

Guidance for Wildlife Rehabilitation to Minimize Potential Risk of SARS-CoV-2 Zoonotic Transmission to Susceptible North American Wildlife

Executive Summary

The COVID-19 pandemic, caused by the newly emerged SARS-CoV-2 virus, poses challenges to state and federal wildlife agencies responsible for protecting the health of native wildlife populations. The full range of wildlife host susceptibility to SARS-CoV-2 is unknown. However, there is potential that virus exposure could result in infection and sustained transmission among some wildlife species. As advances in scientific information continue to inform our understanding of species susceptibility to SARS-CoV-2, wildlife agencies should consider measures to reduce the immediate potential zoonotic disease risks for human-to-wildlife virus transmission, along with the possible future risk of spillback from wildlife-to-humans. Following a brief introduction on SARS-CoV-2, this document summarizes the roles of state and federal wildlife agencies, and of their permitted wildlife rehabilitators, with respect to the rehabilitation of wildlife in the face of the COVID-19 pandemic. The document next describes the Hierarchy of Control (HOC) process to assess potential for risk elimination or to develop and achieve disease risk mitigation measures. A list of recommended actions under the HOC categories of Elimination, Engineering, Administration, and Personal Protective Equipment (PPE) is provided to assist regulatory agencies and their wildlife rehabilitators in developing management plans under permit conditions. Finally, the document identifies longer term considerations to develop biosecurity training and preparation of ‘continuity of operations’ or emergency response plans for wildlife rehabilitation facilities. The purpose of this document is to serve as a guidance for state, federal, tribal, and territorial wildlife agencies, as they develop and tailor agency-specific emergency regulations and best management practices in collaboration with their permitted wildlife rehabilitators. This guidance will be updated as new scientific information becomes available.

Introduction

The ongoing COVID-19 pandemic, caused by the newly emerged SARS-CoV-2 viral pathogen, has caused over a million human deaths and infected millions of people worldwide to date.

Currently, it is thought that the SARS-CoV-2 virus evolved from a genetically-related beta coronavirus in an Asian horseshoe bat. A series of genetic mutations may have occurred through one or more intermediate hosts before becoming a human host-adapted virus causing human disease. Human-to-human virus transmission is primarily spread by respiratory droplets or aerosols, and infected humans can shed the virus with or without exhibiting clinical signs of disease. This has raised concerns that asymptomatic and clinically infected humans may pose a potential risk of SARS-CoV-2 transmission to some North American wildlife. Presently, chiroptera, mustelids, felids, and canids are the key taxa of interest based on reports of SARS-

CoV-2 infections in farmed mink, zoo tigers/lions, and companion animals (dogs, cats) in close proximity to infected humans. At this time, there is no evidence of any free-ranging North American wildlife becoming naturally infected with SARS-CoV-2. The ability of this virus to attach to and infect mammalian cells is related to compatible complexes formed by the host's angiotensin I converting enzyme 2 (ACE2) cell receptor and the SARS-CoV-2 spike protein receptor-binding domain (RBD). These ACE2-RBD complexes suggest species susceptibility for cross-species transmissions of the virus. Recently published genetic modeling studies have postulated a diverse group of mammals may be susceptible to SARS-CoV-2 infection based on their ACE2 receptors while most birds, reptiles, and fish are unlikely hosts (Lam et-al, 2020; Damas et-al, 2020; Conceicao et-al, 2020). Further, a number of infectivity studies in Egyptian fruit bats, ferrets, deer mice, and domestic cats have demonstrated transmission of SARS-CoV-2 from experimentally-infected animals to naïve co-housed control animals (Schlottau et-al, 2020; Shi et-al.2020; Griffin et-al.2020). Additionally, outbreaks of SARS-CoV-2 in domestic mink populations have illustrated the ability of transmission from humans-to-mink and mink-to-mink, and possibly mink-to-humans (i.e., mink farm employees). These advances in scientific information continue to inform our understanding of species susceptibility to SARS-CoV-2 and how to best protect the health of domestic animals, wildlife, and humans.

Role of State, Federal, Tribal, and Territorial Wildlife Agencies

State, federal, tribal, and territorial wildlife agencies are responsible for protecting wildlife populations as held in the public trust. When faced with a contagious disease that may pose a risk to wildlife, it is a priority to determine first if it is possible to eliminate risk of introduction to the populations that may be at risk. Based on disease agent characteristics, agencies may determine how best to mitigate or attempt to eliminate disease risk and transmission among wildlife populations and promote population health. State, federal, tribal, and territorial domestic animal, wildlife, and public health agencies continue to evaluate the latest science on wildlife health concerns related to SARS-CoV-2 and engage with national and international experts to assess the potential risks associated with wildlife contracting the virus. While the susceptibilities of most wildlife to this virus are not yet well known, there is potential that SARS-CoV-2 exposure could result in infection and possible sustained transmission among certain wildlife species, potentially impacting the health of these animals and their populations. As such, state, federal, tribal, and territorial wildlife agencies may consider additional restrictions or other measures to reduce the risk of (1) virus introduction, transmission, and maintenance among wildlife species to include exposure from infected humans, and (2) any future risk of spillback from wildlife to humans (both routes considered as zoonotic transmission). In their risk assessments and mitigation actions, agencies may consider additional factors such as ongoing local human community spread, biosecurity capabilities of individual wildlife rehabilitation facilities, public perception to prohibition of wildlife rehabilitation activities, and agency legal authorities.

In this regard, the risks of SARS-CoV-2 exposure and infection from humans to individual or small groups of wild animals in wildlife rehabilitation settings should be balanced with the

potential benefits of treatment and release of those individuals from a population health perspective when determining which activities should continue, and which should be suspended or prohibited. While there is currently no data suggesting SARS-CoV-2 is circulating in free-ranging North American wildlife, precautionary measures should be considered to minimize that possibility. Therefore, in some circumstances, implementing the most cautious approaches to prevent pathogen introduction into a naïve population may be necessary.

Role of Wildlife Rehabilitators

Wildlife rehabilitation is generally regulated at the state and federal level. In states that allow wildlife rehabilitation, most require wildlife rehabilitators follow regulatory requirements and permit conditions. These conditions can include using species-specific housing standards, working with veterinary supervision, and following proper husbandry and biosecurity practices. Ideally, wildlife rehabilitation facilities should be able to ensure general biosecurity and disinfection measures are met for a wide variety of disease-causing agents.

While wildlife rehabilitators should always follow permit conditions, implement general biosecurity measures in their facilities, and follow all regulations in response to the ongoing COVID-19 pandemic, it is essential that they follow additional precautionary measures to reduce the possibility that mammals in their care could be exposed to the virus. These additional precautions are a key component in the success of the risk mitigation actions provided below. It is important to recognize that general stress in captured wildlife, prolonged interaction with humans during captivity, and the unknown health status of the public and other transporters bringing rescued wildlife to rehabilitation facilities may increase the susceptibility of an animal to SARS-CoV-2 exposure and infection.

If rehabilitation is permitted, rehabilitators should maintain wildlife [known or presumed to be susceptible to SARS-CoV-2 infection](#) only in wildlife rehabilitation facilities where protocols to avoid viral transmission can be followed at all times. If these conditions cannot be met, then it may be appropriate to use a wildlife rehabilitator network (with permission of the wildlife agency) to either transfer the animal or refer the public to another nearby wildlife rehabilitation facility that can meet these protocols.

Hierarchy of Controls to Reduce the Risk of SARS-CoV-2 Spreading between People and Wildlife

The [Hierarchy of Controls](#) (HOC) is a standard tool applied in occupational safety and health practices to minimize exposure to hazards by implementing effective control solutions. The HOC approach is used here to apply the general HOC principles to the context of minimizing disease spread between people and animals.

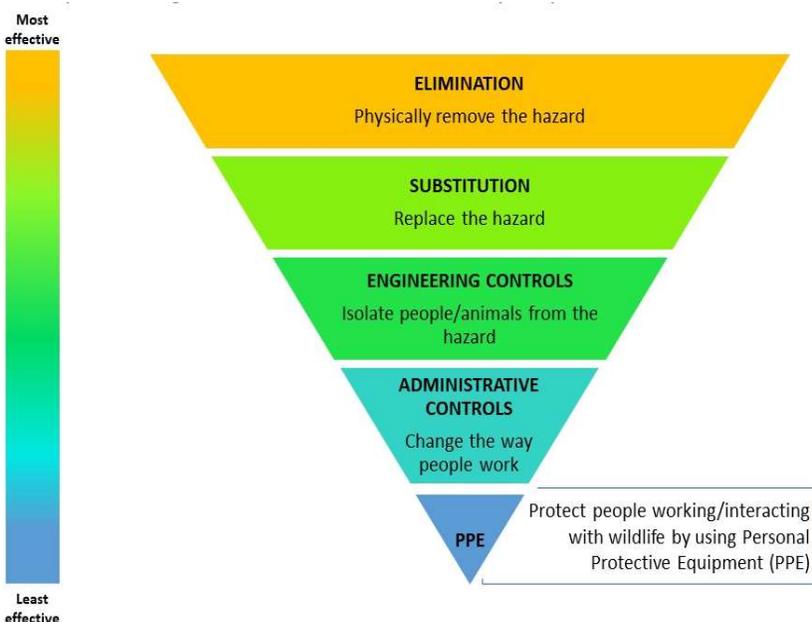
Implementing controls near the top of the hierarchy leads to an inherently safer approach than implementing only controls near the bottom. Levels of control are not mutually exclusive and can be combined as needed.

State, federal, tribal, and territorial wildlife agencies and their wildlife rehabilitators should work together to develop risk-based criteria for which species can and cannot be accepted for wildlife rehabilitation and for approving wildlife species for release. The [Hierarchy of Controls](#) approach, introduced above, would be advantageous to mitigate risk.

The most effective way to eliminate the risk of SARS-CoV-2 transmission to wildlife in wildlife rehabilitation facilities is to suspend or prohibit rehabilitation. However, there can be situations where the benefits of wildlife rehabilitation, when performed in accordance with established policies and guidelines, may outweigh the potential risks of spreading the virus. In those cases, engineering, administrative, and PPE controls can be implemented to mitigate risk.

In addition to implementing a Hierarchy of Controls approach to risk mitigation during the wildlife rehabilitation period, wildlife agencies working with their rehabilitators should develop criteria for release of any known or presumed susceptible wildlife. This should determine the animal's basic fitness for independent survival in its native habitat, any risk of exposure to the virus, and if pre-release testing of the animal and/or its caretakers is warranted, practical, and/or feasible. Routine testing of animals for SARS-CoV-2 is not recommended. [The decision to test an animal](#), including companion animals, livestock, and wild or zoo animals, should be made collaboratively using a One Health approach between local, state, and/or federal public health and animal health officials.

As additional information on the susceptibility and transmissibility of the virus in different wildlife species becomes available, there may be certain situations in which testing should be considered, in coordination with appropriate wildlife health officials and veterinary diagnostic laboratories (see [CDC](#), [OIE](#), and [IUCN](#) guidance) . Before testing sick or dead wildlife for SARS-CoV-2, more common causes of morbidity and mortality should be considered, unless there is cause for suspicion of previous exposure to SARS-CoV-2. It would be prudent to develop wildlife testing protocols with testing criteria and subsequent actions to be taken should there be any positive SARS-CoV-2 results.



Hierarchy of Controls to Reduce the Risk of SARS-CoV-2 Spread Between People and Wildlife in Wildlife Rehabilitation Facilities

The HOC-based risk mitigation recommendations presented below are intended to provide potential measures for eliminating or

reducing the risks of SARS-CoV-2 exposure and infection to wild animals in wildlife rehabilitation settings. These precautionary measures are based on guidance issued by the CDC, USDA, EPA, World Organization for Animal Health (OIE), International Union for Conservation of Nature (IUCN), Wildlife Health Australia, the Association of Fish and Wildlife Agencies, the U.S. Fish and Wildlife Service (USFWS), the National Wildlife Rehabilitators Association (NWRRA), and the International Wildlife Rehabilitation Council (IWRC). These recommendations will be updated as new information emerges.

ELIMINATION CONTROLS	Consider suspending or prohibiting rehabilitation of species with known or suspected susceptibility to SARS-CoV-2 (e.g., felids, mustelids, bats).
SUBSTITUTION CONTROLS	N/A
ENGINEERING CONTROLS	Maintain a log of personnel that have direct contact with wildlife patients that are known or suspected to be susceptible to SARS-CoV-2. At minimum, logs should include personnel name, date(s) of contact, species they interacted with, and duration of interaction.
	When possible, consider implementing flexible, non-punitive sick leave policies that help encourage sick employees to stay home.
	Promote employee mask and social distancing policies, inside and outside of work.
	Follow CDC COVID-19 ventilation guidelines to improve ventilation in the facility.
	Minimize frequent human proximity to susceptible species by keeping patients of those species isolated in properly ventilated areas.
	Place footbaths containing a solution of an EPA-listed disinfectant for use against SARS-CoV-2 at entry and exit points in areas housing susceptible species. Scrub boots with a boot brush before stepping in footbaths to remove organic material. Change footbath solutions at least once per day, since some disinfectants are not effective in the presence of organic matter.
	Distance enclosures used for susceptible species at least 6 feet apart. The use of a solid barrier between enclosures (e.g., between open mesh style small cages) may also help to minimize transmission of virus through the air.
	Do not allow contact between wildlife, pests, and domestic animals and rehabilitation patients in outdoor cages; consider placement of a cover over cages or double fencing.
	Since SARS-CoV-2 may be shed in feces, ensure regular removal of feces with proper disposal based on state/local ordinances.
	Use an EPA-listed disinfectant for use against SARS-CoV-2 on all non-disposable equipment used in the capture, handling, transport, rehabilitation, and husbandry of susceptible wildlife.

	Develop and institute training for personnel on risk mitigation measures that reduce the risk of transmission between people or people and wildlife patients.
ADMINISTRATIVE CONTROLS	Develop and periodically update an emergency response plan to ensure continuity of operations during any type of emergency or disease outbreak. The plan should include contingencies for staff rotations or minimal dedicated staffing; animal care; food, water, and medical supplies; power and utilities supply; communications; and reporting human and animal health concerns to authorities. For SARS-CoV-2, this should include the facility policy for self-reporting of any SARS-CoV-2 positive staff and volunteers.
	People who may have been exposed to COVID-19 or who have symptoms consistent with COVID-19 should stop contact with wildlife and follow recommendations for quarantine .
	Report to the state and/or federal wildlife agency any SARS-CoV-2 susceptible wildlife with possible exposure to a person with COVID-19, especially animals that are displaying clinical signs consistent with SARS-CoV-2 infection .
	If possible, establish dedicated teams of staff and volunteers who work together in rotating work shifts (e.g., 1 week on /1 week off) to minimize the potential spread of COVID-19 between workers.
	Isolate animals with respiratory (coughing, sneezing, nasal discharge) or gastrointestinal signs (diarrhea, vomiting). Limit staff contact and use appropriate PPE . Contact a veterinarian to arrange care.
	Avoid unnecessary handling or other contact with susceptible species and limit the number of staff who handle members of these species.
	Implement a sequence for handling wildlife in rehabilitation: <ul style="list-style-type: none"> • First: Handle or treat susceptible animals. • Last: Handle or treat animals that have clinical signs compatible with SARS-CoV-2 in an isolated area. • All other animals should be treated between these two groups, keeping in mind to handle younger animals before adult animals. • Ideally, separate staff would be assigned to care for each group, or for limited staffing, handle/treat in the sequence listed.
	Pre-arrange backup caregivers for all animals undergoing rehabilitation.
	Follow guidelines in the NWRA/IWRC " Minimum Standards for Wildlife Rehabilitation, 4th edition " to include daily cleaning and disinfection of the facility.
	Wash hands with soap and water or apply hand sanitizer with at least 60% alcohol before and after physical contact with patients, before putting on PPE, after taking off (doffing) PPE, after cleaning or sterilizing equipment, and after using the bathroom.
Work with state wildlife health, animal health, and public health authorities to determine if samples should be collected from rehabilitated animals (if	

	feasible) and submitted to designated veterinary diagnostic laboratories for SARS-CoV-2 testing.
	<p>Have initial quarantine protocol and procedures in place for newly admitted patients as well as strict biosecurity protocols that can help to inform release criteria development.</p> <ul style="list-style-type: none"> • Conduct ‘just-in-time’ training for staff and volunteers on basic biosecurity principles and practices. At a minimum, those working in close contact with wildlife should review the appropriate methods for donning and doffing PPE prior to working with the animals in rehabilitation facilities.
PERSONAL PROTECTIVE EQUIPMENT (PPE)	Follow appropriate guidance from the state wildlife authority, CDC , and the US Geological Survey (USGS) on the use of PPE when handling or working with susceptible wildlife.
	<p>Wear PPE to protect the wearer from exposure.</p> <ul style="list-style-type: none"> • If the animal being handled is suspected or known to be positive for SARS-CoV-2, or if there is a risk of aerosols being generated by a task or procedure, wear a respirator to prevent nose and mouth exposure to respiratory droplets and sprays and to prevent inhalation of small particles. • Respirator use should occur in the context of a complete respiratory protection program in accordance with OSHA Respiratory Protection standard (29 CFR 1910.134), which includes medical evaluations, training, and fit testing.
	N95 respirators with an exhalation valve and masks with vents should not be used when working with wildlife because they do not prevent the wearer’s droplets from being released into the immediate environment and may, therefore, expose animals being handled.
	Wear protective eyewear, such as face shields or goggles where splashes or sprays could occur.
	Wear disposable exam gloves or other reusable gloves (e.g., rubber dish-washing gloves) that can be decontaminated and changed between individual animals.
	Wear dedicated clothing and footwear that can be laundered separately after shifts or can be bagged and thrown away immediately after completing the shift. Disposable protective outerwear such as gowns, suits, and boot covers may be appropriate depending on the activity. Dedicated outerwear that can be changed between patients may be appropriate when working with susceptible species or animals with known exposure to SARS-CoV-2.

Longer Term Considerations

Training

A number of resources are currently available on basic biosecurity principles and practices including several that are specific to working with wildlife that can be immediately used for ‘just-in-time’ training for wildlife rehabilitators. These include guidelines developed by USDA APHIS, Iowa State University, and Wildlife Health Australia as examples listed in the Resources Section of this document. However, developing biosecurity training tailored to the wildlife rehabilitation community should be considered to ensure that biosecurity practices are consistently implemented. This specialized training would cover basic biosecurity practices and include specific recommendations for enhanced biosecurity measures for SARS-CoV-2. The training could be offered as an online course, as hosted webinars, or presented at national/regional wildlife rehabilitation conferences. Professional veterinary and wildlife associations may be available to assist in development of this training. Several are listed in the Resources Section. Eventually this course could become a training requirement for agency-permitted facilities caring for SARS-CoV-2 susceptible wildlife. Providing continuing education credits would incentivize and benefit the wildlife rehabilitator to maintain permit requirements.

At a minimum, those working in close contact with wildlife should review the appropriate methods for donning and doffing PPE prior to working with the animals. A short PPE training video developed by Cornell University College of Veterinary Medicine explains the reason for PPE and the process of donning and doffing: <https://cwhl.vet.cornell.edu/resource/ppe-wildlife-disease-investigation-and-response>.

Continuity of Operations and Emergency Response Plans

All wildlife rehabilitation facilities should develop emergency response plans to ensure continuity of operations during any type of emergency or disease outbreak. The plan should include contingencies for staff rotations or minimal dedicated staffing, animal care, food, water, and medical supplies, power and utilities supply, communication plan, and reporting human and animal health concerns to authorities. Such plans will need time to be properly prepared and should be periodically updated. The American Veterinarian Medical Association (AVMA) and Zoo and Aquarium All Hazards Preparedness, Response, and Recovery (ZAHP Fusion Center) each have guides and templates on preparing facility emergency/disaster plans which could be adapted for wildlife rehabilitation facilities.

Resources for More Information

CDC: [COVID-19 and Animals](#)

CDC: [Evaluation for SARS-CoV-2 Testing in Animals](#)

American Veterinary Medical Association: [Disaster Preparedness](#) Resources

Association of Fish and Wildlife Agencies: [COVID-19 and North American Species of Mustelidae, Felidae, and Canidae](#)

International Wildlife Rehabilitation Council: <https://thewrc.org/>

IUCN: [Guidelines for Working with Free-Ranging Wild Mammals in the Era of the COVID-19 Pandemic](#)

IUCN SSC Bat Specialist Group: [recommendations to reduce the risk of transmission of SARS-CoV-2 from humans to bats in bat rescue and rehabilitation centers](#)

IUCN SSC Bat Specialist Group: [Recommended Strategy for Researchers to Reduce the Risk of Transmission of SARS-CoV-2 from Humans to Bats](#)

The National Association of State Public Health Veterinarians: [Compendium of Veterinary Standard Precautions for Zoonotic Disease Prevention in Veterinary Personnel](#)

National Wildlife Rehabilitators Association: [COVID-19](#)

OIE: Considerations for sampling, testing, and reporting of SARS-CoV-2 in animals
https://www.oie.int/fileadmin/Home/eng/Our_scientific_expertise/docs/pdf/COV-19/Sampling_Testing_and_Reporting_of_SARS-CoV-2_in_animals_final_7May_2020.pdf

OIE/World Organization for Animal Health FAQs on COVID-19: <https://www.oie.int/en/scientific-expertise/specific-information-and-recommendations/questions-and-answers-on-2019novel-coronavirus/>

USGS: [Field Manual of Wildlife Diseases](#)

USGS: [Assessing the Risks Posed by SARS-CoV-2 in and via North American Bats—Decision Framing and Rapid Risk Assessment](#)

Wildlife Disease Association: [COVID-19 Information](#)

Wildlife Health Australia: [Bat Health Focus Group](#)

Zoo and Aquarium All Hazards Preparedness, Response, and Recovery (ZAHP) Fusion Center: [Considerations for the management of non-domestic species in human care during COVID-19](#)

Literature Cited

Curated literature hub for tracking up-to-date scientific information on COVID-19:
<https://www.ncbi.nlm.nih.gov/research/coronavirus/>

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- Washington Department of Fish and Wildlife
- Wisconsin Department of Natural Resources