SCWDS BRIEFS

A Quarterly Newsletter
Southeastern Cooperative Wildlife Disease Study
College of Veterinary Medicine
The University of Georgia
Athens, Georgia 30602

Fall 2023 Volume 41 Number 3

Eds. M. Ruder and B. Kurimo-Beechuk

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SOUTHEASTERN COOPERATIVE WILDLIFE DISEASE STUDY

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Cervid Health Updates

NAS CWD Review

The National Academies of Sciences, Engineering and Medicine (NAS) has appointed an ad hoc committee of experts to review the current state of knowledge regarding the transmission modes and the methods of geographic spread of chronic wasting disease (CWD)

White-tailed deer, D. Carter

in free-ranging and captive cervids. The formal title of the study is Review of Transmission and Geographic Spread of Chronic Wasting Disease in U.S. Cervid Populations, and it is being conducted in response to a congressional request within America's Conservation Enhancement (ACE) Act of 2020. The intent of this review is to bring the best available science and management recommendations to all management and regulatory bodies from a trusted and unbiased source.

The committee began meeting in October and will write a report, based on its review of published and ongoing research on CWD, that addresses the state of knowledge regarding the following four topics:

- The infectious dose of CWD and different modes of disease transmission among cervids;
- The means of geographic spread through cervid dispersal, scavenger activity, and human actions (including carcass handling, transport, and disposal management; live animal transport; and fodder source and transport);
- The effectiveness of interventions to reduce transmission and/or geographic spread of the disease; and
- The population-level and economic impacts of CWD and the effectiveness of different interventions to reduce those impacts.

Expected outcomes from the 12-person committee of subject matter experts include the report that is intended to provide directly actionable recommendations for limiting the spread of CWD and its impacts on wild and captive cervids and stakeholders, and to identify specific, applied science gaps that need to be addressed to direct CWD management actions. Findings of the committee will be used to inform discussions and decisions of a new Federal/State/Tribal/NGO Task Force that is called for in the ACE Act. This Task Force will develop an action plan that gives State and Federal Governments, Tribes, the captive cervid industry, hunters, and landowners specific recommendations to promote consistent and coordinated management and focused, prioritized research to reduce the spread and mitigate the impacts of CWD.

This review is sponsored by the U.S. Department of Agriculture - Animal and Plant Health Inspection Service, U.S. Fish and Wildlife Service, and the U.S. Geological Survey. More information, including videos of committee meetings, is available at the **National Academies website**.

Prepared by John Fischer with information available through the NAS website

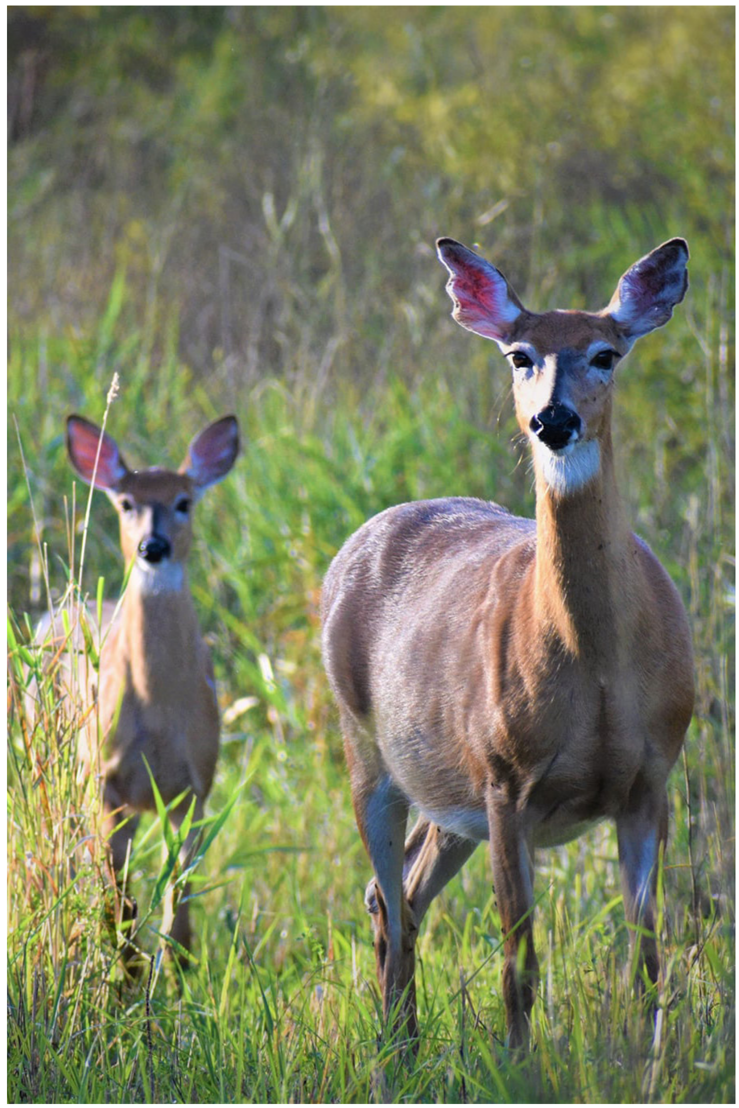
CWD Detected in Kentucky

On December 7, 2023, the Kentucky Department of Fish and Wildlife Resources (KDFWR) announced the first detected case of chronic wasting disease (CWD) in the state. The positive animal was a free-ranging, 2 ½ year old, white-tailed buck harvested by a hunter in Ballard County in November. The positive deer showed no signs of clinical disease and was sampled as part of the KDFWR's CWD surveillance program.

Ballard County is near the western-most tip of Kentucky, where it borders southern Illinois and Missouri. It is adjacent to the 5-county CWD Surveillance Zone established in 2021 as part of the Kentucky CWD Response Plan following CWD detection in a neighboring portion of Tennessee. Submission of samples for CWD testing is mandatory from hunter-harvested deer in the Surveillance Zone during the first three days of modern firearms season. In addition, KDFWR provides sites across the state where hunters may voluntarily bring deer heads to be sampled and tested for CWD. This voluntary system netted Kentucky's first CWD detection. Surveillance for CWD in Kentucky is accomplished with the collaboration of hunters, taxidermists, processors, diagnostic laboratories, and other government agencies. Since 2002, more than 40,000 wild deer and elk have been tested for CWD throughout the state.

As of December 2023, CWD has been detected in free-ranging deer, elk, and/or moose in 32 states. Georgia and South Carolina are the only SCWDS member states that have not detected CWD within their borders. Additional information about CWD in Kentucky can be found at the **KDFWR website**.

Prepared by John Fischer



White-tailed deer, D. Carter

Quail Parasites and Pathogens

For the past several years, SCWDS has collaborated with the Oklahoma Department of Wildlife Conservation on pathogen surveillance to better understand health threats to Northern Bobwhite in Oklahoma. The research was the focus of Seth Wyckoff's Master's research project at SCWDS.


A researcher holds a bobwhite, S. Wyckoff

Range wide, bobwhite populations have been declining with complete disappearance in some northern areas. Annually, the bobwhite population has undergone a ~4% decline per year, resulting in an 85% decline since the mid 1960's. Oklahoma has one of the highest remaining bobwhite densities, but these populations are also experiencing a 31-year statewide decline. Potential causes for declines have been investigated for decades and include habitat loss and fragmentation and a variety of parasitic and infectious diseases. Although there have been studies on bobwhite ecology in Oklahoma, relatively little is known about parasites and pathogens in the region. In our study, we evaluated 206 bobwhite from western Oklahoma (9 sites) from 2018-2020 to investigate their health. Bobwhite were evaluated for gross and microscopic lesions and tested for selected parasites and pathogens. The findings from this research were recently published in two separate journal articles (see below), which we will summarize here.

In general, bobwhite were in good nutritional condition with ample muscle mass and fat stores and no significant gross lesions were observed; however, several pathogens of potential concern were detected. Antibodies to avian adenovirus, the causative agent of quail bronchitis, were detected in nearly 9% of bobwhite. Adult bobwhite can survive infection but younger bobwhite often develop more severe disease, and chicks <3 weeks of age can experience high mortality (e.g., 50%-100%). Although there are several reports of avian adenovirus infection in captive bobwhite, data on free-ranging quail are limited (i.e., one study in Florida reported a prevalence of 23% for antibodies to avian adenovirus). The evidence of avian adenovirus infection in bobwhite in Oklahoma is a potential health concern, especially for chicks. A low prevalence (2%) of antibodies to *Toxoplasma gondii* was detected. Bobwhite are highly susceptible to disease following experimental infection and can develop acute and chronic disease that are often fatal (e.g., 25% of bobwhites inoculated with a high dose of *T. gondii* died within a week). Despite the possibility of severe toxoplasmosis in bobwhite, there are few surveys for *T. gondii* in wild populations, although SCWDS has diagnosed toxoplasmosis in wild bobwhite from Georgia.

A low prevalence of haemosporidians was detected, including *Haemoproteus sp*. (1.5%), *Leucocytozoon schoutedeni* (1.5%) and *Plasmodium homopolare* (4%) haplotype 2 [lineage LAIRI01]). *P. homopolare* is a host generalist and has two haplotypes; H1 is widespread in the Americas and infects numerous bird species, primarily passerines and apodiforms while H2 is more restricted to the western United States and Galapagos Islands and has been reported from passerines, raptors, and galliforms (including masked bobwhite). Lesions in captive masked bobwhite and greater sage-grouse were potentially due to *P. homopolare* infection, which suggest this parasite can be pathogenic in certain species, although these birds had coinfections with other haemosporidians. The *Haemoproteus* lineage was novel and distinct from *Haemoproteus* lineages from captive bobwhite and other quail in California, Utah and Arizona. Our *Leucocytozoon* lineage was similar to *L. schoutedeni*, a parasite of chickens in Africa and Asia and possibly the United States (South Carolina). Since blood smears were not available, comparisons between *Leucocytozoon sp*. and *L. schoutedeni* were not possible. Blood parasites are of particular interest because environmental and climate change are altering the geographic ranges of these parasites and/or their vectors, which can affect disease risk.

There was no evidence of infection with or exposure to several pathogens including reticuloendotheliosis virus, West Nile virus (WNV), respiratory *Mycoplasma spp.*, *Pasteurella multocida*, intestinal *Eimeria spp.*, and oral *Trichomonas spp*. In recent years, SCWDS has investigated the disease threat WNV poses to various birds including bobwhite. Our research showed that adult bobwhite experimentally infected with WNV developed subclinical infections with low viremia titers and readily seroconverted. These results suggest that bobwhite have low susceptibility to WNV-associated disease and are unlikely to play a role in mosquito-bird transmission cycles; however, susceptibility of bobwhite chicks has not been evaluated, and some age variation in manifestation of WNV infection has been observed in other bird species.

We found a number of different endo- and ectoparasites in bobwhite, but two of these parasites cecal worms (*Aulonocephalus pennula*) and eyeworms (*Oxyspirura petrowi),* have garnered considerable interest in recent years due to data from Texas suggesting they could impact quail health. Cecal worms were detected in each year of the study and were the most common parasite detected. We also observed that bobwhite fat scores decreased as the number of cecal worms increased. This is especially important because previous studies in Texas found that more quail were infected and worm burdens were on average higher than what we found in Oklahoma. Thus, in areas with high worm burdens, this parasite could be a health concern. Bobwhites with lower fat stores are less likely to survive through periods of adverse environmental conditions.

Eyeworms have often been suggested as a threat to bobwhite health based on several studies from Texas. In Oklahoma, we detected a relatively low prevalence (5-15%) of eyeworms in bobwhite in all years, which was lower compared to recent studies in Texas (86%-100%). Similarly, the mean worm intensity in bobwhite in our study (mean 4, range 1-10) was much lower than those reported in Texas (mean 6-44, range 1-107). Because these worms are around and behind the eye, any tissue damage and even the presence of the worms themselves have the potential to impact vision and thus, could adversely affect foraging ability and predator avoidance. Although we did not find any inflammation associated with eyeworms in bobwhite in Oklahoma, inflammation and hemorrhage in tissues around the eye was reported in infected bobwhite from Texas.

Eyeworm (*Oxyspirura petrowi)* on the eye of a bobwhite from Oklahoma, S. Wyckoff

The lack of lesions observed in our infected bobwhite could be due to the much lower worm burdens we observed compared to previous studies in Texas. Despite the lack of inflammation noted, more work is needed to determine if their presence can alter behavior or foraging success of bobwhite, especially in areas where worm burdens are high.

We also found many other parasites that were not considered to be of health concern. Additional details on the pathogens discussed above as well as data on the other parasites detected (e.g., *Physaloptera*, *Sarcocystis*, cestodes, and ectoparasites) and exposure to selected toxicants and heavy metals are available in two of our recent publications: **Health**

impacts of gastrointestinal and ocular parasites in northern bobwhite in western Oklahoma, USA and **Surveillance for selected pathogens and parasites of northern bobwhite from western Oklahoma, USA** currently in press with the *Journal of Wildlife Diseases*.

Prepared by Michael Yabsley, Seth Wyckoff, Nicole Nemeth, Mark Ruder and Tell Judkins (ODWC)

HPAI: Remaining Vigilant

After a relatively quiet autumn in terms of reported detections and mortality events related to highly pathogenic (HP) H5N1 influenza A virus (IAV), these viruses are again being confirmed in wild avian species across much of North America, including in the southeast. SCWDS continues to pursue active research to better understand the seasonal, spatial, and population impacts of HP H5N1 IAV, and continues to test both wild avian and mammalian species for HP H5N1 IAV infection in support of our state and federal partners. Since January 2023, we have screened over 500 avian mortality submissions for HP H5N1 IAV. From January through May, this virus was confirmed in 38/193 (20%) of wild birds tested at SCWDS. However, from June through late-October, these viruses were not detected in 155 birds tested at SCWDS. Unfortunately, a different scenario is emerging more recently; from the end of October through December, these viruses have been identified in 53% (54/102) of birds tested. Detections of HP H5 IAV from mortality events involving larger numbers of birds included: black vulture mortality events in Tennessee and Georgia; snow, Ross' and cackling geese, trumpeter swan, bald eagle, red-tailed hawk and mallard duck in Kansas; greater white-fronted, Canada, and snow geese in Louisiana; and wood duck in South Carolina. Detections were also made in snow geese from Tennessee and Kentucky, as well as bald eagles in South Carolina and Florida, and a great-horned owl in Missouri. Some detections are pending confirmation. While there have been limited North American reports of mammalian infection with these viruses recently, the marked avian mortality attributed to HP H5N1 IAV that is being reported across the southeast and throughout the Mississippi Flyway highlights the need for continued vigilance for sick or deceased carnivorous mammals, as well as birds, in/near these outbreak scenarios.

As always, SCWDS is committed to assisting member states and regional partners in disease investigations. As we move through the winter months and continue to receive reports of large-scale mortality events across a range of species, please communicate with us about your plans for more targeted IAV surveillance (e.g., swab-based or serology from live captured birds/mammals, or dead bird/mammal sampling) and specific needs you might have.

Prepared by Becky Poulson

Sick and dead black vultures at a HP H5N1 IAV mortality event in Athens, Georgia during November 2023, M. Ruder

Turtle fraservirus 1

Turtle fraservirus 1 (TFV1) is a newly characterized pathogen that has been associated with severe disease and mortality events in multiple freshwater turtle species in Florida since January 2018. While the population-level impacts of this disease are not yet clear, freshwater turtle species are threatened by additional infectious diseases, as well as habitat loss and illegal collection for trade, making this an important pathogen for ongoing surveillance and research. The Florida Fish and Wildlife Conservation Commission (FWC) is conducting ongoing work to better understand this disease.

Healthy Florida softshell turtle, Hans Hillewaert (Wikimedia Commons)

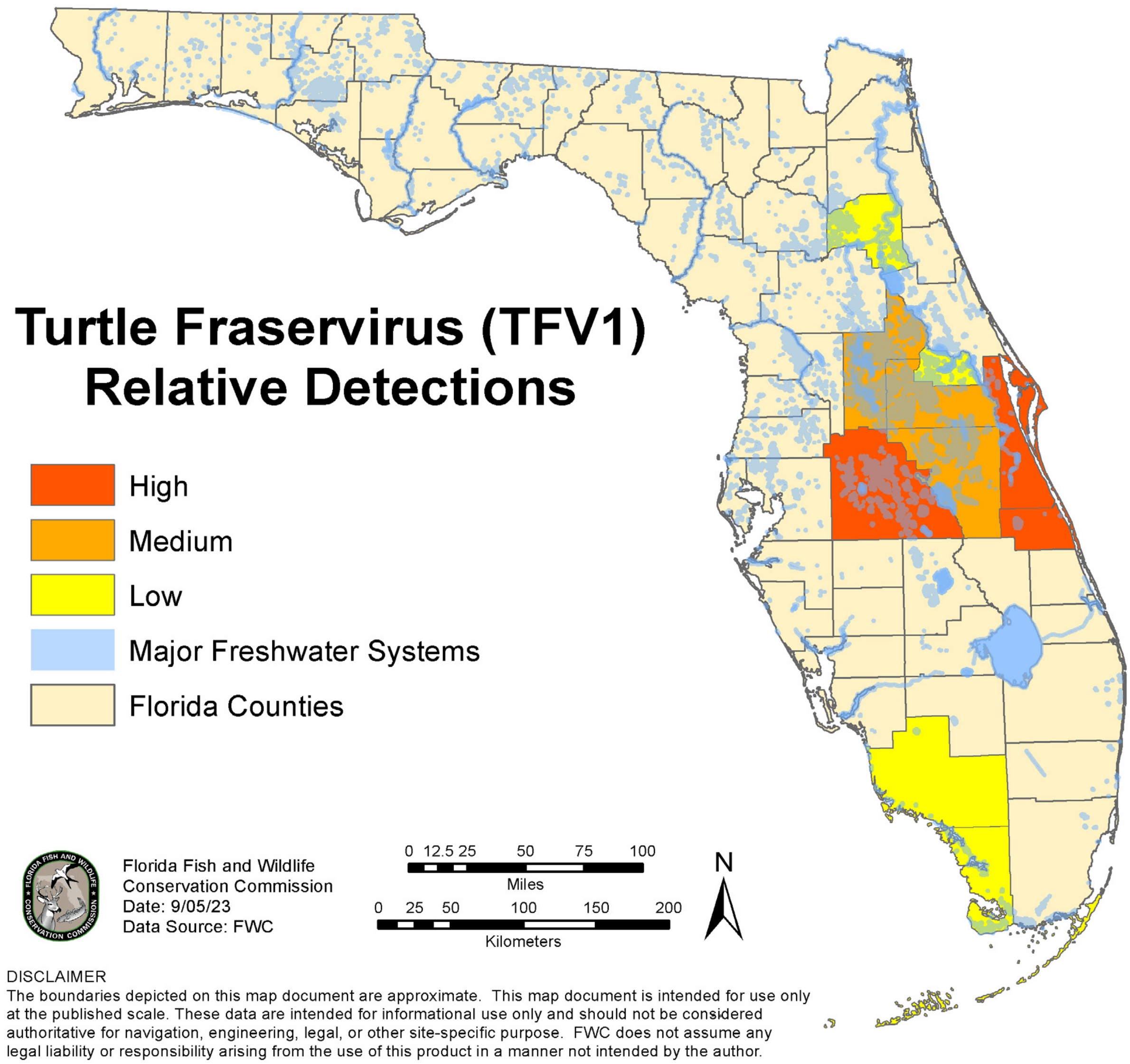
TFV1 is an RNA virus in the genus *Fraservirus* and family Tosoviridae that affects freshwater turtles. It was previously referred to as turtle bunyavirus (TBV). To-date, TFV1 has been detected in five turtle species in Florida: Florida softshells (*Apalone ferox*), peninsula cooters (*Pseudemys peninsularis*), Florida red-bellied cooters (*Pseudemys nelsoni*), pond sliders (*Trachemys scripta*; yellow-bellied sliders and red-eared sliders), and common snapping turtles (*Chelydra serpentina*). It is suspected that related turtle species may also be susceptible.

While the route(s) of transmission of TFV1 are still unclear, it is suspected that the virus is passed between animals through contact. TFV1 has been detected in multiple visceral organs, as well as the brain, and detection of virus in the kidneys and the urine suggests that shedding of virus in the urine may contribute to transmission. Transmission via vectors, such as leeches and mosquitoes, is also being explored as a possibility. The virus has been detected in both adult and immature turtles, and disease events are more commonly detected in winter and spring months.

Clinical signs of TFV1 disease may include all or some of the following: weakness, lethargy, swollen, closed or sunken eyelids, discharge from the nose or eyes, and splotchy red discoloration on the skin (especially on softshell species). Turtles with TFV1 may appear to have difficulty breathing, be reluctant to flee, and swim irregularly. Some infected Florida softshells demonstrate abnormal breathing, via extending and flexing their necks erratically.

Sick softshell turtle showing lethargy and neck extension, Florida Fish and Wildlife Conservation Commission

At this time, there is no evidence indicating that humans or wildlife other than turtles can be infected with TFV1. There are currently no known treatments for this disease. It is possible that TFV1 infects turtle species other than those listed above, so there are ongoing efforts to monitor all reports of sick and dead turtles to determine which species are susceptible to TFV1. In 2021, the FWC enacted an Executive Order prohibiting the take and transportation of certain turtle species to prevent further transmission in native turtle populations while more research is done to fully understand this disease. While the Executive Order is for specific turtle species, it is recommended not to move or relocate any turtle species to minimize potential spread. The current confirmed distribution (pictured below) of TFV1 is limited to the following 10 Florida counties: Brevard, Collier, Indian River, Lake, Monroe, Orange, Osceola, Polk, Putnam, and Seminole. However, sick and dead turtles have been reported across the state of Florida and in neighboring states along the Gulf Coast, and the full range of TFV1 within and beyond the state is unknown.



FWC has created an information page about TFV1 on their **website**, as well as an **online reporting system for the public**. Information provided from this **FWC website**, as well as a recent publication by **Waltzek and others, 2022**, was used in this article.

Prepared by Ellen Haynes, Lisa Shender (USFWS), and Rebecca Hardman (FWC)

Diagnostic Case Highlight

Anticoagulant rodenticide toxicosis in a gray squirrel

Anticoagulant rodenticide toxicosis is a relatively common cause of mortality in wildlife, particularly among small mammals such as squirrels. Unfortunately, other non-target species, including raptors, red foxes, bobcats, and black bears, have also been diagnosed with AR toxicosis at SCWDS. Intoxication typically occurs through direct ingestion of oral bait products put out for other target species, usually pest rodents. However, ingestion of prey or carrion that had recently ingested bait, and malicious intent, also occur.

The carcass of an eastern gray squirrel was collected by the Florida Fish and Wildlife Conservation Commission (FWC) during August 2023 and submitted to SCWDS for diagnostic evaluation. When initially observed by a private citizen, the squirrel's behavior was reportedly normal, but within 12 hours, it became lethargic, was struggling to move and breathe, and died shortly thereafter. Over a dozen other squirrels with a similar clinical presentation were observed in the same area in the preceding two weeks.

Postmortem examination revealed the squirrel to be in good nutritional condition. The skin of the inner thigh of the left hindlimb was bruised and the underlying muscle tissue was dark red due to hemorrhage. Subcutaneous tissues and internal organs (including liver and spleen) were pale. The stomach contained normal-appearing ingesta, consistent with a rapid onset disease process. Microscopically, there was a notable lack of circulating red blood cells in the liver and spleen.

Hemorrhage in the left hind leg of a gray squirrel diagnosed with anticoagulant rodenticide toxicosis, SCWDS

The clinical signs and postmortem findings in this squirrel were strongly suggestive of anticoagulant rodenticide (AR) toxicosis. A liver sample was submitted to the California Animal Health and Food Safety (CAHFS) Laboratory (University of California, Davis) for AR testing. Two AR compounds were detected: bromadiolone (5,400 ppb; reporting limit 50 ppb) and difethialone (150 ppb; reporting limit 50 ppb). Although diagnostic reference ranges for exposure versus intoxication are not established for squirrels, the concentrations detected in combination with the postmortem findings led to a diagnosis of AR toxicosis.

ARs disrupt vitamin K metabolism, which can impair normal blood-clotting mechanisms and lead to uncontrolled bleeding. Clinical signs may vary somewhat depending on the location of the bleeding. For example, intestinal bleeding may cause bloody stool, whereas bleeding in the lungs or chest cavity may cause difficulty breathing. More subtle clinical signs may also include weakness, decreased activity, and pallor (due to reduced blood in the vasculature from bleeding). Many animals are simply found dead. Common postmortem findings include generalized pallor of tissues and localized hemorrhage either within tissues (as in this case) or within a body cavity or organ. A definitive diagnosis requires toxicologic testing to detect a specific AR compound. ARs come in a variety of active ingredients and product formulations. First generation AR products are typically available to all general consumers and require multiple feedings to cause death, while secondar generation ARs, like bromadiolone and difethialone, tend to persist longer in the body and cause mortality after a single feeding. The increased potency and longer persistence in tissues of second generation ARs make them highly effective at pest control, but also increase the risk to non-target species. Accordingly, the Environmental Protection Agency (EPA) has restricted use of these products only for commercial and agricultural pest control.

Alternatives to AR use for rodent control are somewhat limited depending on the specific situation (i.e., location, target population density, etc.) In some regions, owl boxes have been deployed in an attempt to entice barn owls to inhabit areas for rodent control by acting as a “natural rodenticide.” Unfortunately, outdoor cats are also sometimes utilized for this purpose, which poses a significant threat to certain wildlife species as well.

Environmental alterations can be made to try to reduce habitat resources available to pest rodents. This can include removing potential food sources and replacing substrates that are easily appropriated to make burrows or nests. In situations where AR use is necessary, the EPA’s Integrated Pest Management principles should be utilized. Tunnel boxes with small openings to contain the rodenticide can limit exposure to larger wildlife species, although the risk for

Gray squirrel, B. Kurimo-Beechuk

consumption by predators who consume intoxicated rodents is unlikely to be mitigated. Due to the variety of circumstances that necessitate rodent population control, a single solution is unlikely. However, it is important to consider the potential impacts on wildlife health when deciding what kind of pest control modality to use. Raising awareness is key to reducing wildlife AR mortality. The SCWDS diagnostic service would like to thank Florida FWC staff for submitting this case.

Prepared by C. Robert Stilz, Mark Cunningham (FWC), and Nicole M. Nemeth

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Parting views from the Southeast

Golden silk orb-weaver, B. Kurimo-Beechuk