

Biosecurity guidelines for bat research in caves in Australia

Purpose/scope

This document provides guidance on minimising the risk of spread of disease by bat researchers conducting activities in caves. The guidance covers biosecurity (i.e. disease transmission) risks, and does not deal with other risks of bat research to bats or humans e.g. disturbance of hibernating bats, physical safety risks, etc. Please refer to other relevant guidance documents on these issues.

These guidelines focus on bat research in caves, but many of the recommendations also apply to other activities in caves within the range of cave-dwelling bats, and bat research in other situations.

This document was developed by Wildlife Health Australia in consultation with a range of government and non-government stakeholders.

Background

Conducting research on bats in caves presents a risk of disease transmission from bats to humans, from humans to bats, as well as spread of disease from one bat to another or from one cave to another. The biosecurity measures outlined in this document will help to reduce this risk. Specific diseases of concern include Australian bat lyssavirus (ABLV) (risk to humans) and the exotic disease white-nose syndrome (WNS) (risk to bats), however these guidelines are designed to reduce the risk of transmission of other known or unknown diseases.

ABLV is a virus that infects Australian flying-foxes and insectivorous bats. It is related to, but distinct from rabies virus. It causes neurological disease in bats, and can infect people and other mammals with a fatal outcome. Rabies vaccination helps protect people against ABLV, and post-exposure treatment is available for people who have had potentially infectious contact with a bat.

WNS is a fungal disease that affects hibernating insectivorous bats. It has caused significant declines in North American bat populations. It is caused by the fungus *Pseudogymnoascus destructans* (*Pd*), which is found in North America, across Europe and in parts of Asia. White-nose syndrome has not been identified in Australia. Clinical signs include a white or grey powdery fungus on face or wing, wing membrane damage, unusual behaviour e.g. day flying, and mass mortality. The *Pd* fungus requires cold conditions to grow, so the risk of WNS is greatest in the cooler southern parts of Australia. There is no known human health risk from WNS. For more information on WNS, see the [WHA fact sheet](#), and other resources at the end of this document.

Spread of disease from bats to humans

Infection may be transmitted from a bat to a human by a variety of routes, both direct (close contact) and indirect (contact with contaminated items). Pathways for transmission include inhalation, ingestion, via skin or mucous membrane, or through a bite, scratch or wound contamination. Not all diseases are transmitted by all transmission routes e.g. see ABLV exposure information below. To reduce the risk of exposure of people to disease, biosecurity precautions are recommended before, during and after contact with bats and/or their excreta (see [National Wildlife Biosecurity Guidelines](#)). Personal protective equipment (PPE) recommended for handling bats is described in this [information document](#).

Due to the risk of infection with ABLV, bats should only be handled by people who are trained, rabies-vaccinated and with sufficient levels of immunity, and using appropriate [PPE](#). **In the event of a bat bite, scratch or other significant contact (e.g. saliva on mucous membrane or broken skin), seek medical attention URGENTLY.** Bite or scratch wounds should immediately be washed thoroughly with soap and copious water for approximately 15 minutes and a virucidal antiseptic (such as an iodine based antiseptic) applied. Bat saliva in the eyes or mouth should be rinsed out immediately and thoroughly with water.

Histoplasmosis is a disease of humans caused by a soil-based fungus, *Histoplasma capsulatum*. The fungus is found in bat (and bird) droppings. People are usually infected by breathing the fungal spores in from the air e.g. in a cave with a large amount of bat droppings. Histoplasmosis is a rare disease in Australia. For information on this disease and how to avoid infection, refer to the relevant Public Health agency e.g. [Queensland Health](#).

Spread of disease by humans

Humans may transmit disease to bats, between bats or transfer disease from one cave to another. This can occur via direct transmission e.g. aerosol transmission of a virus from humans to bats, via an object e.g. piece of equipment, or in the environment e.g. transmission of *Pd* fungus from one cave to another.

The general biosecurity measures outlined below will reduce the risk of transmission of most diseases. In the case of WNS, *Pd* can persist in the environment for long periods, even in the absence of bats, and fungal spores can be spread on items such as boots and trapping equipment. Although WNS/*Pd* has not been identified in Australia, there is a risk that *Pd* could have been introduced into Australia but not yet detected at the time of the research activity, and the consequence of spreading a significant disease like WNS is very high. Additionally, the measures recommended for WNS will inactivate most disease-causing pathogens, so will help protect bats from a range of diseases.

Spread of disease from humans to bats

Although the focus is generally on diseases that can be transmitted from bats to humans, it is important to also consider that diseases can transmit in the other direction. The general biosecurity measures outlined below are effective in protecting bats as well as humans.

There is evidence from overseas that humans can infect a variety of mammalian wildlife species with SARS-CoV-2, the virus that causes COVID-19, and the virus has now been detected in a bat in the USA.^a It is therefore safest to assume that transmission to a bat could occur following close exposure with an infected human, under similar situations as for human-to-human transmission. Specific guidance on preventing transmission of SARS-CoV-2 to wildlife is provided in WHA's [COVID-19 \(SARS-CoV-2\) and Australian wildlife biosecurity information](#) and [IUCN SSC BSG's recommendations for researchers and cavers](#), and [Field Hygiene guidelines](#). There may be other pathogens that could spread from humans to bats. The risk of transmission will be reduced by following the general biosecurity measures below.

Precautions when conducting bat research in caves^b

General biosecurity measures

Biosecurity practices for working with wildlife are outlined in the [National Wildlife Biosecurity Guidelines](#) (Chapter 5). Always follow the applicable biosafety, permit conditions and animal ethics regulations.

Measures to prevent disease transmission include the following:

- Minimise the number of people interacting with bats.

^a Goldberg AR, Langwig KE et al. (2024) Widespread exposure to SARS-CoV-2 in wildlife communities. *Nature Communications*: 15: 6210. <https://doi.org/10.1038/s41467-024-49891-w>

^b 'In caves' includes where harp traps are set up at or near the cave entrance and where bats are handled.

- Ensure that you are trained and appropriately vaccinated with current immunity (e.g. [rabies](#), COVID-19 vaccination and boosters) before handling or interacting with bats.
- Practice good hand hygiene:
 - Wash your hands and other exposed skin with soap and water for at least 20 seconds and dry thoroughly BEFORE AND AFTER interacting with bats or the cave environment.
 - Avoid touching your eyes, nose and mouth.
- Use disposable gloves. If a sick bat is identified, change gloves and disinfect equipment before handling another bat.
- Always use appropriate [personal protective equipment](#). Due to the risk of transmission of SARS-CoV-2, routine use of face masks (N95 or equivalent) is strongly recommended if you are unable to maintain physical distancing between yourself and the bat i.e. at least 1.5 meters in a well ventilated area. For more information, see WHA's [COVID-19 \(SARS-CoV-2\) and Australian wildlife biosecurity information](#).
- If you are unwell e.g. with viral symptoms, you should consider delaying your participation until you have recovered.

Clothing,^c footwear & equipment used in caves overseas

- The *Pd* fungus is known to be present in North America, across Europe and in parts of Asia.
- To avoid introduction of WNS, clothing, footwear and equipment that has been used in caves, or around bats, overseas should not be used in Australia. If this is unavoidable, strictly follow the WNS decontamination procedure outlined in the [US National White-Nose Syndrome Decontamination Protocol](#) ('US Protocol') – see below. If purchasing or borrowing second-hand clothing, footwear or equipment, follow the decontamination protocol unless you are certain that it has not been used overseas.

Clothing, footwear & equipment

- Choose equipment that is disposable or can be effectively decontaminated whenever possible.
- At a minimum, replacement of disposable equipment and decontamination of reusable equipment should occur when moving between karst regions, or between locations where bats are not known to be interacting in the wild. In some situations, more frequent replacement and decontamination may be considered.
- Refer to the US Protocol for more detail on the WNS decontamination steps. Table 1 of the US Protocol outlines products and applications with demonstrated efficacy against *Pd* (see also 3b below). **Note:** Chemical disinfectants are potentially toxic and should be used strictly according to the manufacturer's instructions and safety data sheet.

Cleaning and decontamination steps:

1. Thoroughly remove all dirt, sediment and debris.
2. If unable to clean and decontaminate on site, change into clean clothing and footwear. Seal used clothing, footwear and equipment in a plastic bag or container for transport, separated from all clean clothing, footwear and equipment e.g. double bag or store the sealed bag in a plastic container.
3. Treat clothing, footwear and equipment using one of the two methods outlined below. Always follow the product instructions and the equipment manufacturer's recommendations. For equipment that cannot safely be treated using one of these, follow the manufacturer's instructions for cleaning (or, if feasible, dedicate the equipment to individual sites).

^c 'Clothing' includes helmets and gloves

- a. Preferred treatment if suitable: Submersion in hot water, maintaining a temperature of at least 55°C for a minimum of 5 continuous minutes. Note that the temperature of hot water from the tap varies and may not be sufficient to achieve this requirement. Avoid trapped air so that all surfaces of the equipment are in direct contact with the water for the full 5-minute period.
- b. Non-submersible equipment: Treat with an appropriate product from Table 1 of the US Protocol. This table lists US products but there are some equivalent products available in Australia, for example:
 - Disinfectants: isopropyl alcohol 50-70%, sodium hypochlorite or bleach 8.25%, Virkon® S
 - Wipes: isopropyl alcohol 70%, quaternary ammonium compound (e.g. Clorox®)

Rinse equipment thoroughly in clean water, and allow to completely dry before the next use.

Note the safety information in the US Protocol: *“The use of any product or application should also consider all manufacturers’ instructions for care of the equipment to ensure its safety and integrity. For equipment that cannot be safely disinfected using an application in Table 1, clean according to the equipment manufacturer’s instructions. Always wear personal protective gear suitable for the application and/or product being used.”*

4. Examples of suitable methods for specific equipment (see the US Protocol, section VI for more detail):
 - a. *Clothes, cotton bags*: Hot water treatment (see 3a).
 - b. *Shoes*: Scrub clean, then immerse in a suitable disinfectant (see 3b).
 - c. *Harp traps (metal frame, nylon strings), mist net poles*: Decontaminate before moving into a different karst region. Apply suitable disinfectant e.g. clean the frame and line carriers with disinfectant wipes, clean the bottom of the legs more thoroughly by first removing any dirt and then immersing in disinfectant; rinse thoroughly and allow to dry. Disinfectant wipes can be pulled through the insides of poles with string.
 - d. *Harp trap bag*: Hot water treatment. If using disposable harp trap bags or liners, discard after each night if bats are trapped.
 - e. *Mist nests*: Hot water treatment.
 - f. *Scales, callipers, plastic weighing containers, etc*: Wipe down with disinfectant or a disinfectant wipe. Autoclaving can be used on some tools and equipment if feasible and appropriate for the items.
 - g. *Cardboard box or disposable cup used for weighing*: Use a new box or cup for each site. If plastic containers are used, submerge in disinfectant.
 - h. *Helmets*: Hot water treatment or wipe down (inside and outside) with disinfectant.
 - i. *Headlamps, torches*: Wipe down with isopropyl alcohol 50-70% or a disinfectant wipe. The strap can be removed and how water treated.
 - j. *Backpack*: Hot water treatment, if appropriate.
 - k. *Tripod*: Apply suitable disinfectant (e.g. clean most of the tripod using hydrogen peroxide wipes; clean the bottom of the legs more thoroughly by first removing any dirt and then immersing in disinfectant), rinse thoroughly and allow to dry.
 - l. *Electronic equipment (e.g. detectors, cameras, carrying cases etc)*: Wipe down with isopropyl alcohol 50-70% or a disinfectant wipe. A plastic protective cover may be applied to equipment, where feasible, to reduce exposure to contamination e.g. a sealed plastic casing, plastic bag or plastic wrap. Clean the surface of the plastic protective cover before removing the equipment, and then dispose or decontaminate the cover.

- m. *Harnesses & ropes*: Follow the manufacturer’s instructions for cleaning and disinfection. See also [Shelley et al. \(2013\)](#)^d for an evaluation of decontamination strategies.
 - n. *Metal climbing accessories (e.g. carabiners)*: Wipe down with disinfectant wipes.
5. Clean the field vehicles inside and out with soap and water, especially areas in contact with equipment and people, and dirty or muddy wheels and undercarriage.

Protocol for sick or injured bats and suspect WNS cases

Sick or injured bats

Seek veterinary advice for any sick or injured bats. Ensure you have nominated a veterinarian for the research project and follow the protocol outlined in the ethics approval. Any unusual signs of disease or multiple deaths should also be reported (see [WHA website](#) for how to report, and for further advice see [Have you seen sick, injured or dead wildlife?](#)).

Suspect WNS cases

If a veterinarian is present, they may collect samples following the [WNS sample submission guidelines](#). If no veterinarian is present, the bat should be removed from the cave if it can be done safely, and taken to a veterinarian for testing. Otherwise, take photos and record details, and report the case as soon as possible (see [How to report a suspect WNS case](#) and [Southern Bent-wing Bat Recovery Team fact sheets](#)). Ensure careful decontamination (see procedure above).

Resources

General

- WHA: [National Wildlife Biosecurity Guidelines](#)
- WHA: [Personal protective equipment \(PPE\) information for bat handlers](#)
- IUCN SSC Bat Specialist Group: [Guidelines for field hygiene](#)

Australian bat lyssavirus

- WHA Fact Sheet: [Australian bat lyssavirus](#)
- State and territory government agency ABLV resources: [Links](#)

White-nose syndrome

- WHA: [How to report a suspect case of white-nose syndrome](#)
- WHA: [National guidelines for sample submission - White-nose syndrome - Exclusion testing](#)
- Southern Bent-Wing Bat Recovery Team: [Disease Surveillance Fact Sheets](#) for public, veterinarians and cavers and cave managers
- WNS Disease Management Working Group: [US National White-Nose Syndrome Decontamination Protocol](#)
- WNS Response Team: [Decontamination information](#) (including videos)
- Wynne JJ (2017). [White-nose syndrome decontamination procedures for backcountry subterranean projects](#). *Park Science*, **33**(1): 50–56
- US National WNS Plan (2016): [Recommendations for managing access to subterranean bat roosts to reduce the impacts of white-nose syndrome in bats](#)
- WNS information: <https://www.whitenosesyndrome.org>
- WHA Fact Sheet: [EXOTIC - White-nose Syndrome](#)

^d Shelley V, Kaiser S et al. (2013) Evaluation of strategies for the decontamination of equipment for *Geomyces destructans*, the causative agent of white-nose syndrome (WNS). *Journal of Cave & Karst Studies*, **75**: 1-10 <https://doi.org/10.4311/2011LSC0249>

COVID-19

- WHA: [COVID-19 \(SARS-CoV-2\) and Australian wildlife - Biosecurity information for people working or interacting with wildlife](#)
- IUCN SSC Bat Specialist Group: [Recommendations to reduce the risk of transmission of SARS-CoV-2 from humans to bats by cavers](#)