Promoting the health and sustainability of wildlife populations through integration of wildlife ecology and veterinary medicine
ADMINISTRATIVE SUMMARY

The New York State Cooperative Wildlife Health Program (WHP) is a partnership between the New York State Department of Environmental Conservation (NYSDEC) and Cornell University’s College of Veterinary Medicine Wildlife Health Lab (CWHL) that works to safeguard the long-term health of wildlife in New York. Initiated in 2011, the program is responsible for monitoring wildlife disease and toxin impacts on species statewide, staff training and support, policy input, and research. Our activities are reported by the state fiscal year (April 1, 2019 - March 31, 2020).

This report covers the case submissions from January 1 - December 31, 2019. During that time, the program processed 1386 cases, including 948 necropsies at our three necropsy laboratories: DEC Wildlife Health Unit at Delmar, CWHL at the Animal Health Diagnostic Center in Ithaca, and Cornell Duck Research Lab on Long Island. This represented a slight increase over 2018, which has shown a consistent upward trajectory as the program has become established. The diversity of species submitted and distribution of cases across the state demonstrates widespread coverage of surveillance activities.

New Leadership & Training

With the promotion of Kevin Hynes to Wildlife Health Program Leader, the DEC Wildlife Health Team met at Cornell in September 2019 to discuss the New York State Wildlife Health Program. This multi-day meeting was the basis for developing a third strategic plan (2021-2026). This plan emphasizes improvements in disease surveillance, targeted staff training and support, and the development of research-based solutions. A program review was conducted in 2019 and areas identified for concerted effort incorporated better inclusion with the Division of Law Enforcement and contacts with indigenous tribes. We have added strength in the forensic skillset from professional training our staff has received and additional pathology training for DEC at Cornell.

Major Staff Updates

Some staffing changes included the addition of Dr. Rachel Abbott, a wildlife veterinarian, who joined the CWHL from the USGS-National Wildlife Health Center. She has considerable experience working on vaccination efforts for black-footed ferrets against plague and white-nose syndrome in bats. Lauren Miller joined the Delmar team as a Fish and Wildlife technician. We also engaged the expertise of Dr. Jarra Jagne to assist with operations at the DEC Game Farm following an outbreak of avian cholera. Dr. María Forzán, wildlife pathologist, left the CWHL for a position at the new veterinary college at Long Island University.

COVID-19

Although this report summarizes activities before the start of the COVID-19 pandemic, it would be remiss to not mention the importance of wildlife health in light of global events and we were heartened to know that the good work and effort spent developing this program and rapport within the agency were valuable in responding to this crisis.
HEALTH AND DISEASE SURVEILLANCE

CASE SUBMISSIONS BY REGION

Case submissions have steadily increased each year since the program's start. There is also a notable expansion in species diversity in cases. With continued improvements in data reporting and analysis, more tools are being created. Our hope is to streamline and inform disease surveillance efforts.

- Mammals
- Birds
- Herpetofauna

948 necropsies performed

MONTHLY CASELOAD

TARGETED DISEASE SURVEILLANCE

Black Bear Mange
CWD
Distemper
Rabies
Rodenticide Poisoning
West Nile Virus

TESTS

0 50 100 150 200 250 300

DIAGNOSED CAUSE OF DEATH

DIAGNOSIS CATEGORY

BACTERIAL
FUNGAL
NUTRITION
PARASITIC
TOXIN
TRAUMA
VIRAL
OTHER
UNKNOWN

1386 animals examined
57 forensic examinations

619 birds 69 species
651 mammals 36 species
108 herpetofauna 17 species

HEALTH AND DISEASE SURVEILLANCE
Eastern Equine Encephalitis

Eastern Equine Encephalitis (EEE) is a virus that is spread by mosquitoes. It is carried by many species of native songbirds, and sometimes will cause serious neurologic illness in the rare cases of people and horses that become infected. It typically shows up in mid to late summer in this area of the northeast. In 2019, EEE was more active and widespread than previous years.

In September 2019, a Cooper’s hawk was found in a road in Schuyler County and brought to the Janet L. Swanson Wildlife Hospital for treatment. The raptor was very weak and dull with no obvious injuries. Radiographs were normal. Blood work was not concerning but showed a few hemoparasites. Tests for West Nile virus were negative and the bird died overnight. Additional testing revealed the bird was infected with EEE. This finding was unexpected since very few EEE cases have been seen in NYS wildlife.

Ranavirus Tadpole Mortality

In May, June, and July 2019, larval amphibians were found dead or dying in a vernal pool on New York City Department of Environmental Protection (NYCDEP) property near the Ashokan Reservoir in Ulster County. DEC Region 3 staff collected 10 wood frog tadpoles in May, as well as four spring peeper tadpoles and four unidentified Ambystoma larvae in July, to submit for necropsy and diagnostic testing. All specimens tested negative for chytrid fungus.

Porcupine Adenovirus Cases

Adenoviruses often affect the respiratory system of infected animals and tend to be specific for certain types of animals. In 2015 and 2017, two young male porcupines were brought to the Janet L. Swanson Wildlife Hospital at Cornell for treatment of respiratory symptoms. Both had nasal and ocular discharge, inflammation of their eyes, and increased breathing efforts. X-rays revealed severe pneumonia in one of the porcupines. Diagnostic workups revealed bacterial infections. After intensive antibiotic treatment and supportive care, both porcupines recovered and were released back into the wild. However, additional analysis of nasal swabs revealed underlying infection with an adenovirus in both porcupines.

Using genetic sequencing techniques, the adenovirus was identified as skunk adenovirus (SkAdV-1), also known as pygmy marmoset adenovirus. In addition to infecting a marmoset and a skunk, this virus has also been identified in hedgehogs. These porcupines were the first time the virus has been isolated from rodents, indicating that SkAdV-1 may have a propensity for transmission across mammalian species that are not closely related, and therefore may have implications for other wildlife species.
MASS MORTALITY IN CROWS

Throughout January and February of 2020, upwards of 1000 American crows (Corvus brachyrhynchos) were reported dead in Middletown, Orange County. DEC Region 3 staff collected approximately 100 of the birds and submitted them for examination to the Wildlife Health Program. The specimens were dispersed to the Wildlife Health Unit, Cornell Wildlife Health Lab, and Cornell University Duck Lab for evaluation.

Gross necropsies were largely unremarkable, except for lung congestion present in the majority of the animals examined. A representative sample of birds were tested for West Nile virus, reovirus, and Eastern Equine Encephalitis virus via PCR, and all were negative. Bacteriology yielded the occasional organism such as E. coli, but results were overall insignificant. Toxicology for rodenticides, avicides, pesticides, and other potential poisons also did not reveal cause of death.

However, histology on the tissues showed oxalate crystals in the kidneys of some birds, which can be indicative of ethylene glycol toxicity (among other differentials). There had been a spill reported at the same address as the staging area for the crow roost at approximately the same time as the mortality event, so the case was turned over to DEC Division of Law Enforcement to pursue since ethylene glycol was implicated.
US Congress Talking About CWD

Dr. Krysten Schuler, wildlife disease ecologist with the New York State Wildlife Health Program, testified before the U.S. House Natural Resource Committee – Oversight Subcommittee on June 25, 2019. The topic was chronic wasting disease (CWD), a serious threat to deer and elk populations. CWD has been detected in 26 states thus far. Once CWD becomes established in a population, it is nearly impossible to eradicate. Therefore, it is critical to follow the “precautionary principle” when dealing with CWD and take preventative action in the face of uncertainty. There are currently several bills in Congress related to CWD.

NYDAMS & Captive Cervids

As part of the NYS Interagency Risk Minimization Plan, DEC and the Dept. of Agriculture and Markets have been conducting joint inspections of white-tailed deer held at captive cervid facilities. Both agencies are responsible for licensing these operations. Increased cooperation and data sharing has been beneficial in prevention of CWD in NYS. An electronic form on the CWHL website allows DEC staff to record inspection information and search by facilities in their region.

Dr. Schuler in the House chamber before testifying on the importance of CWD prevention.

Left: Captive cervid testing kit, prepared to send out to facilities upon request by any NYDAMS field veterinarian

Below: Deer tested for CWD per year from 2014-2019

2781 white-tailed deer CWD tested in 2019
Hands-On and Onsite Training

Research Scientist Ashley Ableman visited the Animal Health Diagnostic Center at Cornell in April 2019 and spent a week in the Anatomic Pathology department. Observing and participating in the intensive pathology teaching program at the College of Veterinary Medicine, Ashley was able to experience the hands-on diagnostic training vet students receive in necropsy.

Research Aide, Melissa Fadden, visited the University of Florida for a conference on Animal Crime Scenes in March, 2020. Melissa received firsthand experience mapping out a crime scene, using forensic equipment such as ground-penetrating radar, and practiced appropriate procedures and evidence collection methods that would stand up in criminal court.

Melissa also spent two days onsite at the Wildlife Health Unit in Delmar in August 2019 to observe the similarities and differences between their processes and those at Cornell. She received instruction in taking diagnostic radiographs, sodium rhodizonate lead testing for recovered bullet fragments, and cementum age determination in furbearing species.

Forensic Training

Ashley Ableman and Melissa Fadden both completed online graduate certificates in Wildlife Forensic Sciences and Conservation through the University of Florida, a 9-credit program that requires coursework in Wildlife Law, Policy, & Ethics, Forensic Science in Conservation Biology, and Wildlife Crime Scene Processing. This rigorous program gave them background information on contemporary illegal wildlife activities and the legislation that surrounds them, as well as skills to handle and interpret evidence in criminal wildlife cases.

eDNA Update and Field Training

CWHL PhD trainee Alyssa Wetterau presented a webinar to DEC biologists with updates on the progress of research into eDNA detection methods for monitoring both the viral pathogen Ranavirus and the occupancy status of herpetofauna of conservation concern identified by the DEC herp health team. She provided training in eDNA collection methods for biologists, discussed the growth of a “Herp DNA library” to aid in eDNA test development and validation, and presented results from three new eDNA tests made possible by this library and eDNA sample contributions from DEC biologists.

USGS Climate Change Meeting

In January 2020, the U.S. Geological Survey hosted a multi-agency group to discuss issues related to climate change and wildlife health. This workgroup in Madison, WI identified key issues that will impact wildlife populations from climatic impacts. Following this meeting, a symposium was organized by The Wildlife Society’s Wildlife Disease Working Group for their annual conference held virtually in September 2020.

Necropsy Wet Lab and Lecture

At SUNY-Environmental Science and Forestry, Krysten Schuler gave a guest lecture in Dr. Jacqui Frair’s undergraduate wildlife management class on the topic of wildlife health. Afterwards, there was a wet lab where students were given the opportunity to conduct a necropsy on a variety of avian species, which introduced them to anatomy and sample collection.

Dr. Schuler discussing wildlife health and the importance of necropsy as a diagnostic tool in disease surveillance

The Long Tailed Salamander (*Eurycea longicauda*) is one of the species targeted with eDNA testing. Photo by Brian Gratwicke. Attribution 2.0 Generic (CC BY 2.0)
Keeping Everyone Informed

With new quarterly reports, the DEC and public have current information on wildlife health available. With this information, you can follow what the WHP is working on and what biologists should keep an eye out for when in the field.

**New York State Wildlife Health Program (WHP)**

**WHP QUARTERLY REPORT**

**Q2 - 2019 (APRIL-JUNE)**

**CASES SUBMISSIONS BY REGION IN Q2**

**95 Positive tests: 4 Positive**

**49 Raptor submissions**

**CAUSES OF DEATH**

- 38 Bird species: 119 submissions
- 28 Mammal species: 145 submissions

**New York State Cooperative Wildlife Health Program (CASES)**

The New York State Cooperative Wildlife Health Program (CASES) is a partnership between the NYSDEC Bureau of Wildlife and Cornell University's College of Veterinary Medicine AHDC that works to safeguard the long-term health of the wildlife populations of New York.

**Submissions**

- 38 WTD submissions
- 20 Mammal species; 134 submissions
- 22 Bird species; 146 submissions

**TARGETED DISEASES**

- Black Bear Mange
- CWD
- Distemper
- Rabies
- Rodenticide Poisoning

**Targeted DISEASES**

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<td>Rabies</td>
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<tr>
<td>Rodenticide Poisoning</td>
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</tr>
</tbody>
</table>

**Students & Field work!**

Thank you to all those that invited students to tag along and get that experience this summer! From goose banding to timber harvest to rattlesnake tracking, getting to see (and do) field work with experienced DEC staff is key to expanding student horizons!

**Optimizing CWD Surveillance**

- Under the Department of Environmental Conservation (DEC), most states are getting started with a multistate project to improve chronic wasting disease surveillance efficiency and effectiveness by combining cutting-edge modeling with state agency needs.

**Lab news impacting wildlife health**

- Dr. Beth Bunting is working with the Cornell Coagulation lab on new testing for West Nile Virus.
- Dr. Krysten Schuler testified to the DEC’s Committee of Environmental Research.
- The New York State Cooperative Wildlife Health Program (WHP) is co-sponsoring the 2019 CWD Symposium at Colorado State University, and in the autumn the WHP will be conducting the next in their series of Animal Disease Workshops. For more information, visit cwhl.vet.cornell.edu.

**Case reporting system**

- Access to the case reporting system is available to all DEC BOW staff.
- EaglePOPd
- IsoPOPd
- StallPOPd
- StaPOPd: Bald Eagle Population Dynamics
- Halting Population Growth
- Stable Population Dynamics

**We want to THANK YOU for taking the time to give us your feedback!**

**New York State Cooperative Wildlife Health Program Survey**

YOU

WHERE’S ALL THE WNV?

We saw 25 bald eagle submissions in Q3 with 14 deaths caused by lead poisoning. Lead poisoning remains a significant concern in New York State. We are working with epidemiologists at Cornell and DEC staff to better understand epidemiology, population scale impacts of lead toxicosis.
Social Media at The Wildlife Society Meeting

At the 2019 NYS Chapter of The Wildlife Society meeting in Syracuse, Jennifer Peaslee and Krysten Schuler presented a poster on Using Social Media as a Mechanism to Inform the Public on Wildlife Health and Human Impact. This poster presented data on the power of social media to boost presence online and attract followers, along with tips on how wildlife organizations can begin using social media.

Outreach Networking at Cornell

With thousands of Cornell alumni on campus for the annual 2019 Reunion event, WHP staff joined the Janet L. Swanson Wildlife Hospital with a display of educational materials including skulls from unique and interesting cases and updates on research involving wildlife in New York.

Left:
Melissa Fadden discussing the Wildlife Health Program, disease surveillance, and ongoing research at Cornell Reunion 2019.

COVID-19 PSA’s

Working with the Cornell University Master’s in Public Health program, the CWHL put out a number of tweets and Instagram posts to inform the public on the importance of social distancing and sheltering in place, washing your hands, and flattening the curve during the COVID pandemic.

The CWHL published over 50 articles in 2019, including news reports, disease alerts, Lab Bites, wildlife 411s, and newsletter emails. Our social media accounts have been an essential tool in expanding our public outreach and education efforts. By tracking website visits following targeted postings, we can see the link between social media posts and website traffic. In 2019 our Twitter program grew from 107 to almost 400 followers and Instagram increased from 281 to over 600 followers. Both of these outlets continue growing and have proven to be important factors in our public outreach efforts.
Modeling Parasitic Disease and Population Declines in the New York Moose Population

Recent moose abundance estimates in New York project a population at significantly lower density than populations in neighboring states. To investigate potential causes for these observed dynamics, we initiated a multi-institutional project, in collaboration with NYSDEC and SUNY ESF, investigating parasitic disease, namely brain worm (*Parelaphostrongylus tenuis*) and liver fluke (*Fasciola hepatica*), as a cause of observed moose population dynamics in the Adirondack Park of New York.

We hypothesized that mortalities of young adults by lethal parasites have influenced population dynamics of moose in the Adirondacks. We incorporated moose necropsy data and demographic characteristics of the life cycle of cow and bull moose into a population matrix model to determine whether mortalities from the aforementioned lethal parasites have impacted the annual survival of moose.

Specifically, we modeled theoretical populations that exist in the absence of these parasites by returning resultant mortalities back into the population in the year of the individual’s death to determine whether parasitic disease has decreased population recruitment. Based on the analysis, parasitic disease, particularly brain worm, has significantly decreased annual survival of juvenile bull moose, which may impact *in situ* population recruitment. We expect to submit a manuscript for publication early next year.

SOP4CWD Project Start Up

*Surveillance Optimization Project for Chronic Wasting Disease ("SOP4CWD")*

In 2019, the CWHL embarked on an ambitious regional approach for state and provincial wildlife agencies to conduct surveillance for CWD, which requires considerable logistic and financial resources. The goal is to have a standardized system for data collection and model-informed output for wildlife managers to most efficiently and effectively test white-tailed deer across the eastern U.S.

Initial support was provided by DEC and grant funding through the Michigan Department of Natural Resources to develop these products, and additional states have joined the project. Currently, 14 state and provincial wildlife agencies are participating with collaboration involving scientific researchers from three academic institutions (plus CWHL) and two federal government agencies. By bringing together modelers with state agency biologists, veterinarians, and administrators, we identified 10 different components of the project that will inform and improve surveillance efforts.

*Phase 1* of the project is focused on the development of a cooperative regional data sharing network and the modeling of data across jurisdictional boundaries.

*Phase 2* will create an online “Dashboard” to display modeling results in a user-friendly online fashion.

*Phase 3* will develop a “Data Warehouse” to store and share state data among researchers and agencies.

*Phase 4* will automate analyses through the development of a “Computational Pipeline”.

The project commenced in summer 2019 and will continue through summer 2022. We are coordinating with other complementary efforts lead by other researchers and organizations, such as the CWD Alliance, so as to streamline efforts around CWD surveillance, management, communication, and reporting.
The NYS WHP provides support on any wildlife health topic, not just limited to disease outbreaks. We routinely review research permit requests, management plans and project proposals to see where we can assist staff in working safely with wildlife, and reduce any potential health impact on species.

Wildlife Health Team Meetings
The Wildlife Health Team assists the program with regional communications and work planning. Health program staff routinely attend other specialty team meetings to keep informed about field projects and provide disease and research updates.

Members of the Wildlife Health Program attended team meetings on:
- Strategic Planning 2022-2026
- Spring/Fall HERP
- Spring/Fall Bird and Mammal Diversity
- Migratory Game Bird
- Bird Banding Workshops
- Mute Swans
- Hunter Education
- Land Management and Habitat Conservation
- NYS TWS meeting in Syracuse

The majority of the respondents stated that they viewed the WHP favorably. Most respondents gave high marks to WHP services, such as the online submission forms and turn-around time of cases, the availability of WHP staff for consultation, case reports, weekly updates, training materials, and the special topic workshops. The survey further provided suggestions for improvement in communications, such as the follow-up of case diagnoses, even when an animal in question has been found to be negative for the suspected disease.

Survey results depicting regional workshop importance and effectiveness, training, website and what wildlife health issues are concerning in NYS

The WHP survey was created to gather feedback on the program from the regional and central office DEC staff to identify areas of success and those in need of improvement. The survey was returned by 68 respondents representing all regions and all levels of experience in DEC.
Avian Cholera (*Pasteurella multocida*) Outbreak at Reynolds Game Farm

In April 2019, the DEC Reynolds game farm experienced higher than normal mortality in a Chinese ring-necked pheasant flock of 3,000. Representative specimens were sent in for necropsy at the AHDC. Gross, histological and bacteriological results indicated a final diagnosis of *Pasteurella multocida*, a bacteria that causes avian cholera. On-site investigations revealed the presence of a high population of rodents on the farm. Rodents are carriers of *P. multocida* and aid in transmission of the disease.

Within a week, the flock was down to 2,400 (20% mortality). We treated the flock with a tetracycline product and assessed antibiotic sensitivity. Biosecurity measures (i.e., rodent control, collecting carcasses, and cleaning and disinfecting feeders and waterers) were put in place to stop the disease from spreading. A Manchurian pheasant breeder flock was close to the affected flock.

The affected flock was depopulated by DEC in cooperation with New York State Agriculture & Markets and the USDA office in Albany. Depopulation of 2,100 birds was carried out almost five weeks after the first case. Birds were composted with the assistance of Cornell's Mortality Management program.

Jarra Jagne, DVM, is an international expert in poultry health and served as a subject matter expert in this outbreak. As a result, Dr. Jagne joined the NYS Wildlife Health Program as a consultant to provide veterinary services to DEC Reynolds Farm, which will include four routine site visits a year, support for quality assurance, and coverage for outbreaks.

In 2020, another outbreak of avian cholera occurred at the farm because birds were placed in the same pen that had the outbreak last year despite mitigation measures (i.e., the use of lime on the grounds as a disinfectant and a resting period of 9 months). We were ready this year with quick diagnostic results and a treatment regime, but again the decision was made to depopulate. In addition, we also diagnosed *E. coli* in chicks and gapeworm in adult birds. Both infections were treated quickly and successfully. Due to COVID-19 restrictions, routine site visits were not possible, but we did work on a hatchery sanitation monitoring program to detect bacterial concentration in hatchery incubators, hatchers, and the area around the machines.

Above:
Flock of pheasants infected with *Pasteurella multocida*

Left:
Racks of pheasant eggs prepared for incubation

The scope of the wildlife health team encompasses all wildlife health related issues involving Bureau of Wildlife programs and responsibilities.

The Wildlife Health Program incorporates the One Health concept, which fosters collaboration among multiple disciplines involving health of humans, domestic animals, and ecosystems. Other specialists from the academic community, Departments of Health and Agriculture & Markets, and federal agencies may participate or provide information as needed.

**Joint Team Meetings Hosted at Cornell**

Cornell Wildlife Health Lab hosted a joint meeting of the Bird and Mammal Diversity Team and the Herp Team for a three-day session. This included break outs specific to each group on project updates/future plans and associated funding, as well as topics shared between the two, such as updates from Central office, and discussion on proposed species listing changes.

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**WILDLIFE HEALTH TEAM MARCH 2019-CURRENT**

**DEC Personnel**

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<thead>
<tr>
<th>Region</th>
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<tr>
<td>Region 1</td>
<td>Leslie Lupo</td>
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<td>Sandy Chan</td>
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<td>Giovanni Pambianchi</td>
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**WPH Personnel**

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<td>Cornell</td>
<td>Beth Bunting</td>
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<td>DLE Liaison</td>
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<td>BMT Liaison (Regional)</td>
<td>Sandy Chan</td>
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**WHU**

Kevin Hynes

**Cornell**

Krysten Schuler

**BMT Liaison Central Office**

Kevin Hynes

**DLE Liaison**

Major Matthew Revenaugh

**BMT Liaison (Regional)**

Sandy Chan
## ANNUAL WORK PLAN FY 2019-2020 REVIEW

### Administrative

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<td>Biannual wildlife health program review (Central Office or Cornell)</td>
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<td>WRC incinerator operation, lab maintenance, facility maintenance and grounds</td>
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### Policy Support

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<td>Wildlife rehabilitation web-based data management and reporting system</td>
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<td>Converting SLU to electronic reporting system for select licenses (NWCO, Game Bird)</td>
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<td>Wildlife rehabilitation procedures evaluation</td>
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<td>Providing scientific/medical wildlife health consultation (public, staff, One Health partners, regulatory, research projects, SLU licenses, etc.)</td>
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### Health and Disease Surveillance

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<td>Wildlife rehabilitation web-based data management and reporting system</td>
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<td>Converting SLU to electronic reporting system for select licenses (NWCO, Game Bird)</td>
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</tr>
<tr>
<td>Providing scientific/medical wildlife health consultation (public, staff, One Health partners, regulatory, research projects, SLU licenses, etc.)</td>
<td>Completed</td>
</tr>
<tr>
<td>Wildlife health and wildlife rehabilitators listserv maintenance</td>
<td>Completed</td>
</tr>
</tbody>
</table>

### Forensic services for DLE                                           | Completed       |

### Research

<table>
<thead>
<tr>
<th>Task</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fisher project - reproductive assessment</td>
<td>In progress</td>
</tr>
<tr>
<td>Fisher project - rodenticide testing</td>
<td>In progress</td>
</tr>
<tr>
<td>Bobcat cytauxzoon study</td>
<td>Nearing completion</td>
</tr>
<tr>
<td>Development of eDNA tools for amphibian and virus detection (yr 5)</td>
<td>In progress</td>
</tr>
<tr>
<td>Complete tissue archive system</td>
<td>Completed</td>
</tr>
<tr>
<td>Bear mange statewide surveillance (publication)</td>
<td>Nearing completion</td>
</tr>
<tr>
<td>P. tenuis study (publication)</td>
<td>Nearing completion</td>
</tr>
</tbody>
</table>

Prepared slides and fixed tissue from samples collected by DEC field personnel for the fisher reproductive assessment research project.


Presentations


Grants


Software Applications


Hanley, B. “Novel management tools for subsidized avian predators and a case study in the conservation of a threatened species.” Bird Damage Management Conference. Salt Lake City, UT, 2020

Hanley, B. “Combinatorial optimization algorithm for a population matrix model.” 60-min. webinar to faculty at the State University of New York. 2020


Hynes, K. “Wildlife diseases in NY, CWD, and proper PPE use.” ECO Training Academy. Pulaski, October 2019


