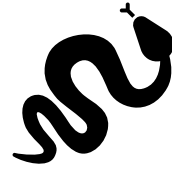


Nongame Wildlife Disease Update

CCWRC 05Nov 2022

Snake Fungal Disease



White Nose Syndrome



Rabbit Hemorrhagic Disease



DEANA CLIFFORD DVM, MPVM, PHD
SENIOR WILDLIFE VETERINARIAN
WILDLIFE INVESTIGATIONS LAB



Reuben Maness, Oakland Zoo



Detection of *Ophidiomyces* *ophidiicola* and Snake Fungal Disease in California



RAQUEL ELANDER, LAURA PATTERSON
& DEANA CLIFFORD

WILDLIFE HEALTH LABORATORY &
WILDLIFE DIVERSITY PROGRAM
CALIFORNIA DEPARTMENT OF FISH &
WILDLIFE

Ophidiomyces ophidiicola (Oo) may lead to Snake Fungal Disease (SFD), aka ophidiomycosis

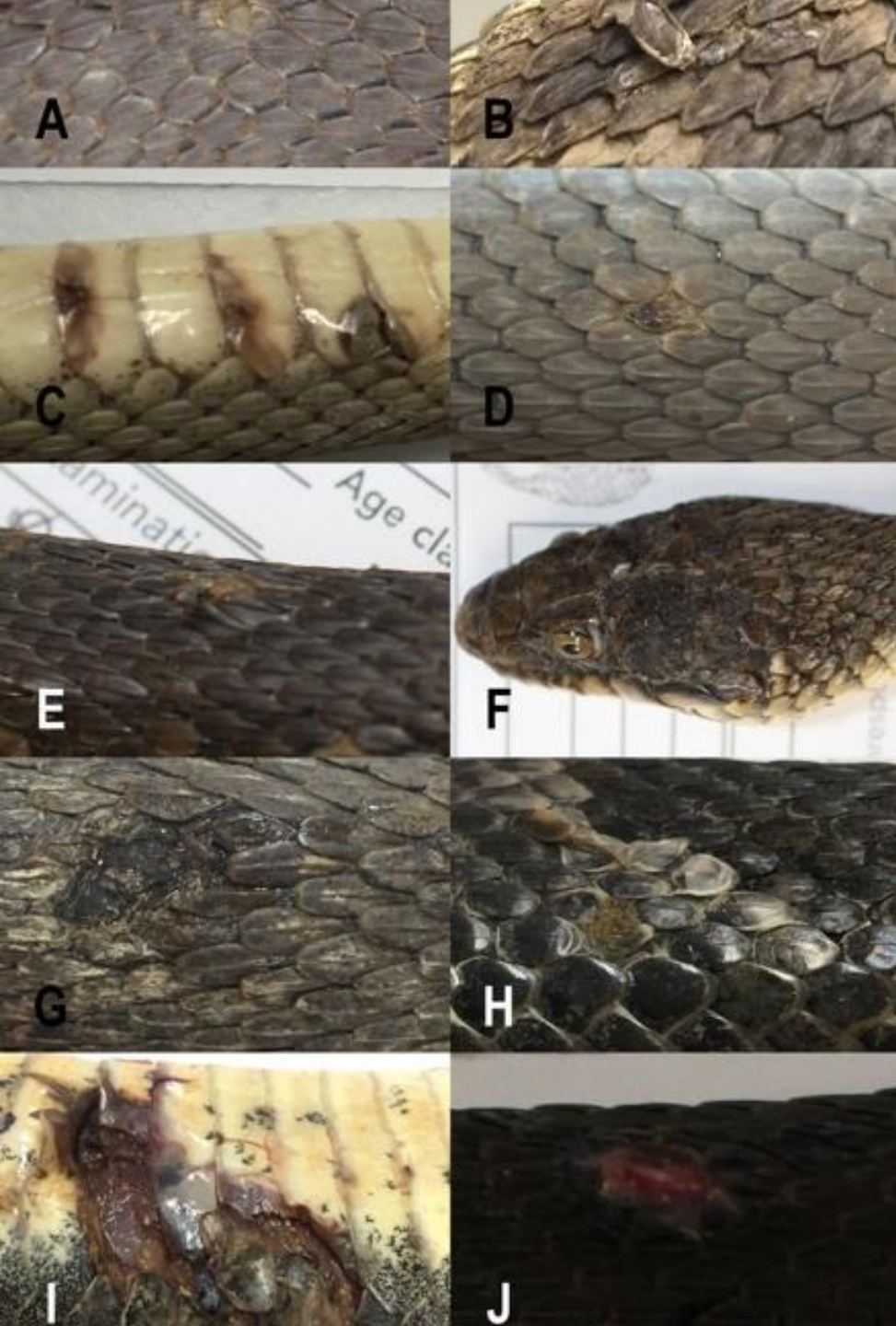
- ALL species considered susceptible
- Severity of infection and disease is species-specific
- Keratinophilic
- Persists environmentally
- Transmission via physical contact with environment/soil or other snakes
- Snakes may carry *Oo* but not show clinical symptoms of disease



Juvenile Broad-Banded Watersnake (*Nerodia fasciata confluens*) with Snake Fungal Disease

By USGS Wetland and Aquatic Research Center

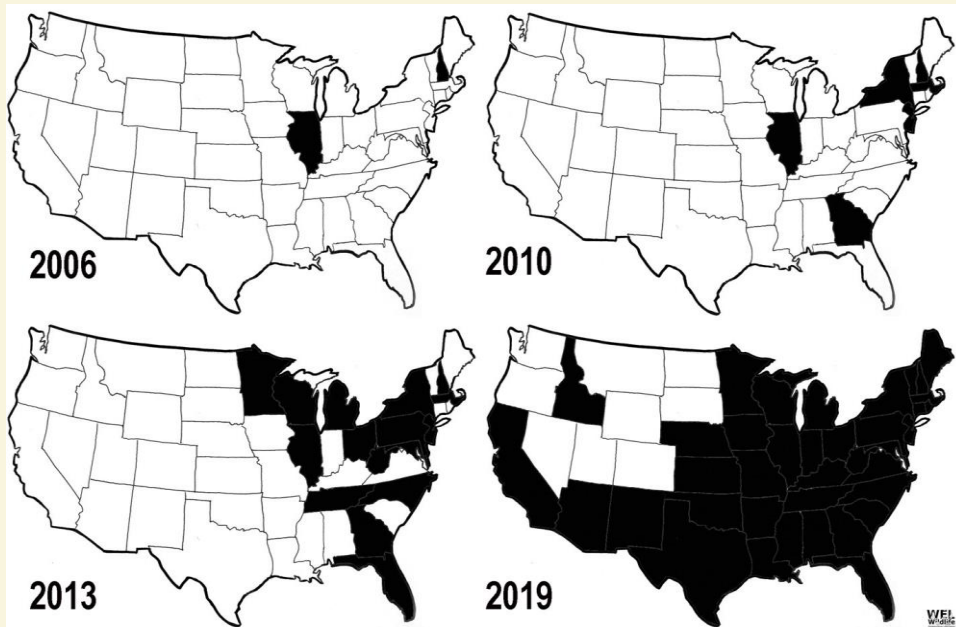
Clinical Symptoms of Snakes with SFD – A Reliable Indicator



1. **Behavioral inconsistency** (ex. basking during brumation period).
2. **Physical:**
 - Scale flaking, crustiness, displacement, thickening, necrosis or discoloration
 - Scales slough off when light pressure is applied
 - Granulomas
 - Ulceration
 - Severe swelling or facial disfiguration
 - Irregular ecdysis/ shed cycling
 - Death

Baker et al. "Case Definition and Diagnostic testing for Snake Fungal Disease." *Herpetological Review*, 50(2), 279-285. 2019.

Movement of Snake Fungal Disease (SFD) and *Ophidiomyces ophidiicola* (Oo) in the U.S.



Geographic distribution of *Ophidiomyces ophidiicola* in the United States, 2006-2019. (Credit: Matt Allender, Wildlife Epidemiology Laboratory University of Illinois).

2006: SFD described in population of Timber rattlesnakes (*Crotalus horridus*) in Illinois
- Population dropped ~50%

2008: SFD confirmed in threatened Eastern Massasauga (*Sistrurus catenatus*) in New Hampshire

2011: *Ophidiomyces ophidiicola*, causative fungus described

2018: Dept. Of Defense sampled snakes on military bases in CA – zero detections

2019: SFD and Oo Detected in California from a California kingsnake (*Lampropeltis californiae*) and invasive Florida banded watersnake (*Nerodia fasciata pictiventris*).

Additional detections in North America, including Canada and Puerto Rico, Europe, Australia, and Asia (2020 case in Hong Kong).



Tri-County Wildlife Care



CDFW Snake Fungal Disease (SFD) Surveillance Project

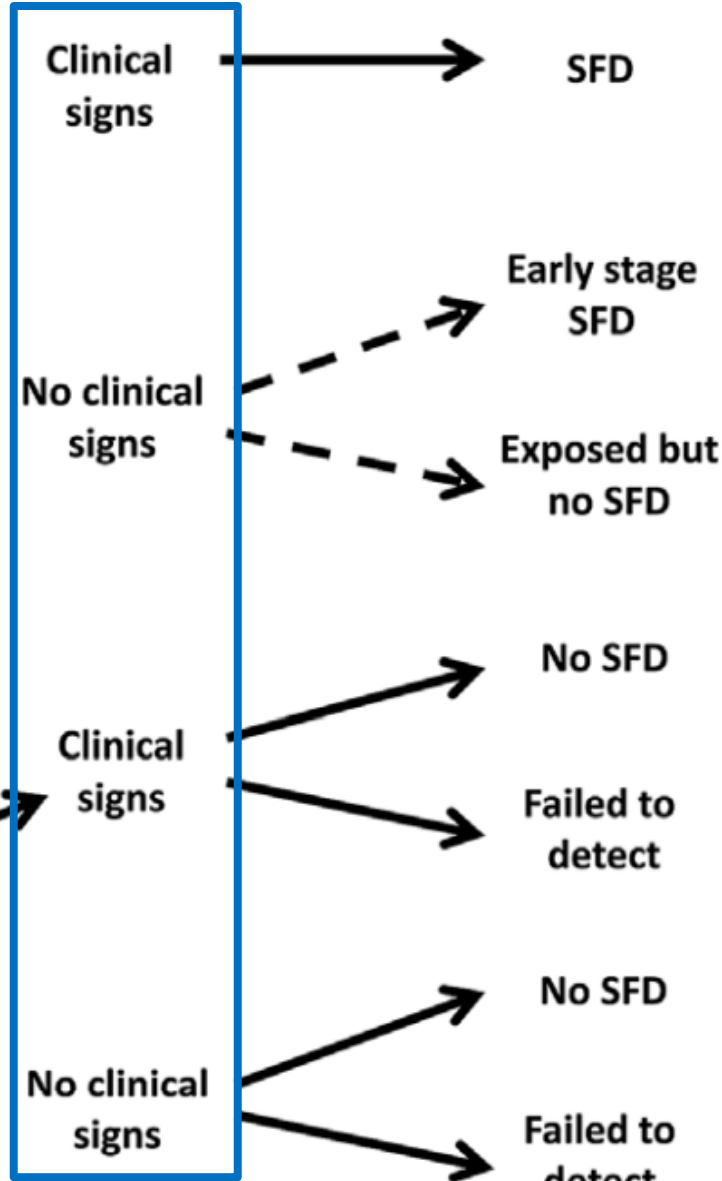
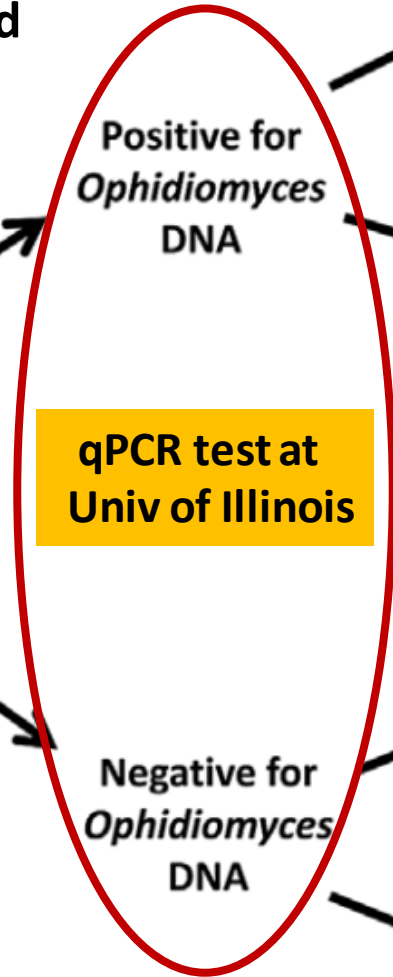
- Started after first detection of SFD in a CA kingsnake brought to Tri-County Wildlife Care in 2019.
- Funded by a State Wildlife Grant to CDFW from the U.S. Fish & Wildlife Service (2020 – 2023).
- Objective: evaluate free-ranging snakes and snakes brought to wildlife rehabilitation centers for pathogen presence, and disease.
- 5 focal geographic areas of interest



Swabbing Training Video

Samples are sent to WEL for qPCR diagnostic testing.

Testing snakes coming into rehab & captured in the field



Exams by field biologists & rehabbers

Results To Date

- Since June 2021, samples collected from **356** snakes from **27** species.
- Samples from **42** of the 356 (12%) snakes were received from wildlife rehabilitation centers.
- Most test results pending

CA counties with Oo and SFD detections:

Amador
Marin
Sacramento



NATIONAL
WILDLIFE
REFUGE SYSTEM

GENERAL GUIDELINES

General Guidelines for the Intake, Quarantine, and Release of Reptiles and Amphibians in Rehabilitation Facilities in Northeastern States, USA



OBJECTIVE

These guidelines are provided to help reduce the risk of pathogen and disease transmission in reptile or amphibian cases brought into rehabilitation facilities. Typically, this would include one to several individuals brought in from a wild, native environment and intended for release upon completion of rehabilitation.

MARCH 2022

<https://parcplace.org/resources/herpetofaunal-disease-resources/>

Gray et al. 2017 Herp Review – for disinfectants – Appendix 1.

WHITE-NOSE SYNDROME UPDATE

DEANA CLIFFORD

AMELIA TAUBER

AMANDA KINDEL

SCOTT OSBORN*



NPS & CDFW Active Pd Surveillance

2021: Low-level detections of Pd throughout eastern California and western Arizona

- Species affected: western small-footed myotis, **California myotis***, Yuma myotis, **canyon bat***, big brown bat and Mexican free-tailed bat

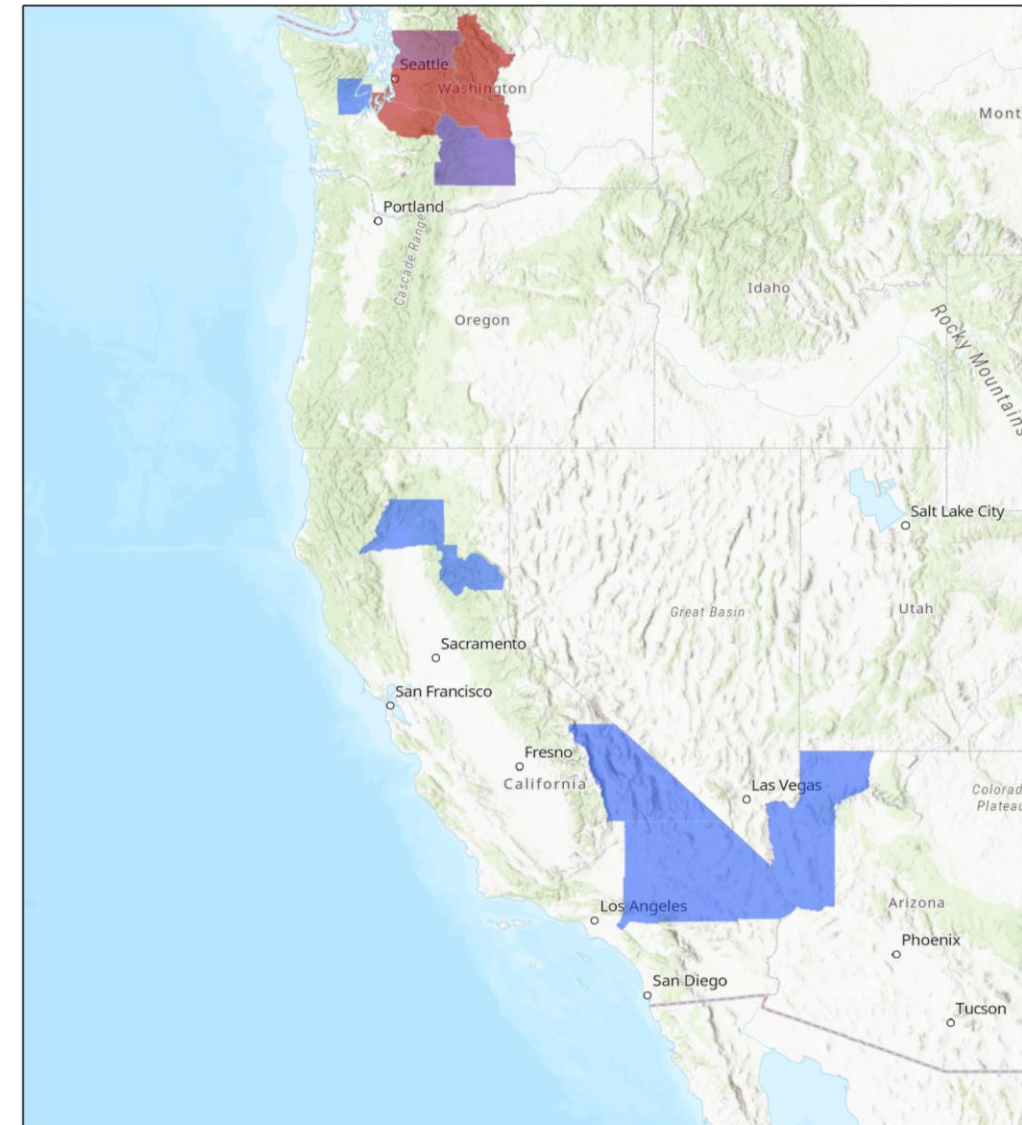
*=new species detection

2022: Repeat and new site sampling yielded only a few low-level detections

- One new detection site in Sutter County

Is the fungus present, but not causing disease?

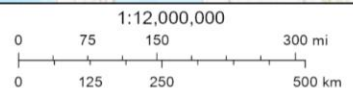
2021 WNS spread Western United States



11/10/2021

WNS Pd detections in the Western United States

- WNS Positive
- WNS suspect
- Pd Positive
- Pd Presumed



Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, Esri, USGS

CDFW Passive Pd Surveillance

- Annual UV screening bats from CA Dept of Public Health
 - Well over 1,000 bats screened to date
- Reports of sick or dead bats from the public

<https://wildlife.ca.gov/Conservation/Laboratories/Wildlife-Health/Monitoring/WNS/Report>



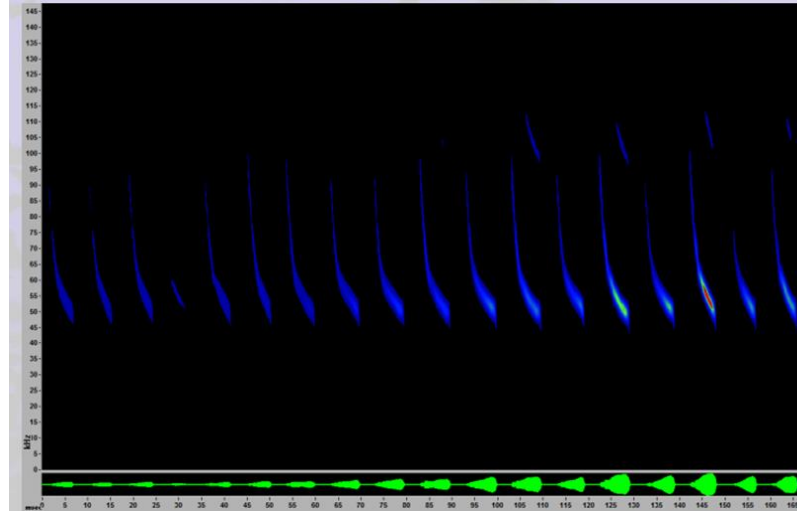
If you know of any bat roosts in your area, please report them using the **CDFW Report a Bat Colony** tool to help us expand our efforts!

<https://wildlife.ca.gov/Conservation/Mammals/Bats/Report-Colony>

CDFW Bat Population Monitoring

Baseline --> Impact if/when WNS arrives in California

- Acoustic monitoring of bat levels of activity:
 - Year-round monitoring
 - 8 detector stations in the Southern Cascades
 - 4 stations on North Coast
 - 4 stations to be installed in mid-Sierra soon
- Video emergence counts at maternity roosts
 - Colony size trends



REHABBERS ARE KEY PARTNER IN DETECTION

- Passive surveillance often detects earliest cases of emerging disease
- Know how to recognize WNS
- Examine all bats admitted & call us if you suspect WNS
- CDFW Fact Sheet

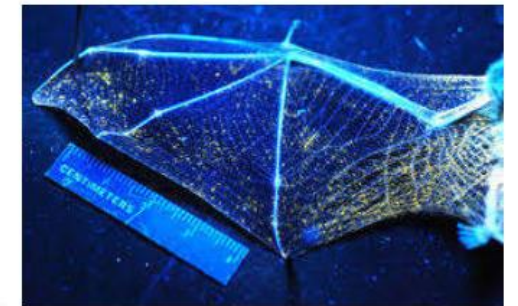
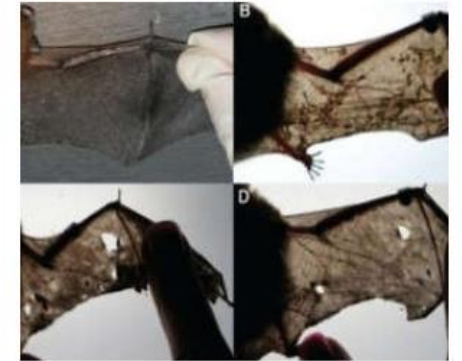


California Department of Fish and Wildlife White Nose Syndrome in Bats

Fact Sheet for Wildlife Rehabilitation Centers

What to look for:

- Light powdery fungus on the muzzle, ears, wings, limbs, or tail of bats;
- Bats exhibiting yellow-orange fluorescence on hairless skin under ultraviolet (UVA) light;
- Thin body condition or dehydrated appearance;
- Wing damage, including thinning, holes, tears, depigmentation, stickiness, or flakes.



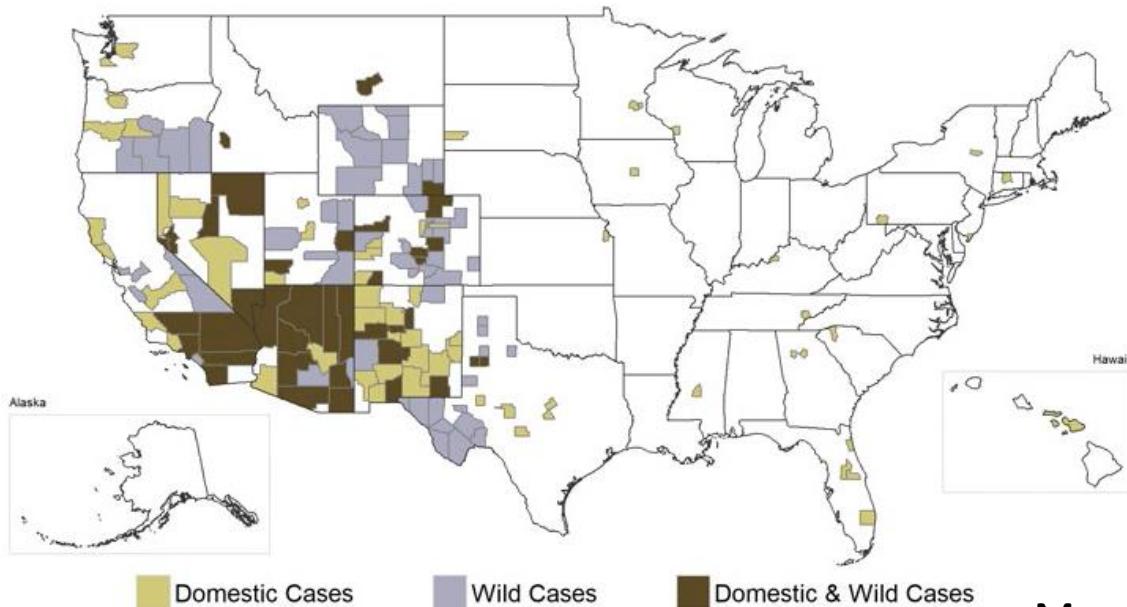
For bats submitted for rehabilitation, please:

1. Conduct a visual assessment of the bat for visible signs of WNS. Look for white fungus, extend the wings to look for damage, and assess whether the bat is emaciated. Also note if a metal wing band is observed.
2. If available, shine an ultraviolet (UVA) light on the extended wings in a completely dark room and look for yellow-orange fluorescence.
3. If the bat exhibits WNS signs, take photos of the bat to help our assessment. Multiple photos should be taken:
 - Whole body with wings extended, front and back,
 - Close-up photos of the face, ears, and wings,
 - Place a ruler next to the bat for scale.
4. If any of the indicators of WNS are observed, please contact CDFW as soon as possible:
 - Dr. Scott Osborn 916-324-3564, scott.osborn@wildlife.ca.gov, or
 - Dr. Deana Clifford 916-358-2378, deana.clifford@wildlife.ca.gov).
5. If the bat dies, please hold the carcass in refrigeration.

Rabbit Hemorrhagic Disease (RHDV2) *2022 Update*

RHDV2 SPREAD

September 2022



Map: Rhdv2.org

Don Cool, USFWS



Dr. J.P. Teifke

Organ pallor, enhanced reticular pattern



Rabbit hemorrhagic disease (RHD)

Clinical signs: hemorrhage, respiratory, neurologic; often just found dead – usually within 2-10d

Disease: virus targets liver—hepatitis, tissue death and bleeding (acute necrotizing hepatitis, microhemorrhages, multi-organ failure & DIC)

Transmission: direct contact, bodily fluids (respiratory secretions, feces, urine), mechanical vectors (scavengers, insects), contaminated fomites (fur, shoes, clothing, products)

***** Virus survives high heat & freezing*****

Diagnosis: RT-PCR preferred, Ag-ELISA, serology ELISAs

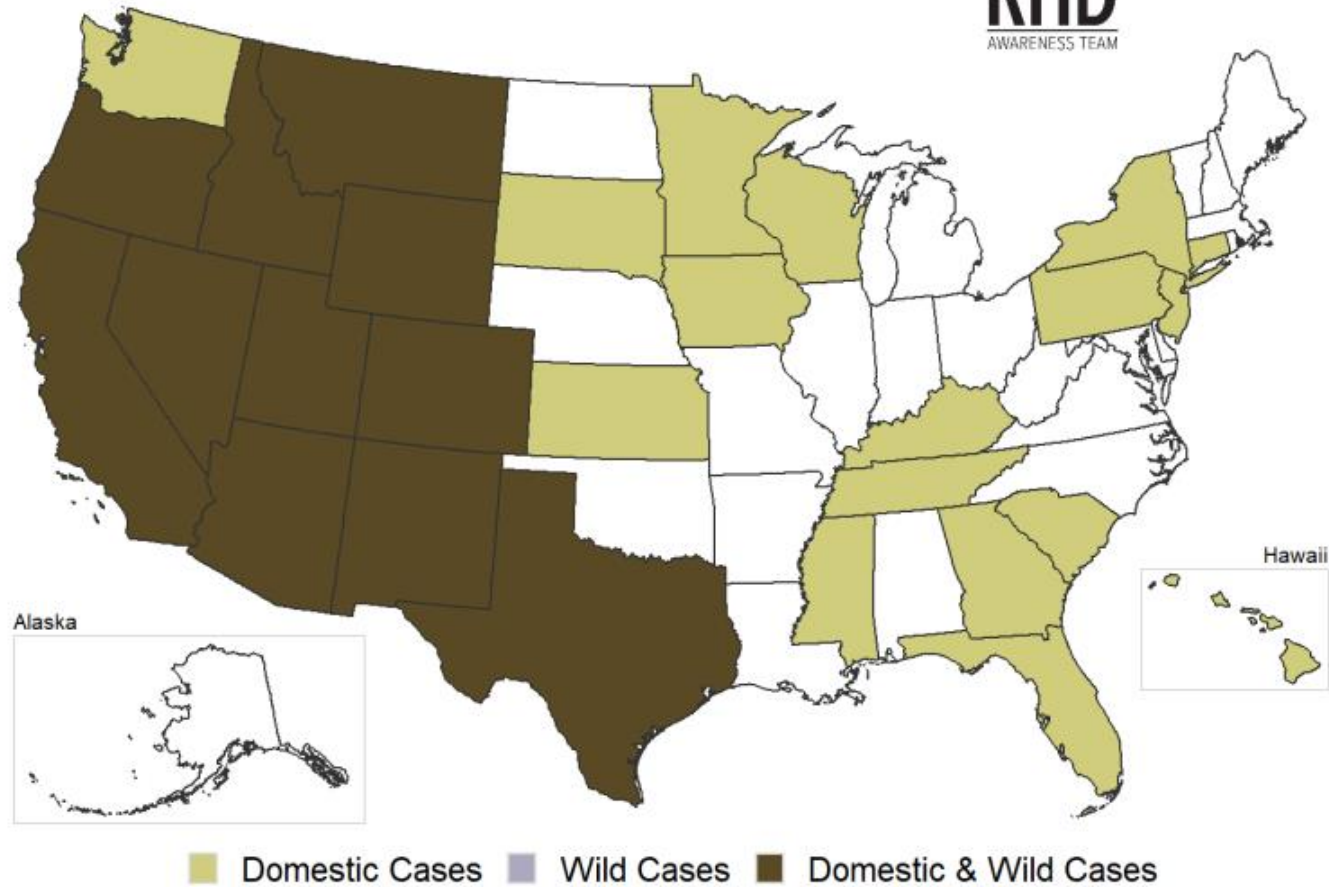
Prevention: biosecurity, vaccine (imported); reduce human-sources of spread

Treatment: supportive care only, hyperimmune serum

RHDV2 Confirmed in 28 states, Canada, Mexico

- 1ST detected Spring 2020 New Mexico
- **WILD SPECIES INFECTED TO DATE**
 - Antelope jackrabbit
 - **Black-tailed jackrabbit**
 - **Desert cottontail**
 - Eastern cottontail
 - Mountain cottontail
 - Pygmy rabbit
 - Snowshoe hare
 - **Western brush rabbit**
 - **** Riparian Brush Rabbit**

RHDV2
September 2022



Data provided by USDA APHIS. Supplemental data reports (e.g., Press Releases) have been collated by Rabbits Rescue Society and WildRescue Inc. since the last USDA reporting period (every 3 months).

See [RHDV2.org/resources](https://www.rhdv2.org/resources) for USDA data disclaimer.
Domestic cases include both domestic and feral rabbit cases.
Map Credit: Dr. Michel Kohl, RHD Awareness Team, University of Georgia.
Data last updated September 15 2022



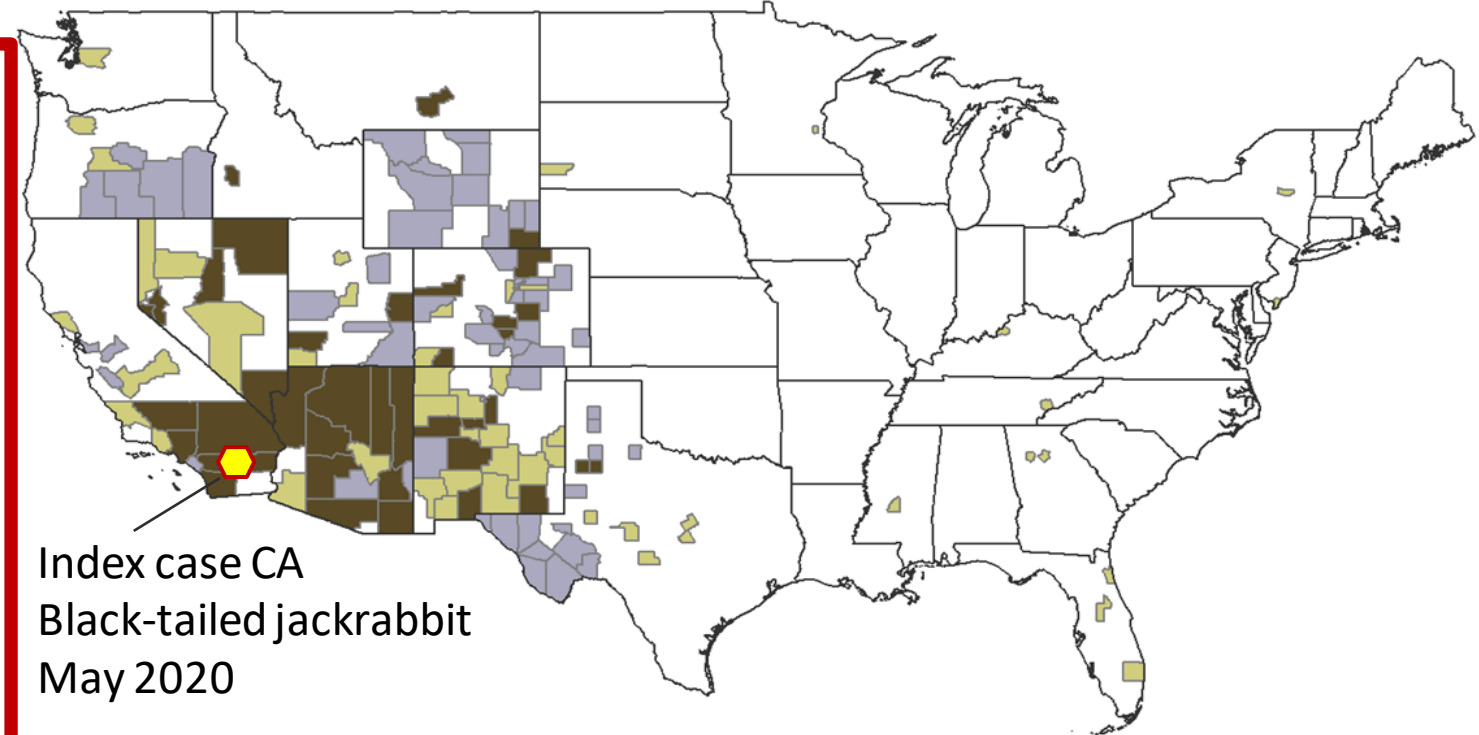
RHDV2 in CA (wild rabbits)



RHDV2
June 2022

May 2020 - November 2022:

- 1,050 wild rabbit mortality reports
- 196 carcasses submitted, 34 counties (33 CA, 1 NV)
- **51 cases from 15 counties**
 - Solano, Marin, Yolo new
- Cases and mortality reports decrease hottest time of year; large case resurgence in Spring 2022 & new cases Fall 2022



Index case CA
Black-tailed jackrabbit
May 2020

■ Domestic Cases ■ Wild Cases ■ Domestic & Wild Cases

Data Source: USDA APHIS
See RHDV2.org/resources for data disclaimer.
Domestic cases include both domestic and feral rabbit cases.
Map Credit: Dr. Michel Kohl, RHD Awareness Team, University of Georgia.
Data last updated June 01 2022

CDFW Response

1. Detect cases & track disease
2. Communication
3. Assess impact to lagomorphs and predators
4. Protect at risk/endangered species
5. Work with stakeholders to prevent human-caused spread



Riparian brush rabbit photo by Moose Peterson

Quick Facts About

Rabbit Hemorrhagic Disease

Rabbit Hemorrhagic Disease virus type 2 (RHDV2) was confirmed in a wild rabbit population in California for the first time in early May 2020. RHDV2 is highly contagious and lethal to both wild and domestic rabbits, hares and pikas.

RHDV2 only affects rabbit species – it is not known to affect humans, livestock or pets other than rabbits.

If it spreads, RHDV2 has the potential to cause significant declines of rabbit populations in California, including the endangered riparian brush rabbit. You can help the California Department of Fish and Wildlife's efforts to fight RHDV2 by reporting sightings of sick or dead rabbits, and taking precautions to not spread the virus to new areas.

HOW IS RHDV2 TRANSMITTED?

The virus is transmitted between rabbits through contact with other infected rabbits or carcasses, their meat or their fur, contaminated food or water, or materials coming into contact with them. People can also inadvertently spread the virus to new areas. The virus can persist in the environment for a very long time, making disease control efforts extremely challenging once it is in wild rabbit populations.

WHAT SHOULD I LOOK FOR?

Infected rabbits, jackrabbits or hares infected may suffer swelling, internal bleeding and liver damage. Often, disease onset is rapid, so only dead rabbits might be seen. A rabbit that has died from RHDV2 may have blood on its mouth or nose.

HOW CAN I HELP?

Sightings of sick rabbits, jackrabbits, hares or pikas exhibiting symptoms of RHDV2 – or any sighting of multiple dead rabbits – should be reported to CDFW. Do not handle or consume sick wildlife, or allow pets to come into contact with wildlife carcasses. Although RHDV2 does not affect people or pets, other diseases that can (such as plague or tularemia) occasionally cause rabbit die-offs.

If you've been recreating outdoors, please take care to wash your clothing and disinfect your footwear and equipment before traveling to other areas or interacting with domestic rabbits. Footwear and equipment should be disinfected by washing in household bleach diluted 1:10 with water for at least 10 minutes before rinsing.

Hunters should wear gloves when field dressing rabbits, bury any remains onsite deep enough to prevent scavenging and wash their hands thoroughly when finished. Meat from healthy rabbits harvested by hunters is safe to consume when cooked thoroughly. Falconers should avoid flying birds in areas with known RHDV2 outbreaks, prevent their birds from consuming dead or diseased rabbits, and take precautions to sanitize gear between outings.



Please report sightings of sick or dead wild rabbits, jackrabbits, hares or pikas to the CDFW Wildlife Investigations Lab at (916) 358-2790 or file an [online mortality report](#) through CDFW's website.



Disease Surveillance

Biological Sampling

Zoonotic Diseases

Chronic Wasting Disease

Rabbit Hemorrhagic Disease

White Nose Syndrome

Rabbit Hemorrhagic Disease

On May 11, 2020, rabbit hemorrhagic disease virus serotype-2 (RHDV2) was confirmed in a wild black-tailed jackrabbit collected from an area where over 10 dead jackrabbits were found near Palm Springs, Riverside county. Since this initial report RHDV2 has been confirmed in the following California counties:

- Los Angeles
- Orange
- Riverside
- San Bernardino
- San Diego



[@USDA Interactive Map of RHDV2 affected counties](#)

This highly infectious virus affects domestic and wild lagomorphs (members of the rabbit family). RHDV2 can spread quickly and can cause high mortality in affected rabbit populations.

Wildlife Investigations Lab

- ▶ Avian Investigations
- ▶ Biological Sampling
- ▶ Disease and Mortality Monitoring
- ▶ Human Dimensions of Wildlife
- ▶ Non-game Wildlife Health Projects
- ▶ Pesticide Investigations
- ▶ Scientific Development
- ▶ Training and Education

CDFW Guidance for Rehabbers – no change



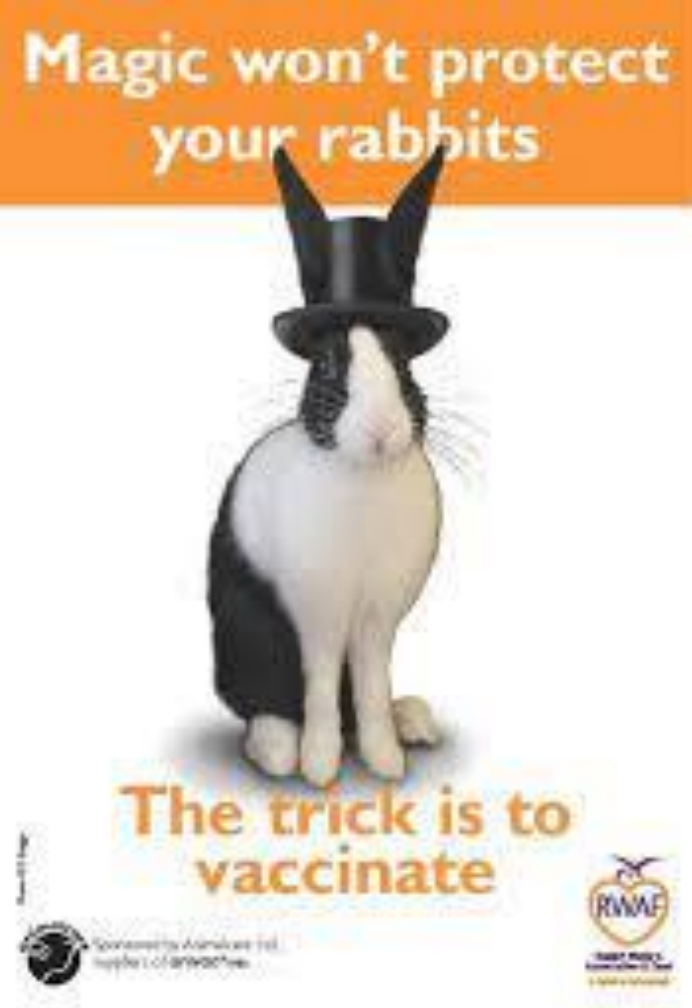
- 1 - Stringent criteria for admission
- 2 - MINIMUM 10 day quarantine at intake
- 3 - Evaluate facility design for separation
- 4 - Follow USDA Disinfection protocols
- 5 - Wear PPE
- 6 - No mixing of wild and domestic rabbits
- 7- Avoid rehabbing wild rabbits if you own domestic rabbits
- 8 - No transfer of rabbits to rehabbers in another county
- 9 - No rabbit movement among RHDV neg and POS areas
- 10 - Report unusual deaths to CDFW – we can test
- 11 - Quarantine if a case is detected
- 12 - No release of rabbits from RHDV + counties into RHDV- counties



International Wildlife Rehabilitation Council – Improving Wildlife Care Worldwide

RHDV2 Vaccination

- Vaccination of rehab rabbits is not a substitute for good biosecurity
- Eravac (Spain) or Filavac (France) no longer allowed to be imported through CDFA
- CDFA emergency authorized recombinant Medgene Lab RHDV2 vaccine for distribution to licensed veterinarians in CA on October 4, 2021
 - ** 2 dose series, 2nd dose 21 days later
 - https://www.cdfa.ca.gov/AHFSS/Animal_Health/RHD.html



Thank you!

WHL Nongame Wildlife Health Contacts

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deana.clifford@wildlife.ca.gov

Dr. Jaime Rudd

jaime.rudd@wildlife.ca.gov



Maddie Sharafian, Pixar Animation Studios

