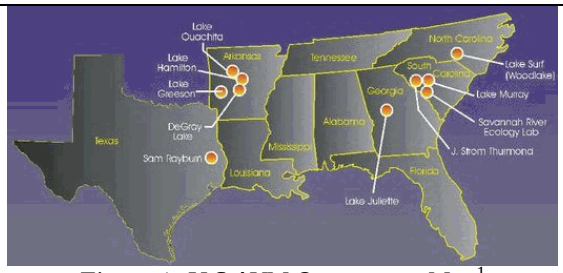
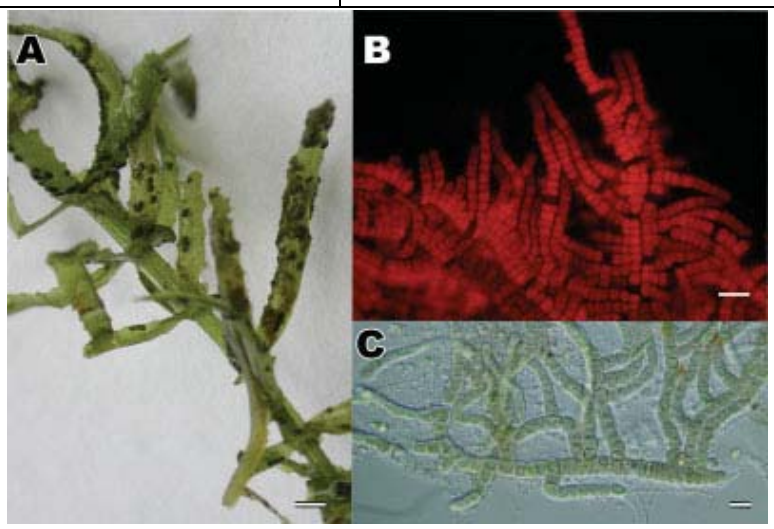
Cyanobacterium	Novel Cyanobacterial Epiphyte of Order Stigonematales
I. Current Status and Distribution	***Stigonema* spp.**

a. Range	**Global/Continental**	**Wisconsin**
Native Range Unknown (novel organism) *This species is implicated in causing Avian Vacuolar Myelinopathy (AVM). AVM-positive sites are the only distribution associated data available*	 *Figure 1: U.S AVM Occurrence Map*[1]	Not recorded in Wisconsin
Abundance/Range Widespread: Locally Abundant: Sparse:	 Undocumented Southeastern United States; recorded in 11 reservoirs[2] Undocumented	 Not applicable Not applicable Not applicable
Range Expansion Date Introduced: Rate of Spread:	 AVM was first noted in 1994[1]; *Stigonema* spp. first implicated in 2005[3] Undocumented	 Not applicable Not applicable
Density Risk of Monoculture: Facilitated By:	 Covers up to 95% of leaf surface area where AVM is present[2] May spread with Hydrilla[2] which has potential to spread extremely rapidly	 Unknown Unknown

b. Habitat	Ponds, lakes, reservoirs[2]
Tolerance	Undocumented[4]
Preferences	Undocumented[4]
c. Regulation	
Noxious/Regulated:	*Not regulated*
Minnesota Regulations:	*Not regulated*
Michigan Regulations:	*Not regulated*
Washington Regulations:	*Not regulated*
II. Establishment Potential and Life History Traits	
a. Life History	Filamentous, heterocystous, true branching cyanobacterium; sect.V, order Stigonematales[5]
Fecundity	Undocumented
Reproduction Importance of Seeds: Vegetative:	Fission, conjugation, transformation Not applicable Not applicable
Hybridization	Undocumented
Overwintering Winter Tolerance: Phenology:	 Undocumented AVM affects birds October through March, and peaks mid-November to early December[1]

b. Establishment	
Climate	
Weather:	Undocumented
Wisconsin-Adapted:	Undocumented
Climate Change:	Undocumented
Taxonomic Similarity	
Wisconsin Natives:	High; genus *Stigonema*
Other US Exotics:	Undocumented
Competition	
Natural Predators:	Various herbivores (algae and macrophyte grazers)
Natural Pathogens:	Undocumented
Competitive Strategy:	Produces neurotoxin which kills predators[3]
Known Interactions:	Associated with Hydrilla in every known case of AVM[6]
Reproduction	
Rate of Spread:	Undocumented
Adaptive Strategies:	Undocumented
Timeframe	Undocumented

c. Dispersal	
Intentional:	Unlikely
Unintentional:	May follow pathways of Hydrilla introduction; wind, water, animals, humans
Propagule Pressure:	Medium; fragments easily accidentally introduced, but source populations not near Wisconsin



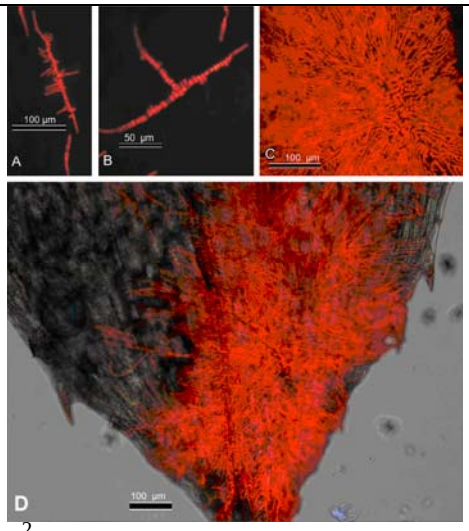


Figure 2: Courtesy of Wilde et al.[2]
Figure 3: Courtesy of Williams et al.[5]

III. Damage Potential

a. Ecosystem Impacts	
Composition	Diversity of diatoms and green algae is lower where Stigonematales is dominant[3]; bioaccumulation of toxins cause death via AVM in bald eagles, coots, owls, and other birds[3]; has killed at least a hundred bald eagles, thousands of American coots, other various birds[7]

Structure	Associated disease targets avian species, some of which are top predators[3]; decreased presence of other algal species[3]
Function	Undocumented
Allelopathic Effects	Order Stigonematales produces lipopolysaccharides, fischerellin A and B, alkaloids[8]
Keystone Species	Potentially; threatens populations of larger herbivores and top predators[3]
Ecosystem Engineer	Potentially; bioaccumulation effects every trophic level
Sustainability	Undocumented
Biodiversity	Decreases[3]; highly associated with exotics *Hydrilla verticillata*, *Egeria densa*, and *Myriophyllum spicatum*[9]
Biotic Effects	Decreased diversity, bioaccumulation of toxins in higher trophic levels
Abiotic Effects	Undocumented
Benefits	Undocumented
b. Socio-Economic Effects	
Benefits Caveats	Undocumented Not applicable
Impacts of Restriction	Increased monitoring, education, and research costs
Negatives	Poses threat to charismatic native species[7,9]
Expectations	Undocumented
Cost of Impacts	Decreased recreational and aesthetic value; decline in ecological integrity; increased research expenses
"Eradication" Cost	Undocumented
IV. Control and Prevention	
a. Detection	
Crypsis: Benefits of Early Response:	Extremely high; PCR assay required[5] Undocumented
b. Control	Undocumented

[1] United States Department of Agriculture Center for Emerging Issues. 2001. Emerging Disease Notice, Avian Vacuolar Myelinopathy (AVM) Retrieved December 8, 2010 from: http://www.aphis.usda.gov/animal_health/emergingissues/downloads/avm_0101.pdf

[2] Wilde, S.B., T.M. Murphy, C.P. Hope, S.K. Habrun, J. Kempton, A. Birrenkott, F. Wiley, W.W. Bowerman and A.J. Lewitus. 2005. Avian vacuolar myelinopathy linked to exotic aquatic plants and a novel cyanobacterial species. Environmental Toxicology 20(3):348-353.

[3] Wilde, S.B., S.K. Williams, T. Murphy, C.P. Hope, F. Wiley, R. Smith, A. Birrenkott, W. Bowerman and A.J. Lewitus. 2005. Mortality of bald eagles and American coots in southeastern reservoirs linked to novel epiphytic cyanobacterial colonies on invasive aquatic plants. International Symposium of Cyanobacterial Harmful Algal Blooms (ISOC-HAB). September 6-10. Monographs.

[4] Poovey, A.G. and M.D. Netherland. 2006. Identification and initial screening of new compounds to control harmful algal blooms. Aquatic Nuisance Species Research Group. ERDC/TN ANSRP-06-2.

[5] Williams, S.K., J. Kempton, S.B. Wilde and A. Lewitus. 2007. A novel epiphytic cyanobacterium associated with reservoirs affected by avian vacuolar myelinopathy. Harmful Algae 6(3):343-353.

[6] Thompson Engineering, Inc. United States Army Corps of Engineers. 2007. Environmental assessment for release of triploid grass carp for hydrilla management. Walter F. George Lake, Alabama and Georgia.

[7] Williams, S.K., S.B. Wilde, T.M. Murphy, C.P. Hope, A. Birrenkott and A.J. Lewitus. 2005. Investigation of a novel epiphytic cyanobacterium associated with reservoirs affected by avian vacuolar myelinopathy. International Symposium of Cyanobacterial Harmful Algal Blooms (ISOC-HAB). September 6-10. Monographs.

[8] Leflaive, J. and L. Ten-Hage. 2007. Algal and cyanobacterial secondary metabolites in freshwaters: a comparison of allelopathic compounds and toxins. Freshwater Biology 52(2):199-214.

[9] Poore, A.B. 2006. Assessment of the potential for an avian vacuolar myelinopathy occurrence in New Hanover County ponds. University of North Carolina-Wilmington. Retrieved December 8, 2010 from: http://people.uncw.edu/hillj/classes/EVS595/Final%20Project%20with%20images.pdf