



**National Wildlife Health Center  
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**Avian Vacuolar Myelinopathy in Wild Birds**

**To: Natural Resource/Conservation Managers**  
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Since 1994, an unusual neurological disease called avian vacuolar myelinopathy (AVM) has killed at least 99 bald eagles and thousands of coots wintering in Arkansas, Georgia, North Carolina, and South Carolina. The disease also has been confirmed in some waterfowl, including mallards, ring-necked ducks, buffleheads, and Canada geese, as well as two great-horned owls, and one killdeer. Although AVM has not been confirmed in species other than birds, little is known about mammalian susceptibility to this disease.

Affected birds have difficulty flying, swimming, or walking and often appear disoriented. Eagles have been observed flying into rock walls and water birds have been seen crash-landing into the water, as well as trailing a leg or lying on their backs or sides while swimming. Typically, clinical disease is noticed in the autumn or early winter—as early as October at some lakes—with people observing sick birds for several months afterwards. Wildlife biologists and managers are encouraged to look for and report sick or dead eagles, waterfowl, and coots to the USGS National Wildlife Health Center (<http://www.nwhc.usgs.gov>), the Southeastern Cooperative Wildlife Disease Study (<http://www.scwds.org>), or state natural resource agencies.

The source and causative agent of AVM remain unknown despite extensive field investigations, diagnostic testing, and laboratory research. Gross lesions are not apparent in affected birds. The consistent diagnostic finding across species, locations, and time is a microscopic lesion in the brains of affected birds. Consequently, AVM currently can only be diagnosed by microscopic examination of brain tissue collected and preserved in formalin shortly after the death of the bird. The appearance of the lesion and the epidemiology of the disease suggest that an anthropogenic or naturally occurring toxicant is the most probable cause of AVM. However, test results have been uniformly negative for a wide range of compounds, including those previously associated with vacuolar myelinopathy in other species. Recent experimental results demonstrate that water birds become affected by ingesting the causative agent, which is associated with aquatic vegetation, and we suspect eagles subsequently acquire AVM via consumption of affected prey.

**Recent field studies and laboratory experiments have demonstrated that:**

- Exposure to the causative agent of AVM is site specific and seasonal.
- Not all birds with brain lesions have clinical signs of disease.
- Brain lesions were experimentally reproduced in red-tailed hawks and chickens when fed tissues from AVM-affected coots.
- Brain lesions were experimentally reproduced in some mallards (but not all) fed hydrilla (*Hydrilla verticillata*, an exotic, invasive aquatic plant) from a lake with an ongoing AVM outbreak.
- AVM lesions also developed in chickens that consumed hydrilla collected at a lake during an AVM outbreak, but did not develop in chickens that ingested hydrilla collected at a lake where AVM never has been detected during several years of monitoring.

The results of the experimental trials suggest that the cause of AVM is either seasonally accumulated by aquatic vegetation, or is produced during the fall months by one or more organisms associated with aquatic vegetation at the affected lakes. It is important to note that hydrilla is *not* the cause of AVM and hydrilla need not be present for an AVM outbreak. Major AVM outbreaks have occurred at lakes without hydrilla, but with other submerged vegetation.

In addition, AVM does not occur at many lakes that have hydrilla (a common situation in the Southeast). More research is needed to identify the source and specific agent that causes AVM and to help determine the conditions that favor outbreaks and the measures that might be taken to reduce AVM's impact on eagles and other wildlife.

For additional information, contact Tonie Rocke at 608-270-2451 at the National Wildlife Health Center or John Fischer at (706) 542-1741 at the Southeastern Cooperative Wildlife Disease Study.

**References for more information on AVM:**

Rocke TE, NJ Thomas, CU Meteyer, C Quist, J Fischer, T Augspurger and SE Ward. 2004. Attempts to identify the source of avian vacuolar myelinopathy for waterbirds. *Journal of Wildlife Diseases*. In press.

Lewis-Weis LA, RW Gerhold and JR Fischer. 2004. Attempts to reproduce vacuolar myelinopathy in domestic swine and chickens. *Journal of Wildlife Diseases* 40: 476-484

Birrenkott AH, SB Wilde, JJ Hains, JR Fischer, TM Murphy, CP Hope, PG Parnell and WW Bowerman. 2004. Establishing a food-chain link between aquatic plant material and avian vacuolar myelinopathy in mallards (*Anas platyrhynchos*). *Journal of Wildlife Diseases* 40: 485-492

Fischer JR, LA Lewis-Weis and CM Tate. 2003. Experimental vacuolar myelinopathy in red-tailed hawks. *Journal of Wildlife Diseases* 39: 400-406.

Augspurger T, JR Fischer, NJ Thomas, L Sileo, RE Brannian, KJG. Miller and TE Rocke. 2003. Vacuolar myelinopathy in waterfowl from a North Carolina impoundment. *Journal of Wildlife Diseases* 39: 412-417.

Fischer JR, LA Lewis, T Augspurger and TE Rocke. 2002. Avian vacuolar myelinopathy: A newly recognized fatal neurologic disease of eagles, waterfowl, and other birds. *Transactions of the 67th North American Wildlife and Natural Resources Conference* 67: 51-61.

Rocke TE, NJ Thomas, T Augspurger and K Miller. 2002. Epizootiologic studies of avian vacuolar myelinopathy in waterbirds. *Journal of Wildlife Diseases* 38: 678-684.

Thomas, NJ, CU Meteyer and L Sileo. 1998. Epizootic vacuolar myelinopathy of the central nervous system of bald eagles (*Haliaeetus leucocephalus*) and American coots (*Fulica Americana*). *Veterinary Pathology* 35:479-487.

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