New York State Wildlife Health Program

Annual Report 2022-2023

Promoting the health and long-term sustainability of wildlife populations by advancing scientific tools and sharing knowledge to protect and improve the health of native wildlife populations

ADMINISTRATIVE SUMMARY

The New York State Wildlife Health Program (WHP) is a partnership between the New York State Department of Environmental Conservation (DEC) and Cornell University's College of Veterinary Medicine Wildlife Health Lab (CWHL) that works to safeguard the long-term health and sustainability 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.

NEW TEAM MEMBERS

In 2022, the WHP recognized that wildlife health issues are expanding in scope and there was an increased demand for services. The WHP gained some new faces in the addition of two new wildlife veterinarians. At the DEC Wildlife Health Unit, Dr. Therese McNamee is the new Research Scientist who will concentrate on wildlife necropsy and disease diagnostics. She is a DVM with a background in public health and an MS in Conservation Medicine. At the CWHL, Dr. Jenny Bloodgood joined as an Assistant Professor of Practices to support efforts in wildlife disease surveillance, research, teaching/training, and policy support. She is a DVM/PhD with a background in terrestrial and marine species. We are lucky to have the skills and knowledge of these two on our team!

In the past year, we were fortunate to have the opportunity to visit in-person with Katie Petronis, Deputy Commissioner of Natural Resource and Jackie Lendrum, Director of Fish and Wildlife, at the Animal Health Diagnostic Center where they were able to see a bear necropsy. We also were back on the road with in-person regional wildlife health workshops in May and June 2022. It's always a highlight to have the opportunity to visit the regions and talk with biologists, technicians, and law enforcement about issues they are seeing and answer questions. We also held a Wildlife Health Team meeting in Ithaca in early 2023, which gave us an opportunity to introduce our new staff, prioritize items in the strategic plan, and address challenges DEC is facing in the field. We anticipate a new level of involvement with the DEC Division of Law Enforcement as it stands up the Wildlife Response Team.
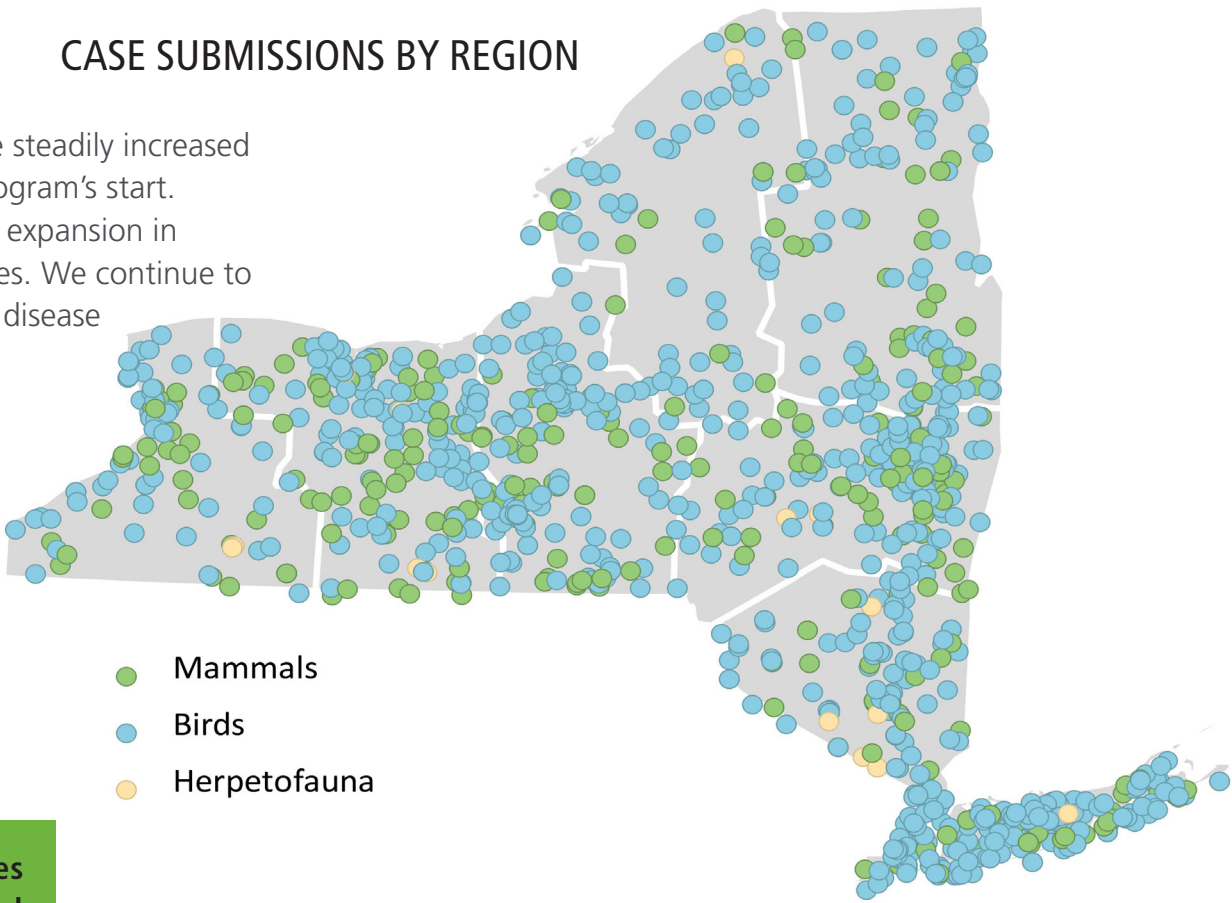
NEW THREATS

The early months of 2022 brought with it a new disease issue – highly pathogenic avian influenza (HPAI). Although we had been preparing for this event for several years, it's never easy to manage a new virus. Over the past year, we have seen a number of species, both avian and mammalian, infected with H5N1. Fortunately, human cases have been minimal. This new pathogen required additional guidance to hunters, rehabbers, and the public to ensure appropriate precautions were taken. Unfortunately, the DEC Reynolds Game Farm did not escape the virus, despite best biosecurity practices and had to be depopulated after an outbreak in late March 2023. The quick work by the CWHL and interagency cooperation with U.S. Dept. of Agriculture and NYS Dept. of Agriculture and Markets handled the event in just one week.

As always, we appreciate the support of DEC Bureau of Wildlife to administer the program and our close collaborations with One Health partners across New York and other states. This report covers WHP activities for DEC fiscal year 2022-2023. Case submissions are provided annually from Jan. 1-Dec. 31, 2022.

CONTENTS

HEALTH & 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. We continue to streamline and inform disease surveillance efforts.
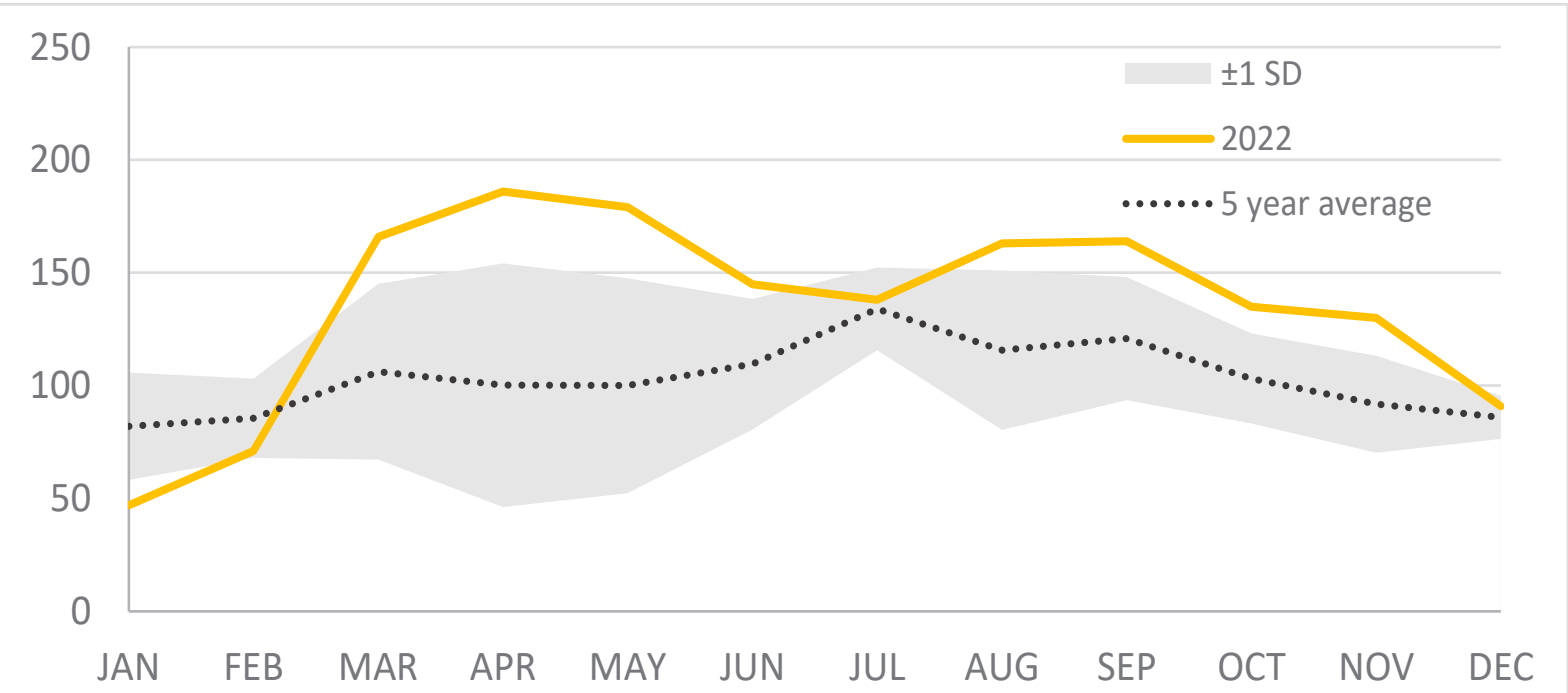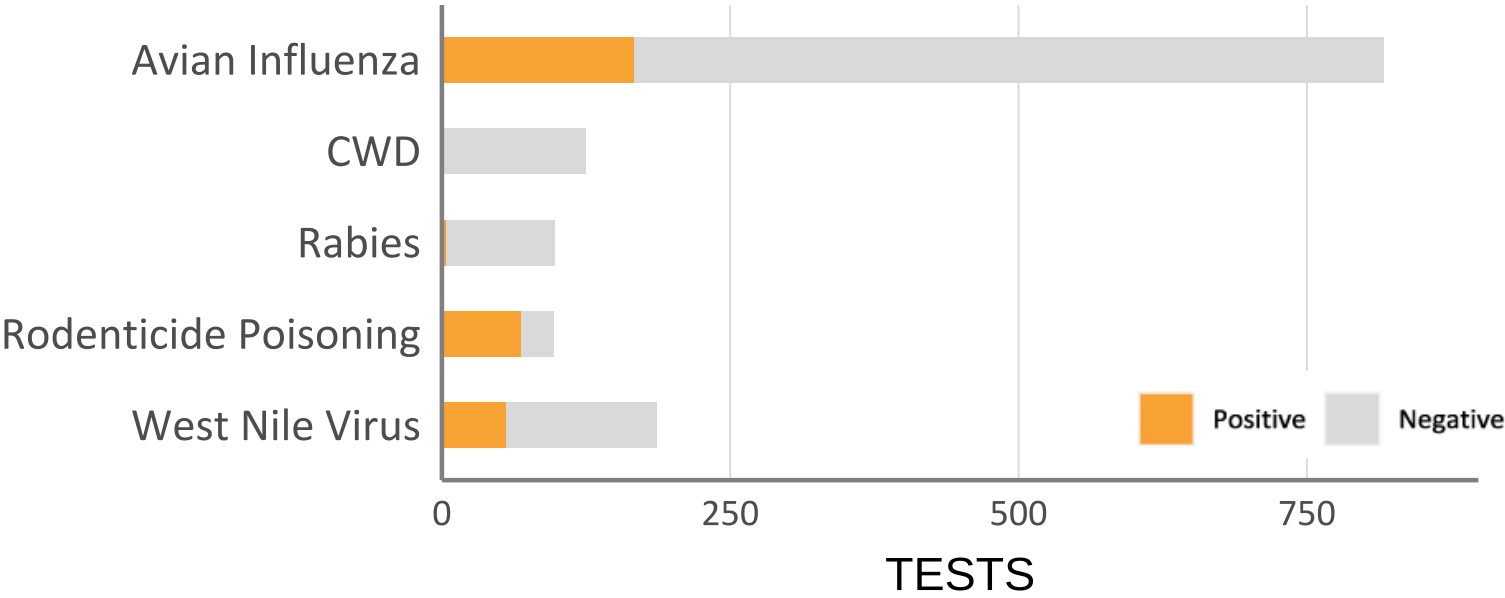
- Mammals
- Birds
- Herpetofauna

1510 necropsies performed

TARGETED DISEASE SURVEILLANCE

Horizontal bar chart showing TESTS (0–750+) for:
- Avian Influenza
- CWD
- Rabies
- Rodenticide Poisoning
- West Nile Virus

Legend: Positive, Negative

1615 animals examined

36 forensic examinations

1155 birds **105** species
414 mammals **28** species
37 herpetofauna **13** species

MONTHLY CASELOAD

Line chart, x-axis JAN–DEC, y-axis 0–250.
Legend: ±1 SD, 2022, 5 year average

DIAGNOSED CAUSE OF DEATH

Bar chart, y-axis CASES 0–300, categories: BACTERIAL, FUNGAL, NUTRITION, OTHER, PARASITIC, POISONING, TRAUMA, VIRAL, UNDETERMINED, PENDING.
Legend: Mammals, Birds, Herpetofauna

4

5
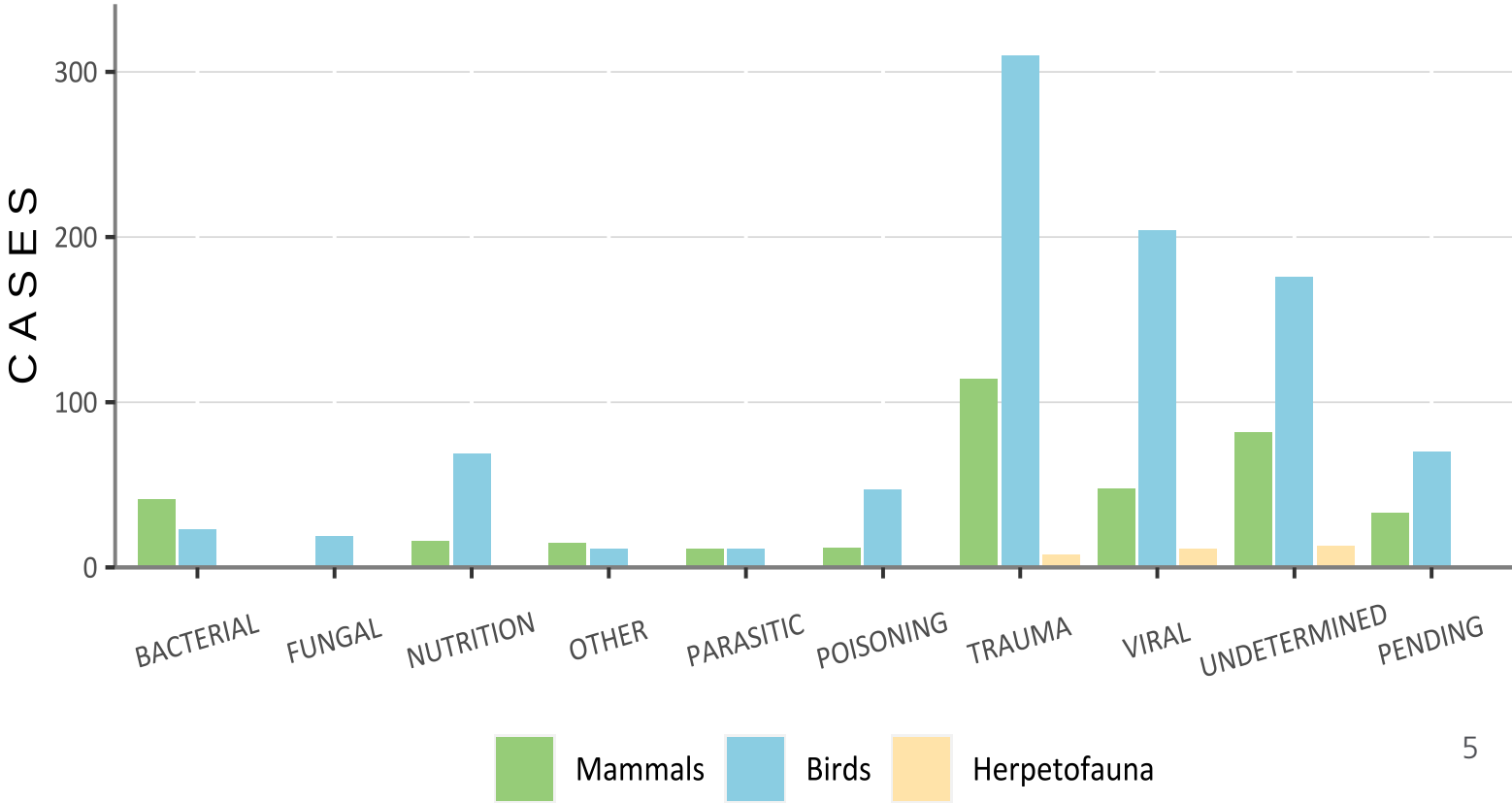
EMERGING & SIGNIFICANT DISEASE ISSUES

EHD & BLUETONGUE

For the third consecutive year, an outbreak of Epizootic Hemorrhagic Disease (EHD) occurred in New York. DEC first began receiving reports of dead deer in August 2022, with confirmed cases of EHDV-2 in Dutchess and Rensselaer counties and later Suffolk County. In mid-September, deer found dead in Southampton tested positive for Bluetongue virus (BTV), notably the first time this virus has been detected in New York deer. This virus is closely-related to EHDV and can cause morbidity and mortality in deer and livestock. Both viruses are transmitted via biting midges.
In collaboration with hunters and state and federal agencies, we have conducted surveillance in wild deer for EHDV for two years and BTV for one year. In fall/winter 2021-22, 14% of 314 apparently healthy deer were seropositive for EHDV. Antibodies to EHDV-6 were detected in hunter-harvested deer in Dutchess County, whereas antibodies to EHDV-2 predominated in live-sampled deer in Richmond County. In fall/winter 2022-2023,


Photo courtesy of Art Kirsch

368 apparently-healthy deer underwent serological testing for EHDV-2 and -6, and 143 of those deer also for BTV. Preliminary results indicate bluetongue virus was not restricted to Suffolk County, but was also present in Westchester County.

Future research by our group will investigate environmental and climatic drivers of EHDV and BTV expansion into New York and New England and targeted *Culicoides* surveillance to identify species which may serve as the as-of-yet unidentified vector(s) in this region.

SARS-CoV-2 SPILLOVER TO WHITE-TAILED DEER

Leveraging samples collected for CWD testing, we conducted two years of surveillance on NY white-tailed deer for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) to identify if the virus that causes COVID-19 had spilled over from humans into wildlife. We evaluated 5,462 lymph nodes collected from hunter-harvested deer during the 2020-2021 and 2021-2022 hunting seasons for SARS-CoV-2 by real-time RT-PCR. In the first year of the outbreak in 2020-2021, only 17 samples (0.6%) were positive. By the second year, 583 (21.1%) had detectable virus.

We identified multiple hotspots of deer infection across the state despite low human densities. Sequence analysis identified that deer had three different variants of concern circulating in 2021-2022: Alpha, Gamma, and Delta. Some of these variants were present after human cases subsided, indicating initial human-to-deer spillover with deer-to-deer transmission and viral adaptation. We plan to evaluate samples from 2022-2023 to assess the potential for white-tailed deer to serve as a long-term reservoir of the virus.

2020-2021

Percent Positive
75%

0%
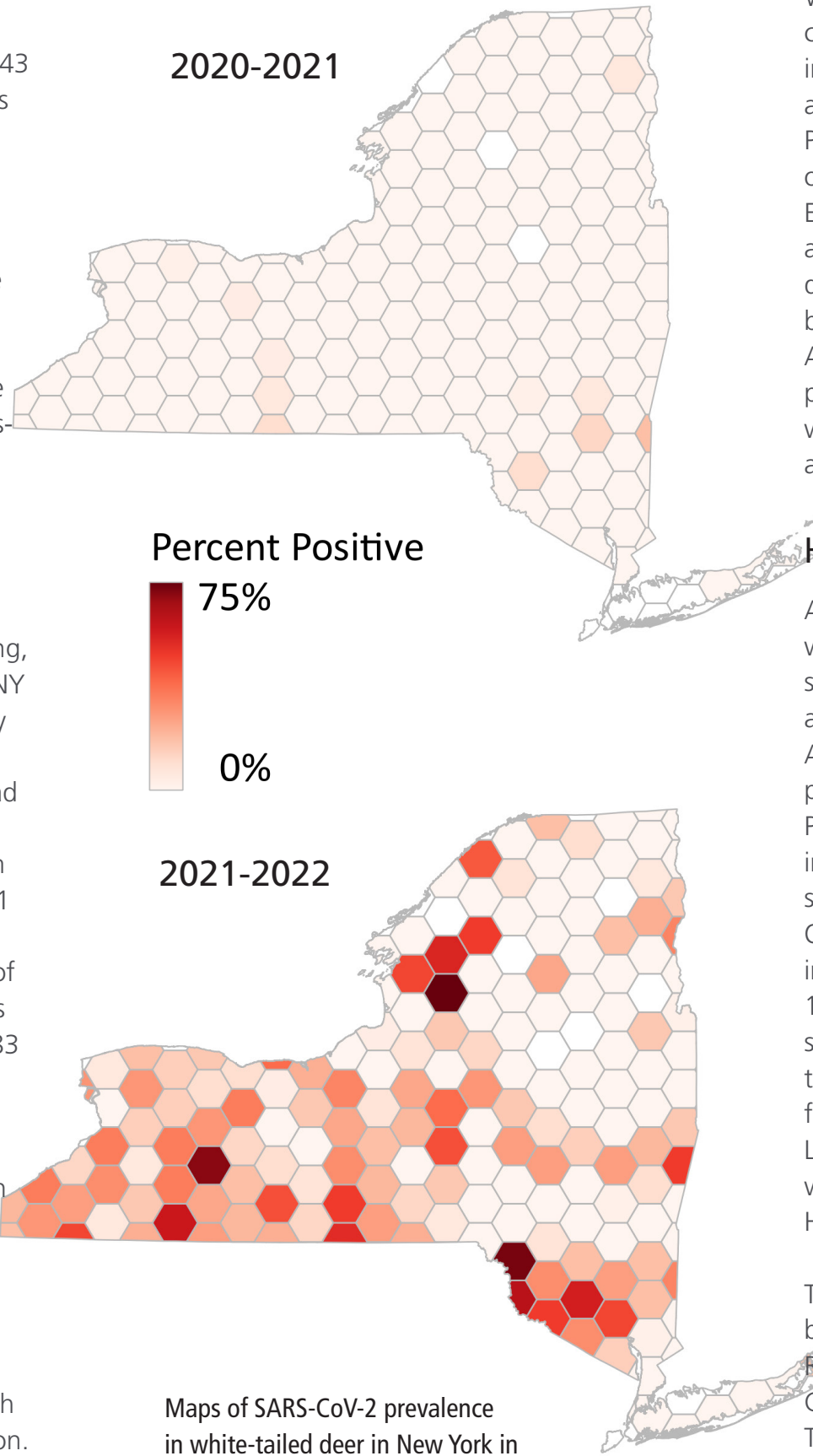
2021-2022

Maps of SARS-CoV-2 prevalence in white-tailed deer in New York in 2020-2021 (top) and 2021-2022 (bottom)

CONTAMINANTS IN WATERFOWL

We conducted the first comprehensive evaluation of chemical contaminants in waterfowl in the Northeast in 30 years to assess the potential impact to hunters and waterfowl. CWHL and DEC partnered with Pennsylvania Game Commission, New Jersey Division of Fish and Wildlife, and Connecticut Department of Energy and Environmental Protection to collect duck and geese tissues. Preliminary findings suggest that dioxin levels vary by species, but mercury loads may be higher in males compared to female waterfowl. Analysis of tissues samples for organochlorine pesticides, PFAS, and PCBs is ongoing. Our results will be used to update waterfowl consumption advisories for hunters.

HIGHLY PATHOGENIC AVIAN INFLUENZA (HPAI)

Avian influenza viruses exist naturally on the landscape with low pathogenic strains endemic in native birds, such as waterfowl. An outbreak of highly pathogenic avian influenza (HPAI) has been circulating in North America since late 2021, following migratory pathways of free-ranging birds. The Wildlife Health Program started screening for influenza in New York in January 2022, and the first detected case was a sanderling from Suffolk County in February 2022. Over the course of the year, a total of 1017 avian influenza matrix PCR tests were submitted, of which 190 were non-negative. Non-negative samples were subsequently tested for H5 and H7 influenza subtypes to determine pathogenicity. These samples were forwarded to the USDA National Veterinary Services Laboratory for confirmatory testing and sequencing, where the majority were confirmed positive and the HPAI strain identified as EA/AM 2.3.4.4 H5N1.

The positive tests represent 34 different species of birds, as well as multiple detections in red foxes. Raptors and waterfowl, most commonly bald eagles, Canada geese, and vultures, make up the majority. The remainder were shore birds and passerines (crows).

TEST DEVELOPMENT

for CWD (immunohistochemistry) can only be done on tissues collected from a deer after it has died. These tests are both time- and labor-intensive and can miss low-grade infections.

This multi-lab validation study compared the diagnostic sensitivity and specificity of RT-QuIC laboratory protocols among labs for two different tissue types, using a shared set of samples processed in each lab. Data from this research is being used by USDA to guide decisions about approval of RT-QuIC for CWD testing.

eDNA – TIGER SALAMANDER

CWHL and NYSDEC Region 1 are collaborating on a project to expand population monitoring tools for eastern tiger salamanders (*Ambystoma tigrinum*) by adding environmental DNA (eDNA) to the monitoring toolkit. We developed a two-part study to determine the most efficient and sensitive method to collect tiger salamander eDNA from seasonal breeding pool water. In February 2023, Alyssa Kaganer and Melissa Fadden visited Region 1 to support the first round of sample collection, which is ongoing.

RT-QUIC – MULTI-LAB VALIDATION STUDY

With support from the USDA, CWHL has partnered with veterinary diagnostic laboratories from Michigan, Minnesota, Missouri, Pennsylvania, and Wisconsin on a multi-center validation study for a new Chronic Wasting Disease (CWD) surveillance tool, Real-Time Quaking Induced Conversion (RT-QuIC). Currently, the "gold standard" tests

LIVER FLUKE eDNA

As part of the larger study on moose health in New York, we are testing eDNA methods to use in monitoring for parasites important in moose conservation and population dynamics. In the summer of 2022, we collected and filtered water samples from northern Adirondack ponds, lakes, and wetlands to screen for the presence of giant liver fluke eDNA.

We collected four samples from a single wetland in each of 105 grid cells for a total of 420 eDNA samples. In the lab we developed a qPCR assay specific to the giant liver fluke. We then extracted the DNA from filtered samples and are in the process of analyzing samples with qPCR. Preliminary results indicate the potential presence of giant liver fluke in a small number of samples. Following additional PCR testing, we plan to analyze the presence-absence results in a multi-scale occupancy framework to quantify our ability to detect the fluke in our samples and incorporate results in our spatial analysis of moose infection risk.

Below: Liver flukes removed during necropsy
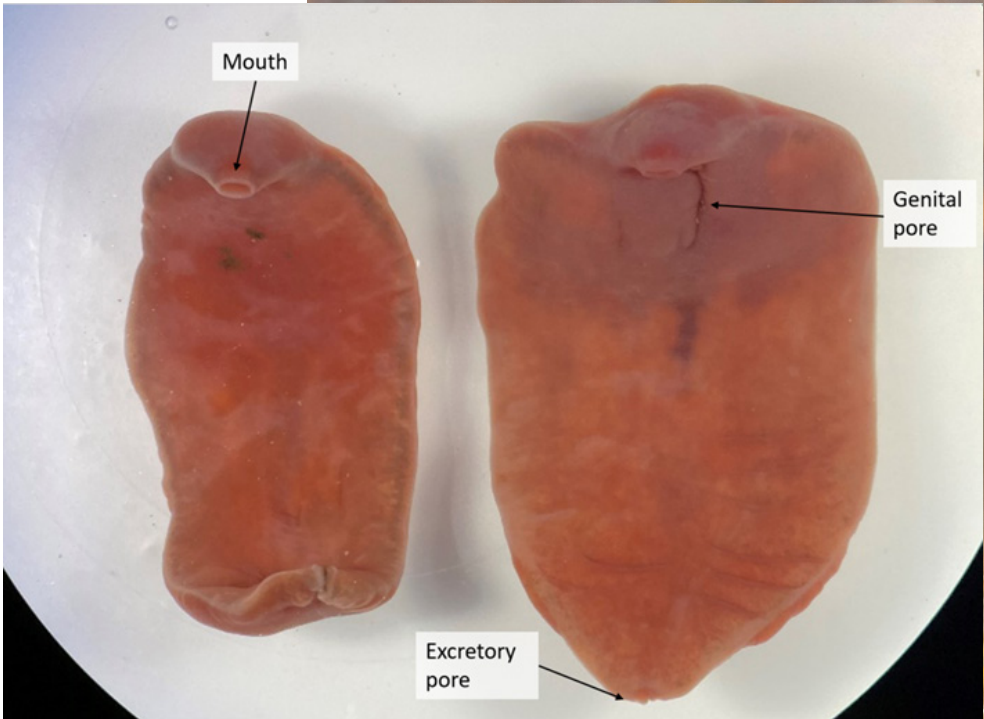
CHRONIC WASTING DISEASE UPDATE

SURVEILLANCE OPTIMIZATION PROJECT FOR CHRONIC WASTING DISEASE

The CWHL has been coordinating with 17 state wildlife agencies and one provincial agency on CWD through the Surveillance Optimization Project (SOP4CWD) and has amassed over ¾ million data points from these agencies. In line with open science policies, Dr. Rachel Abbott of the CWHL has worked closely with Cornell's librarian to archive data in the CVM collection of the Cornell Library digital eCommons (https://ecommons.cornell.edu/handle/1813/33367). Prior to archiving, each agency signed a data use agreement with Cornell to pave the way for regional pooling of data, rendering this endeavor the first of its kind in teaming up across so many state boundaries to combat a shared threat to our wildlife.

A product of the SOP4CWD collaboration is the CWD Data Warehouse, an online platform for CWD surveillance planning and data management. The DEC is now using the Warehouse to streamline their data collection and reporting processes.
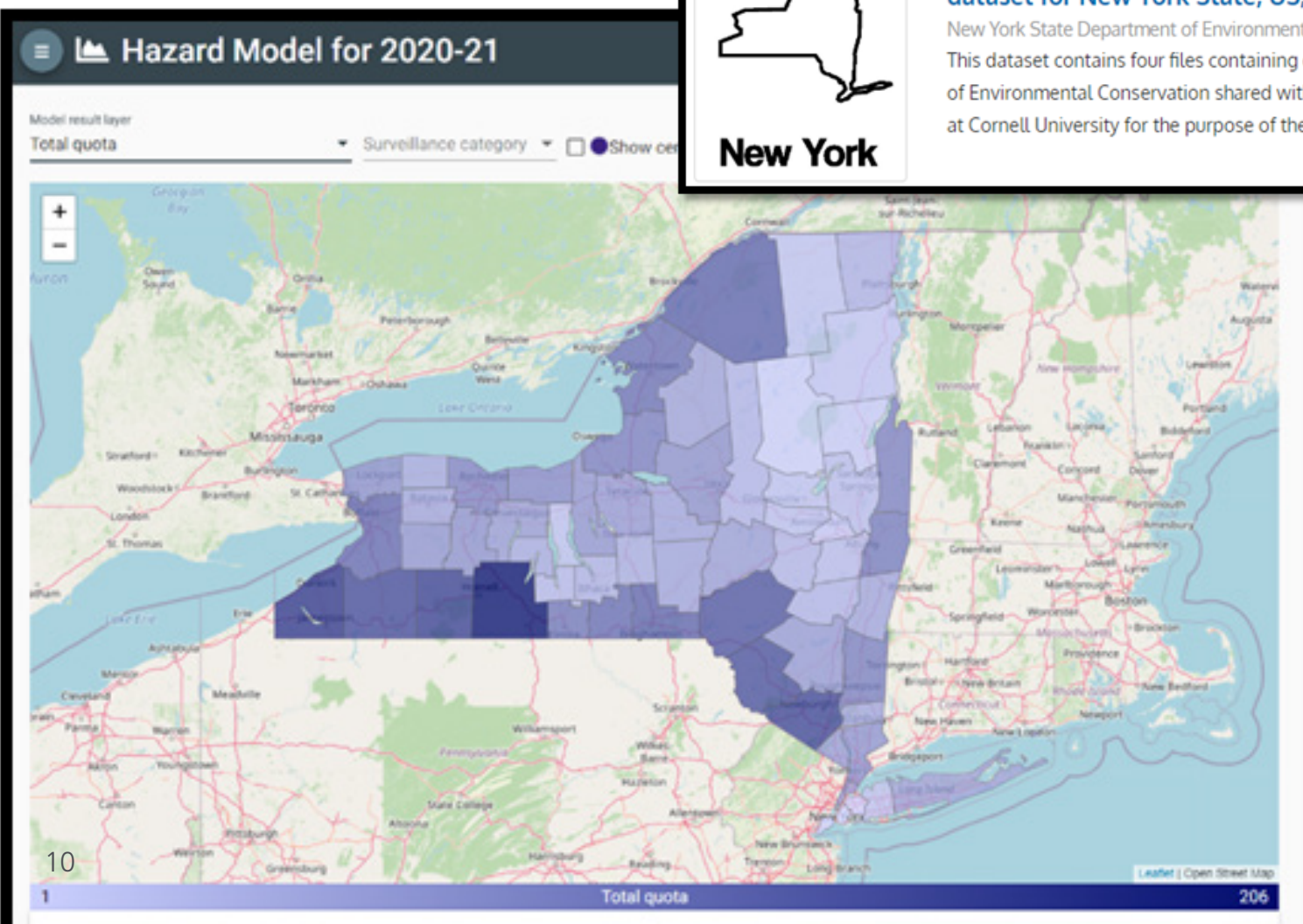
CWD SAMPLING

During the 2022-2023 hunting season, we opportunistically sampled 2,720 hunter-harvested deer for CWD. We also examined 106 CWD-clinical suspect deer during the reporting period. We have successfully engaged taxidermists to expand our surveillance efforts; during the 2022-23 sampling season, 708 of the CWD surveillance samples were collected by trained taxidermists through our Taxidermist Partnership Program.

DIGITAL DEER CHECK

For the 2022-23 deer hunting season, we launched the digital CWD Data Warehouse, which provides access to mathematical modeling and data science tools to increase interagency data-sharing and to inform decision-making. This digital transition also included a more modern approach to deer check slips; we created a process using Survey123 and ArcGIS Online that allowed field staff to collect, access, and visualize deer check data and surveillance quotas in real-time. This digital automation saved staff time and effort, reduced errors, and created infrastructure for future increases in surveillance sampling.

Photo courtesy of Art Kirsch

Hazard Model for 2020-21

Model result layer
Total quota

Surveillance category ▾ ☐ ● Show ce

Total quota   206

Surveillance Optimization Project for Chronic Wasting Disease dataset for New York State, US, 2002-2021
New York State Department of Environmental Conservation (2023-03-28)
This dataset contains four files containing data from the New York State Department of Environmental Conservation shared with the Cornell Wildlife Health Lab (CWHL) at Cornell University for the purpose of the Surveillance ...

New York

167
282
571
440
624
313
291
32

2720
white-tailed deer CWD tested in 2022-2023 season
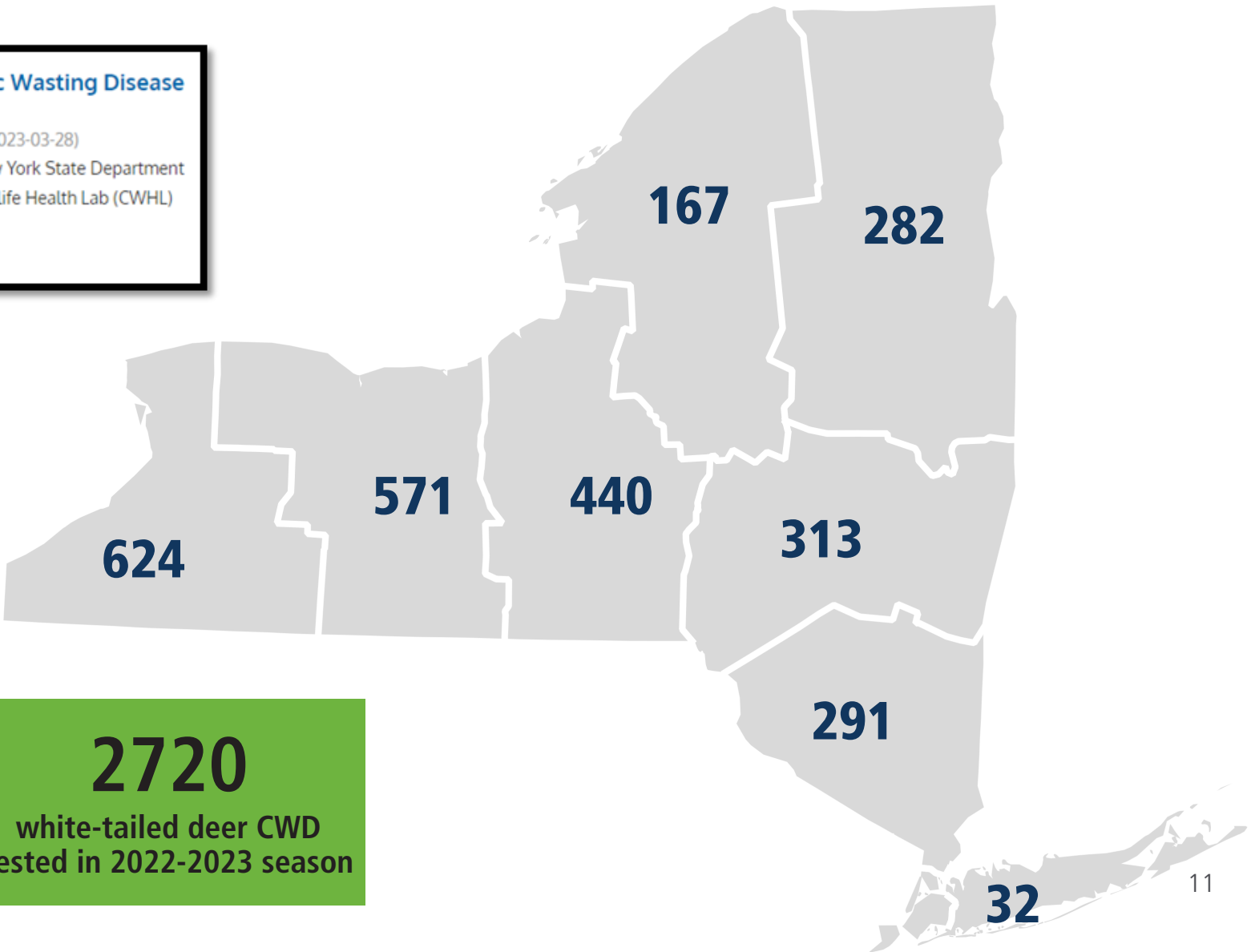
IN-PERSON REGIONAL WILDLIFE HEALTH WORKSHOPS

The WHP team hit the road in May and June 2022 for regional training workshops across the state with participation from over 125 professionals within the DEC, NYS Parks, and Division of Law Enforcement. The workshops covered a range of topics, including a 10-year review of the Wildlife Health Program, along with herpetofauna and research project updates, emerging risks to wildlife, and an HPAI field exercise. Most important was training on personal protective equipment (PPE) and basic handling precautions for wildlife cases. We also discussed the recent outbreaks of SARS-CoV-2 in wildlife, HPAI in birds and mammals, and rabbit hemorrhagic disease virus 2. DEC staff got updates on projects studying population impacts of lead ammunition on bald eagles, epizootic hemorrhagic disease virus in deer, moose health research and distribution of anticoagulant rodenticides in furbearers.

Kevin Hynes demonstrating the appropriate technique to swab birds for avian influenza testing during regional training workshop.

GRADUATE TEACHING

CWHL continues to look for ways to support the next generation of wildlife conservation scientists. This year, Dr. Alyssa Kaganer helped develop curriculum for a class that prepares graduate students, including the Zoology and Wildlife Conservation program participants, to write successful scientific proposals. She led a small pilot of the class in Spring 2022 for three students and has expanded the course in Spring 2023 to 18 students.

SPECIALTY TRAINING

In June 2022, WHU Research Scientist Lauren Miller spent a week at the Cornell Animal Health Diagnostic Lab. He toured the facility, worked in the necropsy rotation, learned how samples were analyzed in the toxicology lab,

and learned the processes of receiving samples from his colleagues in Delmar.

Staff from the WHP (Kevin Hynes, Lauren Miller, Melissa Fadden) attended the New York State Veterinary Medical Society's Forensic Radiology course, an interactive case reading session. Staff learned how to evaluate and interpret forensic radiographs.

DEC staff attended Cornell's Conservation Social Science Methods Workshop in January 2023. The workshop was intended to enhance decision making through social science, as well as stimulating new thinking about how social science can be used to inform wildlife management, as well as disease management.

Krysten Schuler, Melissa Fadden, and Jenny Bloodgood instructing vet students on appropriate sampling of deer for CWD.

CWD WET LAB AT CVM

To broaden knowledge of wildlife diseases, Dr. Schuler hosted an annual chronic wasting disease lecture and wet lab for the DVM students interested in wildlife. At this evening training session, students learned to age deer by tooth wear and replacement, extracted CWD samples, and examined the brain/skull for *P. tenuis* (brainworm).

SUNY-ESF NECROPSY WET LAB

Wildlife health is a topic of interest for all wildlife students. Dr. Frair, SUNY-ESF, invited CWHL and USDA-Wildlife Services to demonstrate wildlife necropsy techniques for her Wildlife Management students to gain hands-on experince. The students were able to examine a variety of avian species.

STUDENT PROJECTS

UNDERGRADUATE RESEARCH

In 2022, CWHL welcomed three new undergraduate students into our molecular laboratory team. Evan Zhang and Genesis Contreras have been hard at work improving molecular tools for hellbender environmental DNA detection. Alyssa Koczan is working to test whether environmental RNA can be used to detect active ranavirus infections in amphibian breeding pools.

In addition to our new undergraduate researchers, the CWHL molecular lab team now also includes a service dog, Nugget. We developed a risk assessment framework and SOPs for safe inclusion of service animals in molecular laboratories. These resources have been used to ensure that Nugget can safely do his job in our laboratory and are being adapted for broad dissemination to reduce barriers to access for other service animal users in molecular labs.

David Dayan is back with the lab to continue working on the waterfowl contaminant study. David has helped with sample organization and preparation, data analysis, and manuscript writing for the waterfowl contaminant study.

GRADUATE RESEARCH PROJECTS

Amanda Bielecki

Amanda is a second year veterinary student and is currently working on a research project assessing lead exposure of fishers (*Pekania pennanti*) in New York via inductively coupled plasma mass spectrometry (ICP-MS) to learn more about low-level lead concentrations within the population.

Jen Grauer

Jen is studying the importance of parasites and disease for moose health and juvenile survival in New York. She has completed two years of her PhD program, including multiple seasons of field work and data collection through collaring of moose, camera trapping, and water sampling and deer pellet collection (below) for parasite detection. Her research aims to quantify the impacts of disease and assess parasites as a factor limiting moose population growth to inform moose conservation in the state.

Pat Connelly

Pat (right) is a PhD candidate at Fordham University investigating drivers and dynamics of emergent epizootic hemorrhagic disease virus and bluetongue virus in the Northeast U.S., in collaboration with the CWHL. He has completed two field seasons of surveillance for these viruses in hunter-harvested and culled wild deer in New York. Upcoming work includes modeling environmental drivers of viral range expansion and vector surveillance to identify *Culicoides* species which warrant attention as potential vectors in our region.

Martin Feehan

Martin (right) is a Cornell University PhD student and the Massachusetts State Deer & Moose Biologist for the Massachusetts Division of Fisheries and Wildlife. His doctoral research focuses on urban white-tailed deer population ecology and maternal transmission of *Neospora caninum* at Fort Drum, NY. He also regularly collaborates with the WHP on several regional wildlife health programs in his capacity as state cervid biologist.

Georgianna Silveira

Georgianna (left) is an MS student at SUNY-ESF where she is studying landscape patterns and population effects of anticoagulant rodenticide exposure in fishers (*Pekania pennanti)* in the northeastern United States. This work builds on her experience with urban rodent ecology and prevention, investigating the spillover effects of pest control and pesticide use on wildlife.

Corinne Conlon

Corrine (right) is a masters student at SUNY College of Environmental Science and Forestry (ESF) in the Whipps Lab of Fish and Wildlife Disease. She is collaborating with the CWHL on a surveillance study for zoonotic *Echinococcus* parasites in wild canids in New York State.

SCIENCE COMMUNICATION & OUTREACH

SOCIAL MEDIA AND WILDLIFE DISEASE FACT SHEETS

From 2022-2023, the WHP has added **4** new disease fact sheets to the resource library on the website: Avian Avulavirus (Paramyxovirus), Avian Pox, Harmful Algal Blooms, and Hemorrhagic Disease of Deer.

With **47** available sheets, nearly **10,000** views per month on different fact sheets, and over **130,000** total views during the year, these valuable tools continue to educate and inform the public, DEC biologists, technicians and staff.

Website visits averaged **300-500** daily with over **210,000** page views for the year. The website continues to be a valuable resource for wildlife health.

Our social media platforms have grown in followers during the last year with over **150** new Twitter followers and over **200** new Instagram followers. The power of social media was utilized when the WHP and BOW participated in social media marketing research focused on CWD messaging.

The Mange Disease Fact Sheet had over 19,000 views last year (right).

Mange

Cornell University
College of Veterinary Medicine
Animal Health Diagnostic Center

BASICS

Mange is a skin disease that affects mammals caused by microscopic mites that burrow into skin.

There are different species of mites that can cause the disease. SARCOPTIC MANGE can affect wild and domestic mammals and is often reported in wild canids such as red foxes, coyotes, gray wolves, and red wolves. NOTOEDRIC MANGE is generally host specific to squirrels and has been reported in the western gray squirrel, eastern gray squirrel, fox squirrel, and rarely in bobcats. DEMODECTIC MANGE, also called demodicosis, has been reported in many mammalian species including white-tailed deer, mule deer, elk, and black bears.

CLINICAL SIGNS vary by type but a common sign is hair loss.

SARCOPTIC MANGE signs often include hair thinning and hair loss and thickening and wrinkling of the skin. Scabs and foul-smelling crusts result from secondary infections with bacteria and yeast. NOTOEDRIC MANGE results in hair loss in affected squirrels that begins over the chest and shoulders and progresses to affect the entire body. DEMODECTIC MANGE signs include hair loss and dry, flakey, thickened skin. Disease is more severe in stressed animals with weakened immune systems or poor nutrition.

TRANSMISSION occurs when a host becomes infected by direct contact with an affected animal or by coming into a contaminated environment like burrows or nests where free-living mites can survive for several weeks in high humidity and low temperatures.

Mites can be IDENTIFIED by examining SKIN SCRAPINGS from affected animals under a microscope. Differences in appearance can help determine the type of mite.

Oral administration of Ivermectin can TREAT mange but is not typically used in free-ranging wildlife because of the need for repeat treatments several weeks apart.

HAIR LOSS

DIRECT CONTACT & ENVIRONMENT

ALL CANIDS & SEVERAL MAMMALS

ALERT HOW WHO

The NYS Wildlife Health Program | cwhl.cornell.edu
A partnership between NYS Dept. of Environmental Conservation and Cornell Wildlife Health Lab
2018

TARGETED SCIENCE OUTREACH

Skype a Scientist

Dr. Alyssa Kaganer has connected with elementary, middle, and high school students across the country through Skype a Scientist, a program that brings together students and professionals to introduce scientific ideas and career opportunities. This year, she has joined classrooms in California, Indiana, Ohio, Pennsylvania, and Texas to talk about wildlife conservation.

Write a Researcher

Dr. Alyssa Kaganer has also participated in Write a Researcher, a Cornell program that matches scientists with high school student pen pals to exchange letters discussing careers in STEM. This year, Alyssa was matched with two students from Washington State.

Hunter Outreach

In response to hunter interest and concern for the impact of epizootic hemorrhagic disease virus on the deer herd, Pat Connelly presented on the topic at several meetings. This year, he was an invited speaker at the New York Bowhunters Annual Banquet and the New York State Fish and Wildlife Management Board Fall Meeting. He also demonstrated sample collection with hunters participating in our seroprevalence study at the Cary Institute for Ecosystem Studies pre-hunt orientation and at the National Hunting and Fishing Day event in Rockland County

Science Podcast

Wildlife Disease Association Wildlife Health Talks: #1 Lazy turtles, freezing manatees and the oil spill aftermaths with Dr. Jenny Bloodgood.
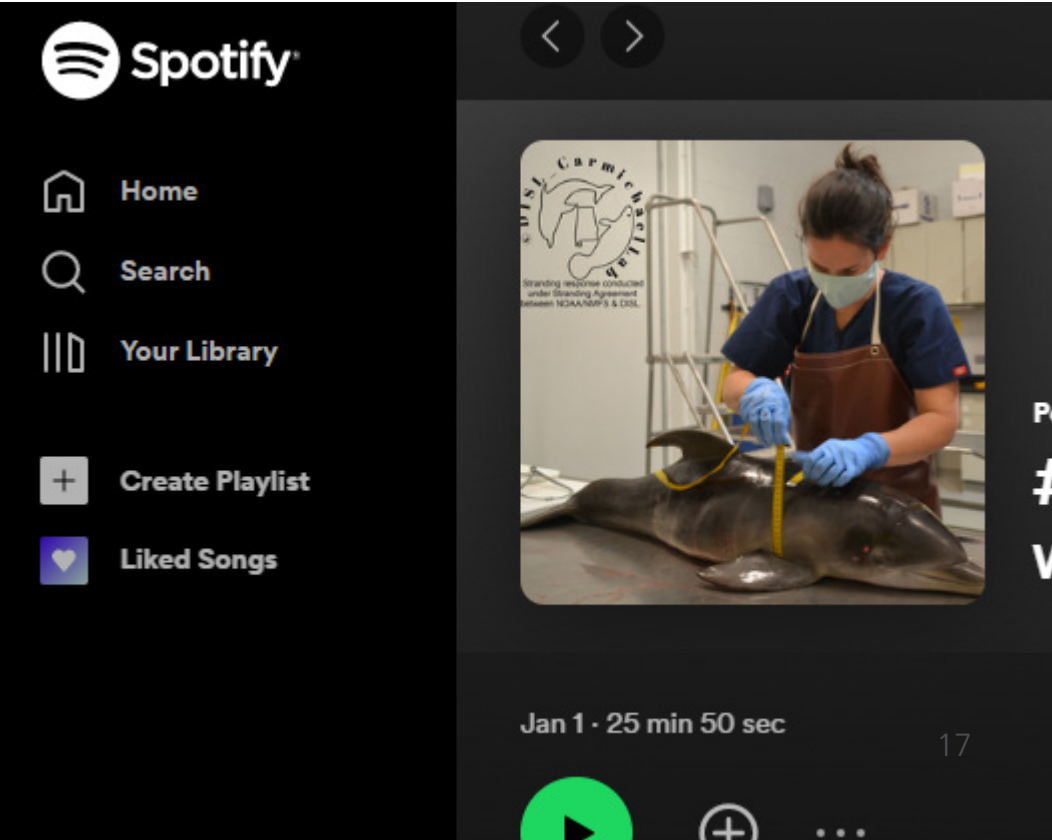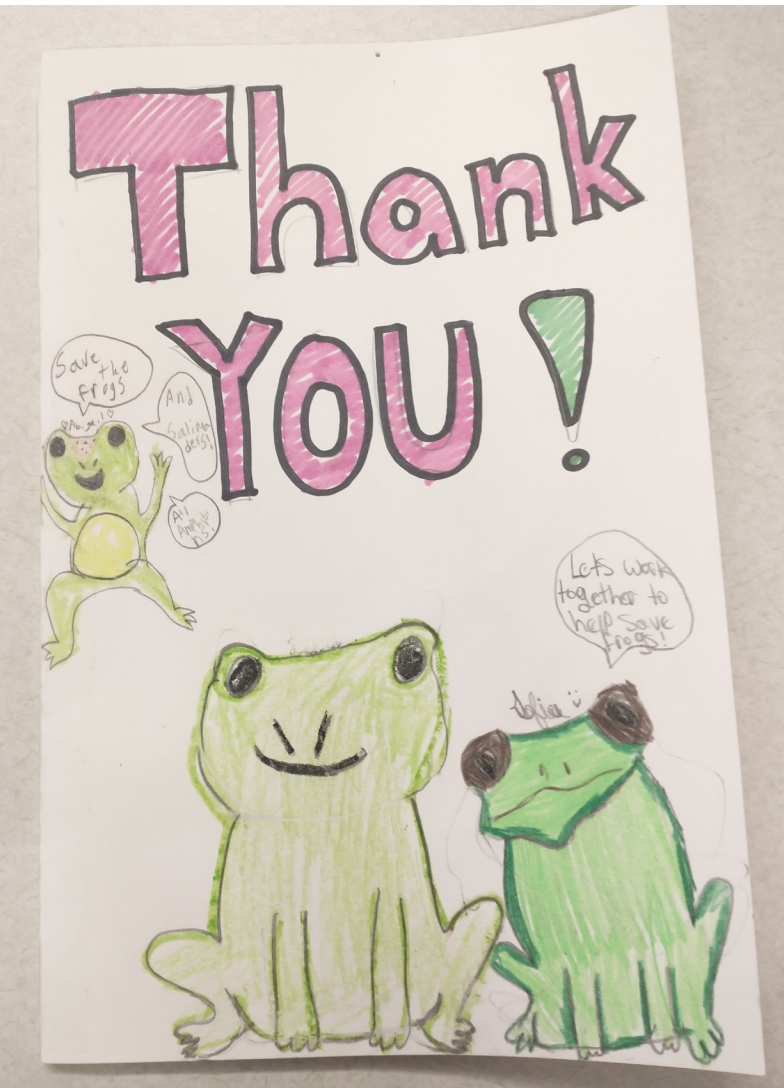
RESEARCH

FISHER RESEARCH

WHP has ongoing collaborative research on fishers with the DEC Furbearer Team, SUNY College of Environmental Science and Forestry, and the Comparative Coagulation lab at the Animal Health Diagnostic Center.

Using byproducts of the managed harvest of fishers, DEC collected livers, female reproductive tracts, and stomach contents. Livers were analyzed for anticoagulant rodenticides and lead; 83% were positive for at least one rodenticide, and 56% had a detectable level of lead. Additional samples will be tested for lead in summer 2023. The reproductive tracts were evaluated by a wildlife pathologist for indicators of reproductive health and productivity to aid in population studies. Stomach contents were sent to Finger Lakes Community College for dietary analysis.

In parallel to the recreationally harvested animals, DEC undertook a complementary four-year live trapping effort (2019-2022) to evaluate fisher demographics in the Northern management zone. CWHL received blood from captured females to measure progesterone level, an indicator that an individual may be pregnant and warrant close observation for denning. We sent blood samples to the Comparative Coagulation lab in support of their efforts to create a test for anticoagulant rodenticide toxicity in live animals. All study animals found deceased were necropsied at the Wildlife Health Unit to determine cause of death.

MOOSE PROJECT

This year, we continued monitoring moose that had been captured and collared in January 2022. One moose died in June 2022, and we conducted a field necropsy to ascertain the cause

of death, which appeared to be heavy liver fluke infection. In January 2023, we captured and collared 19 moose calves by contracting with Native Range Capture Services. Four of these moose have died from liver flukes and bacterial infections, and one collar slipped off. We will continue monitoring the remaining moose calves until we receive mortality alerts, the collar batteries fail, or they drop off after approximately 2.5 years.

In the summer of 2022, we collected white-tailed deer pellets to quantify the prevalence of parasites that impact moose. We will examine these deer pellets for brain worm and liver fluke larvae to understand parasite infection risk for moose across the northern Adirondack Park. We also collected water samples across the study area to check for the presence of the free-living life stage of liver flukes in ponds and wetlands. Finally, we monitored 105 trail cameras across the study area in the summer and fall of 2022 to look for impacts of winter ticks on moose and assess the spatial and temporal overlap of moose and white-tailed deer.

PORCUPINE HEALTH

Skunk adenovirus 1 (SkAdV-1) is a primary respiratory pathogen in the North American porcupine causing significant, often fatal, respiratory disease. Our retrospective and prospective study of SkAdV-1 in North American porcupines evaluated a total of 69 cases with an overall clinical disease prevalence of 13.0%. The oldest case in our records was from October 2016, correlating with a previous report from New York State that identified two cases of SkAdV-1 infection in free-ranging porcupines with respiratory disease from 2015 and 2017 (Balik et al. 2019. J Zoo Wildl Med. 50(4):1012-1015).

Our study revealed that SkAdV-1 has a wider tissue distribution resulting in significantly more morbidity than previously reported, affecting the eye, middle ear, and peritoneum in some cases. Additionally, our study showed that SkAdV-1 may manifest as a primary hepatitis without respiratory lesions.

A subset of porcupines in our study were PCR-positive for SkAdV-1 but did not have clinical signs or pathologic lesions, raising the potential possibilities of subclinical carriers, differences in virus strains, or varying stages of infection. Finally, our study showed that conjunctival swabs may be a promising, less invasive method than deep nasal swabs for virus detection in live porcupines.

In early January 2023, this young moose is under sedation, while researchers are preparing to collect samples and fit a GPS collar.
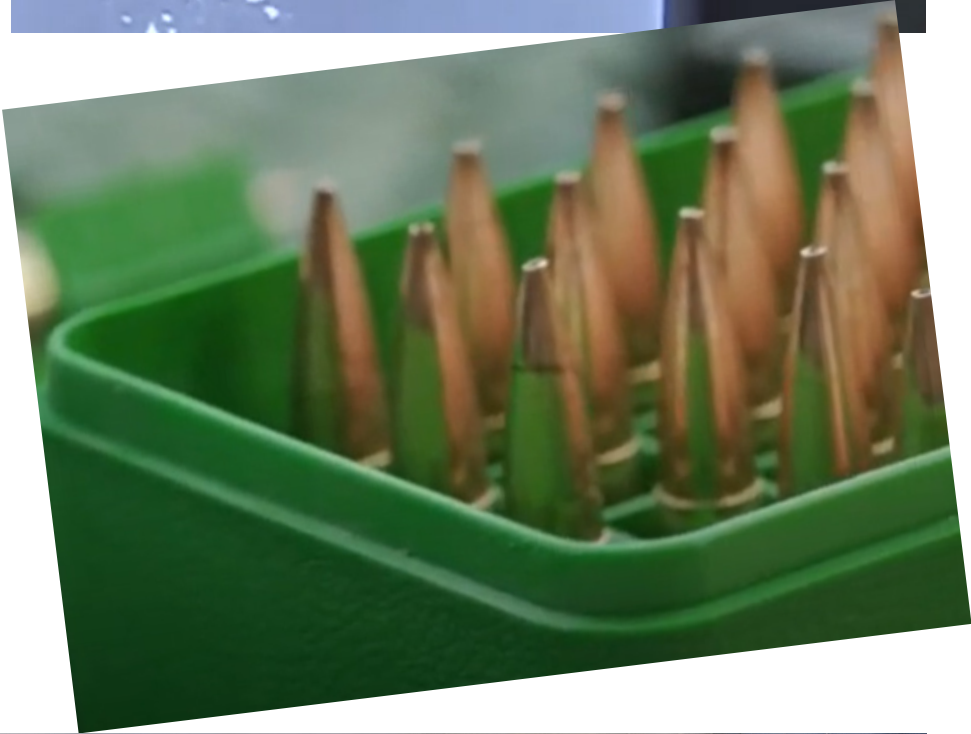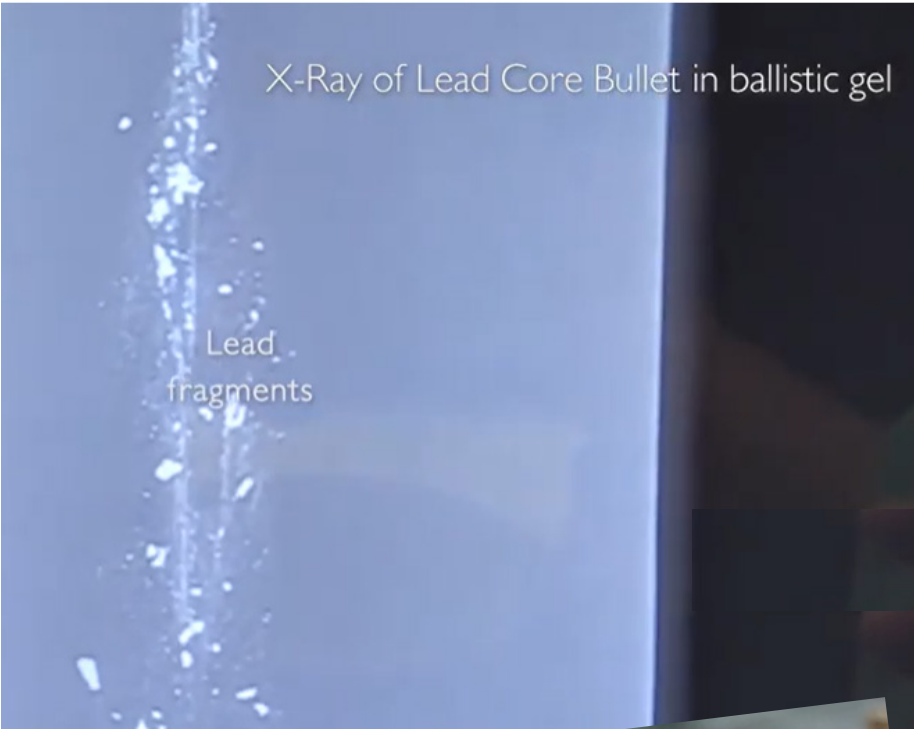
HISTORICAL RECORDS & SAMPLE ARCHIVES

By 1960, only one active eagle nest was known in New York State. So, in the late 1970's, an intensive restoration program began to rebuild the population in the state. Since 1969, the Wildlife Health Unit has been examining cases of morbidity and mortalities in eagles, including the experimental populations used in 1970's restoration project. We maintain over 1,100 historical necropsy records and are working to digitize and archive them for future research.

In mid-2023, a NYS Assemblyman requested statistical information on eagle mortalities examined over the past 15 years. DEC staff were able to provide information quickly and efficiently using the newly digitized bald eagle necropsy archives. This information may be pertinent for current and future legislative actions related to the effect of lead ammunition within the state's landscapes and watersheds regarding the native bald eagle population.

The Wildlife Health Unit alone maintains a historical tissue bank of over 4,400 samples. These samples date back to the 1980's and include 173 bird, mammal, and herpetofauna species. Current projects are underway to organize and inventory the samples so they can be more easily accessed for future research.

In January 2022, Brenda Hanley, Krysten Schuler, Kevin Hynes, Beth Bunting, and external-to-NY coauthors published "Environmental lead decreases resiliency of bald eagle populations" in the *Journal of Wildlife Management,* which demonstrated a population-level impact of lead poisoning on bald eagles across seven Northeast states. This article garnered attention in hundreds of media outlets.

Since then, the team has published additional articles on the topic, including the NYS-specific paper, entitled "Population impact to bald eagles by ingested lead in New York State, 1990–2018" (Hanley et al. 2023) and "Towards an evidence-informed strategy for communicating lead ammunition risks" (Balog-Way et al. 2023), that will be in a special issue of the *Wildlife Society Bulletin* on lead issues. Our Cornell collaborators also published "Expanding on Behavioral Outcomes in the Risk Information Seeking and Processing Model: Socio-Cognitive Factors Predicting Information Seeking, Sharing, and Discussion" in *Science Communications* (Leong et al. 2023).

To reach the public, we produced a video on non-lead ammunition that is now available on the DEC YouTube channel and website, along with the report produced by the NYS Interagency Pb working group (released April 2022).

Finally, Dr. Schuler was invited to participate in The Wildlife Society's Lead Ammunition working group to revise the professional society's position statement. This statement was approved by TWS Council in June 2022.

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TWS POSITION STATEMENT: LEAD IN HUNTING AMMUNITION AND FISHING TACKLE

June 21, 2022 by The Wildlife Society

FURBEARER DEMOGRAPHICS

Dr. Brenda Hanley continues to develop new mathematical methods and tools to analyze trapping data for several furbearer species in New York as well as for Vermont, New Hampshire, and Maine. She is currently on an odyssey into the fisher harvest literature as well as into her stats and theoretical math books to determine whether she can apply non-random harvest data to population questions. It has been quite an interesting problem whose solution has the potential to augment furbearer population monitoring.

RAPTOR HEALTH V3

The lab's prior research on bald eagles, which sought to compute the population scale impact of Pb on the greater wild population, necessitated that we derive a new mathematical method to mix time series data with non-random necropsy data. Once successful, we realized we had invented mathematical equations that were invariant to the cause of death of interest, and thus, we had created a novel tool that allows managers to compute the population scale impact of any disease, contaminant, or toxin, on the greater wild population of eagles.

Based on peer reviews of our manuscript, we have expanded our model to apply to additional raptor species. Today, the Raptor Health V3 software is capable of computing the population scale impact of any source of mortality to species with three life history stages, including 91 Accipitriformes, 4 Cathartiformes, 15 Falconiformes, and 36 Strigiformes.

EXTERNAL PROPOSALS AND EXPANDING RESEARCH

This year has ushered in exciting collaborations for future projects. Building off Drs. Schuler and Ahmed's 2022 PNAS paper, "White-tailed deer (*Odocoileus virginianus*) may serve as a wildlife reservoir for nearly extinct SARS-CoV-2 variants of concern," we have teamed up with Cornell statisticians and UC-Davis epidemiologists to pitch a proposal to the National Science Foundation entitled "Statistical foundations and practical applications for surveillance of disease in wildlife populations." We eagerly await the decision on this $2.1 million proposal.

Below: Juvenile bald eagle submitted for necropsy at Cornell Wildlife Health Lab.

Data science and emerging technologies are changing entire industries and scientific fields - including wildlife health. The Wildlife Health Program has always emphasized the importance of high-quality data to support wildlife management and policy decisions. Now, the WHP is incorporating the latest technologies for disease surveillance and research, including mobile applications, cloud computing, and novel analytical approaches adopted from data science and mathematics. These new tools have led to more efficient data collection processes and better data, and ultimately better information about the health of wildlife populations in New York State.

COMMUNITY SCIENCE SUPPORTS DISEASE SURVEILLANCE

Epizootic Hemorrhagic Disease is an emerging wildlife health issue in New York State. To understand the timing and spread of the disease, the DEC asked the public to report sightings and occurrences of sick and dead white-tailed deer using an online reporting tool, Survey123 from Environmental Systems Research Institute (ESRI), saving valuable staff time. During the past two years, over 1,500 reports have been submitted, allowing the DEC to collect more samples for diagnostic testing and characterize the spread of the disease.

ENSURING AN INFORMED AGENCY AND AN INFORMED PUBLIC

Timely and accurate information about emerging wildlife health issues is important for situational awareness in the agency and for ensuring an informed public. The WHP creates automated data pipelines and data dashboards which provide the agency and the public with the latest wildlife health data. For example, in

2022, the WHP introduced a Highly Pathogenic Avian Influenza (HPAI) data dashboard, which summarizes the distribution of HPAI detections in both captive and wild birds across New York State.

IMPROVING EFFICIENCY THROUGH MOBILE APPLICATIONS AND CLOUD COMPUTING

This year, the DEC, with help from the WHP, upgraded the data collection processes it uses for CWD. The DEC annually collects over 2,500 tissue samples from white-tailed deer for testing for the purpose of early detection and response. This year, paper forms were replaced with a new digital form using the ESRI Survey123 mobile application, and a "data pipeline" on Microsoft Azure cloud services provided a connection to the CWD Data Warehouse, a new web platform created in partnership with DJ Case & Associates. The CWD Data Warehouse provides a range of functions, including data management, analytics, visualization, reporting, and data sharing between multiple state agencies. The introduction of these technologies has improved data quality, reduced processing times, and enhanced situational awareness.

MATHEMATICAL MODELING

Dr. Brenda Hanley and the team continue to pump out novel equations and software tools to help managers learn about system dynamics and how they can be impacted by diseases or interventions. As part of the larger SOP4CWD project, their modeling team published novel equations in the paper entitled "Informing surveillance through the characterization of outbreak potential of chronic wasting disease in white-tailed deer" (Hanley et al. 2022). One doesn't need to be a mathematician to understand all the theoretical notation; the publication is accompanied by two interactive point-and-click software, entitled the Susceptible-Exposed-Infected (SEI) and Susceptible-Latent-Exposed-Infected (SLEI).

Additional software arising from SOP4CWD involve interactive maps and displays that depict the state of chronic wasting disease and testing across the eastern US and Canada. You are welcome to download the free *Regional Wildlife Disease Positives Software*, or any of the scores any of the other softwares published by the lab, by visiting the tools page on the CWHL web site (https://cwhl.vet.cornell.edu/resources/tools-data) or by searching the CVM collection of the Cornell Library digital eCommons (https://ecommons.cornell.edu/handle/1813/33367).

Most of the questions of interest to managers seek to find novel ways to improve populations given myriad forces that deplete populations. But questions of interest to managers can involve the opposite forces! For example, Dr. Hanley and a team of researchers from the west coast explored approaches to reduce raven populations that have exploded due to inadvertent human subsidies. The publication, entitled "Identifying population management strategies for avian predators: a decision tool," allows managers to find ways to stabilize raven populations as a way to protect their prey, the threatened desert tortoise and sensitive sage grouse. Feel free to play with the corresponding interactive tool, entitled the StallPOPdV4 web interactive.

Collect Better Data Collect Data Better

Left: Screenshot of the new mobile app using Survey123 for recording CWD sampling in deer in New York.

POLICY SUPPORT

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 assist staff in working safely with wildlife and reduce potential health impacts.

TRIBAL RELATIONS

One of the goals of our strategic plan is to improve our support for Native American tribes whose sovereign nations fall within the area serviced by the Wildlife Health Program. Currently, we are collaborating with the Seneca Nation of Indians (SNI) for assistance with CWD education and support.

Additionally, in August 2022, CWHL members Melissa Fadden, Alyssa Kaganer, and Evan Zhang (undergraduate) had the opportunity to join SNI for eastern hellbender population surveys. We participated in two days of field work and provided materials to test captured hellbenders for the infectious chytrid fungus, Bd.

STRANDING COLLABORATIONS

CWHL is building collaborations with marine species stranding groups in New York and surrounding states. In January 2023, Dr. Bloodgood joined two humpback whale necropsies, one in NY and one in NJ, in collaboration with the Atlantic Marine Conservation Society. Dr. Gavin Hitchener assisted in the NY whale necropsy. In April 2023, Dr. Bloodgood collaborated with the Marine Mammal Stranding Center in NJ to bring two short-beaked common dolphins to Cornell University for necropsies

as educational opportunities for veterinary and graduate students. One was completed during the Special Species Symposium, an event at Cornell attended by veterinary students from all over North America, and the other was done as an event hosted by the Cornell Student Chapter of the World Aquatic Veterinary Medical Association. Dr. Bloodgood hopes to continue to expand Cornell's capacity to aid the regional stranding groups.

CHEMICAL IMMOBILIZATION

The annual Safe Capture Chemical Immobilization training provided by the San Diego Zoo Academy was held virtually in March with 50 members of DEC staff including biologists, technicians and ECOs from all regions.

Dr. Jenny Bloodgood and DEC regional biologists are working to create a chemical immobilization training course for DEC personnel that would offer consistency across regions. She recently attended a Wildlife Capture and Chemical Immobilization course put on by the Center for Wildlife Studies at the Wildlife Science Center in Stacy, MN. As part of that course, she was able to use multiple types of dart guns and anesthetize mountain lions, black bears, gray wolves, and bobcats. She hopes to use her experience as a resource for DEC personnel and ultimately build a training course focused on the equipment and species most likely to be immobilized in NY.

TACKLING AVIAN INFLUENZA AT REYNOLDS GAME FARM

In mid-March, DEC Reynolds Game Farm in Tompkins County noticed an increase in mortality in their primary breeding pheasant flock. With concern for Avian Influenza, they expedited getting birds to CWHL for diagnostics; all birds tested positive for HPAI subtype H5N1. The farm was quarantined immediately, and the NYS Dept. of Agriculture and Markets and USDA assisted in management of the outbreak and development of a depopulation protocol to prevent spread of the disease. The Game Farm conducts regular disease surveillance in its flocks and maintains strict biosecurity protocols, including use of netting over enclosures to keep wild birds from mingling with the pheasants, rodent control measures, and thorough disinfection practices. Avian influenza can be spread easily, even potentially from feces dropped by infected waterfowl or other birds flying over the facilities. The Game Farm staff are participating in post outbreak surveillance research and actively sampling equipment and facilities throughout the farm.

IMPROVING WILDLIFE REHABILITATOR REPORTING FOR DISEASE SURVEILLANCE

Each year, licensed wildlife rehabilitators in New York State care for nearly 20,000 animals per year. These close interactions may provide opportunities for gathering data about the health of our native wildlife populations. The Wildlife Health Unit and the DEC's Special Licenses Unit have been working toward the development of an online reporting system for wildlife rehabilitators. This year, the WHP partnered with DJ Case & Associates to design and build the user interface. The system is in the final stage of preparation before its planned release in 2023.

WILDLIFE HEALTH TEAM MEETINGS

Between 2022-2023, representatives of the WHP attended meetings with the Big Game, Herp, Migratory Game Bird, Bird and Mammal Diversity, Land Management and Habitat Conservation, and the Furbearer and Small Game Mammal teams to provide updates on current and emerging wildlife health issues.

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.

WILDLIFE HEALTH TEAM MARCH 2022-CURRENT

DEC Personnel

Region	
Region 1	Leslie Lupo
Region 2	Christina Knoll
Region 3	Nate Ermer
Region 4	Stacy Preusser
Region 5	Tim Watson
Region 6	vacant (Andy McDuff)
Region 7	Ashley Meyers
Region 8	Frank Phillips
Region 9	Ryan Rockefeller

WHP Personnel

WHU	Kevin Hynes (chair)
Cornell	Krysten Schuler
BMT Liaison Central Office*	Kevin Hynes
DLE Liason*	Major Matthew Revenaugh
BMT Liaison (Regional)*	vacant

*DEC Personnel

ANNUAL WORK PLAN

Administrative

Annual Wildlife Health program report	Complete
Biannual wildlife health program review (Central Office or Cornell)	Complete
Wildlife Resources Center (WRC) infrastructure, equipment management and maintenance	Ongoing
WRC incinerator operation, lab maintenance, facility maintenance and grounds	Complete
Administration: budgeting, fiscal, personnel, T&A, LATS, FMIS	Complete
Explore feasibility of developing our own LIMS system	Not started

Policy Support

Participate in NYS Non-Lead Ammunition Working Group	In progress
Wildlife rehabilitation web-based data management and reporting system	In progress
Converting SLU to electonic reporting system for select licenses (NWCO, Game Bird)	Central Office
Participate in wildlife health related meetings IRC, CWD, BOW, Wildlife Health and other meetings	Complete
Providing scientific/medical wildlife health consultation (public, staff, One Health partners, regulatory, research projects, SLU licenses, etc.)	Ongoing
Wildlife health and wildlife rehabilitators listserv maintenance	Complete
Support cricket frog introduction	In progress

Health and Disease Surveillance

Migrating to new CWHC case database (WHIP)	Complete
Update CWD surveillance plan and conduct annual surveillance digitally	Complete
Forensic services for DLE	Ongoing
Wildlife rehabilitation web-based data management and reporting system	Complete
Case management and reporting: Wildlife necropsies (>1000/yr)	Ongoing
DEC CWD data collection and digitization	In progress
SARS-CoV-2 in WTD evaluation	Complete
Support development of mobile app and web-based field and public data collection	Complete

Preparedness and Response

Implement CWD Risk Minimization Plan action items	Complete
SARS-CoV-2 guidance webinars and documents	Complete
RHDV2 guidance documents	Complete
Bald eagle population impact study	Complete
Develop Wildlife Disease Field Response document	Complete
CWD Marketing Campaign	Complete

Training, Teaching and Outreach

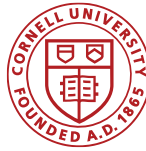|	
Regional Wildlife Health Workshops	Complete
Training workshops for DLE staff	Complete
Communicate with veterinarians regarding wildlife health issues	Complete
Collaborate and coordinate with other agencies under One Health	Complete
Safe Capture International chemical immobilization training	Complete
Wildlife health presentations for public	Complete
Annual Furbearer training at DEC Fur School/computational workshop	Complete
Forensic services for DLE	Complete
Provide the public information about wildlife health issues on CWHL website	Ongoing

Research

Fisher: 1) reproductive assessement, 2) rodenticide testing, 3) population demographic parameter estimation	Complete
Bobcats: 1) cytauxzoon study, 2) demographic population parameter estimation	Complete
Development of eDNA tools for amphibian and virus detection	In Progress
Complete tissue archive system-integration with WHIP	Complete
Bear mange statewide surveillance (publication)	Complete
P. tenuis study (publication)	In draft
Construct software applications to support research and disease surveillance efforts	In progress
Moose population health assessment (publication)	In draft
Multi-lab validation of RT-QuIC CWD testing	In progress
eDNA Tiger salamander study	In progress