Ferrets, Mink, and SARS-CoV-2

Dr. Brian Joseph, Washington State Veterinarian

Animals do not play a significant role in spreading the virus causing COVID-19 in humans, but we should still keep our distance and take precautions to prevent spreading this dangerous disease to some animals such as mink and ferrets.

Severe Acute Respiratory Syndrome corona virus, commonly known as SARS, was first reported in humans in February 2003 and rapidly spread to more than two dozen countries in North America, South America, Europe, and Asia before the global outbreak was contained. No cases of SARS have been reported since 2004.

Virologists recognized similarity between SARS, and the SARS-CoV-2 responsible for the current COVID-19 pandemic. Both viruses are probable animal origin, are zoonotic, and seem to spread most often by respiratory droplets when an infected person coughs or sneezes.

Scientists were not surprised when it was determined ferrets and mink could become infected with the virus because they share respiratory receptors like those of humans that allow the virus to gain a respiratory foothold. Unlike cats—which can become infected, shed the virus, but not necessarily show signs of illness—ferrets and mink shed the virus, can transmit it to other animals, can become sick and may die (mink). Numerous mink farms in the Netherlands reported mink sick and dying from SARS-CoV-2 in early June 2020. As of August 2, 2020, over one million mink had either died or been depopulated in the Netherlands.

CONTINUED ON PAGE 2
A few weeks later, mink in Denmark began dying of SARS-CoV-2, followed by farms in Spain. As a result, all mink on affected farms have been culled. A factor in the decision to cull the farmed mink was there is credible evidence of mink-to-human and mink-to-farm-cat transmission of SARS-CoV-2. More recently, several hundred mink per day have been dying from SARS-CoV-2 on mink farms in Utah. As has been the case in Europe, it appears mink were infected by workers infected by COVID-19. The Centers for Disease Control and Prevention (CDC) and the USDA Animal and Plant Health Inspection Service offered Utah’s Department of Fish and Wildlife assistance ensuring the virus does not spill over into wildlife by trapping feral cats and wildlife on the premises. The National Veterinary Services Laboratory is investigating if the Utah viral strain is identical to the strain affecting European mink.

Ferrets are commonly used as animal models for viral respiratory infections in humans and do not appear to be as seriously affected by SARS-CoV-2 as mink. Two recent experimental studies tested ferret susceptibility to SARS-CoV-2. Both studies reported SARS-CoV-2 replicates well in ferrets and ferrets may become sick, but those not euthanized as part of the investigations recovered. Ferrets were experimentally inoculated with intranasal virus in both studies. In one study, two ferrets were inoculated in March 2020 (Kim et al., 2020). Two days later, uninfected ferrets were placed in the infected ferrets’ cage and other uninfected ferrets were placed in adjacent cages. This study documented that after inoculation, ferrets developed fever, lethargy, and cough, but none died except for those euthanized as part of the study. Virus was detectable two days after inoculation in all infected ferrets; virus levels were highest in nasal secretions. This study demonstrated ferrets in direct contact with infected ferrets were infected and became ill, but those in adjacent cages were infected but did not become ill, indicating the virus was spread by direct and indirect contact and infection severity may be related to viral exposure dose.

The second study looked at SARS-CoV-2 susceptibility in a wider range of animals including cats, dogs, ferrets, pigs, and poultry (Shi et al., 2020). Live virus was detected in nasal washes 2 to 8 days after inoculation. PCR detected low levels of virus in these ferrets but live virus was not recovered. All ferrets developed antibodies consistent with infection and returned to normal health and behavior 12 days after inoculation.

What does this tell us? SARS-CoV-2 is predominantly a human virus, but it can spread to animals such as cats, ferrets, mink, and dogs as a reverse zoonosis. According to the CDC’s webpage on “Covid-19 and Animals” at cdc.gov/coronavirus/2019-ncov/daily-life-coping/animals.html:

- Currently, there is no evidence animals play a significant role in spreading the virus causing COVID-19.
- Based upon information available to date, the risk of animals spreading COVID-19 to people is considered low.
- It appears the COVID-19 virus can spread from people to animals in some situations.

Thus, it is important to keep infected humans away from susceptible animals and keep infected animals away from people. The CDC website maintains up-to-the-date information on how to increase human and animal safety through reducing the amount and closeness of human-animal interactions and using precautions to prevent the spread of the virus, such as personal protective equipment. Guidance from the CDC concerning SARS-CoV-2 and animals is at cdc.gov/coronavirus/2019-ncov/daily-life-coping/animals.html.

Specifically, practical guidance veterinarians can provide includes:

- If you are sick, do not contact ferrets.
- If a ferret is exposed to an infected person, keep it away from other people and pets.
- Ask owners about household COVID-19 exposure to help protect themselves from disease transmission from owners and consider potential issues when caring for their pets.


References
### Washington Reportable Disease Stats

#### OCTOBER 2020

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**SWINE**

Stop swill feeding to prevent disease

Dr. Susan Kerr, WSDA Education and Outreach Specialist

This year, the WSDA Animal Health Program asked the state legislature to ban garbage feeding for swine in Washington. The proposal would strengthen biosecurity and reduce the risk to swine and human health posed by feeding raw or undercooked meat to pigs. Garbage feeding can transmit several swine diseases of concern (African swine fever, classical swine fever, and foot and mouth disease) and a human health concern (trichinosis).

Washington defines “garbage” (swill) as table scraps or food waste from caterers, restaurants, food processors, school cafeterias, or home kitchens that may include or have contacted meat, poultry, or fish.

Under our requested change, producers could continue feeding bakery waste, vegetables, fruits, and dairy products to pigs.

Currently, garbage feeding is allowed if an applicant applies for and receives an annual license, pays an annual fee, abides by program requirements, and is inspected annually. If granted, our requested legislation would discontinue the garbage-feeding license program and ban garbage feeding in the state.

As of April 2020, 23 states prohibit garbage feeding and 27 states plus Puerto Rico and the Virgin Islands allow it. States allowing garbage feeding have permitting processes requiring garbage to be boiled for 30 minutes before feeding to swine to reduce the risk of disease transmission.

Garbage feeding was popular decades ago before much was known about swine nutrition, food processors had a great deal of by-products without other markets, most pigs were raised outdoors, and commercial swine rations were not widely available.

Feeding damaged, over-ripe, unmarketable, or expired products from grocery stores is still a popular practice on small-scale farms to help reduce feed costs. However, such rations often lack sufficient protein for growing pigs; commercial rations meet animals’ nutritional needs at various life stages much more effectively.

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**Resources**


Bugged by vector-borne disease

Dr. Susan Kerr, WSDA Education and Outreach Specialist

If you follow national animal health news, you might have noticed more and earlier cases of mosquito-borne equine encephalitic diseases in recent years. According to the Equine Disease Communication Center, cases of Eastern Equine Encephalitis (EEE) were reported from March through November in 2019; 2020 is on track to be an equally active year for this viral disease. Regulatory veterinarians on a federal and state animal health officials teleconference on September 10, 2020 reported seeing more and earlier cases of EEE in their state this year, with wider distribution; they also observed cases of vesicular stomatitis east of its usual range. Bovine practitioners have observed an expanding range for anaplasmosis (personal communication, AABP list serve); outbreaks of epizootic hemorrhagic disease and bluetongue have been locally extensive; and co-infections of equine infectious anemia and piroplasmosis are being detected at quarter horse bush races.

What’s the deal with all these vector-borne diseases?

It’s difficult to be sure case numbers are truly increasing. Not all cases get reported and there isn’t a centralized reporting place for many of these diseases. Perhaps horse owners are not vaccinating as much as in the past, so immunity to EEE has declined; that would explain increasing cases of one vector-borne disease. Reporting and communicating are easier and faster than ever, so perhaps we are just hearing more about the cases occurring in a typical year. However, subjectively, the range and activity period of vector-borne diseases seem to be on the rise.

Why are vector-borne diseases on the rise?

Milder winters in some areas may enable more vectors such as ticks, mosquitoes, and fleas to survive and be active earlier in the subsequent year. Extensive flooding can move vectors into new areas. High wind events and increasing storm intensity can also move vectors thousands of miles. Human movement and activity no doubt moves vectors (particularly ticks) into novel areas, as does the legal and illegal movement of animals. Finally, the pathogens—bacteria, viruses, and parasites—moved by vectors may be mutating to more virulent and/or resilient forms.

Modes of transmission

The mode of transmission of vector-borne diseases can be mechanical or biologic. Examples of mechanical transmission include flies transmitting pathogens causing pinkeye, contagious mastitis, orf, pigeon fever, or dermatophilus. Examples of biologic transmission include bluetongue and vesicular stomatitis viruses via midges; anaplasmosis, babesiosis, Q fever, and Lyme disease via ticks; and EEE and WNV via mosquitoes. The newly-arrived Asian longhorned tick (*Haemaphysalis longicornis*) is a concern because it is a known vector of several human and livestock diseases. This tick is native to countries bordering the Sea of Japan and is a significant livestock pest in Australia and New Zealand; it has been found in at least 15 states in the U.S. Whether or not these ticks will vector livestock diseases in the U.S. remains to be seen.

**Mechanical transmission:** the disease agent does not replicate or develop in/on the vector; it’s just transported by the vector from one animal to another.

**Biological transmission:** the vector uptakes the agent, usually through a blood meal from an infected animal, replicates and/or develops it, then regurgitates the pathogen onto or injects it into a susceptible animal.

---Center for Food Security and Public Health, Iowa State University
African swine fever (ASF) is not in the U.S. currently, but the ongoing outbreak in Eurasia is a worldwide concern. The virus can be sustained in tick populations for years, making eradication of the disease a challenge. The U.S. has three species in the Ornithodoros soft tick genus believed to be capable of harboring the ASF virus.

**Control**

Control of vector-borne diseases can be directed at the pathogen and/or vector. Vaccines are available for many vector-borne pathogens, particularly those caused by viruses. Indeed, horses affected by WNV and EEE are almost exclusively unvaccinated or undervaccinated. Vaccines are also available to reduce the risk of anthrax, pinkeye, orf, Lyme disease, Potomac horse fever, anaplasmosis, bluetongue, WEE, VEE, iatrogenic transmission of vector-borne agents can be prevented by generally accepted best practices such as using a new needle for each injection; not transfusing blood between animals unnecessarily; cleaning and disinfecting tools and instruments between animals; and using new disposable gloves when examining each animal.

Vector control can focus on immature stages, adults, and/or their habitats. Efforts directed at habitat control should include:

- eliminating weeds and brush
- removing manure, dirty bedding, spilled feed, and other organic matter
- mitigating mud and wet areas
- eliminating sources of stagnant water
- housing animals away from water sources
- mowing pastures

Actions directed at vector control should start early in the vector season for best effect. Parasitic wasps or other biocontrol agents feed on immature vector stages and are very effective, as are commercial feed-through products for fly control. Sprays, traps, and baits are available to control adults, and some of these products have residual effects. Sprays to control ticks and fleas on pastures are not practical, but some municipalities spray to control mosquitoes due to the zoonotic nature of mosquito-borne diseases. Licensed commercial insecticide products can also be applied to animals’ bodies according to label instructions. Confining animals under fans during periods of peak vector activity (e.g., stalling horses in screened barns from dusk to dawn when mosquitoes are active) and using fly blankets and face masks can also reduce the risk of disease transmission via some vectors.

**Conclusion: role for veterinarians**

Practitioners are encouraged to keep an eye out for vectors and vector-borne diseases, whether known or emerging. Remember to consider vector-borne diseases when generating differential diagnoses. If unknown insects are encountered, collect a specimen and submit it to a diagnostic laboratory for identification. Bear in mind several vector-borne diseases are zoonotic concerns and educate clientele about these diseases.

**Tick tock: control of a famous cattle disease vector in the US**

Cattle fever killed millions of cattle in the southern U.S. from the 1800s through the 1950s. Also called babesiosis, this vector-borne disease is caused by the protozoan blood parasites Babesia bigemina and B. bovis. Thanks to federal programs focused on eliminating cattle fever vectors (*Rhipicephalus annulatus* and *R. microplus*), the threat of this disease has been greatly reduced.


**Resources and references**


CDC - [cdc.gov/vitalsigns/vector-borne](http://cdc.gov/vitalsigns/vector-borne)

Center for Food Security and Public Health - [cfsph.iastate.edu/Infection_Control/Routes/vector-borne.php](http://cfsph.iastate.edu/Infection_Control/Routes/vector-borne.php)

2020 Washington State rabies update

Dr. Susan Kerr, WSDA Education and Outreach Specialist

As of October 19, eight bats in Washington State have tested positive for rabies in 2020: four in King County and one each in Pend Oreille, Spokane, Island, and Lewis counties. In descending order, the counties with the highest numbers of positive rabies cases in the last 5 years are King, Chelan, Spokane, Snohomish, and Lewis. This does not necessarily mean rabies is more prevalent in these counties; bat-human interactions are just more likely in these areas based on population density and/or human activities. Fifteen of Washington’s 39 counties have not identified a rabies positive bat in the last 5 years. See Table 1 for more details.

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Table 1. Bats Tested for Rabies Virus by County of Submission, Washington State, 2015-2020 (to date).
**Washington’s rabies reservoir**

Although skunks, raccoons, foxes, and coyotes are also known rabies transmitters, bats are the main concern in Washington. The state Department of Health reports less than 1% of wild bats are probably infected with the rabies virus, but 3 to 10% of those tested are positive. The latter number is higher because those bats are often sick or hurt and easier to catch. Human contact with sick or hurt bats creates a public health risk and results in these bats being tested. Since 1988, 522 bats, 2 cats, 1 horse, and 1 llama have tested positive for the virus in Washington.

**People and wildlife**

Wildlife poses disease and injury risks to humans, especially children. Children should be taught to notify an adult if they find any kind of wildlife, healthy or sick, indoors or outdoors. Adults should assess the situation; oftentimes, there is no need for any action. If the animal seems sick or injured and contact is needed, it should be done by a trained animal control officer or wildlife rehabilitator. This person will be able to handle the animal with the least risk to humans and stress to the animal.

Wildlife should not be kept as pets for safety and health reasons. Washington State rabies law make it illegal to own any of the above-mentioned species associated with rabies transmission. The WSDA has a [web page listing animals designated illegal to own, transport, or import in Washington](http://www.wsdacatlaw.com/).

**Vaccinations**

Why is it so important to keep dogs, cats, and ferrets up to date on rabies vaccinations? Pets are the bridge between wildlife—healthy or rabid—and humans. They may come across a sick or injured bat outside and interact with it out of curiosity. The bat may try to defend itself and bite the pet. If a pet is not current on its vaccinations, it may contract the disease and in a worst-case scenario, become positive and transmit the virus to humans through a bite or contact with infective saliva. Rabies vaccinations are just as important for indoor and outdoor pets because bats can easily enter many homes.

Rabies vaccines are approved for use in cats, dogs, ferrets, horses, cattle, and sheep. They can be administered to other species at risk under the guidance of a licensed veterinarian. They must be boosted every year or three years, depending on the animal’s age and species. In many states, a licensed veterinarian must administer rabies vaccinations. Regulations vary between states—see the [AVMA’s rabies chart](http://www.avma.org/) for specifics.

Humans whose activities put them at increased risk of rabies exposure (veterinarians, veterinary hospital staff, laboratory technicians, wildlife workers, spelunkers, etc.) should consult a healthcare professional regarding pre-exposure vaccination. Anyone who suspects he/she may have contacted a rabid animal should also contact a healthcare professional ASAP so the need for post-exposure treatment can be determined. If treatment is indicated, best outcomes are associated with prompt treatment.

**Washington State rabies cases**

In the last 25 years, there have been two cases of human rabies in Washington, both due to contact with infected bats. In the last 33 years, two cats, one llama, a horse, and one dog died from rabies.

- **Did you know?**

  Cats, dogs, and ferrets are required to be vaccinated for rabies in Washington State.

**Client education**

If clients are reluctant to vaccinate an animal due to low perceived risk, inform them about the minimum four-month quarantine period for unvaccinated animals bitten by stray/wild animals and the minimum 10-day quarantine for healthy animals that have bitten people. The cost of quarantine and its associated stress to the animal may convince the owner to opt for prevention.

**Resources**

CDC - [cdc.gov/rabies/](http://cdc.gov/rabies/)

AVMA - [avma.org/one-health/help-control-rabies](http://avma.org/one-health/help-control-rabies)

DOH - [doh.wa.gov/YouandYourFamily/IllnessandDisease/Rabies](http://doh.wa.gov/YouandYourFamily/IllnessandDisease/Rabies)


Feral hogs: gateway to disaster

Dr. Ric Torgerson, Washington State Region 2 Field Veterinarian

Feral hogs (a.k.a. wild boar, razorbacks, or wild pigs) are an amazingly resilient, adaptive, and destructive invasive species. They eat anything, out-compete other species, have few predators, and reproduce efficiently. Their numbers are growing rapidly in North America and elsewhere. The U.S. population is estimated at 5 million animals in at least 39 states.

Feral hogs in Washington?

Although a sustained population of feral hogs is not currently established in Washington, the state has had sporadic and localized wild sounders (groups of pigs) in the past. For example, a small number of feral pigs was present in Grant County from 2016 to 2018, but that population was eradicated through aggressive action by the Washington State Department of Fish and Wildlife with assistance from the Washington Invasive Species Council and USDA APHIS. Canada has an exponentially growing population of wild pigs moving ever closer to the U.S. border; we know from experience pathogens and invasive species do not abide by state or national borders.

Destruction machines

Damage from feral swine is diverse and includes destroying habitats, decimating crops, eating endangered species, devastating lawns and landscaping, killing livestock, wrecking fences, and spreading diseases. The impact of this destruction and associated control costs is assessed at $1.5 billion annually. Razorbacks are dangerous, as well: they can attack and can even kill people; a fatality occurred in Texas in 2019.

Disease concerns

If introduced to the U.S. and its feral pig population, African swine fever (ASF) would be incredibly difficult to control and would cost billions in losses and control efforts nationwide. This could happen if illegally imported raw or undercooked pork products contaminated with the ASF virus were fed to U.S. pigs. Any unusual morbidity or mortality event should be reported immediately, whether found in feral or domestic pigs. However, diseases transmitted by feral hogs are of particular concern:

- Classic swine fever
- Swine vesicular disease
- Vesicular exanthema of swine
- Nipah virus
- PRRS
- Porcine epidemic diarrhea virus
- Brucellosis
- TB
- Pseudorabies
- Leptospirosis
- Influenza
- Foot and mouth disease

Hunting as a control measure

Feral swine are hunted in some states for recreational, food harvesting, and control purposes, but hunting will not solve a country’s feral swine problem. Unless all the animals can be contained and killed, hunting disperses a group and surviving animals can spread far and wide and start new groups of feral pigs. Pigs are extremely smart and soon learn how to avoid hunters. Efforts focused on trapping and eliminating entire sounders at the same time are much more effective.

chronline.com/sports/bringing-home-the-bacon-feral-pigs-may-entice-hunters-to-eastern-washington-this-fall/article_39f81a32-5e90-11e6-88ae-7f29e6d8d4b5.html

Wild pigs vs. domestic pigs in Washington

Feral hogs are Sus scrofa and domestic pigs are Sus scrofa domestica. Feral hogs decimating parts of the country tend to be S. scrofa or their crossbred descendants. The few occurrences of “feral hogs” in Washington have involved escaped domestic pigs.

Squeal on Pigs!

If you see or hear about unconfined pigs, notify the Washington Invasive Species Council at invasivespecies.wa.gov/report-a-sighting or 888-268-9219.

Practitioners, if you see anything suspicious or unfamiliar such as unusual morbidity or mortality events, escalating severity of signs, unusual signs of disease, or signs resembling a vesicular or hemorrhagic disease, please contact the state’s veterinary office immediately. We can help identify, control, and resolve the problem in partnership with you. Also please let us know if you suspect pigs have been imported illegally into Washington State, such as without a certificate of veterinary inspection and/or permanent identification tag for each animal. Together we can make a difference and control pigs and pig diseases!
Livestock losses due to wildfires: information for producers

Dr. Minden Buswell

The summer 2020 wildfires in eastern and central Washington have been devastating. As veterinarians, you are in a position to recommend resources that can help affected producers begin the recovery process. Here are some resources they may find useful.

Document livestock and crop losses

- WSDA does not have a fire relief fund but federal assistance related to wildfire losses may be available, so document losses to crops and livestock. More information is available from your county Extension educator or USDA Farm Services Agency office. Visit fsa.usda.gov for information on their assistance programs.
- Anyone who suffers livestock losses should document where they are found and photograph dead livestock where they lay. This will help with insurance claims.

Livestock identification

- The WSDA Livestock Inspection Program at agr.wa.gov/departments/animals-livestock-and-pets/livestock can help farmers and ranchers through brand inspection or ear tag identification if they need to identify livestock lost to a disaster. You can email LivestockID@agr.wa.gov for help or visit agr.wa.gov and search for the Livestock Inspection Program.

Disposing of livestock mortalities

Disposal methods approved by WSDA, the Washington State Department of Ecology and the Washington Board of Health include:

- **Direct burial of carcasses**: appropriate for small numbers of carcasses.
- **Composting**: must be conducted in compliance with chapter 70.95 RCW and chapter 173-350 WAC.
- **Incineration**: animal mortalities and byproducts can be incinerated in incinerator or cremation unit permitted by regional Clean Air Agencies.
- **Rendering**: carcasses may be rendered only by a rendering plant licensed under chapter 16.68 RCW.
- **Landfill**: certain landfills are allowed to take carcasses and butchering waste.
- **Open burning of animal carcasses and byproducts**: is not allowed under RCW 70.94.775.

Anyone who has experienced large numbers of mortalities and needs help with carcass disposal, including suitable locations, can contact WSDA at 360-902-1800.

Photo: Adam DuBrowa/ FEMA

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Read posts and subscribe at: wastatedeptag.blogspot.com
LOOKING FOR RESEARCH PARTICIPANTS

We are collecting opinions from veterinary and animal care workers on disaster preparedness related to the COVID-19 pandemic, with the goal to develop and maintain a resilient animal care workforce capable of responding to this and future crisis situations.

We encourage you to participate if you are a:

- Veterinary medicine worker
- Animal shelter or animal control worker
- Zoological facility or wildlife worker

If you fit into the above categories and would like to participate in this study, please or scan the QR code

CLICK HERE
<www.tinyurl.com/covetsudy>

This survey should take approximately 10-20 minutes to complete.

Please feel free to widely distribute to other co-workers and colleagues.

If you have questions or would like more information on this study, please visit

Our Website
<eh.ihu.edu/research/covet>

or email us at:

covet@jhu.edu