STATE OF MICHIGAN

DEPARTMENT OF NATURAL RESOURCES

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Michigan Wildlife Diseases:

http://www.michigan.gov/wd

Michigan Wildlife Diseases Manual:

http://www.michigan.gov/wdm

2019 Summary of Selected Michigan Wildlife Health Issues

Report to the Fish & Wildlife Health Committee

Association of Midwest Fish and Wildlife Agencies

Updated 03/23/2020

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Figure 1. Michigan counties and bordering great lakes.

BOVINE TUBERCULOSIS

Image 1. Heavily lesioned lungs of white-tailed deer. Photo: D. Kenyon.

Routine surveillance for bovine tuberculosis (*Mycobacterium bovis*; bTB) in free-ranging white-tailed deer began in 1995 after identifying a positive animal from northeastern Lower Michigan in late 1994. Surveillance in this area has been continuous ever since. In 2019, surveillance activities for bTB focused on an 11-county area of northeastern Lower Michigan. The 11 counties include: the 5-county area of Alcona, Alpena, Montmorency, Oscoda, and Presque Isle; and six counties surrounding this area: Cheboygan, Crawford, Iosco, Ogemaw, Otsego, and Roscommon. There was also increased surveillance around positive livestock herds in a 3-mile radius circle in Newaygo county as well as in 10-mile circles in Emmet, Lake, Ottawa, and Kalamazoo-Barry counties. Thirty-one white-tailed deer cultured positive (Figure 2) out of the 25,066 tested statewide. Since 1996, 4,201 elk have been tested, with seven testing positive since 2003; and 113 moose have been tested, with no positives detected. In 2020, intensive surveillance activities for bTB will continue in the 11 northeastern Lower Michigan counties, around any bTB-positive cattle herds outside of the 11 counties, and any animals from the remainder of the state submitted for testing.

Image 2. Example of close proximity between white-tailed deer and cattle in Michigan.

Since the index case was first identified, more than 315,000 free-ranging deer have been tested for bTB and 929 positive deer have been found. Approximately 97% of all positive animals were collected in the 5-county area (See Figure 2). Within the 5-county area, a core outbreak area has been defined as Deer Management Unit (DMU) 452, where approximately 80% of positive deer have been collected. The spatial arrangement of cases is highly clustered within DMU 452, in spite of relatively geographically uniform sampling effort. White-tailed deer are the maintenance host and primary reservoir for bTB in Michigan. Strategies for eradication of bTB continue to focus on reducing deer population densities to biological carrying capacity and reducing artificial congregation of deer by restriction or elimination of baiting and feeding. These strategies have been implemented via additional antlerless deer firearm seasons, additional antlerless deer licenses to reduce the deer population, and through the prohibition of deer baiting and feeding in Alcona, Alpena, Montmorency, and Oscoda counties. This ban has recently been extended (as of January 31, 2019) to Michigan's entire lower peninsula.

Over the past 25 years, hunters have played a critical role in the control of bTB in Michigan. However, demographic changes, primarily the aging of the “baby boomer” generation, have contributed to a loss of approximately 30% of hunters in the 5-county area since 2001, and is projected to average another 2-3% loss per year statewide for at least another decade. Consequently, the 5-county deer population has likely increased steadily from its twenty-year low of 70,659 in 2010. While current management efforts focus on increasing harvest per hunter, the time when bTB in deer could be kept in check with hunter harvest alone is coming to a close. Both prevalence metrics and modeling suggest that prevalence likely reached a low point in about 2011, and is likely to increase slowly but steadily for the foreseeable future.

BOVINE TUBERCULOSIS

Trend analysis of prevalence data from 1995 to 2019 indicates a statistically significant decrease. However, there is no significant trend in prevalence over the last five years (Figure 3), either in DMU 452 or in the remainder of the five -county area outside the core. Apparent prevalence in 2019 in DMU 452 was 2.1%, and 0.4% in the remainder of the five-county area outside DMU 452 (Figure 4). Although substantial progress has been made towards control of bTB in Michigan over the past two decades, those gains, and the investments made in obtaining them, may be lost. Strategies to maintain deer harvest in the face of declining hunter numbers and time spent hunting, a significant long term investment in vaccinating the deer herd, or a combination of the two, combined with maintenance of the recently imposed ban on deer baiting and feeding the entire Lower Peninsula, will likely be critical to sustaining gains made to date.

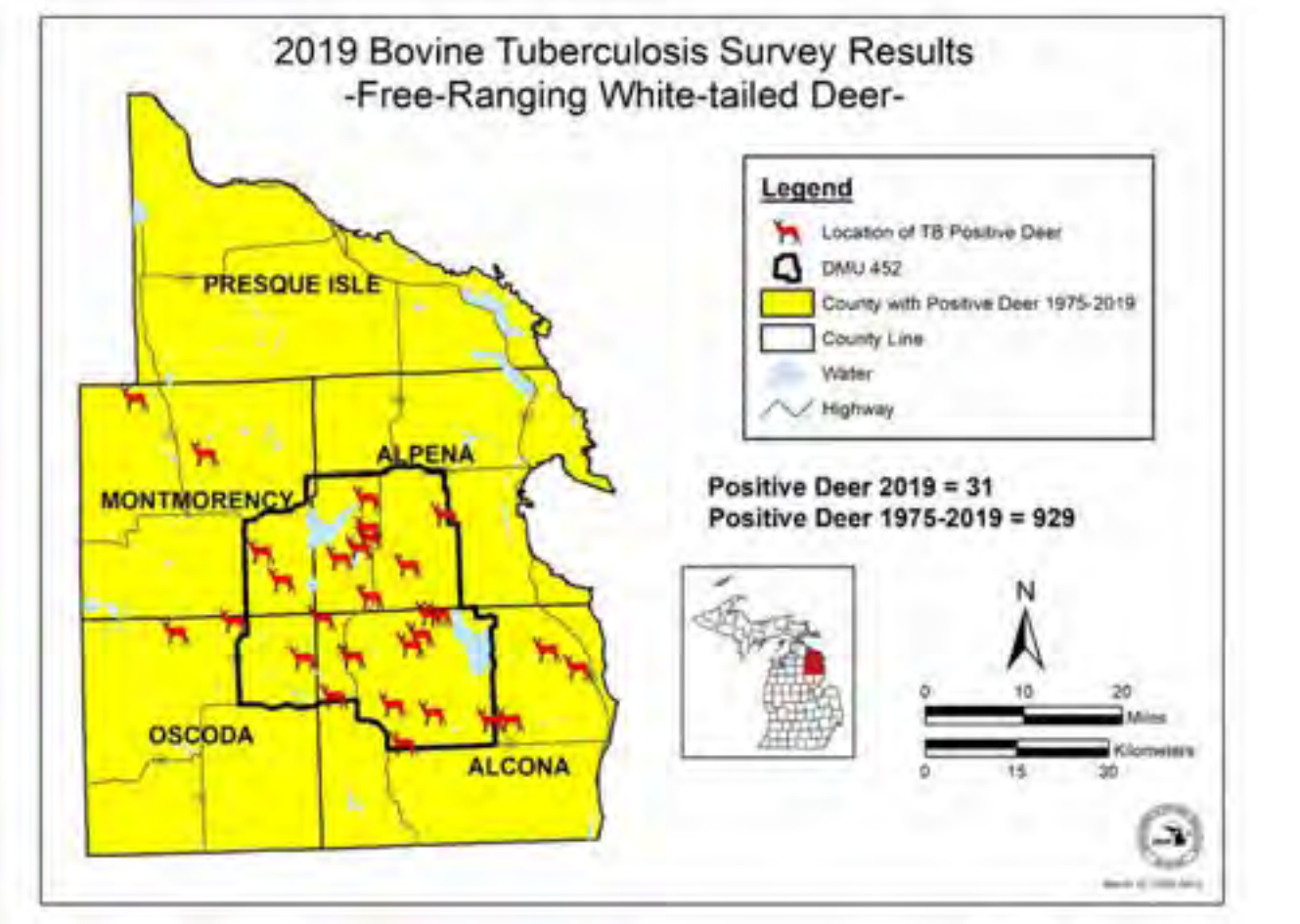


Figure 2. White-tailed deer positive for bovine tuberculosis in 2019.

BOVINE TUBERCULOSIS

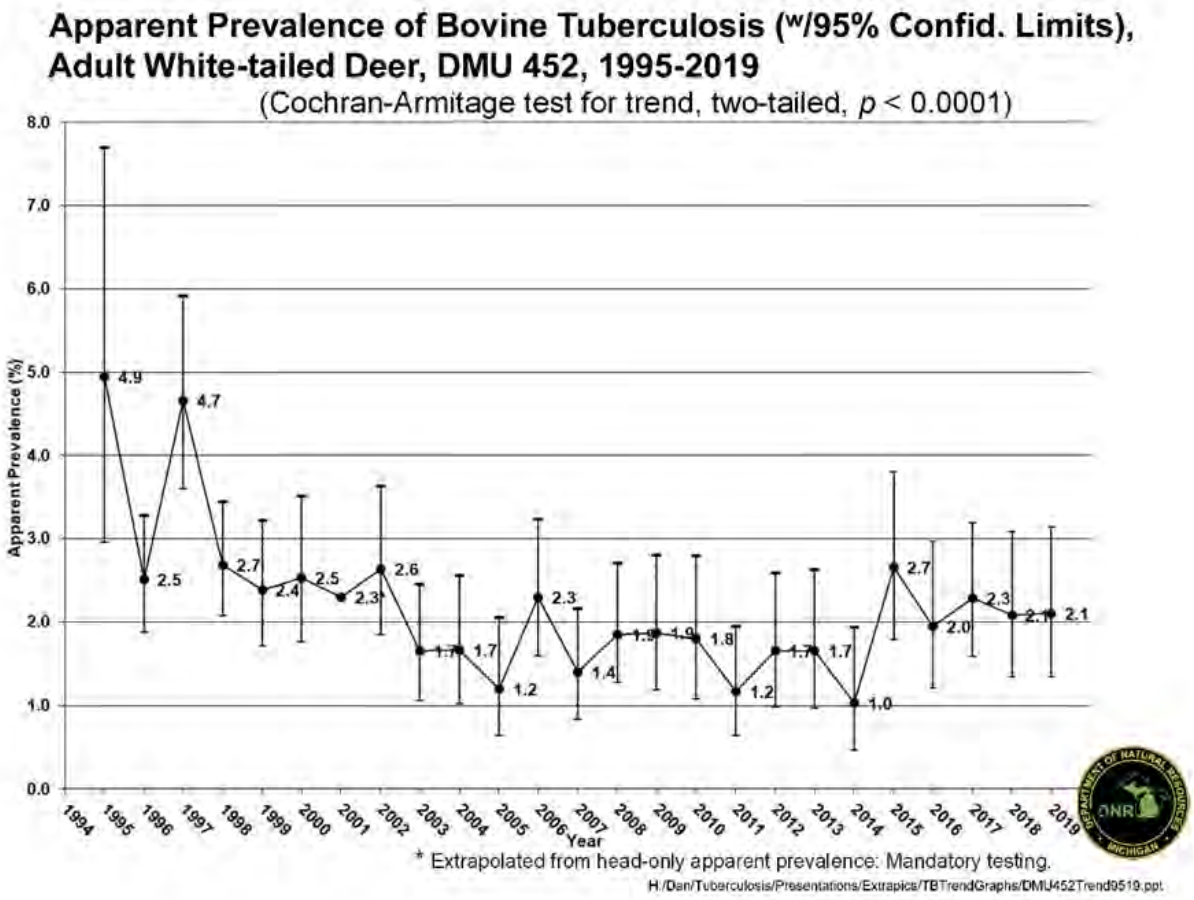
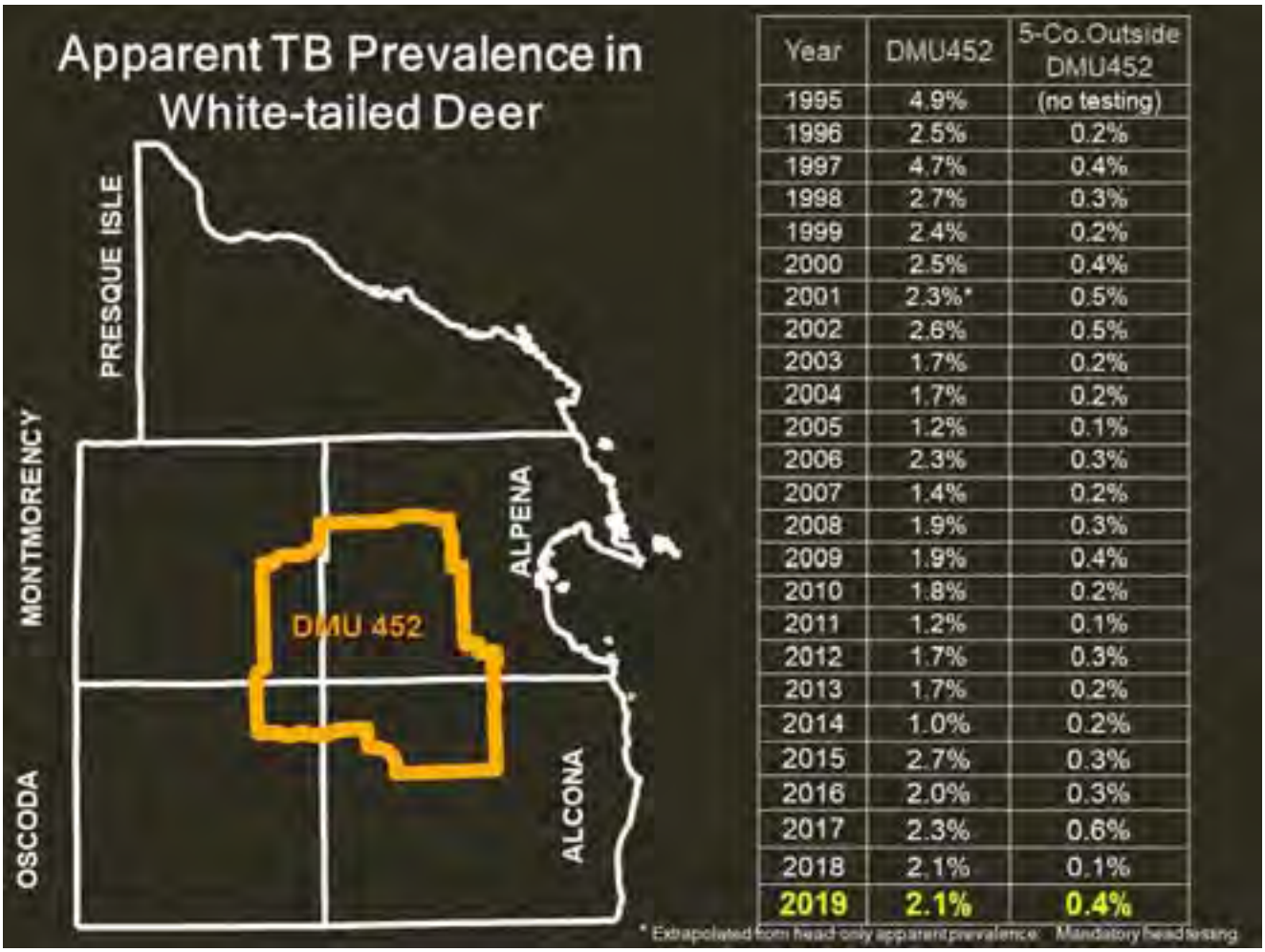


Figure 3. Apparent prevalence of bovine tuberculosis in adult white-tailed deer 1995-2019.

BOVINE TUBERCULOSIS



Year	DMU452	5-Co.Outside DMU452
1995	4.9%	(no testing)
1996	2.5%	0.2%
1997	4.7%	0.4%
1998	2.7%	0.3%
1999	2.4%	0.2%
2000	2.5%	0.4%
2001	2.3%*	0.5%
2002	2.6%	0.5%
2003	1.7%	0.2%
2004	1.7%	0.2%
2005	1.2%	0.1%
2006	2.3%	0.3%
2007	1.4%	0.2%
2008	1.9%	0.3%
2009	1.9%	0.4%
2010	1.8%	0.2%
2011	1.2%	0.1%
2012	1.7%	0.3%
2013	1.7%	0.2%
2014	1.0%	0.2%
2015	2.7%	0.3%
2016	2.0%	0.3%
2017	2.3%	0.6%
2018	2.1%	0.1%
2019	**2.1%**	**0.4%**

* Extrapolated from head only apparent prevalence Mandatory head testing

Figure 4. Apparent prevalence of bovine tuberculosis in white-tailed deer from DMU 452, 1995-2019.

BOTULISM, TYPE E

Botulism is a paralytic condition brought on by the consumption of a naturally occurring toxin produced by the bacterium *Clostridium botulinum.* The toxin produced during growth of the bacterium is one of the most poisonous substances known. There are 2 types of botulism detected in wildlife, Type C and Type E. Type C occurs in bottom sediments and occurs annually in Michigan. Type E botulism is associated with the ingestion of fish and occurs mainly in gulls, loons, mergansers, grebes, and cormorants, and has been less common in Michigan. Type E botulism has become more prevalent in recent years in Lake Erie and Lake Ontario, because of the introduction of Zebra and Quagga mussels and round gobies (species native to the Black and Caspian Seas, which are located between Turkey and Russia). The bacterium *C. botulinum* Type E is found in bottom sediments, in aquatic invertebrates, and in the guts of fish.

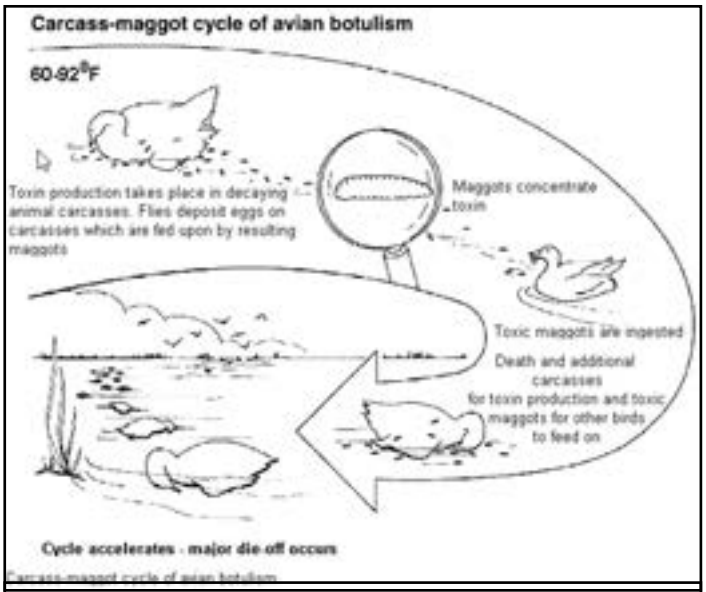


Image 3. Carcass-maggot cycle of avian botulism (USGS Field Manual of Wildlife Diseases).

Zebra and Quagga mussels feed on bottom sediments, obtaining the bacteria, and are in turn fed upon by the goby. Gobies become sick and/or die due to the botulinal toxin, and the live or dead fish is then eaten by a fish-eating bird. This results in a Type E botulism die-off occurring coincidentally in fish and birds (Image 3).

Since 2006, die-offs from Type E botulism have been reported in Lake Michigan in both the Upper and Lower Peninsulas (Table 1). In 2019, Type E botulism (confirmed or probable) was diagnosed in 15 common loons in Charlevoix, Emmet, Delta, Grand Traverse, and Schoolcraft Counties, along with one red-necked grebe in Emmet County. Increases in Cladophora algae, mussels, and goby populations in Lake Michigan have likely resulted in mortality due to Type E Botulism becoming an annual event.

SPECIES	YEAR													
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Coot, American					X									
Cormorant, Double-crested	X		X	X	X	X	X	X	X	X	X	X		
Duck, Long-tailed		X			X	X	X			X	X	X		
Eagle, Bald		X												
Goldeneye, Common				X										
Goose, Candada												X		
Grebe, Horned	X	X			X		X				X	X		
Grebe, Red-necked	X	X			X		X				X	X		X
Gull, Herring	X	X	X	X	X	X						X		
Gull, Ring-billed	X	X	X	X	X	X	X	X	X	X		X		
Heron, Great Blue												X		
Killdeer												X		
Loon, Common	X	X	X	X	X	X	X		X	X	X	X	X	X
Merganser, Common				X								X		
Merganser, Red-breasted					X	X	X	X				X		
Merganser (species unknown)											X			
Plover, Piping		X												
Sandpiper, Spotted					X									
Scoter, White-winged		X			X	X	X	X	X	X	X	X		
Teal														
Tern, Caspian		X		X										
Tern (species unknown)			X											
Warbler, Yellow-rumped												X		
Estimated mortality	1500	7500	150	175	3000-4000	135	1900	576	108	429	1548	378	116	223

Table 1. Species and total number of individuals confirmed with Botulism Type E in Michigan.

CANINE DISTEMPER

Canine distemper is a highly contagious disease of carnivores caused by a paramyxovirus. The virus is widespread, and mortality in juveniles is higher than in adults. The canine distemper virus is very resistant to cold, and the majority of distemper cases in domestic dogs are seen in the fall and winter. In wild animals, since the juveniles are more susceptible to infection, the majority of cases are seen in the spring and summer, but cases are observed year-round.

Image 4. Skunk, showing crusting over of the eye, a symptom of canine distemper.

There has been an ongoing statewide die-off of canine distemper species since 2014. In 2019 canine distemper was diagnosed in 6 species: striped skunks, gray fox, red fox, and coyotes in the Lower Peninsula, and in raccoons in both the Upper and Lower Peninsulas (Figure 5). A gray wolf from the Upper Peninsula also tested positive in 2019. This is consistent with findings from past years. All the diagnosed animals displayed some of the clinical signs consistent with a canine distemper infection: seizures, active at abnormal times of the day, no fear of humans and pets, active near residences/kennels, matting of the eyes, diarrhea, and breathing difficulties.

Figure 5. 2019 species and distribution of confirmed cases of canine distemper in Michigan.

CHRONIC WASTING DISEASE

Michigan conducted its first surveillance for Chronic Wasting Disease (CWD) in free-ranging white-tailed deer in 1998 by opportunistically testing 459 deer during Michigan's on-going bovine tuberculosis surveillance. No evidence of CWD was found in the deer tested. Surveillance began on a continuous basis beginning in 2002. In 2008, the first privately-owned cervid tested positive for CWD in Kent County. In 2015, the state confirmed its first CWD positive free-ranging white-tailed deer in Ingham County and surveillance in white-tailed deer increased substantially. In 2017, a positive deer was discovered in Montcalm County, more than 30 miles northeast of Ingham County where surveillance had been focused. By the end of 2017, 45 deer had tested positive in of Montcalm and northeast Kent alone, shifting attention to this area as the potential foci of infection.

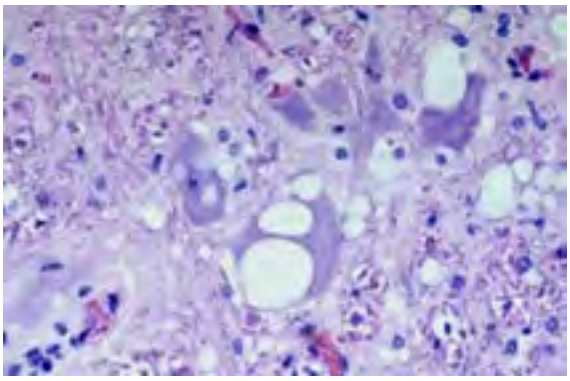


Image 5. Microscopic view of lesions (holes) in white-tailed deer brain due to chronic wasting disease.

In 2019, the former 16-county CWD Surveillance Area in the lower peninsula was expanded to 19 counties and baiting and feeding were banned throughout the entire peninsula. The focus of surveillance goals for 2019 was to concentrate most the effort in areas with 'outlier' positive cases to determine if these were indeed outlier or another focus of infection. In late summer of 2018, the first positive deer was found in Dickinson County in the Upper Peninsula (U.P.) of Michigan and a surveillance area was established surrounding this detection that continued in 2019. During 2019, 65 deer tested positive for CWD out of 20,071 tested (Figure 7). No further detections have been made in the U.P. to date.

Surveillance goals for 2020 are still being determined. However, the goal is to focus efforts in areas where CWD has been detected but overall sampling is still low, and possibly begin a rotational sampling scheme to include other areas of the state that have not yet had CWD detected but have also not been heavily sampled. The on-going demand for hunter service testing, those heads tested due to hunter request outside of set surveillance goals, will be a limiting factor to the extent of sampling that can be done in new areas. Surveillance for CWD continues year-round through collection of road-kill deer, issuance of disease control permits, and culling by sharpshooters around 'outlier' positive deer locations.

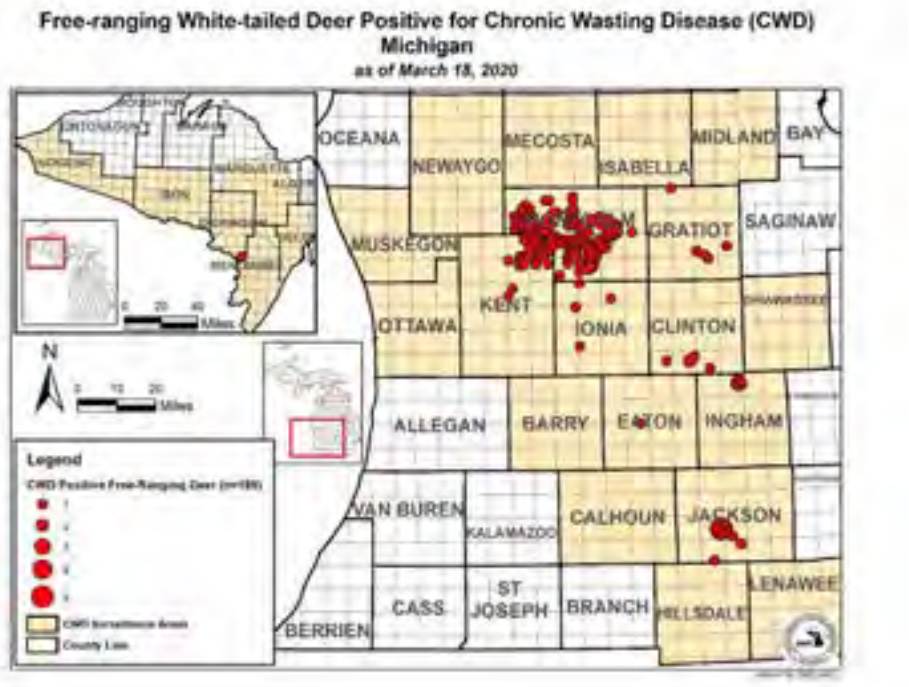
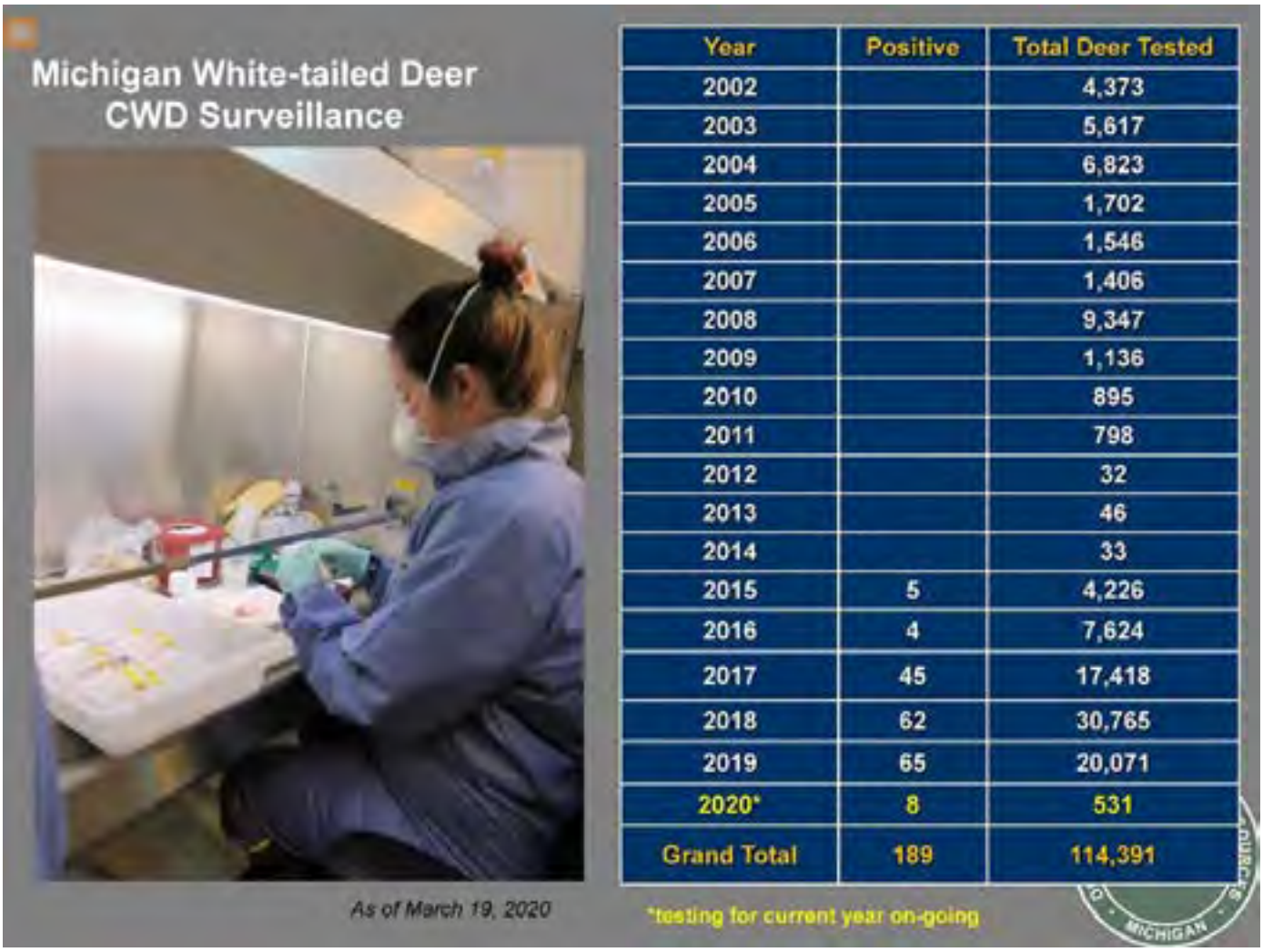


Figure 6. Free-ranging white-tailed deer testing positive for CWD in Michigan.

CHRONIC WASTING DISEASE



Year	Positive	Total Deer Tested
2002		4,373
2003		5,617
2004		6,823
2005		1,702
2006		1,546
2007		1,406
2008		9,347
2009		1,136
2010		895
2011		798
2012		32
2013		46
2014		33
2015	5	4,226
2016	4	7,624
2017	45	17,418
2018	62	30,765
2019	65	20,071
2020*	8	531
Grand Total	189	114,391

Figure 7. Free-ranging white-tailed deer tested for CWD in Michigan, 2002-2020.

EASTERN EQUINE ENCEPHALITIS (EEE)

Eastern Equine Encephalitis (EEE) is an infectious, often fatal disease of horses, humans, wild ruminants (white-tailed deer), and some wild bird species. EEE is caused by an RNA virus in the family *Togaviridae* and is mosquito-born (Arbovirus). The virus is maintained by wild bird reservoirs and mosquitoes (enzootic phase). Horses, humans, white-tailed deer, and some wild bird species are accidental (dead-end) hosts and they can be infected, develop clinical disease, and die (epizootic phase).

Mortality attributed to white-tailed deer has only been reported in five states: Georgia (1 in 2001), Rhode Island (3 in 2019), Massachusetts (1 in 2019), Wisconsin (1 in 2004), and Michigan (8 in 2005, 1 in 2009, 2 in 2010, 3 in 2015, 1 in 2016, 1 in 2017, 3 in 2018, and 14 in 2019). EEE was also diagnosed in 1 mute swan and 1 ruffed grouse in 2019, the first time the disease has been diagnosed as a cause of death in free-ranging birds in Michigan.

In 2019 in Michigan, there were 10 human cases and, of these, 6 fatalities. There were 33 domestic/captive animal EEE cases in 2019: 29 equine, 2 canine (captive wolves), 1 sheep, and 1 goat.

Eastern Equine Encephalitis Positives 2019		
County	Species	Number Positive
Allegan	White-tailed Deer	1
Barry	White-tailed Deer	3
Berrien	White-tailed Deer	1
Cass	White-tailed Deer	1
Cass	Mute Swan	1
Eaton	White-tailed Deer	1
Genesee	White-tailed Deer	1
Houghton	Ruffed Grouse	1
Jackson	White-tailed Deer	1
Kalamazoo	White-tailed Deer	2
Kent	White-tailed Deer	1
Van Buren	White-tailed Deer	2
		16

Table 2. EEE positive animals by county 2019.

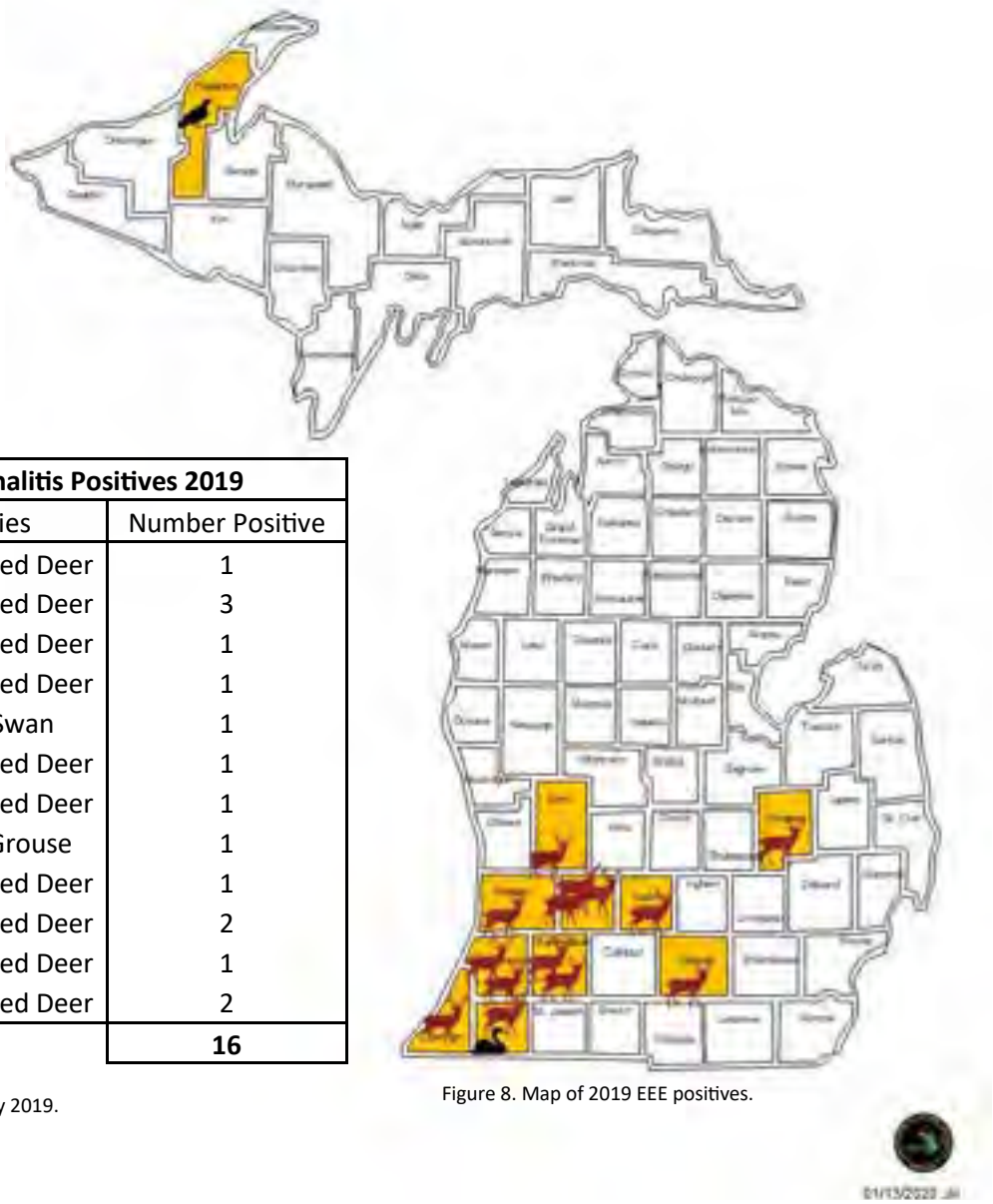


Figure 8. Map of 2019 EEE positives.

MOLECULAR WORK- CWD

- Results on the distribution and prevalence of Prnp genotypes from the first 120 CWD positive Michigan, wild, white-tailed deer were reported (Figure 9). Additional data has been collected and is currently being analyzed to assess negative controls, randomly selected background samples, and additional positives.
- Data collection has begun on state-wide genetic structure of white-tailed deer to be used in informing management.
- Funding has been secured and collaborative work has begun to develop a suite of genomic tools for white-tailed deer. It is anticipated that the new panels will replace the current technique and offer greater insight and data collaboration. Collaborating states include Georgia, Iowa, Michigan, Minnesota, Mississippi, Missouri, Pennsylvania, South Dakota, Texas, and Wisconsin.
- New collaboration with Michigan Technological University has begun data collection for wolf genetics.
- The second year of collaboration with Michigan Technological University has begun for pathogen prevalence and landscape genetics surveys of river otter in the Upper Peninsula.
- Initial results for Toxoplasmosis and Sarcosystis screening by Oklahoma State University are anticipated to be presented at the American Association of Veterinary Parasitologists (June 2020).
- Work begins to develop and test a proposed black bear population estimator for the Upper Peninsula. This new method, close kin mark recapture (CKMR), is a relatively new, non-invasive genetic method for the wildlife field.

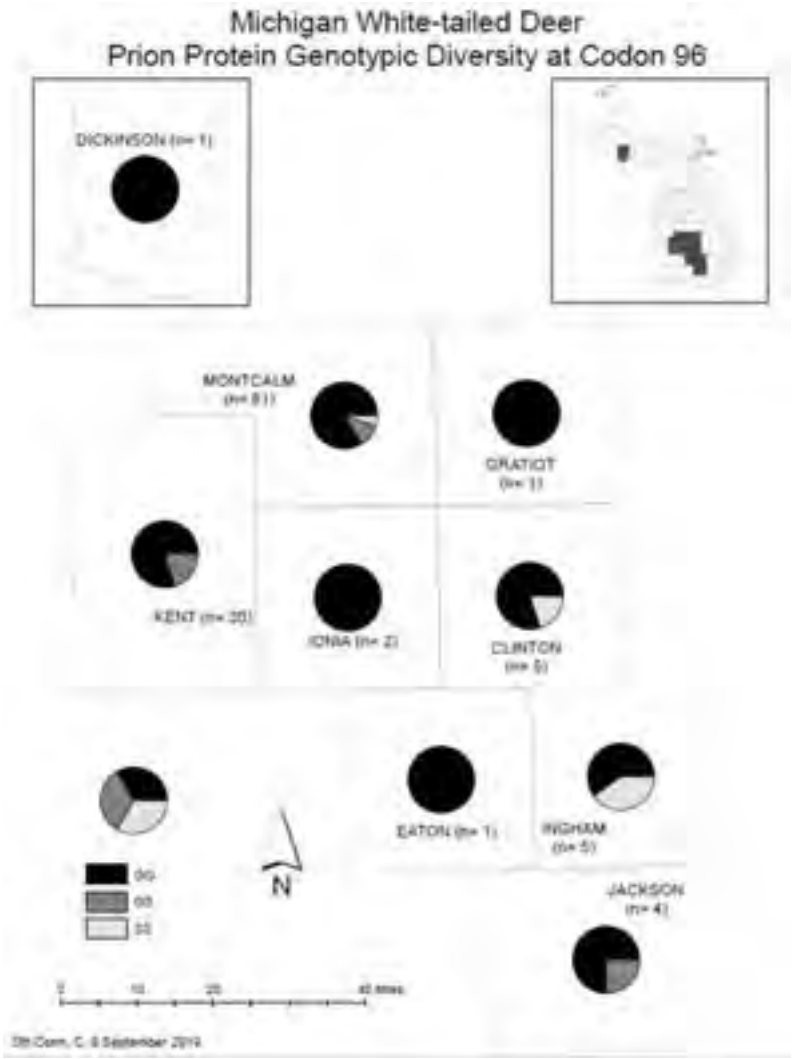


Figure 9. Distribution and prevalence of the prion protein genotypes from the first 120 CWD positive Michigan, wild, white-tailed deer.

LEAD POISONING

Lead poisoning has been recognized as a mortality factor in waterfowl since the late 1800's. Lead poisoning cases today are either the result of ingestion of bullet fragments, spent lead shot, fishing sinkers or jig heads during normal feeding activities. When the lead reaches the acidic environment of the gizzard (loons, ducks, geese and swans) or the ventriculus (eagles), it is worn down, dissolved, and absorbed into body tissues. Once the lead reaches toxic levels in the tissues, muscle paralysis and associated complications result in death.

Eagles, loons, ducks, geese, and swans are the animals most commonly affected by lead ingestion; however, upland game birds including mourning doves, wild turkeys, pheasants, and quail are also occasionally affected.

The switch from lead to non-toxic shot has significantly reduced the number of waterfowl that die from lead poisoning in Michigan and in the U.S.; however, mortality still continues to be seen in loons and eagles, as the sources of lead consumed by these two species are still legal to use (lead sinkers and jigs and lead bullets, respectively).

Image 6. Lead bullet fragments in the stomach of a Bald Eagle.

Image 7. Lead bullet fragments in the stomach of a duck.

In 2019 lead poisoning was diagnosed in 25 birds from 2 species: bald eagle (20) and trumpeter swan (5).

The swans that were examined had ingested either unidentifiable lead (completely eroded or passed out of the gizzard)(2), lead shot (1), or lead sinkers (2). The bald eagles had ingested unidentifiable pieces of lead (due to the small lead fragments that result from bullet fragmentation, lead is oftentimes not observed grossly) (18), lead fragments (1), and lead pellets (1).

RABIES

The primary strain of rabies seen in Michigan is the bat-strain. Skunk-strain and fox-strain rabies have also been reported in the state with the thumb area historically being an area where the skunk-strain commonly occurred. Fox-strain rabies has occurred in the past and was detected primarily in the Upper Peninsula, the result of spill-over from Canada. In recent years, rabid red foxes have been identified throughout the state but the strain they had was either bat-strain or skunk-strain. There have been a small number of rabies-positive raccoons in the state, but these were bat-strain as well and occurred many years ago.

Big brown bats are the species most commonly identified with rabies, and the species most commonly involved in human exposures. This is a colony species that is commonly observed in building structures in the southern portion of the Lower Peninsula, where the human population is higher.

Over the past 18 years, due to concerns of raccoon-strain rabies entering the state, a cooperative surveillance project between the Michigan Department of Natural Resources, the Michigan Department of Health and Human Services, and the Michigan Department of Agriculture and Rural Development, has resulted in neurologically abnormal raccoons being collected and submitted for rabies testing and necropsy. County or City Animal Control agencies and DNR personnel have been involved in these collections. To date, none of the raccoons submitted have been positive for rabies, and canine distemper has been suspected or proven to be the cause of the animal's abnormal behavior.

Rabies surveillance in 2019 resulted in 58 positive animals, a number considerably lower than 2018 (79). As usual, bats were the primary species affected (45), with the big brown bat being the most common positive bat species. Additionally, 12 striped skunks and a cat were positive for rabies, all from Oakland County (Table 3; Figure 10).

	Wildlife Species				Domestic Species				
Year	Bat	Red Fox	Striped Skunk	Woodchuck	Cat	Cow	Dog	Horse	All Species Total
2006	39	1	3		1	1		4	49
2007	197	1	5		2		1	1	207
2008	70	2	6		1				79
2009	53	3	10		1				67
2010	60	2	8		1		1	1	73
2011	57	1	5	1			1		65
2012	53	1	8						62
2013	41								41
2014	39		3						42
2015	33	1	1						35
2016	37		4						41
2017	35		2		1				38
2018	77		2						79
2019	45		12		1				58
Total	836	12	69	1	8	1	3	6	936

Table 3. Count of individuals tested positive for rabies by year in Michigan.

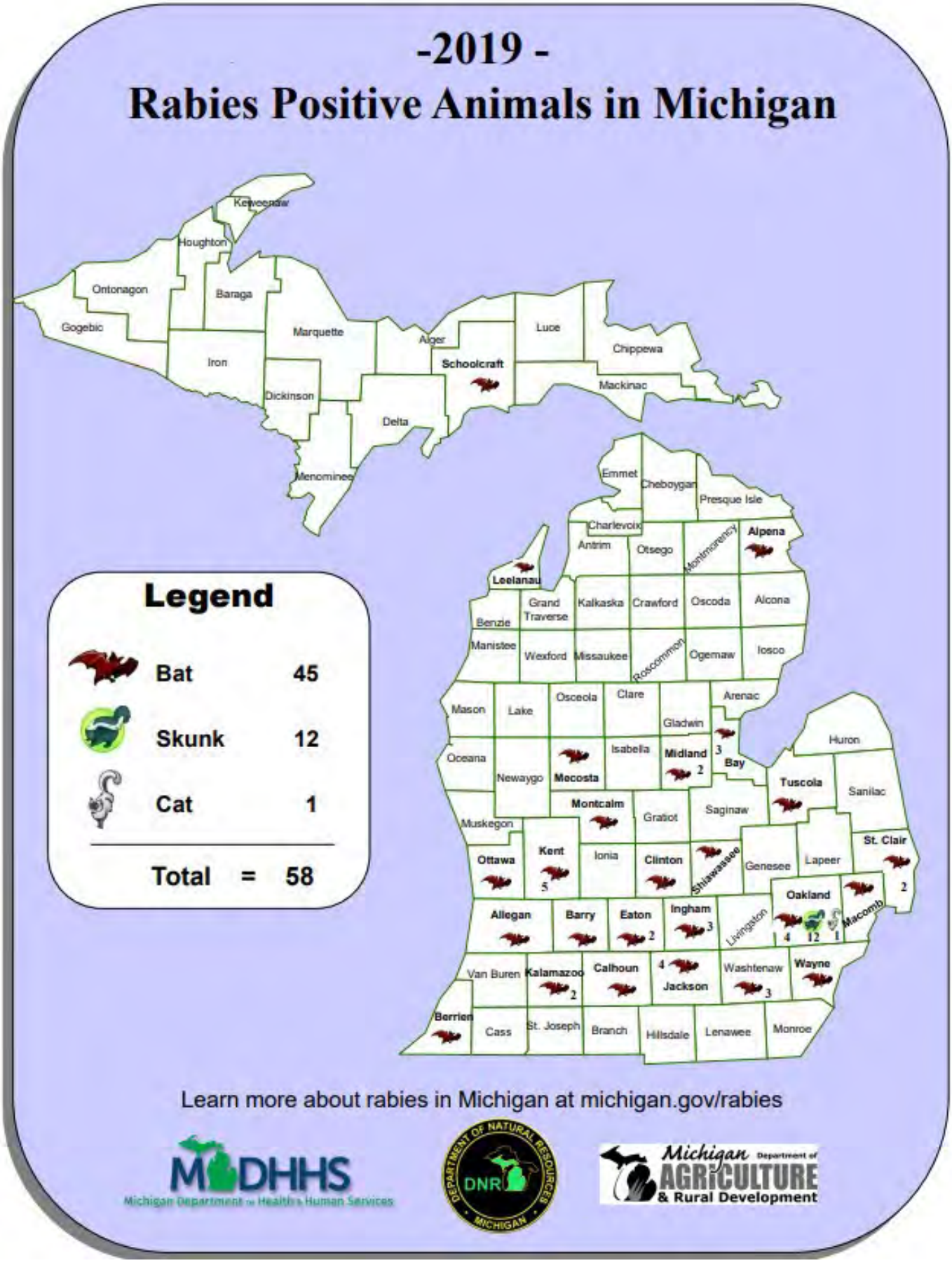


Figure 10. 2019 distribution and count of species confirmed with rabies in Michigan.

WEST NILE VIRUS

Since 2001, the Michigan Department of Natural Resources in cooperation with the Michigan Department of Agriculture & Rural Development, the Michigan Department of Health & Human Services, the Michigan Department of Environmental Quality, and Michigan State University have conducted dead bird surveillance for West Nile Virus throughout the state. WNV was first detected in Michigan in 2001 in corvids (American crows and blue jays) and subsequently in humans, horses, wildlife, domestic pets and exotic animals in 2002. Due to their sensitivity to the virus, members of the Corvid family have been the primary species surveyed. If funding is available any bird or mammal submitted to the WDL during the mosquito season are tested for WNV.

Image 8. Great Horned Owl showing symptoms of West Nile Virus infection.

In 2019, WNV was detected in very few wild animals, causing the death of only 13 animals submitted to the lab for examination. It was diagnosed as the cause of death in 3 corvids (3 American Crows) and 10 non-corvids (Table 4). 2019 was by far the lowest mortality we have seen attributed to WNV since surveillance began in 2001.

Detection of the virus in wildlife is an important indicator of West Nile Virus activity within an area. Because West Nile Virus is zoonotic (can be transmitted to humans) knowledge of when and where the virus is present allows the Wildlife Division to inform public health officials, who can alert communities to take precautions against mosquito bites and implement mosquito control if necessary.

Species	# Positive
Osprey	1
Red-shouldered Hawk	2
Cooper's Hawk	2
Merlin	1
Mute Swan	1
Canada Goose	1
American Crow	3
Common Grackle	1
Northern Flicker	1
Total	13

Table 4. Species positive for WNV in Michigan in 2019.

WHITE-NOSE SYNDROME

Ongoing winter bat surveillance (by Dr. Allen Kurta of Eastern Michigan University, and Steve Smith, Dickinson County Mine Inspector, under contract to MDNR) serves to continue population monitoring at previously visited sites, with ongoing assessment of the effects of WNS. During winter 2017–2018, 30 previously surveyed sites (23 mines, 3 caves, 2 surge tunnels, a hydroelectric dam and a bluff with 'sea' caves/crevices) were surveyed in Alger, Alpena, Berrien, Delta, Dickinson, Keweenaw, Mackinac, Manistee and Ontonagon Counties. Based on previous surveillance, clinical white-nose syndrome remains confirmed in fourteen Michigan counties (Alger, Alpena, Baraga, Clare, Delta, Dickinson, Gogebic, Houghton, Keweenaw, Lake, Mackinac, Manistee, Marquette, and Ontonagon). The presence of *P. destructans* on asymptomatic bats is confirmed in two others (Emmet and Grand Traverse). No new clinical cases have been examined in the past two years, and the fungus is considered to be statewide in distribution at this point.

Image 9. *Photo: A. Kurta, Eastern MI Univ.*

The cumulative effects of white-nose syndrome are shown by combining the results of the two most recent surveys (winters 2017-2018 and 2018–2019) and comparing to counts made near 2012–2013, the year prior to the outbreak. Counts at 45 unique sites, representing ~55% of all colonial hibernacula known, declined 89%. Twenty-four sites registered declines >90%. Bats have been eliminated from eight hibernacula, although pre-WNS populations there were small (≤54 bats).

Disease-induced morbidity and mortality continue to show distinct species differences. The little brown bat (*Myotis lucifugus*), the most common species in northern Michigan, has experienced an overall decline of 94%, although the number is now expected to stabilize near these greatly reduced levels as it has in other parts of the continent. Two previously uncommon species, the tricolored bat (*Perimyotis subflavus*) and the northern long-eared bat (*Myotis septentrionalis*) are now projected to be approaching extinction in Michigan. Tricolored bats have now disappeared from all the sites where they were previously noted; northern bats have declined by >96%. In contrast, big brown bats (*Eptesicus fuscus*) have experienced little change in overall population or geographic distribution, but now comprise a much higher proportion of the bats resident in MI mines (4.5%) compared to their pre-WNS levels (0.5%). Big brown bats are the most abundant species in southern Michigan, and point out the necessity to taking species differences into account when assessing the statewide impact of the disease.

The largest remaining hibernaculum in Michigan, Tippy Dam on the Manistee River, is enigmatic. Both the causative fungus *P. destructans* and individuals with clinical WNS confirmed on histopathology were demonstrated at the site beginning in 2015, yet there have still been no significant population declines or evidence of the characteristic behavioral changes that have typically accompanied them at other sites. Kurta and Smith now consider it unlikely that disease progression documented elsewhere is simply delayed at Tippy. Contingent on funding, they intend to examine in winter 2019–2020 attributes of both the site (temperature, humidity, light levels) and the bats (thermoregulatory patterns, fungal loads, stage of infection) to gain insight into what allows them to continue to survive in the presence of WNS.

WHITE-NOSE SYNDROME

Under direction of Wildlife Division field staff based in Baraga, a project is underway to re-engineer the natural ventilation of a bat hibernaculum (Mead Adit of the Carp Lake Copper Mine, in Porcupine Mountains State Park, Ontonagon County) to reduce its temperature. A fan and duct system pulls cold air in from outside the mine and exhausts warmer air, aiming to decrease temperature in the manipulated area by 6-8°F. Bat occupancy, abundance and species, as well as the presence of *P. destructans,* are being monitored simultaneously. Prior to WNS, Mead Adit held ~17,700 bats; in winter 2018-2019, it held 208.

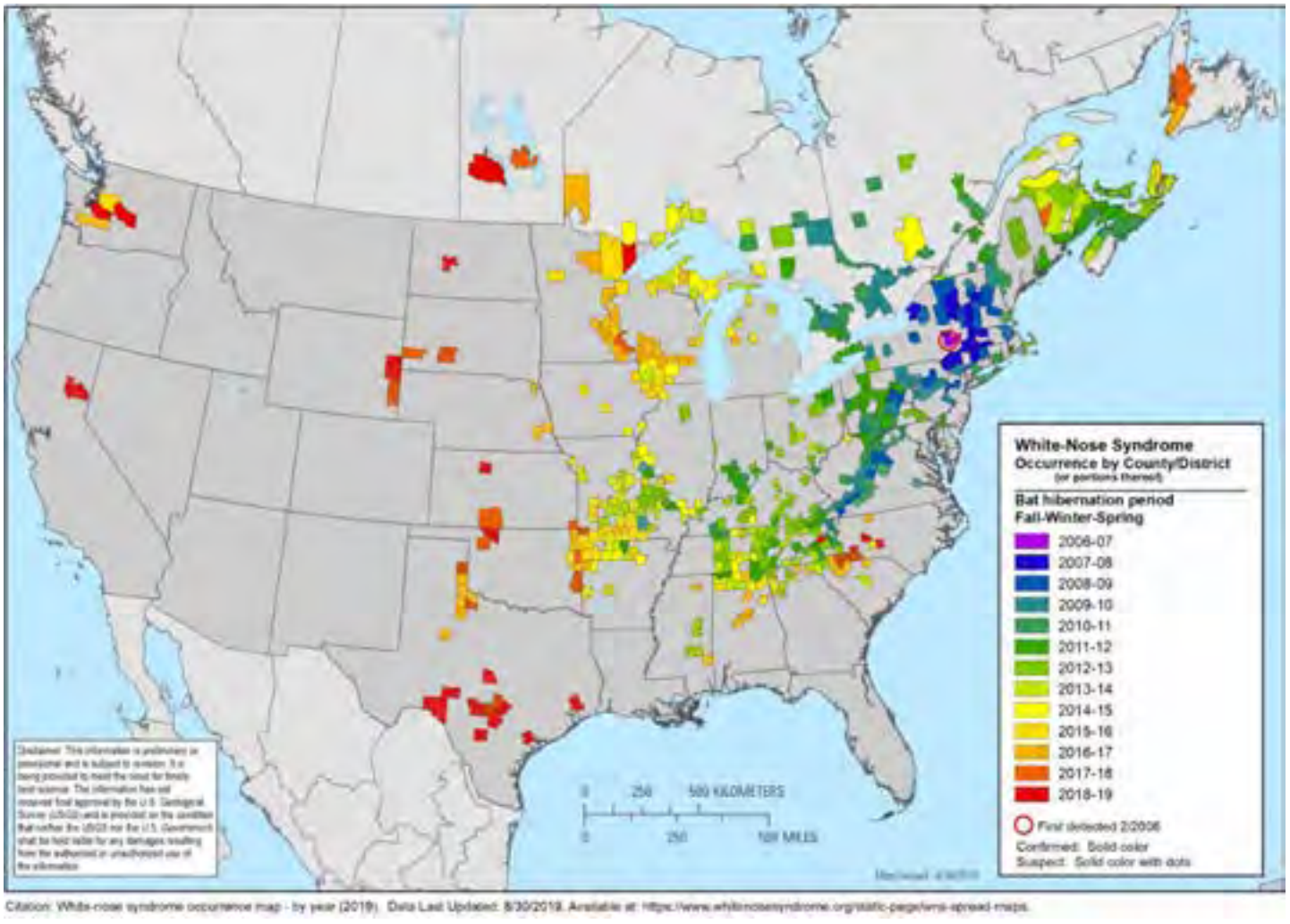


Figure 11. 2019 occurrence of white-nose syndrome. https://www.whitenosesyndrome.org/resources/map

For more information on wildlife disease and surveillance in Michigan, visit

www.michigan.gov/emergingdiseases and

our Wildlife Disease Manual at www.michigan.gov/wdm

NECROPSY NEWS

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Michigan Department of Natural Resources Wildlife Health Section

New year, new look, same Necropsy News! As usual, we hope you enjoy the images and learn something new!

Image 1: Left to right: Erin Bax, Katie Farinosi, Julie Melotti, Tom Cooley, and Meredith Anderson

This picture includes a gray wolf, raccoon, fisher, black bear, striped skunk, and common merganser.

In this Issue

Total Necropsies

1/01/20-3/31/20

White-tailed deer: 37

Bald eagle: 36

Raccoon: 30

Top 3 Diagnoses

1) Trauma: 79

2) Canine distemper: 25

3) Pneumonia: 16

Image 2. Just like with deer heads, it takes a lot of time and people to work through all the furbearer skulls that we receive!

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Cranial Abscesses in Deer

We routinely see cranial abscesses in white-tailed deer with most cases occurring in the fall and winter months. They usually occur in bucks (~80%), but we occasionally see them in does (~20%; Table 1 and Graph 1). They are caused by a fracture in the skull (Image 3), where bacteria can enter the cranium causing an abscess filled with purulent material to form in the brain (Image 4). The fracture can be caused by intraspecies conflict (i.e. two bucks fighting) or other trauma to the head. Interestingly, the fracture and subsequent abscess are more commonly seen on the right side of the head and we are not sure why that is the case. Symptoms of a cranial abscess are primarily neurological and include being disoriented and confused, walking in circles, drooling, a hunched posture, approachable and not afraid of humans. Occasionally poor body condition is observed if there were traumatic injuries and bacterial infections to other parts of the body. Since 2015, we have diagnosed cranial abscesses as the primary diagnosis in 89 deer (Table 1). We likely saw an increase in cases in 2019 due to an increase in submissions of deer for Eastern Equine Encephalitis (EEE) testing. Field staff, along with the public, were already submitting deer with neurological symptoms because of CWD, but with the rise in EEE cases in 2019, more deer were being observed and submitted for examination with these clinical signs.

Image 3. Fracture in skull cap of a white-tailed deer shown using a precision probe.

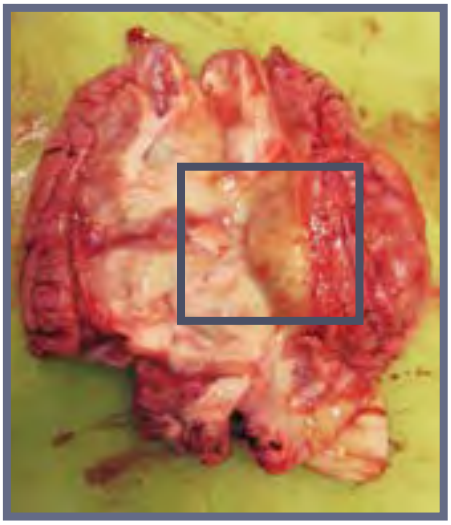
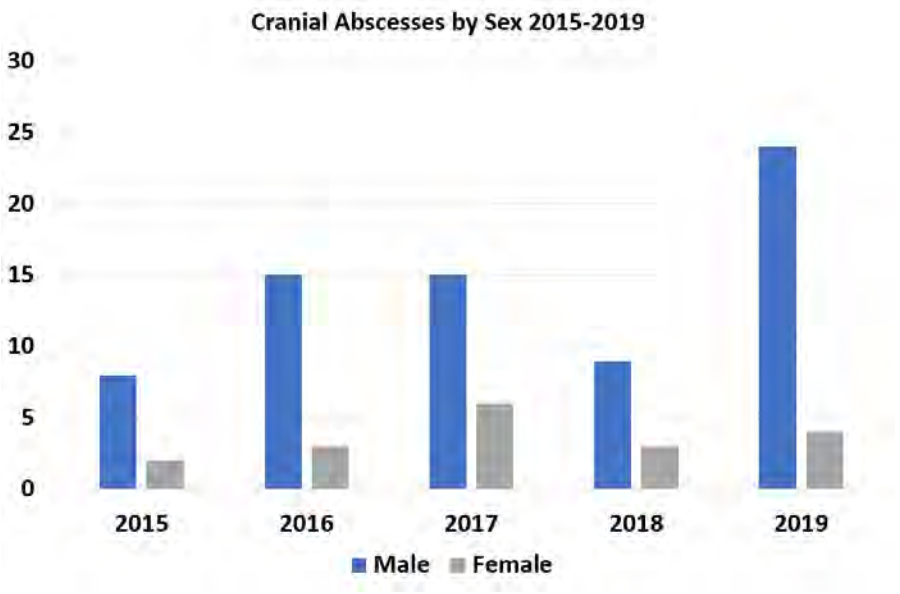


Image 4. Deer brain with abscess material throughout.



Graph 1. Cranial abscesses by Sex 2015-2019.

Year	Male	Female	Total
2015	8	2	10
2016	15	3	18
2017	15	6	21
2018	9	3	12
2019	24	4	28
	71	18	**89**

Table 1. Total cranial abscesses diagnosed 2015-2019.

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Aspergillosis

Image 5. View of the chest and abdominal cavities of a swan with aspergillosis.

Aspergillosis is a fungal disease typically caused by the fungus *Aspergillus fumigatus* that effects the respiratory system of birds. Large numbers of spores are inhaled or ingested and embed in the air sacs and lungs where they begin to grow. Clinical signs seen in birds include diarrhea, loss of body condition, reduced respiration, loss of appetite, and neurological symptoms. Pathological findings seen during necropsy include thickened air sacs lined with necrotic material and fungal plaques. On the lungs, tan spherical necrotic foci are present throughout the tissue. The swan in the picture was from Kalamazoo County and was brought to a wildlife rehabilitator in late October after it was illegally shot. During its time there, its appetite was noted to never be normal and it had to be tube-fed. In mid-January the swan lost function in its right leg and two days later it started having tremors. Symptoms continued getting worse with labored breathing, slowed heart rate, and bloody stool, and the swan had to be euthanized. During necropsy, the tell-tale fungal plaques of aspergillosis were seen, but a lot of yellow fluid and yellow coagulative material was seen in the abdomen and the liver was pale in color (Image 5). Samples were sent to the Michigan State University Veterinary Diagnostic Lab (MSU VDL) for histopathological examination. The swan was diagnosed with aspergillosis which caused a bacterial septicemia. In 2019, we diagnosed aspergillosis in a double-crested cormorant, mourning dove, bald eagle, Canada goose, herring gull, blue jay, common raven, and three trumpeter swans.

Mandibular Osteoma

This 2.5 year old doe was harvested in St. Joseph County and the head was submitted for examination due to the large mass on the symphysis (where the two portions of the lower jaw are fused in the front) of the mandible. The mass measured 9 x 9 x 8.5 cm and had incisors and canines protruding from the right side. Upon further investigation (and sawing), we discovered that the bony mass was hollow and filled with a moderate amount of fibrinous and purulent material. A piece of it was sent to the MSU (VDL) for histopathological examination where it was determined that it was a mandibular osteoma tumor, or a benign bone tumor. Aside from the weight of the bony mass and the difficulty it likely created for the deer to eat, the mass was harmless.

Images 6. A view of the left side of the head of the deer, showing the size of the mass.

Image 7. A view of the mass after it was cut open.

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Hemorrhagic Enteritis in Deer

Hemorrhagic enteritis is characterized by hemorrhaging in the small intestine, typically caused by *Clostridium perfringens*, a common bacteria found in most environments and in the intestines of both humans and animals. The bacteria can become dangerous in ruminants when it is ingested in food or water and, if the animal has a high amount of carbohydrates in its system (i.e. corn), the amount of bacteria can increase rapidly and start releasing toxin. The toxin that is released can then cause enteritis (inflammation of the small intestine) and enterotoxemia (hemorrhaging in the small intestine caused by a toxin), leading to death (Image 8). In 2019, we diagnosed this as the primary diagnosis in four white-tailed deer and one black bear.

Image 8. Inflammation and hemorrhaging of the small intestine of a deer.

Veterinary Externship

This quarter, we had the privilege of hosting three veterinary students for two to three weeks each. Meredith Anderson (Image 9) is a fourth year veterinary student at MSU, Erin Bax (Image 10) is a third year veterinary student at the University of Missouri, and Hailee Butler is a 3rd year veterinary student from MSU (Image 11). While here, all three students got to participate in a number of activities including necropsies, deer heads for CWD and TB testing, furbearer skulls, and processing ruffed grouse for our WNV study. They also observed the Natural Resources Commission in action at their meeting at the Wildlife Disease Lab. The students are also assigned a small project while at the lab. These include a short communication on Eastern Equine Encephalitis (EEE) in ruffed grouse, a manuscript on our EEE die-offs in white-tailed deer, and contributions towards a wildlife disease manual field guide.

Image 9: Meredith Anderson

Image 10. Erin Bax

Image 11. Hailee Butler

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Working from Home

While it's not possible to perform our necropsy work from home, we still have plenty to keep us busy. We hope you all are settling into your home work spaces and finding the balance between work, home, and family. Stay safe and stay healthy!