



**National Wildlife Health Center
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Snake Fungal Disease in the United States

To: Natural Resource/Conservation Managers
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Snake Fungal Disease (SFD) is an emerging disease in certain populations of wild snakes in the eastern and midwestern United States. While fungal infections were occasionally reported in wild snakes prior to 2006, recently the number of free-ranging snakes with fungal dermatitis submitted to the USGS National Wildlife Health Center (NWHC) and other diagnostic laboratories has been increasing. Laboratory analyses have demonstrated that the fungus *Ophidiomyces* (formerly *Chrysosporium*) *ophiodiicola* is consistently associated with SFD, but often, additional fungi are isolated from affected snakes. At this time, definitive evidence that *O. ophiodiicola* causes SFD is inconclusive. As its name implies, SFD is only known to afflict snakes.

To date, the NWHC has confirmed fungal dermatitis (or the suspected fungal pathogen in association with skin lesions) in wild snakes from nine states, including Illinois, Florida, Massachusetts, Minnesota, New Jersey, New York, Ohio, Tennessee, and Wisconsin. However, it is suspected that SFD is more widespread in the United States than is currently documented. Multiple species of snakes have been diagnosed with SFD at the NWHC (see attached figures; view additional photographs at http://www.nwhc.usgs.gov/disease_information/other_diseases/snake_fungal_disease.jsp), including northern water snake (*Nerodia sipedon*), eastern racer (*Coluber constrictor*), rat snake (*Pantherophis obsoletus* species complex), timber rattlesnake (*Crotalus horridus*), massasauga (*Sistrurus catenatus*), pygmy rattlesnake (*Sistrurus miliarius*), and milk snake (*Lampropeltis triangulum*).

The most consistent clinical signs of SFD include scabs or crusty scales, subcutaneous nodules, premature separation of the outermost layer of the skin (*stratum corneum*) from the underlying skin (or abnormal molting), white opaque cloudiness of the eyes (not associated with molting), or localized thickening or crusting of the skin (hyperkeratosis). Skin ulcers, swelling of the face, and nodules in the deeper tissues of the head have also been documented. Clinical signs of SFD and disease severity may vary by snake species. Aside from the presence of fungi with disease-associated lesions, specific pathological criteria for the disease have not yet been established.

While mortality has been associated with some cases of SFD, population-level impacts of the disease are not yet widely known and are difficult to assess due to the cryptic and solitary nature of snakes, and a general lack of long-term monitoring data. In New Hampshire, clinical signs consistent with SFD were associated with a 50 percent decline of an imperiled population of timber rattlesnakes from 2006 to 2007. In areas where susceptible snake species occur in small, isolated populations, the added threat of SFD may threaten viability of these populations. In other regions, SFD has been observed without suspected or, as yet, documented population declines.

Several agencies, organizations, researchers, and other key stakeholders, including the NWHC, are working together to investigate this potentially emerging disease and to learn more about the impacts

that SFD is having on snake populations in the eastern and midwestern United States. We encourage conservation agencies and natural resource managers to contact the NWHC if snakes with clinical signs consistent with SFD are encountered.

References:

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To report or request assistance for wildlife mortality events or health issues, please visit the NWHC Web site at http://www.nwhc.usgs.gov/mortality_events/reporting.jsp or contact Dr. Anne Ballmann, 608-270-2445, aballmann@usgs.gov; Dr. LeAnn White, 608-270-2491, clwhite@usgs.gov; Barb Bodenstern, 608-270-2447, bbodenstern@usgs.gov; Dr. Thierry Work, 808-792-9520, thierry_work@usgs.gov (Hawaii and Pacific Islands); or Jennifer Buckner, 608-270-2443, jbuckner@usgs.gov (single animal mortalities, nationwide).

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Figures



Figure 1. Eastern racer (*Coluber constrictor*) showing signs of fungal skin infection. Obvious external abnormalities are an opaque infected eye (spectacle), roughened crusty scales on the chin, and several discolored roughened scales on the side of neck. Snake captured in Volusia County, Florida, in January 2013 (case 24266). Photograph by D.E. Green, USGS National Wildlife Health Center.



Figure 2. Eastern rat snake (*Pantherophis alleghaniensis*) showing signs of fungal infection. Obvious external abnormalities are an opaque infected eye (spectacle) and roughened, crusty scales on the snout. Snake captured in New Jersey in March 2012 (case 23906). Photograph by D.E. Green, USGS National Wildlife Health Center.



Figure 3. Northern water snake (*Nerodia sipedon*) with crusty and thickened scales overlaying raised blisters as a result of a fungal skin infection, captured from island in western Lake Erie, Ohio, in August 2009 (case 22747). Photograph by D.E. Green, USGS National Wildlife Health Center.