

SALMONELLA IN WILDLIFE

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SALMONELLA NOMENCLATURE:

The genus *Salmonella* has over 2,463 recognized serovars with classification based on H (flagellar) and O (somatic) antigens. Historically *Salmonella* serovars were considered as species and serovar names were italicized (such as *Salmonella typhimurium*). A decision by the Judicial Commission of the International Committee for Systematics of Prokaryotes was issued making the type species of *Salmonella* now *Salmonella enterica* (not *S. choleraesuis*).⁴ Now for example, one would write *Salmonella enterica* subsp. *enterica* serovar Typhimurium instead of *Salmonella typhimurium*. To shorten this, people will often refer to *Salmonella enterica* subsp. *enterica* serovar Typhimurium as *Salmonella* serovar Typhimurium or simply *Salmonella* Typhimurium as the preferred abbreviated name. This might be more information than you ever wanted to know but it does overturn generations of veterinary school training and has simplified international agreement on naming a complex and expanding genus.

ZOONOSIS

An estimated 1.2 million cases of salmonellosis occur annually in the United States (approximately 42,000 are laboratory-confirmed and reported to the Centers for Disease Control; CDC). Transmission comes primarily from contaminated food, water or contact with infected animals only some of which are wild animals. Of the 50 *Salmonella* outbreaks reported by the CDC between 2006 and 2013, only 5 (10%) were related to wildlife. These included the 2013 outbreak related to small turtles (*Salmonella* Sandiego, Pomona and Poona), two 2012 events associated with hedgehogs (*Salmonella* Typhimurium) and small turtles (*Salmonella* Sandiego, Pomona and Poona), the 2011 outbreak connected to Africa dwarf frogs (*Salmonella* Typhimurium) and the 2010 water frog-related outbreak (*Salmonella* Typhimurium).

REPTILES AND AMPHIBIANS

While according to CDC outbreak records frogs and turtles (species unspecified) are responsible for the majority of the wildlife-related *Salmonella* outbreaks in the United States, numerous species of reptiles and amphibians can be asymptomatic carriers of *Salmonella*. Consequently the CDC provides the following advice to veterinarians:

- Veterinarians should provide education to amphibian and reptile owners about the risks of acquiring salmonellosis from these animals.
- Veterinarians should provide education to amphibian and reptile owners on how to properly clean the animal habitat.

Additionally, veterinarians working with wildlife biologists studying reptiles and amphibians should advise them of the occupational hazards associated with working with potential asymptomatic carriers of *Salmonella*.

BIRDS

Salmonella-infection in wild birds can be sub-clinical or clinical. Epornitics are frequently diagnosed in passerine birds at backyard feeders. Clinical signs in these songbirds can include difficulty swallowing, anorexia, intense thirst, ruffled feathers, listlessness, convulsions and death. Common postmortem lesions include yellow pinpoint necrotic areas in the liver, spleen or upper gastrointestinal tract mucosa; focal necrosis in the adrenal gland, testes and muscles, or abscesses in the lower esophagus.³ It also can cause mortality in raptors that prey on sick birds or scavenge dead birds. The population-level significance of salmonellosis in wild birds is unknown. Prevalence in wild birds is likely highly species time and space dependent. Wild birds have been implicated in *Salmonella* contamination of feed and in outbreaks of salmonellosis in domestic animals (such as the abortion epizootic in dairy ewes from Spain related to *Salmonella* Indiana in pigeons and doves) and livestock have been implicated as the source of *Salmonella* in wild birds (as with the positive association of *Salmonella* Typhimurium from wild birds collected in the proximity of pig farming operations in Spain).¹

MAMMALS

As with birds, *Salmonella*-infection in wild mammals can be sub-clinical or clinical. Also, like with birds, infection can be naturally occurring or be due to transmission from domestic animals. Disease (salmonellosis)

has been demonstrated in many wild mammal species including white-tailed deer (*Odocoileus virginianus*), raccoons (*Procyon lotor*) and river otters (*Lontra canadensis*). In Europe, it is considered a significant disease in European hedgehogs (*Erinaceus europaeus*). Clinical disease can be a direct result of stress, overcrowding, parturition or other concurrent diseases. This was likely the case in some river otters captured for translocation programs where the disease had a rapid course (2-3 days) and resulted in high mortality. Clinical signs can vary greatly depending on serotype, host and external stressors. Disease can range from peracute to chronic and can include listlessness, anorexia, dehydration, diarrhea and death. Gross lesions can range from catarrhal to fibrinohemorrhagic enteritis with septicemic animals showing widespread hemorrhage on serous membranes, splenomegaly, lymphadenopathy and edema and congestion of organs.⁵ Note that bacterial isolation of *Salmonella* from the intestines is not sufficient to diagnose salmonellosis in dead animals as other evidence of disease compatible with salmonellosis must be present.

MARINE WILDLIFE

Relatively little is known about *Salmonella* in free-ranging marine mammals. It has been isolated from harbor porpoise (*Phocoena phocoena*), a killer whale (*Orcinus orca*), sea otters (*Enhydra lutris nereis*), northern elephant seals (*Mirounga angustirostris*), California sea lions (*Zalophus californianus*), Northern fur seals (*Callorhinus ursinus*), and harbor seals (*Phoca vitulina*).² Far more isolations have been made than actual documentation of disease. *Salmonella* Newport-associated septicemia has been documented in a harbor porpoise and a killer whale. *Salmonella* also has been isolated from marine birds such as Western gulls (*Larus occidentalis*).⁶ While one study found prevalence of *Salmonella* in 40% of California sea lion pups and 33% of northern fur seal pups on San Miguel Island, the prevalence in most marine wildlife populations is unknown but probably highly variable.

TREATING SALMONELLA IN WILDLIFE BEING REHABILITATED

Due to concerns about antibiotic sensitivity and the release of rehabilitated animals that could potentially spread antibiotic resistance, antimicrobial treatment of animals infected with *Salmonella* spp. is controversial but is often attempted for animals with clinical disease. Proper sanitation and husbandry practices are important tools for preventing the in-treatment spread of *Salmonella* in rehabilitation centers. *Salmonella* is hardy and is capable of surviving for long periods in biological material and can infect new hosts if sanitation of the environment or the rehabilitation center does not adequately remove all organic material.

REFERENCES

1. Andres, S., J. P. Vico, V. Garrido, M. J. Grillo, S. Samper, P. Gavin, S. Herrera-Leon and R. C. Mainar-Jaime. 2012. Epidemiology of subclinical salmonellosis in wild birds from an area of high prevalence of pig salmonellosis: phenotypic and genetic profiles of *Salmonella* isolates. *Zoon. and Pub. Heal.* 60:355-365.
2. Colegrove, K. M., J. A. St. Leger, S. Raverty, S. Jang, M. Berman-Kowalewski and J. K. Gaydos. 2010. *Salmonella* Newport Omphaloarteritis in a Stranded Killer Whale (*Orcinus orca*) Neonate. *J. Wildl. Dis.* 46:1300-1304.
3. Davidson, W. R. 2006. Salmonellosis. *In* Field Manual of Wildlife Diseases in the Southeastern United States, 3rd Edition. Southeastern Cooperative Wildlife Disease Study, Athens, GA pp.333-336.
4. Heyndrickx, M., F. Pasmans, R. Ducatelle, A. Decostere and F. Haesebrouck. 2005. Recent changes in *Salmonella* nomenclature: the need for clarification. *The Vet. Jour.* 170:275-277.
5. Morner, T. 2001. Salmonellosis. *In* Infectious Diseases of Wild Mammals, 3rd Ed. E. S. Williams and I. K. Barker, Eds. Iowa State University Press, Ames, IO pp. 505-507.
6. Smith, W. A., J. A. K. Mazet, and D. C. Hirsh. 2002. *Salmonella* in California wildlife species: prevalence in rehabilitation centers and characterization of isolates. *J. Zoo and Wildl. Med.* 33:228-235.