FEBRUARY 2022
NEWSLETTER

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SARS-CoV-2 Research in Wildlife

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On March 11, 2021, President Biden signed into law the American Rescue Plan (ARP) Act, also known as one of the COVID-19 stimulus bills. Under the umbrella of USDA activities funded in the legislation, the Secretary of Agriculture designated the Animal and Plant Health Inspection Service (APHIS) as the lead agency to develop a plan to conduct monitoring and surveillance of susceptible animal species for SARS-CoV-2 (the virus that causes COVID-19). The ARP allocates $300 million for this charge and the money is available until expended.

APHIS is leading efforts to develop and carry out a robust early warning surveillance system to alert public health partners of potential disease concerns in animals and potentially prevent or limit the impacts of SARS-CoV-2 and future zoonotic disease outbreaks in people and animals. The system leverages and expands upon APHIS' existing disease monitoring and surveillance capabilities and expertise.

Findings from captive studies lead to wild deer surveillance

Close to 300 million white-tailed deer live in the United States. They are found in every state except Alaska and are enjoyed by many wildlife watchers, recreationalists, and hunters. Studies conducted in 2020 and early 2021 showed that white-tailed deer have protein (ACE-2) receptors capable of binding to SARS-CoV-2, allowing the virus to enter susceptible cells. Research conducted by the USDA Agricultural Research Service subsequently found that deer experimentally exposed to the virus are susceptible to infection and could infected naïve deer. Given these findings and the fact that white-tailed deer often come into close contact with people, APHIS further investigated SARS-CoV-2 in wild, free-ranging deer.

USDA-APHIS Wildlife Services is partnering with multiple states and tribes to survey for SARS-CoV-2 in hunter-harvested deer. Image Credit: Adobe Stock

Nasal and blood samples collected from deer in December 2021 as part of the ARP-funded white-tailed deer surveillance for SARS-CoV-2.
Image Credit: USDA-APHIS Wildlife Services

"Widespread human infections with SARS-CoV-2 combined with our close associations with wildlife create the potential for spillover between people and animals," says Dr. Tom DeLiberto, Assistant Director for APHIS-Wildlife Services' National Wildlife Research Center (NWRC).

"Studying the susceptibility of deer and other mammals to SARS-CoV-2 helps to identify species that may serve as reservoirs or hosts for the virus, as well as understand the origin of the virus and predict potential impacts on wildlife, domestic animals, and people."

In 2022, USDA-APHIS Wildlife Services researchers plan to test archived wild animal samples from potentially susceptible canid species, such as coyotes, wolves, and foxes, for SARS-CoV-2 antibodies. *Red fox,* Image Credit: Adobe Stock

Before the passage of the ARP Act, APHIS Wildlife Services (WS) opportunistically obtained serum samples from wild, free-ranging white-tailed deer as part of wildlife damage management activities WS conducted in 32 counties in Illinois, Michigan, New York, and Pennsylvania from January 2020 to 2021. These samples were tested at the NWRC and APHIS National Veterinary Services Laboratories (NVSL). Antibodies to SARS-CoV-2 were detected in 33 percent of the 481 samples collected. The results varied by State (in Illinois, 7 percent of 101 samples contained antibodies; in Michigan, 67 percent of 113 samples; in New York, 19 percent of 68 samples; and in Pennsylvania, 31 percent of 199 samples). None of the deer populations surveyed showed signs of clinical illness associated with SARS-CoV-2.

In summer of 2021, NVSL confirmed SARS-CoV-2 infection in wild white-tailed deer in Ohio, based on samples collected between January and March 2021 by The Ohio State University College of Veterinary Medicine as part of ongoing deer damage management activities. Later, a study conducted by Pennsylvania State University in collaboration with the Iowa Department of Natural Resources found that free-ranging and captive deer in Iowa also were infected with SARS-CoV-2 and provided evidence of deer-to-deer transmission.

The finding that wild white-tailed deer were exposed to and infected with SARS-CoV-2 was not unexpected given that white-tailed deer are susceptible to the virus, are abundant in the United States, often have close contact with people—and that more than 114 million Americans were estimated to have been infected with the SARS-CoV-2 virus by the summer of 2021, according to the CDC.

ARP Funds Next Steps

Currently, Wildlife Services and its partners are leveraging ARP funds to build upon initial findings and conduct a phased, multi-year approach to understand the impacts of SARS-CoV-2 in white-tailed deer to human and animal health. The goals are to determine how widespread the virus is in deer populations in the United States, whether SARS-CoV-2 negatively impacts deer populations, and if deer can serve as a reservoir for the virus and lead to new virus variants that may impact human and animal health. It initially involves partnering with approximately 30 state fish and game agencies and tribes across the United States to opportunistically collect nasal swab and blood samples from hunter-harvested white-tailed deer. This will be supplemented with opportunistic sampling of white-tailed deer during Wildlife Services wildlife damage management and state agency harvest activities through the winter. Findings from this initial work will be used to target surveillance in the future.

Wildlife Services will also be conducting surveillance and research on SARS-CoV-2 in other potentially susceptible wildlife, including wild canids, mesocarnivores (raccoons, skunks, etc.), and feral swine.

For more information, please contact Gail Keirn, WS Communication Program Specialist at gail.m.keirn@usda.gov.

Frederick A. (Ted) Leighton named an Officer of the Order of Canada

Ted Leighton, recipient of the WDA's Ed Addison Distinguished Service Award (2008) and the joint American Association of Wildlife Veterinarians (AWWV) and WDA Tom Thorne and Beth Williams Memorial Award (2015) has been named an Officer of the Order of Canada in the 2022 New Year's Day honours list, for his contributions to veterinary pathology and the field of wildlife disease. This is the second highest level in Canada's civilian honours system, awarded for "achievement and merit of a high degree, especially service to Canada or to humanity at large".

A faculty member of the Western College of Veterinary Medicine, University of Saskatchewan, in addition to his career as an educator, Ted combined his broad knowledge of wildlife disease with implementation of policies affecting wildlife management, and wildlife, domestic animal and public health in Canada, and more widely. He was applying the principles of 'One Health' since well before the concept was defined.

With Dr Gary Wobeser, in 1992 Ted was a founding Co-Director of the Canadian Cooperative Wildlife Health Centre, now the Canadian Wildlife Health Cooperative, and from 2002 to June 2014, when he retired, he was full-time Executive Director of the Centre. During his tenure in that role, he expanded and consolidated the position of the CWHC as the 'go-to' agency in Canada for wildlife disease information, policy coordination and surveillance, despite it being a non-governmental organization. In addition, he extended its activity into the international arena as an OIE Collaborating Centre for Wildlife Disease Surveillance and Monitoring, and in providing courses and technical support in English, French or Spanish, as appropriate, to wildlife and animal health agencies in Latin America, Africa, Eastern Europe, and Southeast Asia.

Dr. Ted Leighton is a visionary thinker, an inspiring scientific leader, and was a successful and highly effective 'biopolitician' on the Canadian and international scene.

As the result of his influence, in 2003 the Canadian Wildlife Service convened a national multi-agency consultation which resulted in development of Canada's National Wildlife Disease Strategy, principally authored by him. Formal ratification of this document by the federal and provincial/territorial ministers responsible for wildlife forced relevant natural resources, environment, health and agriculture agencies to recognize an obligation to deal with wildlife disease issues.

As the well-informed leader of a university-based non-political NGO, Ted had tremendous credibility among the numerous federal and provincial agencies with which he interacted across Canada. Technically authoritative, a good listener and a very persuasive and politically sensitive conciliator, he repeatedly found ways to bring federal and provincial government bodies together to deal nationally with emerging wildlife disease problems common to many jurisdictions, such as West Nile virus and Highly Pathogenic Avian Influenza surveillance, Management of Chronic Wasting Disease of cervids, and White Nose Syndrome in bats.

The Canadian Wildlife Health Cooperative is a monument to Ted's vision and hard work, and a model for translating an understanding of the implications of wildlife disease into policy and action on a regional, national and international scale.

In addition to the Order of Canada and awards from the WDA, Ted Leighton's scientific contributions and leadership have led to recognition as the Albert Franzmann Memorial Lecturer (AAWV, 2010), election as a Fellow of the Canadian Academy of Health Sciences (2013), and an honorary DSc from the University of Guelph (2014).

H5N1 Identified as the cause of disease event in common cranes in Israel

Sarah Sirica, with assistance from Barry Hartup, Director of Conservation Medicine with the International Crane Foundation, with updates derived from a Jan 10, 2022 webinar featuring Dr Yoav Perlman and Nadav Israeli of Bird Life Israel/ The Society for the Protection of Nature in Israel.

On the 15 and 16th of December, 2021, reports began coming out from the Hula Valley that there were more than a dozen dead Common Cranes *(Grus grus)* observed by birders and tourists. The Hula Valley region is a vital area for both stopover and overwintering of this species, as well as being a popular ecotourism attraction for the region. More than a dozen dead birds obvious to the public at this time was an irregular occurrence, and scientists with Bird Life Israel / The Society for the Protection of Nature in Israel alerted the National Parks Authority (NPA) to test the deceased birds to determine causation.

The test results that came in a few days later from the NPA confirmed that the cause of death in those common cranes was a strain of high pathogenic avian influenza – H5N1. The die-off peaked over the next week, and by late December, it was evident that six to eight thousand cranes had died. This loss was a shock to the public and made national news. Videos were taken and posted to YouTube that show birds sick and dead. The signalment, which is evident in the posted videos, included almost exclusively Common Cranes with ataxia, neurologic decline, generalized weakness, or simply being dead in the water. Weather appeared to be a factor of both the time of outbreak and for cleanup – birds were being blown across the surface of the water and into muddy shorelines for the duration of the outbreak.

The Hula Valley is located in the northern section of the rift valley in Israel, and once was the location of a large wetland area, which had been extremely ecologically important for a variety of migrating avian species. In the 1950's, the wetlands were drained and the land repurposed for agricultural use, with the effect of extirpating many species from the region. However, with both a change in dominant crops from cotton to peanuts and corn, as well as a new contingent of environmentally-conscious leaders in the area, the area began to revive its ecological importance. Steps have been taken to add back regions of wetlands for migratory species over the last few decades, particularly at Agamon Hula. Allowances were made between agricultural, environmental, and then tourism industries which has led to a "delicate equilibrium," as Dr Perlman phrased it, for this vital ecosystem.

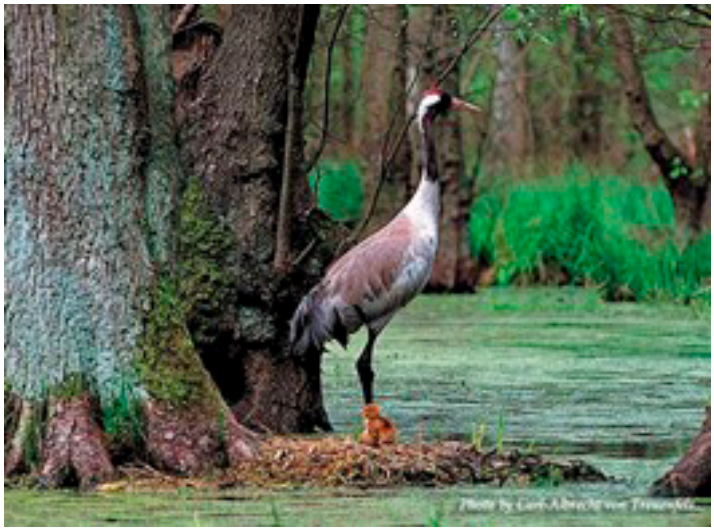


Image Credit: International Crane Foundation
https://savingcranes.org/species-field-guide/eurasian-crane/

One of the organizations which has played a vital role in the resurgence of the area is The Crane Project, which developed in the late 1990's, and has worked on lessening conflict between cranes and farmers, allowing for feeding zones to be created, and developing new partnerships. This has not only led to a massive increase in the annual number of cranes from around 1,000 to now in the mid 20,000's, but has been of benefit to a larger ecosystem, including other migratory birds and raptor species, such as the vulnerable Eastern Imperial Eagle and Greater Spotted Eagle. In the webinar, Dr Perlman stressed that an increase in locations that can be biodiversity hotspots is key to conservation of the species in the Hula Valley, as well as a general tenet of conservation moving forward.

In concert with this region's ecological resurgence, global changes to the climate and regional conflicts have lessened access to land and food sources for migratory species, and changes to the previous patterns of where many migratory species stage, stopover, and overwinter have been occurring. There have been many positive aspects of some migratory species being supported with new or reclaimed land and food sources, but it may be possible that with spatial changes along with a changing climate, that additional disease is observed.

Highly Pathogenic Avian Influenza (HPAI) is currently being monitored throughout most regions with migratory birds, and it has generally been assumed that the main classes of concern are waterfowl and poultry. Though there have previously been a small handful of deaths due to HPAI strains in raptors, songbirds, and cranes, large die-offs have not occurred. But with this recent outbreak in the Hula Valley and a smaller, but still significant, outbreak affecting hundreds of demoiselle cranes in India in November of 2021, that status quo is shifting.

Image of Water in Hula Valley with Crane carcasses in water.
Image Credit: https://www.facebook.com/SPNI.EN/

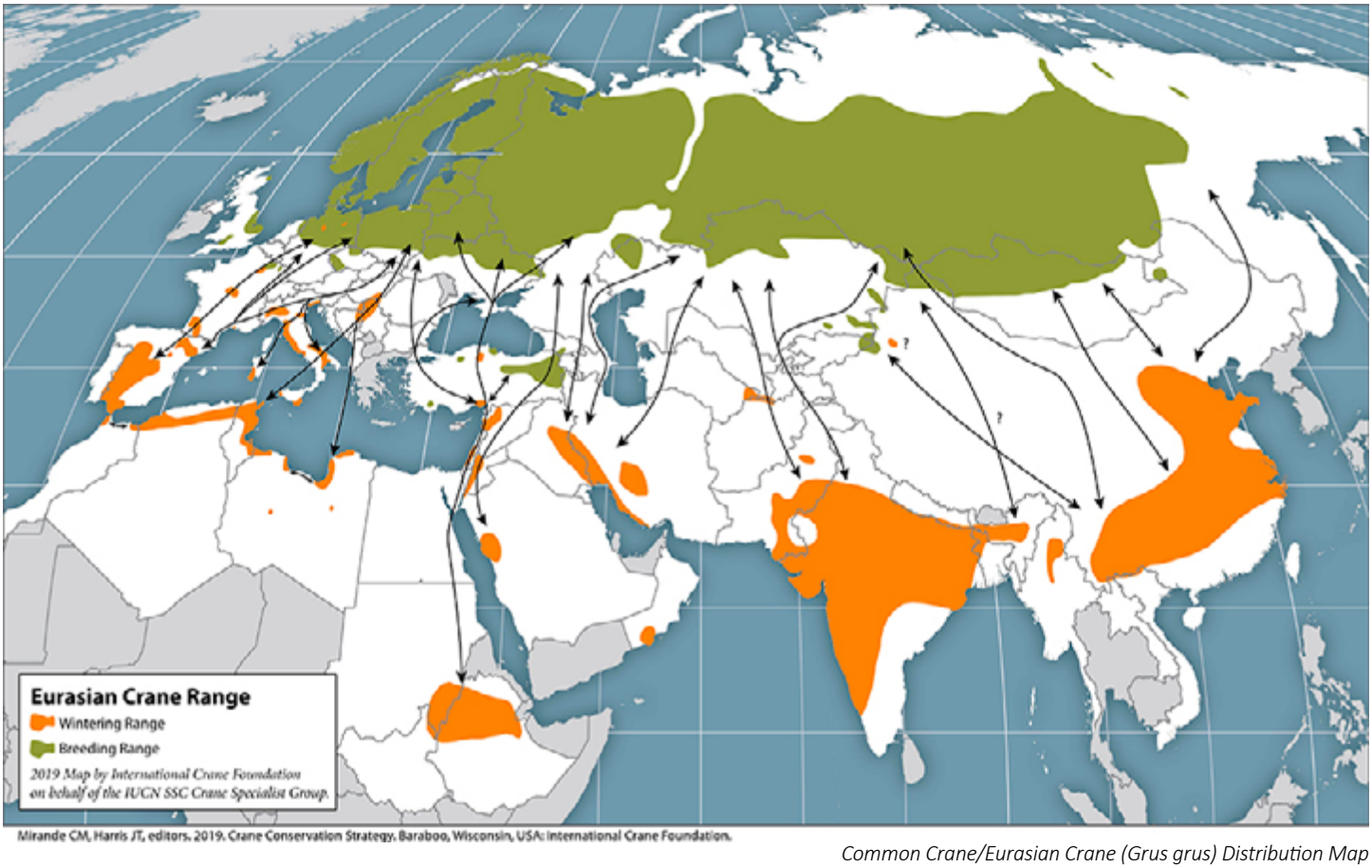
Management of avian influenza has always been a bit of a moving target. It is in fact so good at antigenic drift and shift that it is frequently used as the example virus for educating students about those processes. Poultry are able to be managed with closed flocks, vaccines, or other biosecurity measures, but migratory birds live quite the opposite life, giving ample opportunity for pathogen spread locally at water sources or over vast geographic regions based on their flyways. Particular strains affecting a new species is not at all uncommon, and after an outbreak in waterfowl affecting bar-headed geese in China in 2006, the wildlife and zoo community had a wake-up call about this historically poultry-focused pathogen.

The wildlife sectors began more intensely monitoring migrating waterfowl in wilderness areas for strains of avian influenza and studying the effects of this pathogen's spread across the Northern Hemisphere in particular. Dr Hartup also described this as a time in which there was a focus on developing prevention measures and ramping up biosecurity at facilities with captive animals. The AZA shortly thereafter came out with management plans for captive facilities, which can be found here. Those guidelines, and biosecurity measures that organizations like the International Crane Foundation have created, are coming into play this year.

There are many variables not yet determined in the Hula Valley outbreak, including epidemiologic characteristics. Was it was transferred from local turkey farms experiencing an outbreak at the time when Common Cranes began arriving en masse to the region, or did it travel with other birds flying south to Israel – perhaps the spread was related to the outbreak of barnacle geese in Scotland? Why did a pathogen that has been present in the area every year for the past 15 suddenly affect thousands of birds, rather than the handful that it usually affects? And, lastly, and possibly of greatest importance – why this species? The common crane is a generalist species and was excreting massive amounts of pathogen into the environment, but very few other species were affected. The next most-affected wild species were Great white pelicans, but less than 20 were found infected.

Before determining all of the answers, the governmental and non-governmental stakeholders in the area had to act – the virus can survive for months in the water, and with every windy day blowing more carcasses around, they did not know how far it would spread downwind or downriver. The National Security Council took over the disaster response, and together with other authorities determined what action to take. There was some public outcry over the 10-day timeline between initial reports of deceased birds to a cleanup being initiated. Removing crane carcasses became the priority, but it needed to be done in a way that was safe to the humans involved. PPE, safety measures, and rapid action were vital aspects of the cleanup, and that meant that counting the carcasses as they went to tally the mortality was not accomplished. Instead, drones were used to scan the area, and software which tallied birds with and without a shadow were used to make mortality estimates. They also attempted to slow the flow of water out of the Agamon Hula and Hula Reserve and took samples of the surrounding waterways as well as downriver through the Jordan River Basin.

The management of the region now is something that the international community is watching. One possibly controversial decision was to continue to feed the cranes on site. Some have blamed the food availability as a point-source location



Common Crane/Eurasian Crane (Grus grus) Distribution Map
Image Credit: International Crane Fountation - https://savingcranes.org/species-field-guide/eurasian-crane/

for disease spread. But as Dr Perlman points out, the cranes congregate as part of their natural history, so he argues that the outbreak would have occurred regardless of being fed. The idea of continuing to feed during the outbreak was both to lessen dispersal elsewhere, and to avoid the fallout of cranes eating or damaging regional crops and developing new conflict with the agricultural community. They do plan to modify the feeding method, to spread things out more, and there is discussion of how to clean or sterilize the feeding areas to reduce the presence of virus in the soil and water.

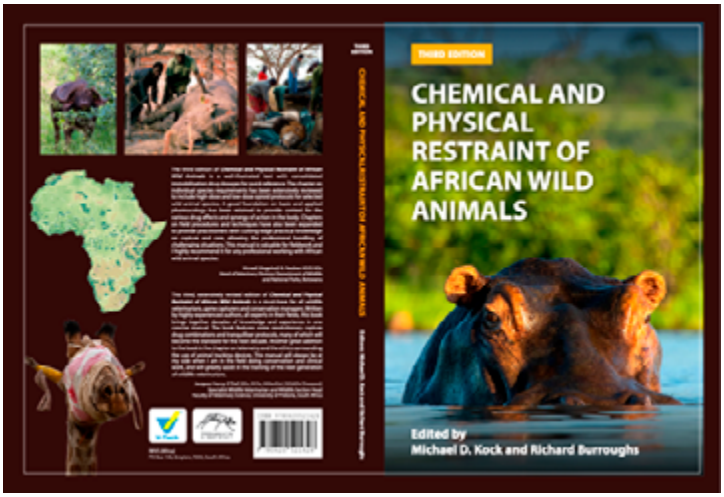
The management response during and after the outbreak, and also the potential for change in management in the future, is vital for not only the Hula Valley region, but numerous other locations where ecosystems have been changed, then changed again, with massive effects on populations of wildlife. The Hula Valley region is not unique in sustaining a population with artificial feeding. One species in similar circumstances that Dr. Hartup mentioned deep concern about is Hooded Cranes. This species brings together around 80% of the total population to winter at Izumi, on the Japanese island of Kyushu every winter. A few reports of individual hooded crane mortality related to HPAI have been previously reported, but nothing like this report from Israel. However, with overlapping flyways, there is a huge risk for spread.

In North America, there have been reports over the last month noting spread of H5N1 in focal locations in both Canada and the United States. Monitoring is increasing, and the US National Wildlife Health Center has issued expanded submission criteria for HPAI with its most recent wildlife health bulletin. The updated submission guidelines are more inclusive than the general recommendations, with a broader scope that involves increased assessment of both morbidity and mortality of waterfowl, raptors, and scavenging species.

For more information, The OIE has details on HPAI here. And you can find many relevant articles in the Journal of Wildlife Disease here.

This balance of agriculture, migratory birds, and tourism is becoming increasingly common worldwide as we try to please all stakeholders and their often contrasting goals. Unfortunately, no location is going to have perfect biosecurity, and this is in tandem with climate change, land and water development, and migration, which all effect the ecology of pathogens. The paths taken by the scientists and politicians in Israel will continue to be watched closely by the international community for guidance and wisdom in preparation for the next inevitable outbreak.

Chemical and Physical Restraint of African Wild Animals: The Third Edition is coming soon!



The eagerly awaited Third edition of the Chemical and Physical Restraint of African Wild Animals, edited by Drs Michael D Kock and Richard Burroughs will be available in early 2022. Copies are being shipped from the printers in Hong Kong in December 2021 with an ETA for South Africa, USA and UK estimated to be late January 2022.

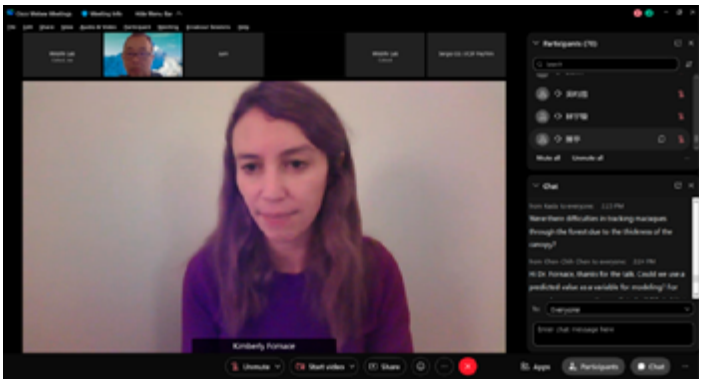
It has been extensively updated, reflecting current trends in immobilisation and handling of African wildlife. The additional 98 pages includes a total of 18 chapters with a new chapter on telemetry and its application in wildlife management. There have been extensive updates made to the Species chapter, which is still the largest section of the book, with updates of detailed information on the use of high-dose and low-dose opioid protocols in herbivores, the use of novel butorphanol-azaperone-medetomidine combinations that are under development (amongst others), handling of megaherbivores and details of rhino de-horning, and a detailed examination of the pathophysiological aspects of the capture and care of wild animals.

This a unique, beautifully compiled cutting-edge book that can be used in zoological and academic institutions, to support training programs and as a wildlife capture field guide in your vehicle, helicopter or office. See www.cprwa.co.za

WDA-AP Geographic Information System Online Workshop report

The Asia-Pacific Section of Wildlife Disease Association (WDA-AP) held an online workshop related to the topics of GIS for wildlife disease data analysis on November 24th,2021. The workshop was free and open to everyone interested in the topic. They invited three speakers who are experts in spatial analysis of disease data. The topics included the introduction of GIS, and the spatial analysis of malaria and tick-borne disease.

316 people registered for the workshop and around 70 participants attend the workshop. During the workshop, Dr. ToshioTsubota and Dr. Chen-Chih Chen chaired the workshop, and all the participants enjoyed the talks. WDA-AP appreciates the contribution from the invited speakers and all the participants to make the workshop such a successful event. Although this is the first workshop target on applying GIS for wildlife disease data, they believe it would not be the last one. The WDA-AP committee will continue to hold the workshop or webinar in the future.



Above Image: Screenshot of the workshop. Dr. Kimberly Fornace gave a talk on spatial analysis of macaque malaria

Right Image: The flyer of WDA-AP workshop

NWDA – Summing up the ongoing wildlife health surveillance programs in the Nordic countries

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To give an overview of official Nordic wildlife health surveillance we present titles and web links for ongoing activities in the region. Institutional websites are often in Nordic languages and members of the NWDA board are happy to help facilitate contact with relevant people and assist with any questions.

Denmark

The history of wildlife disease surveillance in Denmark has become increasingly long and complicated. Wildlife disease surveillance was initiated as early as the 1930's in Denmark. Because of repeated reorganisation of government institutes and government tenders, the tasks have been moved between departments and split up. The Danish Food Administration funds surveillance of notifiable diseases in wildlife. The task of doing necropsies of wildlife species suspected to carry notifiable diseases is now located at Copenhagen University, while SSI performs the associated laboratory analyses. The two institutes joined in the consortium DK-VET and have been responsible for the laboratory component of the Danish veterinary contingency plan since 2019. Targeted surveillance programmes for rabies, West Nile Disease and avian influenza are run by DK-VET.

The so called "Faldvildtundersøgelser", the general surveillance of causes of death and disease in fallen game submitted by the public and other surveillance of non-notifiable wildlife diseases is funded by the Danish Environmental Agency and has in recent years been conducted by the Danish Technical University in a consortium with the Aalborg University. DTU ceased performing veterinary diagnostic services at the end of January 2021 including necropsies of wildlife and related tasks. Though the future of the Danish "Faldvildtundersøgelser" currently remain undetermined, the Environmental Protection Agency and involved universities are working to find out how the tasks will be continued and hopefully a plan will be announced soon.

Specific programs with annual reports:

Reports of general surveillance of causes of disease and death in fallen game (faldvildtundersøgelser) are available in Danish on the homepage: http://www.vildtsundhed.dk/

Detection of notifiable diseases is reported in the The European Union One Health Zoonoses Reports. Also data from the survaillance of avian influenza in wild birds is currently available (in Danish) at: https://ai.fvst.dk

Finland

The Finnish Food Authority, among other things, promotes, monitors and studies the health and wellbeing of domestic and wild animals and conducts the national wildlife disease surveillance. General surveillance is based on opportunistic sampling and animal samples are provided by veterinary officials, hunters and other citizens. In principle, all wild animal species are included. Targeted surveillance programmes are in place for rabies, Echinococcus spp., Trichinella spp. and avian influenza. People take active part in the surveillance and annually around 1300-1500 samples of wild animals (whole carcasses or organs) are submitted for pathological analyses. Sample providers receive a report of the results of their samples.

Specific programs with annual reports:

Annual zoonoses reports (EFSA): https://www.ruokavirasto.fi/en/themes/zoonosis-centre/zoonoses/publications/finlands-annual-zoonoses-report/

Animal disease information, open access, real-time data base (in Finnish): https://avointieto.ruokavirasto.fi/

Norway

The Norwegian Veterinary Institute (NVI) is the national body responsible for carrying out health surveillance in both domestic and wild animals. NVI monitors wildlife health threats passively by gathering information and investigations by necropsies. Additionally, specific programs are running for pathogens with special focus. The primary financial support of wildlife health surveillance is the Norwegian Environment Agency and additional support from the Norwegian Food Safety Authority. The oldest program in wildlife, ViltHOP, has its records more than 20 years back. In the beginning, it covered wild cervid health (including CWD) and musk ox, with expansion the last year to cover more species.

Specific programs with annual reports:

The surveillance programme for diseases in wild boars in Norway 2020 (Helseovervåkning villsvin * (vetinst.no))

The surveillance programme for Echinococcus multilocularis in red foxes (Vulpes vulpes) in Norway 2020 (Revens dvergbendelmark (Echinococcus) hos vilt * (vetinst.no)

The surveillance programme for Chronic Wasting Disease (CWD) in free ranging and captive cervids in Norway 2020 (Chronic wasting disease (CWD) hos vilt * (vetinst.no)

Helseovervåkingsprogrammet for vilt (ViltHOP) 2020 (Helseovervåkingsprogrammet for vilt (ViltHOP) * (vetinst.no)

Sweden

The Swedish National Veterinary Institute (SVA) is the only laboratory in Sweden that systematically works with disease surveillance of wildlife. The so called "Fallviltundersökning", the surveillance of causes of death and disease in fallen game submitted by the public, has been ongoing since 1948. An expanded Wildlife Disease Surveillance Programme that includes targeted disease surveillance and large carnivore (bear, wolf, lynx and wolverine) health surveillance, was established in 2006, in cooperation with the Environmental Protection Agency. The work is funded by state grants, by the Game Conservation Fund which is a research fund based on the annual state game conservation fee paid by hunters, by the Swedish Environmental Protection Agency and by project funding by the Swedish board of Agriculture. In 2020, a programme for health and disease monitoring of marine mammals was launched in cooperation with the Swedish Museum of Natural History and funded by the Swedish Agency for Marine and Water Management.

Specific programs with annual reports:

Wildlife Disease Surveillance in Sweden (general disease surveillance, mainly of birds and terrestrial wild mammals), annual report on the website of the National Veterinary Institute (available in English). Wildlife-SVA

Large predator surveillance, annual report on the website of the National Veterinary Institute (in Swedish). rapport_stora-rovdjur_2020.pdf (sva.se)

Marine mammal health and disease monitoring, annual report on the website of the National Veterinary Institute (in Swedish). Rapport: Hälsa, sjukdomar och dödsorsaker hos marina däggdjur i Sverige under 2020- SVA

A small "good news" story about E. multilocularis: Norway and Finland still free of *Echinococcus multilocularis*

In order to retain preventive health measures for the control of *Echinococcus multilocularis* infection in dogs, meaning mandatory deworming of dogs entering the country, Norway and Finland need to demonstrate the freedom of *E. multilocularis* in the natural hosts, red foxes, and in Finland also raccoon dogs. This is done by sampling and examining them, recently by copro-PCR. The annual surveillance has been designed to fulfil the requirements of the Commission Delegated Regulation (EU) 2018/772 of 21 November 2017: to detect the infection, if present in any part of the country at a prevalence of not more than 1% at a confidence level of at least 95%. No *E. multilocularis* has been found during the decade of surveillance, or before, in Norway (mainland) or Finland, even though the parasite has been found present in Sweden situated midway between these two countries. In Sweden, however, the latest available prevalence figure in red foxes is around 0.1%, one tenth of the design prevalence of the ongoing surveillance. Looking backward, accumulated evidence during the past decade has corroborated the view that Norway (mainland) and Finland may actually have been free of *E. multilocularis*. The latest surveillance report is from 2020 and available from the EFSA website https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2021.6945

On the ground at COP26 in Glasgow: Dr. Alonso Aguirre shares his experience

Pictures and content by A. Alonso Aguirre; edited by Aikwan Chong

Previously published at GMU News Website.

The 26th UN Climate Change Conference of the Parties (COP26) was held in Glasgow from 31 October – 12 November 2021. Department of Environmental Science and Policy Chair Professor A. Alonso Aguirre attended the event as part of the Global Council for Science and the Environment (GCSE) COP26 delegation, and also representing the College of Science at George Mason University. In a series of pictures and daily logs, Dr Aguirre shares with us his experience on the ground at COP26 in Glasgow.

What exactly is COP26 and why is it important? Read the full text of COP26 Explained.

What needs to be achieved at COP26? Four goals, as outlined below:

1. Secure global net zero by mid-century and keep 1.5 degrees within reach
2. Adapt to protect communities and natural habitats
3. Mobilize nance
4. Work together to deliver

My first days were spent learning about water, impacts of climate to the European Union, and Brazil and Colombia's approaches to reach net zero and green businesses.

Some thoughts to share:

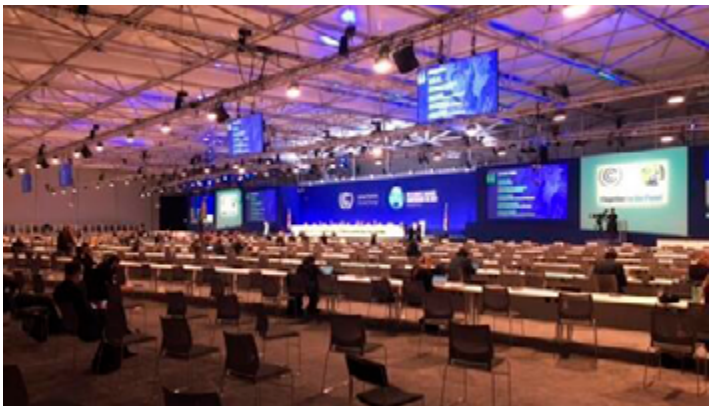
- There is a major imperative of climate action to protect human health. I will go further and say- to protect the health of all species in the planet. We need to have a clear understanding on how human, animal, plant and ecosystem health connect through One Heath/Planetary Health. This will be the only way forward to implement change.
- The Arctic and Mediterranean regions are warming faster than any other regions on the planet, and integrated strategies for mitigation and adaptation are needed.
- The political, social, and economic benefits of changing our ways are obvious, but we need to make a case for the general public to understand climate is changing, the poles are melting, and we cannot continue with business as usual. Knowledge through research and integration of databases is key.
- Transdisciplinary collaborations are instrumental in reaching out to climate change, health, biodiversity and sustainability communities. We call them communities of practice. These need to be integrated to implement practical solutions to bring mitigation and adaptation together.
- I am optimistic that this meeting will be able to steer the future of humanity for a positive outcome. Water is vital and we need to reach out to all scienti c communities across disciplines, ecosystems, and species that will link science, practice, communication, and transformative change.

Aguirre at the Japan pavilion where they were taking photos with a barcode.

COP26 is considered to be one of the most important COPs due to the urgency to reduce emissions 50% globally by 2030 and to net zero by 2050. The event drew massive crowds - over 40,000 were registered to attend, doubled from the last UN climate conference in 2019.

The organizers were overwhelmed during the first days of the conference, where all participants needed to show proof of COVID testing in a daily basis. The first days would take up to 3 hours (!) to get into the venue.

On my second night, I watched a wonderful concert: Vital Signs of the Planet Concert at the Glasgow Royal Concert Hall which included new footage of climate change from NASA and National Geographic. It was the most beautiful live show I have seen in years. The Royal Orchestra performed impressive and powerful pieces, starting with Vivaldi's Four Seasons, giving us hope. The voice of a young leader from indigenous peoples in Panama, a young YMCA leader in Ghana, and a National Geographic Explorer were among those who asked for the opportunity to act now, to let them contribute to change our ways. The new generation is ready and is acting to implement transformative change, applying nature-based solutions and breaking down disciplinary barriers. This was a wonderful evening bringing science and the arts together by connecting our foundational knowledge (what we know), our humanistic knowledge (what we value), and our metaknowledge (how we act).



Plenary session at the Blue Zone: Leaders, mostly behind closed doors, discussed many decisions that need to be made moving forward to achieve the IPPC 2021 targets.

Youth voices for climate justice - young people are ready to tackle climate change, the largest threat to humanity, as theirs and their children's futures are threatened.

Last night, the young professional musicians, the artists and the performers brought us together in a truly amazing transdisciplinary and transformative experience of Science+Art at its best.

WHO representatives called this meeting the first COP for Health after 26 COPs. Finally, Health is on the COP agenda. Many countries opposed adding this topic in the past because they didn't want to be sued "for killing people." In fact, ~7 million premature deaths occur globally every year due to air pollution alone. Data was presented on the benefits of carbon reduction on air quality. Sophie Szopa, coordinating lead author of Chapter 6 of the AR6 IPCC WG1 IPCC 2021 report, added that a reduction of air pollution leads to a slight additional warming due to decrease of aerosols; however, the net warming will be lower in the long term. Also, methane has a pivotal role and needs to be mitigated. Decarbonization will need strong systemic changes in all sectors.

Policies across sectors and international organizations need to be integrated in order to be successful and begin to focus on achieving the SDGs as One Health/Planetary Health overlap with all 17 objectives. These integrative, transdisciplinary, and transformative approaches need to reach governments, NGOs, the private industry, policy makers and the general public.

Youth Voices for Climate Justice-Climactivists from the world rewriting COP26's agenda was a wonderful panel of five young advocates in their early 20's, and moderated by Jacopo Bencini from the Italian Climate Network and Serena Bashal from the UK Youth Climate Coalition Ltd. hosting a diverse, inclusive panel from Africa, Europe, Middle East and Latin America.

A peaceful march of over 100,000 people, led by Greta Thunberg. They marched to downtown Glasgow on Saturday, November 6th.

All panelists pleaded for an opportunity to fully participate in the decision-making process during the negotiations at the closed sessions of the summit. They referred to the lack of inter-generational justice, equity, and inclusivity. They stated that young people are ready to tackle the largest threat to humanity as it is their lives and their children's future which are being threatened by climate change.

(From left to right) Kathleen Rogers, President, EARTHDAY.ORG; Haldis Holst, Deputy General Secretary, Education International; Stefania Giannini, Assistant Director-General, UNESCO; A.A. Aguirre, and Moderator Andrew Jack, Global Education Editor, Financial Times.

There are many youth organizations across the planet rewriting policies and statements for this and the upcoming COPs, expressing many emotions described as eco-anxiety: feeling discouraged, frustrated, guilty, worried, and having an urgent need to implement change. Organizations such as We Are Tomorrow Global Partnership are showing solutions, implementing actions, and they want to collaborate globally with decision makers on the climate change agenda. There is no better time to launch the Global Youth Science Partnership next week here at COP26.

Country negotiations to implement change is a long and slow process. The future generations are concerned that there is no time left. Since I arrived at COP26, I have felt that my presence here was more self-serving than contributing to the progress of negotiations that have already occurred. However, I was happy to have had the opportunity to participate and share my point of view as part of a roundtable "Why Climate Literacy & Civic Skill Building Will Solve the Climate Crisis- Answers from Civil Society, Educators, and Governments" hosted by EarthDay.org

One of the focuses of COP26 was on land use change and nature to address deforestation and to accelerate sustainable agriculture. Leaders of 105 countries covering 85% of the forests in the planet announced the "Action on Forests and Land Use" initiative to end deforestation by 2030 by "promoting and inclusive rural transformation" and committing over USD 22 billion. This has been declared in past COPs, but now we have the governments, leaders, youth organizations, companies, financial actors, and entrepreneurs, united and committed to achieve this.

A panel on SMEs (small to medium enterprises) organized by GEFs on sustainable agriculture and forests

A. A. Aguirre (George Mason University, Fairfax, Virginia, USA) and Alex Godoy-Faúndez (School of Engineering, Universidad del Desarrollo, Santiago, Chile), both delegates representing the Global Council of Science and the Environment at COP26, Glasgow, Scotland.

discussed the Sustainable Riceland Initiative to transform food production in partnership with industry and local communities in Indonesia. Several actions including how to focus on healthy soils and biodiversity included farmer practices through procurement requests to make the government aware and apply science and practice on the ground including coordination with 6 UN organizations linking health and environment. Also, Paraguay has implemented specific initiatives with the directive of maintaining carbon in soil using/recycling previous harvests. Their minister of environment highlighted that they would halt early transformation of land use and apply sustainable livestock pasture systems; for example, multi-crop multi-livestock sustainable approaches like soybean and meat production will be important moving forward.

I was also made aware that PlugAndPlay, a company that connects blue chip corporations to the brightest startups across the globe, had developed a sustainability program focused on three key words: produce, protect, and include. There is no good or bad in sustainability, but it is just a state of transition. Many landscapes and multi-holder organizations need to be connected. We need to bring investment for large scale transformation; for example, the Cocoa Forest Initiative in many countries is bringing social and environmental change. In addition, we need to fund partnerships close to forest hotspots and not away as we may be financing farmers who don't need those incentives.

My thought is that focusing on zero deforestation will require legislation to end deforestation in many countries. We have partly reduced cutting forests and changed agricultural use, but illegal systems and corruption continue to happen and these practices need close monitoring. Perhaps a series of incentives to farmers linked to environmental services can promote major productivity while protecting forests. Net zero is a weighing point. Companies need to be ambitious and engage in the supply change. The current momentum that is building should be used to tackle deforestation.

During the last day of COP26, over 200 countries struck a deal to do more for climate change. Wealthy nations will double their commitments and funding by 2025 to reduce emissions and reduce fossil fuels globally. However, youth and many activist groups believe that these agreements won't do enough, that better deals and more commitments should have been accomplished to reach our planetary goals. While talking to my fellow GCSE delegate Diane Husic, we discussed attending this

US climate envoy John Kerry in many of his engagements at the US Center Pavilion, is con dent of an agreement at COP26. "Negotiators from almost 200 governments are trying to strike a deal on how we tackle climate change." BBC, 2021.

conference as a unique experience to think about what we see/learn/think- an experience most people in the world would never get to experience. It was an opportunity to network and create new friends and relationships that will impact not only ESP, but COS and the University. As Diane told me, "One of our responsibilities is to seriously consider *what we each do* with this information when we go back home." Most importantly, our attendance at COP26 increases our credibility with state and local decision makers. Perhaps I can provide input for policy development related to adaptation, risk reduction, and capacity building on climate change in Virginia. I am hopeful for the future of humanity, species, and ecosystems. Together, we will take care of the "little blue dot."

Quarterly Wildlife Mortality Report *January 2021*

Written and compiled by members of the U.S. Geological Survey's National Wildlife Health Center.

West Nile virus infection in a gray squirrel from Wisconsin

In September 2021, the Wisconsin Department of Natural Resources (WI DNR) reported a mortality event involving two eastern gray squirrels *(Sciurus carolinensis)* and three eastern cottontail rabbits *(Sylvilagus floridanus)* from a residential neighborhood in Madison, Wisconsin, to the U.S. Geological Survey's National Wildlife Health Center (NWHC). The animals were reportedly ataxic and unable to stand. WI DNR submitted one squirrel and one rabbit found dead to NWHC for cause-of-death determination.

On examination at NWHC, the squirrel was a juvenile in fair body condition and the rabbit was an adult in emaciated body condition. There were no significant gross abnormalities in either animal. Microscopic assessment of the squirrel revealed chronic inflammation in the brain (Figure 1; lymphoplasmacytic meningoencephalitis) and heart (myocarditis) and tissues tested positive for West Nile virus (WNv) by PCR and virus isolation. There were no significant microscopic findings in the rabbit to indicate a cause of emaciation, neurologic signs, or death. Tissues from the rabbit were negative for WNv by PCR and virus isolation; rabbit hemorrhagic disease virus-2 was not detected by PCR. The cause of illness and death of the rabbit was not determined.

Tree squirrels, including eastern gray squirrels, are reported to be among the mammals most susceptible to WNv infection and disease. Squirrels may shed WNv in oral secretions and even infect mosquitoes due to high viremia (Padgett et al. 2007). Microscopic findings of meningoencephalitis and myocarditis in this gray squirrel from Wisconsin are similar to those reported in WNv-positive gray and fox squirrels *(Sciurus niger)* from Illinois (Heinz-Taheny et al. 2004). Eastern cottontail rabbits have proven to be susceptible to WNv in laboratory settings and can also develop viremias capable of infecting mosquitoes but are not known to develop clinical disease (Tiawsirisup et al. 2005).

The NWHC would like to thank the Wisconsin Department of Natural Resources for their continuing partnership and for submitting this case which is also chronicled in the NWHC Case of the Month.

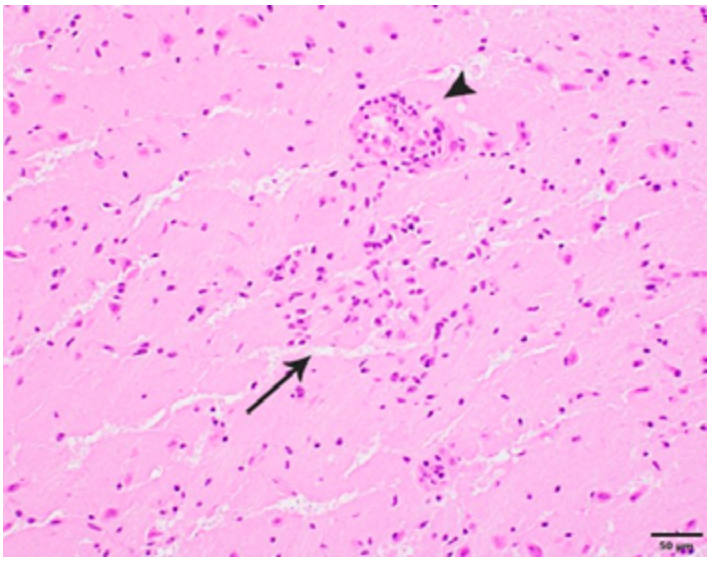


Figure 1. Photomicrograph of eastern gray squirrel brain. Microscopically, there are areas of gliosis (arrow) and lymphoplasmacytic perivascular cuffing (arrowhead) throughout the brain. Hematoxylin and eosin. Photo credit: Dr. Julia Lankton, NWHC.

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Highly Pathogenic Avian Influenza in Newfoundland and Labrador, Canada

In December 2021, highly pathogenic avian influenza (HPAI) subtype H5N1 was confirmed in both domestic fowl at an exhibition farm and a great black-backed gull *(Larus marinus)* in the Avalon Peninsula of Newfoundland and Labrador, Canada. This followed a substantial number of HPAI H5N1 outbreaks in Europe during the fall of 2021, with 867 detections reported in 27 European Union countries. Based on this high level of disease activity, the European Food Safety Authority cautioned "the observed persistence and continuous circulation of HPAI viruses in migratory and resident wild birds will continue to pose a risk for the poultry industry in Europe for

the coming months" (Adlhoch et al. 2021). Phylogenic analyses indicate that the viruses confirmed in Newfoundland and Labrador correspond to the Eurasian H5N1 virus circulating in 2021 (Immediate Notification to OIE). Phylogenetically, all eight gene segments of the Canadian virus are related to the clade 2.3.4.4b H5N1 virus currently circulating widely in wild birds and poultry in Europe (OFFLU 2021). While it is uncertain how the virus was introduced to Canada, movement by wild waterfowl is suggested (OFFLU 2021).

Despite ongoing monitoring for this pathogen, these are the first detections of HPAI H5 in North America since the summer of 2015. Most recently, the U.S. Department of Agriculture – Animal and Plant Health Inspection Service – Wildlife Services, in partnership with state and tribal natural resource management agencies and the National Animal Health Laboratory Network, completed fall waterfowl sampling in the U.S. called for in the Implementation Plan for Avian Influenza Surveillance in Waterfowl in the United States, and HPAI was not detected in the nearly 6,000 samples collected.

In recognition of the high level of HPAI activity reported to the Organisation for Animal Health (OIE) in 2021 (Figure 2), the U.S. Geological Survey's National Wildlife Health Center (NWHC) issued expanded submission criteria for HPAI, and issued a Wildlife Health Bulletin in early December calling for increased vigilance. Pursuant to the initial detection of HPAI H5N1 in Newfoundland and Labrador, the U.S. Interagency Steering Committee for Highly Pathogenic Avian Influenza is calling for enhanced sampling of avian morbidity/mortality events by state, federal, and tribal natural resource professionals, especially those events including:

- Mortality involving five or more waterfowl (ducks, geese, or swans) or other water birds (loons, grebes, coots, shorebirds, or wading birds such as egrets, herons, or cranes)
- Mortality involving any number of raptors or avian scavengers (e.g., ravens, crows, gulls)
- Morbidity involving raptors, waterfowl, or avian scavengers (e.g., ravens, crows, gulls) observed with clinical signs consistent with neurological impairment
- Mortality events involving any species of birds that exceeds 500 animals

As the initial gull cases in Newfoundland and Labrador exhibited neurological signs and were collected by wildlife rehabilitators, state natural resource agencies may consider alerting rehabilitators in their states to be vigilant for birds exhibiting signs consistent with neurological impairment.

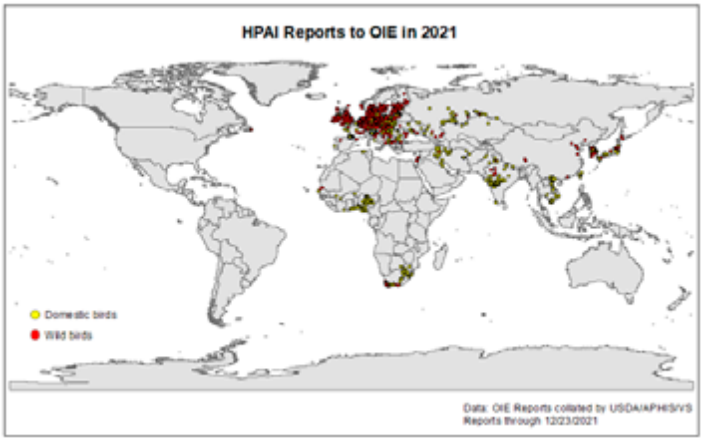

Figure 2. Reports of HPAI to the OIE during calendar 2021 (through 12/23/2021). Collated OIE reports provided courtesy of USDA – APHIS – Veterinary Services.

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SARS-CoV-2 in white-tailed deer

As SARS-CoV-2, the virus that causes COVID-19 in humans, continues to spread globally, questions have emerged about the potential for humans to transmit the virus to North American wildlife, its potential effects on native wildlife populations, and the resultant possibility and consequences of establishing a persistent wildlife reservoir. One method for predicting the potential susceptibility of wildlife species to SARS-CoV-2 infection is comparative and structural analysis of the angiotensin-converting enzyme 2 (ACE2) receptor, the binding site for the SARS-CoV-2 spike protein. Damas et al. (2020) found that the white-tailed deer (WTD, *Odocoileus virginianus*) ACE2 receptor has a "high propensity for binding the SARS-CoV-2 spike protein," and therefore concluded that WTD may be susceptible to infection.

During 2021, subsequent reports demonstrated the susceptibility of WTD to SARS-CoV-2 and provided evidence of

exposure and transmission in both free-ranging and captive populations. Those reports include the following:

- Palmer et al. (2021) determined that WTD fawns were susceptible to subclinical infection with SARS-CoV-2 in a controlled indoor study, that the infected fawns did not display clinical signs of disease, and that the fawns actively shed virus in nasal secretions and were able to transmit the virus to uninoculated contact fawns in the same facility, separated by a plexiglass barrier.
- Martins et al. (2021), in a follow-up study, showed that inoculated WTD fawns shed infectious virus up to five days post-inoculation, with high viral loads shed in nasal and oral secretions. Uninoculated control fawns commingled with infected fawns beginning on day three post-inoculation became infected as well, with viral RNA loads measured in nasal turbinate, palatine tonsil, and medial retropharyngeal lymph nodes comparable to those observed in inoculated animals.
- Chandler et al. (2021) documented exposure of wild WTD to SARS-CoV-2 in four states (Illinois, Michigan, New York, and Pennsylvania) via serology. Antibodies to SARS-CoV-2 were detected using a surrogate virus neutralization test in 154 of 385 samples (40%) collected in 2021, with seroprevalence between 50 and 100% in 11 of 33 sites sampled.
- Palermo et al. (2021), using a standard plaque reduction neutralization assay, showed that 37% (20/54) of samples collected from WTD in Travis County, Texas, in 2021 were positive for antibodies to SARS-CoV-2.
- Kuchipudi et al. (2021) utilized archived retropharyngeal lymph nodes from WTD collected in Iowa in 2020 to demonstrate widespread SARS-CoV-2 infection in WTD. Positive samples (94 of 283, i.e., 33%, were positive for SARS-CoV-2 RNA via RT-PCR*) were collected from captive and free-ranging populations in ten Iowa counties, with apparent prevalence rising to over 80% in samples collected during the early winter of 2020/2021. Twelve SARS-CoV-2 lineages were detected, and the geographic distribution and nesting of clusters of deer and human lineages led the authors to conclude there were likely "multiple zooanthroponotic spillover events and deer-to-deer transmission."
- Hale et al. (2021) confirmed SARS-CoV-2 via rRT-PCR** in 129 of 360 (36%) deer collected from nine sites in northeast Ohio in early 2021. Three virus lineages were detected, and the researchers concluded that SARS-CoV-2 "spilled over multiple times into deer populations in different locations" and that "deer-to-deer transmission may have occurred in three locations."

Based on the work completed to date, it is apparent that WTD are susceptible to infection with SARS-CoV-2, that, via undefined mechanisms, they have been repeatedly exposed to the virus in the wild across broad geographic areas, and that once infected they mount an immune response and may infect other herd members, apparently without clinical disease impacts at either the individual or population level. What remains unclear is whether WTD will be a persistent reservoir of SARS-CoV-2, and what risk, if any, this poses to humans or other animals. To further our knowledge of SARS-CoV-2 in WTD, the U.S. Department of Agriculture – Animal and Plant Health Inspection Service – Wildlife Services is working with multiple state natural resource agencies to assess a broader spectrum of WTD for SARS-CoV-2. To address potential human risk, the Centers for Disease Control and Prevention (CDC) has issued guidance for hunters, out of an abundance of caution, that includes "wearing rubber or disposable gloves," "wearing a mask to reduce your risk of coming into contact with pathogens transmitted through respiratory droplets," and "cooking all game meat thoroughly (to an internal temperature of 165°F or higher)." The CDC guidance is echoed by the Association of Fish and Wildlife Agencies, who modified their Guidance on SARS-CoV-2 and Free-Ranging White-Tailed Deer to recommend "following the same guidelines recommended to reduce human to human infection (i.e., wearing gloves and masks when handling the deer, and hand washing after handling the deer)." Multiple state agencies also issued specific guidance for deer hunters, including the Wisconsin Department of Health Services, who, in addition to the CDC guidance, recommended that "if you are immunocompromised, consider asking for assistance with carcass processing and handling."

* RT-PCR: Reverse Transcriptase Polymerase Chain Reaction

**rRT-PCR: Real-time Reverse Transcriptase Polymerase Chain Reaction

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For additional information on the USGS National Wildlife Health Center see the following links:

- *Main website: www.usgs.gov/nwhc.*
- *Disease Investigation Services: www.usgs.gov/nwhc/services.*
- *Report Mortality Events and Submit Specimens: www.usgs.gov/NWHC/submit.*

To view, search, and download historic and ongoing wildlife morbidity and mortality event records nationwide visit the Wildlife Health Information Sharing Partnership event reporting system (WHISPers) online database: http://whispers.usgs.gov/

http://conferences.union.wisc.edu/wda2022

February 2022 Student Corner

Marianthi on a Mission

Sarah Sirica, Newsletter Editor

In case you haven't noticed, the Student Corner of our Newsletter has been very busy over the last few years! If you have journeyed this far down the page, you will have noticed that with every newsletter, there have been new opportunities for students: virtual and in-person education seminars, an intense rehaul of our mentorship programs, and redefining updates to grants for science and travel. This has been happening despite a major world-shifting pandemic that has affected everyone in our international membership.

The woman behind it all has been the Chair of the Student Activities Committee at WDA, Marianthi Ioannidis. Marianthi officially started this roll in October of 2018. She liked it so much, and was so successful, that she was re-elected to the position for a second term. In addition to this role where she receives daily emails and maintains contact with student members across the globe, she has been on her own education journey. Marianthi is originally from Brussels, where she completed her Bachelor of Veterinary Medicine at the University of Brussels, and continued to her Master's in Veterinary Medicine at the University of Liège. She worked as a locum veterinarian in France and later moved to The Netherlands to start a residency in anatomic pathology at the University of Utrecht. She is finishing up and all set to graduate in a year! So, between finishing her schooling and revolutionizing the WDA SAC, she's had her hands full.

With her time as chair of the SAC, Marianthi has lead students and the WDA council towards new and exciting prospects for growth and change. Once in leadership,

she was able to work on updating the student chapter grants in a more defined organization, developing the Blossom and Seed Grants. There was a new award developed in partnership with BioOne, and her involvement with the WDA Student Awards was a highlight of her time. She has also been part of managing major financial contributions to student workshops, both before the International Conferences in 2019 in California, and the one set for this year in Wisconsin, as well as the EWDA student workshops in Lyons and virtually. There have been less travel grants and grant requests to start up new student chapters during her tenure due to the COVID-19 pandemic, but she has been able to work with council to pivot some of those funds towards building a new mentorship program.

The mentorship program's pilot will have 30 mentor-mentee pairs, and is in collaboration with WDA, EAZWV and EAAV and will kick off in a few months

and last until 2023. She was able to secure a grant for €5,000 from the Morris Animal Foundation, with an additional €3,000 to be split between the participating organizations, to cover the costs of a company specialized in developing mentorship programs.

In addition to this formal mentorship program development, Marianthi has been growing a network of students online through various social media platforms. This has been a game-changer at connecting students from Europe and North America, as well as the WDA-AP, WDAA, and WDA-AME student communities. There is now a monthly online seminar in collaboration with the Zoo and Wildlife Medicine Study Group that is arranged by rotating student chapters on an applicable topic with interesting and varied speakers. Marianthi said that this has been a great way to highlight motivated students, and she was able to use this platform to foster the growth of a new student chapter in North America who will coordinate the pre-conference student workshop!

Speaking of motivated students, Marianthi was overwhelmed with excitement that during her tenure the first official student chapter in the WDA-Asia Pacific section was created, based in Taiwan. She had been concerned that there may be language or cultural barriers limiting the interaction of this corner of the world, and wants the SAC to have a balanced, globally-accessible feel. This first new chapter meant another opening to broader perspectives and greater knowledge sharing between students internationally, and she is thrilled.

When we chatted about how COVID-19 had affected the student members of WDA during her time, she mentioned disappointments such as losing student chapters due to lack of activities or even the ability to be active based on various struggles, and a decline in grant applications. However, it did give the SAC the opportunity to start the monthly online seminars, which have been at no cost to the chapters thanks to a Zoom account with webinar features that WDA has covered. Those seminars and a burgeoning online community of students have strengthened the student membership in new ways, and in an increasingly-virtual future, will likely be a building block to greater things.

As she winds down her term with the SAC, she does have a few pieces of advice for the next chair. The most important of which she says, is “do not hesitate

to delegate!” She says the next student chair should be ready for daily emails and lots of coordination with global members. One highlight is in fact interacting with students from around the world, and learning about the various scientific cultures and points of view that make this such a culturally-rich organization. Keeping an open mind has benefited her throughout the last few years.

Lastly, she wanted to make sure that she extended a huge thanks to everyone involved in WDA, because the last few years have benefited her in numerous ways that she never expected. She said that she will be extremely busy finishing the end of her residency, but she will miss her daily interactions with the global student community as she transfers the reigns to the next chair.

You can meet her virtually, or at the next International Conference – be on the lookout for signups to be involved with the mentor mixer and photo contest, both of which have been updated during her time as chair.