transects to monitor bee populations and species composition at a research site in the NJ Pinelands to collect baseline data over the course of spring, summer, and early fall. This site is part of several management activities including thinning and prescribed forest fire management and the impacts of this activity on bee populations will be assessed.

Conclusions/Recommendations:
- Rutgers University is conducting extensive native bee research in the State of NJ and we should continue to partner with them to share data and develop joint research projects.
- Bee research projects should continue and be expanded to assess the impacts of different management activities on bee and other insect species populations. A second bee survey site should be added at a site where forest management activity is occurring in the Stafford Forge Wildlife Management Area.
- New Jersey should expand efforts to plant and maintain a variety of habitats beneficial to native pollinators and the variety of other species that depend on those habitats.

Cicindelidae (Tiger Beetles- Ellipsoptera)
Project Leader: Robert Somes

Key Findings:
- No survey efforts were conducted related to tiger beetles this season due to COVID-19 restrictions.

Conclusions/recommendations:

- Surveys should be targeted at tiger beetle species identified as Species of Greatest Conservation Need in NJ's State Wildlife Action Plan to better understand their distribution and habitat requirements in New Jersey.
- Preliminary research and data collection should be completed to conduct a status assessment of tiger beetles found in New Jersey.

Subjob D.3. Impact of Dam Removals on Macroinvertebrates

Project Leader: Jeanette Bowers-Altman

Objective:

Identify and monitor rare freshwater mussels and Odonata that occur up and downstream of dams in the Musconetcong and Raritan rivers, and potentially other watersheds throughout New Jersey to 1) document short and long-term impacts of dam removal to populations 2) determine whether there are safe alternatives to current dam removal methods and 3) develop strategies to mitigate short-term impacts of dam removal to minimize injury and/or mortality to individuals. Stream segments adjacent to dams planned for removal within the next two years will be emphasized.

This project focuses solely on impacts of the Columbia Dam Removal Project, Warren County.

Key Findings:

- The Columbia Dam was the lowermost dam on the Paulins Kill, located 475 meters from the Delaware River. The dam was 5.5 m high, 100 m long and created a 1.5-mile-long, 32-acre impoundment. In addition to the dam, there was an associated remnant structure located 300 m downstream of the dam. Both structures were located within the Columbia Wildlife Management Area, which is owned and managed by the NJ Division of Fish and Wildlife (DFW).
- Both the Columbia Lake dam and its associated remnant structure were removed in 2018 as part of a conservation effort to restore aquatic habitat, ecosystem processes and the thermal regime of the lower part of the river, along with reestablishing connectivity and historic habitat for migratory fish and other aquatic species. Partners including The Nature Conservancy (TNC), American Rivers, DFW, FWS, and others had been planning the removal since 2013.
- To minimize impacts of the dam removal to freshwater mussels (including three state threatened species and one special concern) living below the dam, along with more common species above the dam, TNC contracted Biodrawversity LLC to perform a mussel relocation. Listed mussels were tagged and moved to one of several relocation areas; common species were also moved, but not tagged. Biodrawversity LLC is monitoring all tagged individuals.
- We contracted Biodrawversity LLC in 2019 and 2020 to assess habitat changes above and below the former Columbia Dam as part of a long-term monitoring effort to determine impacts of dam removals on freshwater mussels. The research will ultimately help inform decisions regarding future dam removal projects in the state. Habitat changes were documented using photographic/visual observations pre- and post-removal, presence/absence of freshwater mussels, comparison to habitats of relocated individuals, and other metrics.
- In 2019, freshwater mussel habitat was evaluated post-removal at 10 segments between the Delaware River near the Paulins Kill confluence and upstream to near Brugler Road and compared to pre-removal conditions. Mussel surveys were performed at seven out of 10 segments. Three segments were excluded from survey efforts due to pre-removal low densities or difficulty in accessing the channel because of unstable substrate. In general, mussel habitats within close proximity of the dam fared poorly after the removal: no live mussels were found near the footprint of the former dam. Similarly, the former lower impoundment underwent major habitat changes. The area is now a relatively straight channel with long shallow runs, riffles and rapids. Substrate includes areas of firm gravel and cobble, but also contains large

sections of clayey muck in which it is difficult to walk. The habitat is somewhat homogenous, with moderate to strong flows. No mussels or shells were found. Other habitats showed fewer impacts due to the dam removal. Habitat was found to be mostly unchanged in the Delaware River near the Paulins Kill confluence and in lower Paulins Kill to the Rt. 46 overpass. This area is a sediment transport reach, with flows generally too strong to allow fine sediments to accumulate. There may have been some sediment accumulation near the confluence, river left on the inside bend. Otherwise flow, substrate and depth were comparable to pre-removal conditions. A 40-minute mussel survey yielded approximately 50 live Eastern elliptio (*E. complanata*) and Two alewife floater (*P. cataracta*).

- In 2020, Biodrawversity LLC conducted qualitative surveys for juvenile and adult mussels in the former Columbia Lake to determine post-dam removal mussel densities, assessed mussel habitat suitability and selected potential sites for long-term monitoring. In addition, Biodrawversity is assisting the ENSP with developing a long-term study plan that will document potential mussel colonization and recovery in the areas of the Paulins Kill.
- Biodrawversity LLC surveyed nearly the entire length of the former impoundment, from near the footprint of the former dam to 175 meters upstream from Warrington Road. The entire reach from I-80 to the upper end was kayaked; both photos and video were recorded to help document habitat through this reach. The reach from the former dam to I-80 were accessed on foot. Biologists identified, surveyed, and assessed several areas with suitable mussel habitat, which could be used for long-term monitoring. However, mussel densities remain extremely low in the impoundment. Biologists found a small number of relic shells of Eastern elliptio (*E. complanata*), Eastern floater (*P. cataracta*), and Triangle floater (*A. undulata* - T*)*, but found live mussels (Eastern elliptio, *E. complanata*) only at the uppermost site upstream from Warrington Road. There is no evidence of recruitment in the former impoundment.
- ENSP staff were unable to conduct Odonata surveys at the former dam site during the 2020 field season due to concerns relating to COVID-19 exposure, restrictions placed on field work by the State of NJ in response to the pandemic, and a 10-day State-imposed furlough during optimum survey times.

Conclusions:

- It is undetermined whether freshwater mussel habitat will return to or surpass previous pre-dam removal levels in the Paulins Kill within Columbia WMA. Despite disrupting aquatic connectivity, the dam was instrumental in creating stable, well-oxygenated habitat for a variety of species (n=6) such as Yellow lampmussel (*Lampsilis cariosa*), which is prevalent in the Delaware River, and Eastern lampmussel (*Lampsilis radiata*), which occurs in the Paulins Kill. It was the only site in the state where these two species were known to co-occur. Although restored aquatic connectivity will allow the passage of some host fishes to travel up the Paulins Kill and increase mussel distribution via glochidial transport, migratory fish such as American eel and *Alosa sp*. serve as hosts to common Eastern elliptio and Alewife floater, respectively. It is too early to determine what the impacts of dam removal will be on listed freshwater mussels in the long-term.
- Some areas in the impacted stretch may in time provide suitable habitat for mussels. For example, although it was impossible to access the main channel between I-80 and Warrington Road (former lake bed) due to instability, Biodrawversity biologists reported that this location shows promise. With the extensive riparian plantings being done in this area, and the low gradient stream channel that should retain coarse woody material and sediment and thereby promote habitat complexity, the former lakebed could become good mussel habitat in the future. However, there is no evidence to date of mussel recruitment in this area. Similarly, the area of the former lower impoundment, with the addition of large trees to create habitat complexity, may in time support mussels.
- Close inspection of the post-removal conditions suggests that several river specialist Odonata species will potentially colonize newly freed waters in the next 5-10 years. Species that may move into these habitats include River Jewelwing, American Rubyspot, Fawn Dawner, Dragonhunter, Black-shouldered Spinyleg, Spine-Crowned Clubtail, Rabids Clubtail (State special concern), Brook Snaketail (State threatened), Eastern Clubtail, Illinois River Cruiser, Uhler's Sundragon and Umber Shadowdragon.

Recommendations:

- Work with the NJ DEP's Bureau of Dam Safety to determine schedule of dam removals.
- Continue monitoring dam removal sites over time to document changes in species diversity and abundance. Monitoring will continue for at least five years. Monitoring of the Paulins Kill above and below the former Columbia Lake dam should be a priority. This area provides a unique opportunity to study short- and long-term impacts of large dam removal projects on freshwater mussels, Odonata, and their habitats.
- Investigate methods to mitigate dam removal impacts on freshwater mussels, Odonata, and other macroinvertebrates. Mitigation methods may include, for example, relocating rare mussels to suitable areas outside the direct zone of impact where individuals may be smothered or exposed to excessive sedimentation.
- Well targeted habitat restoration may prove to be a valuable tool for mitigating impacts of dam removals. Creation of instream mussel habitat in select areas may be helpful in jumpstarting post-removal colonization.

JOB F. THREAT ASSESSMENT: Emerging Diseases

Subjob F.1. Emerging Diseases

Project Leader: Kris Schantz and Brian Zarate

Key Findings:

- Staff biologists learned of northern red-bellied cooters (*Pseudemys rubriventris*) showing significant lesions on the plastrons from several ponds primarily in the Salem River watershed in 2019. Observations were made in the fall 2019 season when a volunteer happened to be working in the area. In coordination with volunteers, wildlife disease specialists, and the NJ Division of Fish and Wildlife's (DFW) pathologist, biopsies and other samples were taken from affected individuals and submitted for testing.
    - Staff presented a case study on the observations, lesions, and lab results to date as part of a virtual wildlife health symposium that originally was set for the 2020 Northeast Association for Fish and Wildlife Agencies meeting that was canceled due to COVID-19.
    - Staff, volunteers, and faculty from Montclair State University and Stockton University assisted DFW with sampling of cooters from three study ponds, but a late start to the sampling due to COVID-19 restrictions resulted in few new turtles or samples, so monitoring was postponed until March 2021.
- ENSP required permit holders and volunteers conducting snake research to report snakes exhibiting symptoms of snake fungal disease (SFD) to populate a database of such observations. None provided such information to the ENSP, however one group of researchers in the Pine Barrens has been working with the USGS National Wildlife Health Center on wintering snakes and confirmed SFD in wintering snakes and within the den soil.

Conclusions & Recommendations:

- ENSP will execute red-bellied cooter monitoring plan for 2021 and report results next performance period.
- ENSP will continue to request and encourage permit holders and volunteers to report SFD-symptomatic snakes for future reference should New Jersey snake populations demonstrate severe declines.

Performance Report

Project: **2. Habitat Management and Planning**
Federal Aid Project: T-1-8 (State Wildlife Grants)
Segment dates: January 1, 2020 to December 31, 2020

JOB A. Strategic Habitat Conservation

Project leader: Sharon Petzinger, Brian Zarate and John Heilferty

Objectives: Enhance, create or restore habitat to support species of greatest conservation need.

Key Findings:

- ENSP did not work on rare snake-specific habitat management due to COVID-19 restrictions and safety concerns.
- ENSP staff continued overseeing forestry activities and habitat planning on Sparta Mountain and Weldon Brook WMAs after the retirement of the Division's northern region habitat planner.
    - The tree marking and practice plan for Year 2 forestry activities at Sparta Mountain WMA was completed in January 2020 and 9.1 acres of modified seed tree treatment was completed in March 2020. The purpose of treating the 9.1 acres was to create young forest habitat for golden-winged warblers and other species dependent upon young forest habitat. The forester was paid for this work in 2020 with non-federal funds.
    - Staff worked with stakeholder groups opposed to forest management to determine criteria in selecting future forestry activities at Sparta Mountain WMA. Based on those meetings and criteria, a draft map was created to delineate roughly where 14 additional sites for young forest management would take place. Draft language was also created to agree to not manage any forest other than those 14 new sites and six previously managed sites on Sparta Mountain WMA. That draft language has not been finalized, and instead a new wildlife management area plan for Sparta Mountain is in the beginning stages of being drafted.
        - The site for Year 3 forestry activities at Sparta Mountain WMA was selected based on the criteria mentioned above and in accordance to the approved forest stewardship plan. The same stakeholder groups mentioned above were notified and the tree marking and practice plan to conduct 10 acres of modified seed tree treatment was completed in June 2020. The purpose of treating the 10 acres is to create young forest habitat for golden-winged warblers and other species dependent upon young forest habitat. The forestry activities were to begin November 2020, however last-minute concerns submitted from the same groups mentioned above delayed the project. Staff evaluated those concerns, and in order to address them the trees and boundaries were re-marked and acreage reduced to 9.2 acres. Implementation will likely occur January through March 2021. The forester was paid for this work with non-federal funds.
        - During these various discussions, these same stakeholder groups continued to oppose forest management, made false accusations against the project organizers, and stated they do not want to compromise but instead want to change regulations and cease all forest management on state lands.
    - Forestry activities were not implemented on Weldon Brook WMA in 2020 because the tree marking on the 27 acres did not align with the prescription. Concerns about the long skid were also expressed and the project was terminated due to timing constraints and the need to obtain stakeholder feedback prior to relocating the project.
- ENSP staff continued to monitor the bird response to forest management on Sparta Mountain (Figure 2A-1) and Weldon Brook WMAs.

- During the 2020 surveys, 46 species (18 of which are SGCN) were observed in at least one of the seven managed sites on Sparta Mountain WMA. A total 19 species (10 of which are SGCN) were observed in the one managed site on Weldon Brook WMA.
- Based on observations from 2014 through 2020, 82 different bird species, 30 of which are SGCN, have been observed using managed sites on Sparta Mountain WMA.

Conclusions

- Forest management conducted on state lands to allow the regeneration of oak/hickory forests (i.e. Modified Seed Tree with Wildlife Reserves) within a mature forested landscape creates breeding habitat for many bird species of conservation need and is also used by mature forest bird species, including the endangered red-shouldered hawk.

<u>Recommendations</u>

- Continue identifying, assessing, managing and monitoring habitats to benefit snake conservation within the Pinelands, Highlands and Ridge and Valley Regions. Work with other snake researchers to determine best management strategies to benefit the snakes while avoiding the creation of sinks. When possible, use alternate, non-federal funding sources to accomplish this work.
- Continue to manage forests on state lands to allow the regeneration of oak/hickory forests (i.e. Modified Seed Tree with Wildlife Reserves) within a mature forested landscape, provided the amount of forest in the young forest stage (<20 years post-harvest) does not exceed 20% of the forested landscape at a given time.
- Conduct Year 3 forestry activities on Sparta Mountain WMA during the winter of 2021 as outlined in the approved forest stewardship plans.
- Assess the benefit of spending time and money continuously meeting with stakeholder groups who are opposed to forest management and unwilling to compromise.

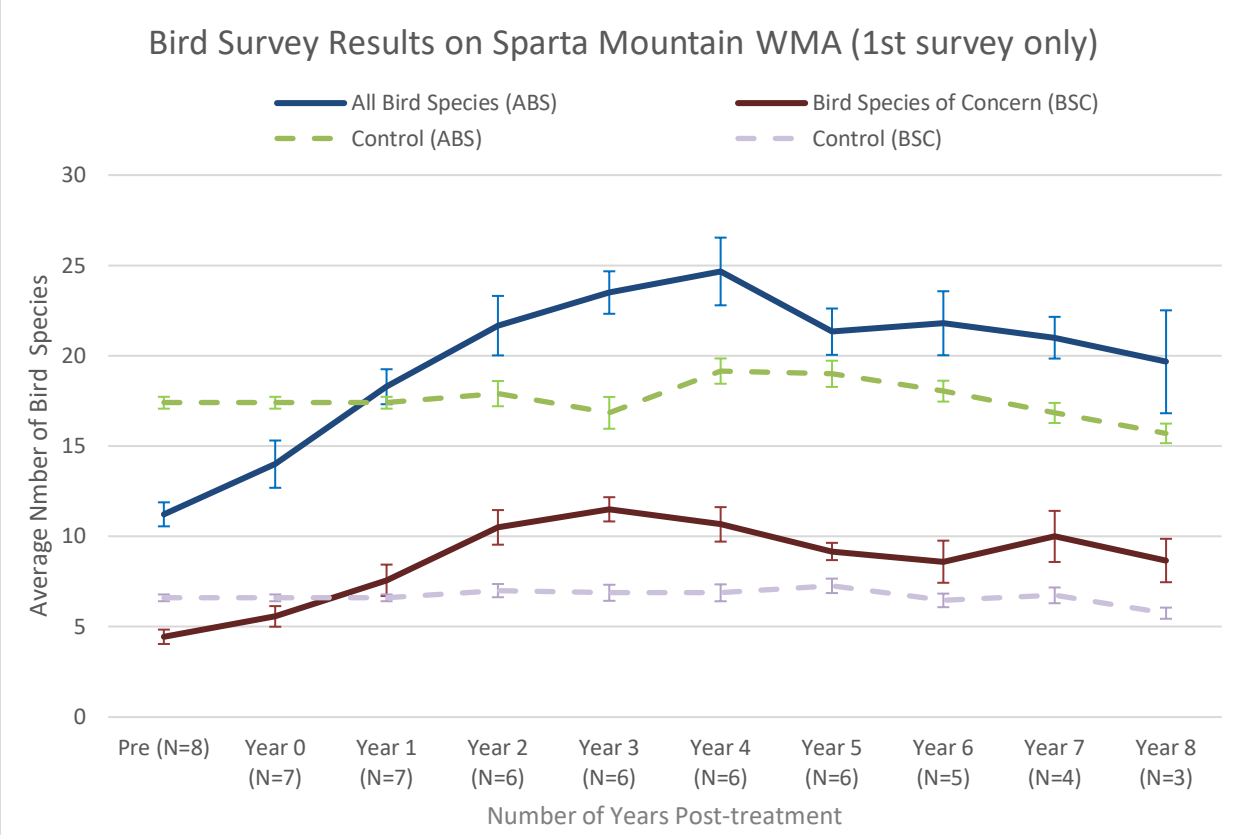

Figure 2A-1. Average (± SE) number of bird species (blue, green) and bird species of concern (red, violet) observed during breeding bird surveys on Sparta Mountain WMA. Pre-treatment surveys were conducted in 2004 and/or 2008 and selected based on proximity to treatment sites (conducted 2012-2020) within the same forest stand, or conducted on site prior to treatment.

JOB B.1. Forest Habitat Management

Key Findings:

- Due to COVID-19 restrictions, no outreach seminars or field tours were offered in 2020.
- ENSP, NRCS, Conserve Wildlife Foundation of New Jersey, and NJ Audubon jointly visited two private landowners interested in Working Lands for Wildlife (WLFW) in 2020.
- In 2020, surveys for all bird species, including golden-winged warblers (GWWA), were conducted to evaluate the success of Working Lands for Wildlife in terms of the number of bird species and presence of *Vermivora* species. Many of the WLFW surveys were conducted by NJ Audubon using non-federal monies.
    - A total of 133 locations relating to WLFW were surveyed for all bird species in NJ in 2020: 27 WLFW, 23 Management (MGMT), 61 Natural (NAT), and 22 pre-management (PRE). NAT sites represented naturally occurring "young forest" habitat within wetlands and were considered the control sites. MGMT sites represented other forest management prescriptions on private and public lands to promote young forest habitat that were not enrolled in WLFW. WLFW sites were only considered if they were enrolled in the WLFW-GWWA program. PRE sites are intended to be managed to create young forest habitat, regardless of ownership or enrollment in WLFW. Most PRE sites are closed-canopy deciduous forest stands with an average age between 70 and 100 years.
    - Three GWWAs were observed on managed sites in 2020: Two on MGMT sites and one on a WLFW site. Four GWWAs were observed on NAT sites in 2020.
        - This is the first year a GWWA has been observed on a WLFW site! The WLFW site with the GWWA was entering its 6th growing season in 2020.
    - Based on a combination of years since treatment and regeneration rates, only 21 managed sites (9 WLFW sites, 12 MGMT) surveyed in 2020 were considered suitable breeding habitat for GWWAs. Of those, 15 sites (6 WLFW, 9 MGMT) contained >70% forest cover.
        - GWWAs were detected on three of these sites (1 WLFW, 2 MGMT), which equates to 14% naïve occupancy on all suitable sites and 20% naïve occupancy on suitable sites with >70% forest cover. Occupancy on sites with 70% forest cover align with the 20% naïve occupancy found in the eastern study region (McNeil et al. 2020).
    - All NAT sites were considered suitable habitat for GWWAs. Forty-eight (78%) of the 61 NAT sites contained >70% forest cover.
        - All four GWWAs were detected at NAT sites containing >70% forest cover, which equates to a naïve occupancy of 8.3%.
    - From 2014 – 2020, species richness (SPP) in NAT sites had a trend of -0.09 per year while bird species of concern (BSC) had a trend of -0.055 per year. Species richness in MGMT+WLFW sites had a trend of 0.32 per year while BSC had a trend of 0.3 per year (Fig. 2B1-1).
        - Overall species richness was lower again this year. Over 60% (37/61) NAT sites had lower species richness than the average in 2019. Furthermore, species richness was lower in 65% (17/26) of WLFW sites and 28% (4/14) of MGMT sites surveyed in 2019.
    - A paired T-test was used to analyze differences of SPP and BSC between NAT sites and WLFW+MGMT sites from 2014 - 2020. As expected with an increasing trend, WLFW+MGMT sites had significantly greater SPP and BSC compared to the NAT sites (two-tailed; $P=0.003$; $P<0.001$).

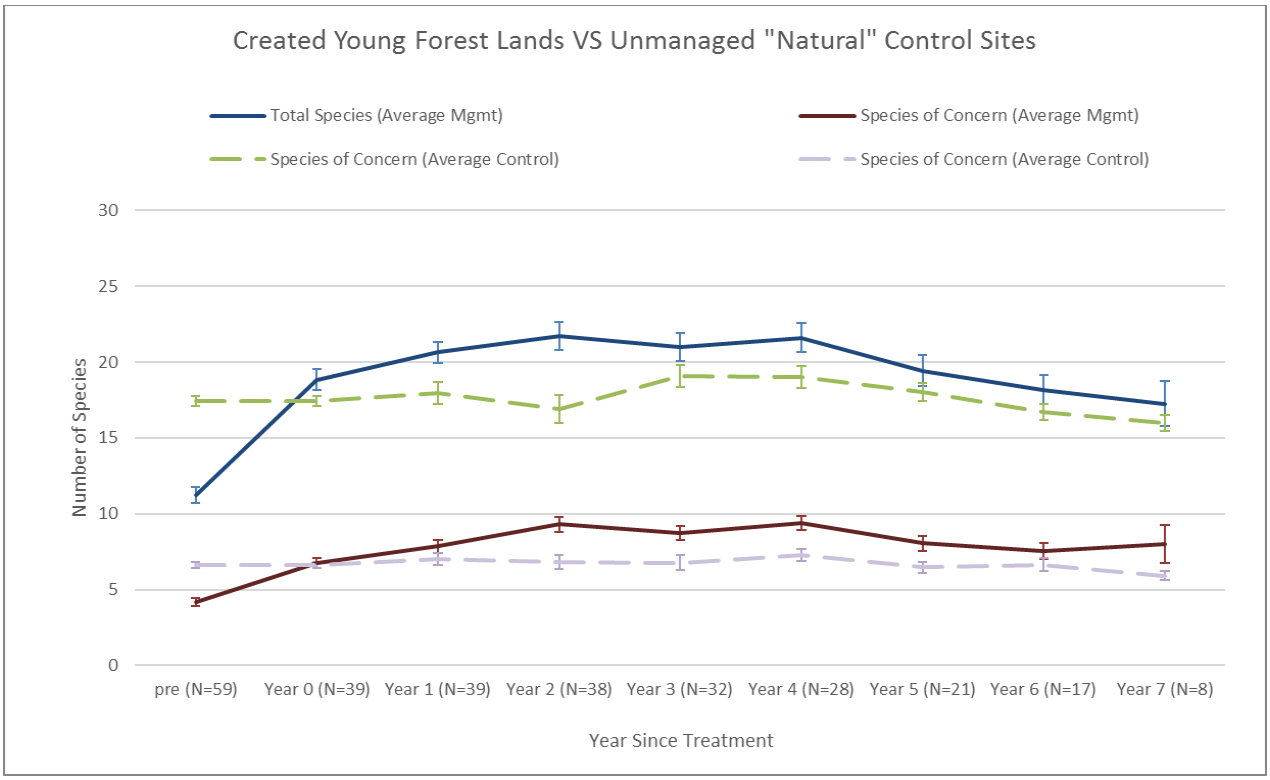

Figure 2B1-1. Average (± SE) number of bird species (blue, green) and bird species of concern (red, violet) observed during breeding bird surveys on Managed (WLFW & public lands treated to create or enhance habitat for GWWAs) and Unmanaged (Natural Control) sites.

Conclusions

- For an unknown reason, there was a decline in bird species richness detected in about half of the managed and control sites. Even so, managed sites continued to have a higher number of bird species than control sites.
- Overall naïve occupancy of golden-winged and blue-winged warblers in managed sites, regardless of forest cover, is lower this year than in 2019.
- Even in its early stages, young forest management on private properties has benefited a number of early-successional songbird species and attracted a greater diversity of bird species than other managed and natural sites. Overall, opening the forest canopy to create GWWA breeding habitat results in a 50% increase in the number of bird species using the site during the breeding season. However, most of the managed forest sites are still too young to attract golden-winged warblers.
- Without the maintenance of existing and/or creation of new breeding habitat in NJ specifically for golden-winged warblers, the population will continue to decrease as NJ runs out of new potential breeding sites to survey, and occupancy or recolonization of previously-occupied sites continues to decline.

Recommendations

- Continue to provide technical assistance pertaining to forest management for golden-winged warblers and other wildlife habitat needs on private and public lands, including WLFW.
- Continue to work with utility companies, NJ Division of Parks and Forestry, NJ Division of Fish and Wildlife's Bureau of Lands Management, Morris County Park Commission, Passaic County-Newark Watershed, National Park Service, and The Nature Conservancy-New Jersey Chapter to manage the last remaining active golden-winged warbler breeding areas.

JOB B.2. Habitat Connectivity and Management

This was inactive here, but is covered in NJ W-78-R.