MICHIGAN 2015 - 2025

EMERGING DISEASES

Wildlife Action Plan

Today's Priorities, Tomorrow's Wildlife

EMERGING DISEASES

Disease is a part of natural systems, however emerging diseases can have significant impacts on wildlife populations, especially for species that are already rare. Often these diseases are relatively unknown and therefore basic research is needed to understand how they function and their potential impacts on wildlife. This part of the Wildlife Action Plan outlines current key diseases affecting Species of Greatest Conservation Need that are important to understand and address. Additional emerging diseases and focal species may be added to this mini-plan if the disease has the potential to significantly impact (>50% declines) wildlife populations in Michigan.

PLAN CONTRIBUTORS

Detroit Zoological Society
Eastern Michigan University
Grand Valley State University
Michigan Department of Natural Resources
Michigan Natural Features Inventory
Michigan State University
National Park Service
Private Citizens
Organization for Bat Conservation
U.S. Fish and Wildlife Service
Western Michigan University

WHAT IS SNAKE FUNGAL DISEASE?

Snake fungal disease is an infection found in free-ranging and captive snakes that is associated with the fungus *Ophidiomyces ophiodiicola*. The fungus is able to break down and use the keratin in skin tissue as a carbon source. Infected snakes exhibit skin lesions, cloudy eyes, irregular molting, and facial disfiguration (Allender et al. 2015; Tetzlaff et al. 2015). They also can have open wounds and crusty scabs, or sometimes more subtle signs such as swelling, thickened skin, or bumps under the skin. Preliminary research suggests that *O. ophiodiicola* may be present in many different ecosystems and it may become more problematic as temperatures increase (Allender et al. 2015). There are currently no effective treatments for snake fungal disease in the Eastern Massasauga (Allender et al. 2011). Snake fungal disease was first observed in 2006 affecting pitvipers in the eastern United States (Clark et al. 2011) and was confirmed in Eastern Massasauga in Illinois in 2008 (Allender et al. 2011). It was first confirmed in Michigan in 2013 when two Eastern Massasauga tested positive. In 2014, 100 snakes from three sites in Michigan were tested for the fungus; five individuals tested positive (Allender et al. 2014); samples were collected in 2015 and are now being processed. Snake fungal disease appears to be fatal in the Eastern Massasauga. At this time very little is known.

WHAT IS WHITE-NOSE SYNDROME?

White-nose syndrome is an emerging infectious disease of bats in North America caused by a nonnative invasive species of fungus called *Pseudogymnoascus destructans* (Blehart et al. 2009). The fungus most likely originated in Europe. It was first noticed in North America at a commercial tourist cave in eastern New York in 2006. Since then, the fungus has spread rapidly throughout the eastern United States and Canada. It first reached Michigan in the spring of 2014 (Kurta and Smith 2014). The fungus currently occurs in 25 states and 5 Canadian provinces (www.white-nose syndrome.org) and is likely to spread throughout the temperate areas of the continent (USFWS 2013).

Pseudogymnoascus destructans is a “cold-loving” fungus that grows on the hairless skin of hibernating bats, such as the wings and muzzle, which are maintained at a temperature below 10°C (50°F) for prolonged periods. The fungus produces multiple structural and physiological effects as it attacks the skin, but an unfailing result of infection is that a bat rouses from hibernation twice as often as normal (Reeder et al. 2012). The specific cause of these arousals is debatable, although it appears that the fungal attack on the skin leads to increased water loss and the bats are forced to become active to drink (Cryan et al. 2010; Willis et al. 2011). These incidents are energetically expensive and deplete the animal’s body fat at a rapid rate. If a bat totally consumes its stored energy by February or March (Reeder et al. 2012), when 1–3 feet of snow still cover the northern parts of the state and food is not available, it dies from starvation.

Between 2006 and 2012, more than 5.5 million bats perished from this disease (U.S. Fish and Wildlife Service 2012). After only 5 years of exposure to the fungus, populations of six species of bats hibernating in caves or mines in the Eastern U.S., declined by an aggregate 88% (Turner et al. 2011). Similar declines are now occurring in the Midwest.

– Excerpted from Mammal Technical Advisory Committee 2014

WHITE-NOSE SYNDROME IN MICHIGAN

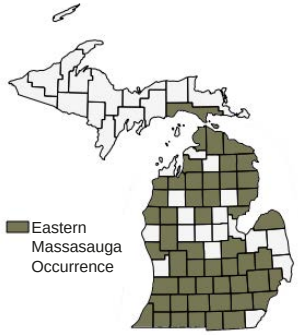
As of the spring of 2015, the fungus has been found in nine of the 15 largest hibernating bat populations in Michigan. Throughout the state at least one hydroelectric dam, one tunnel, one cave, and 20 mines with populations of various sizes are infected (Kurta and Smith 2015).

WHAT ARE THE EMERGING DISEASES FOCAL SPECIES?

Where we are now and what we think we can realistically achieve over the next 10 years.

Eastern Massasauga
(Notropsis anogenus)
Federally Threatened

The Eastern Massasauga is Michigan's only rattlesnake, and is a shy docile snake that prefers to remain hidden. When threatened, they typically will sound their rattle and try to escape, preferring to avoid confrontations. Hedgecock (1992) found that the only thing that elicited a striking response from a Massasauga was being stepped on, and that was only 7% of the time. This snake offers little threat to reasonably careful people willing to leave them alone. Massasauga sites appear to be characterized by a combination of open and shaded areas for thermoregulation, hibernation areas with water table near the surface, and a juxtaposition of wetlands and upland areas (Lee and Legge 2000). Michigan is the last stronghold for this snake in the United States, which is listed as endangered in every other state and province where it occurs. This species has likely declined by 30% over the last 30 years. Massasauga populations appear to be somewhat stable in the southwestern and northern portions of their range in Michigan. According to the state's Natural Heritage Database there are 127 potentially viable element occurrences in Michigan.



GOALS

- Maintain known populations.

Tricolored Bat
(Perimyotis subflavus)
Special Concern

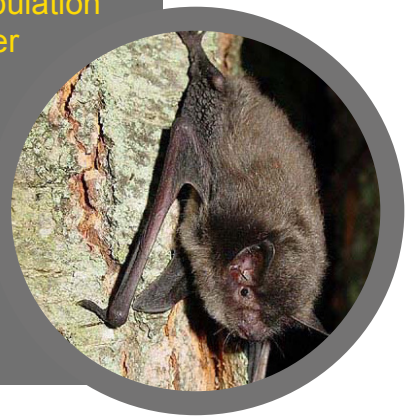
Formerly known as the Eastern Pipistrelle, the Tricolored Bat was renamed after its distinctive hairs that are dark at the base and tip with yellow in the middle (MNFI 2007). Tricolored Bats hibernating in caves and mines in the eastern United States have undergone a 75% decline after five years of white-nose syndrome exposure (Mammal Technical Advisory Committee 2014). They are especially susceptible to white-nose syndrome due to the small number of individuals (fewer than 250 individuals documented in Michigan) and they roost in areas with the highest temperatures (Unger and Kurta 1998). Environment Canada has listed the Tricolored Bat as Endangered.

ECONOMIC IMPORTANCE OF BATS

Bats play a critical role in pest control. It has been estimated that a single colony of bats can eat nearly 1.3 million pest insects each year (Boyles et al. 2011). And with losses from White-nose Syndrome in the northeastern United States, it is estimated between 660 and 1,320 metric tons of insects are no longer being consumed each year (Boyles and Willis 2010). If Michigan sees similar losses, this could be a significant ecological service lost with a high price tag.

Indiana Bat
(Myotis sodalis)
Federally and State Endangered

The Indiana Bat is a small, grayish brown bat with short, rounded ears. They hibernate in the caves of Kentucky, Indiana, and Missouri, but in the summer, Indiana Bats roost under loose bark of mature trees in Michigan. Indiana Bats have been found in 14 counties in Michigan and 25 general locations. Females form maternity colonies of between 20-30 adults during the summer and express high site fidelity from year to year (Mellos et al. 2014). Since the onset of white-nose syndrome, Indiana Bats have exhibited an annual median decline of 10.3%. In 2015, 99% of the range-wide population of Indiana Bat was hibernating in sites either confirmed or suspected of infections of white-nose syndrome (USFWS 2015b). Many of Michigan's Indiana Bats hibernate in Indiana, Ohio, and Kentucky; and Indiana and Ohio have seen some of the largest hibernacula losses since 2013 (USFWS 2015b).



Little Brown Bat
(Myotis lucifugus)

Little Brown Bats can vary in color from dark brown to cinnamon. They are considered the most common bat species of the northeast United States, but have undergone a 91% decline in the region after five years of white-nose syndrome exposure and are predicted to go extinct in the Northeast as early as 2026 (Frick et al. 2010). In Indiana and Ohio, populations have shown similar responses since the onset of white-nose syndrome, declining 80% and 98%, respectively. The U.S. Fish and Wildlife Service is currently evaluating the species for potential listing as Federally Endangered; Canada has already listed them as Endangered. There is a predicted decline of 40-98% (Langwig et al. 2014) of Little Brown Bats hibernating in Michigan.

Northern Long-eared Bat
(Myotis septentrionalis)
Federally Threatened

Northern Long-eared Bats are medium to dark brown on the back with particularly long ears; they have a symmetrical, spear-like tragus (USFWS 2015a). In winter, they are less social than other *Myotis* species and tend to hibernate alone or in very small groups within crevices (Kurta 2008). They form maternity colonies in trees in the summer (Kurta 2008). In 2015, the Northern Long-eared Bat was listed as Federally Threatened in the United States; they also have been listed as Endangered in Canada. Northern Long-eared Bats hibernating in caves and mines in the eastern U.S. have undergone a 98% decline after five years of White-nose Syndrome exposure. In the major hibernacula of Michigan, declines will likely range from 40-98% (Langwig et al. 2014) with the emergence of white-nose syndrome.

GOALS FOR BATS

- Prevent extirpation.
- Complete an approved bat Habitat Conservation Plan (HCP).

WHAT ARE THE CONSERVATION ACTIONS?

Key actions that need to be implemented over the next 10 years

Conservation ACTIONS for Snake Fungal Disease

Research and Monitoring

SFD1. Continue to investigate basic information about snake fungal disease, including its prevalence, how it is transmitted, and potential vectors.

SFD2. Examine snake habitat and population characteristics at sites where the disease occurs to determine if there are environmental factors affecting its prevalence and impacts.

SFD3. Investigate the snake community to determine prevalence and potential vectors from other species.

SFD4. Identify environmental, genetic, and health factors that may contribute to emergence or persistence of snake fungal disease.

SFD5. Continue to implement standard decontamination protocols, and update the protocols as new information becomes available.

Institutional Development

SFD6. Re-establish the Eastern Massasauga workgroup to facilitate regular information sharing and best practices.

Conservation ACTIONS for White-nose Syndrome

Land & Water Management

WNS1. Protect and restore summer, swarming, and winter habitats at known sites. [NWNS; IB]

Species Management

WNS2. Continue to implement Michigan Department of Natural Resources White-nose Syndrome (WNS) Response Plan. [MWNS]

WNS3. Contribute to implementation of the national plan for managing white-nose syndrome in bats. [NWNS]

WNS4. If feasible white-nose syndrome treatment options become available, establish priorities for application to bats or hibernacula; monitor effectiveness of any treatments. [MWNS]

Raising Awareness

WNS5. Build support with private landowners and members of the public by sharing concerns about Michigan bat populations and the devastating effects of white-nose syndrome. [NWNS; IB]

WNS6. Continue to educate operators and provide guidance for evaluating risk, best management practices and mitigating effects of wind energy developments.

Conservation Designation & Planning

WNS7. Work with Minnesota and Wisconsin to develop and implement a bat Habitat Conservation Plan (HCP). [IB]

WNS8. Continue to address emerging concerns that will inhibit recovery efforts.

WNS9. Develop or use an existing system to organize bat data from multiple sources, including consultants, state and federal permit holders, nuisance wildlife control operators, and wind energy facilities as well as researchers, managers, and conservation specialists. This could include streamlining reporting requirements to facilitate and standardize data entry. [NWNS; IB]

WNS10. Develop citizen science programs to enhance information on bat distribution, abundance, and habitat use.

Research & Monitoring

WNS11. Determine how bats use habitats around hibernacula, especially during the swarming and spring staging periods. [IB]

WNS12. Determine how bats move among hibernacula to better understand transmission of the disease.

WNS13. Map migration pathways and summer breeding areas of bats from different hibernacula to aid management efforts.

WNS14. Explore ways to minimize mortality during migration, especially at wind farms.

WNS15. Identify and prioritize areas for inventory to gain knowledge on bat distribution, abundance, and habitat use during summer. Implement surveys and research on priority areas including natural bedrock communities that are currently under-surveyed.

WNS16. Conduct research to determine if pesticides affect bat populations. [IB]

WNS17. Continue to assess mortality of specific bat species at wind energy production sites.

Institutional Development

WNS18. Continue to coordinate with key partners such as the Midwest Bat Working Group, county mine inspectors, mine and cave operators, and other states and provinces.

WNS19. Continue to use and expand the role of the Michigan Bat Working Group for bat conservation.

HOW WILL WE MONITOR?

Assessing status and measuring progress

SNAKE FUNGAL DISEASE

- Develop long-term population monitoring at key sites to provide information on population impacts to Eastern Massasauga, including population demographics.
- Continue snake fungal disease monitoring using standardized swabbing protocol across Michigan.
- As new, more effective techniques for monitoring become available, implement standardized protocols.

WHITE-NOSE SYNDROME

- Continue and expand hibernacula surveys to discover new sites and to visit known sites at least biannually. [NWNS; MWNS; IB]
- Continue active and passive surveillance of white-nose syndrome. [MWNS]
- Develop and implement a collaborative monitoring program to evaluate bat distribution, abundance and habitat use during the summer period. This could include using citizen science efforts, acoustic surveys, and the development of targeted surveys for northern and tricolored bats. Ensure program links with other efforts (e.g., North American Bat Monitoring Program) while continuing to evaluate and resolve Michigan-specific survey issues and needs. [NAB; IB]
- Monitor bat mortality at wind turbines, and determine if mortality changes over time.

HOW DOES THIS PLAN LINK WITH OTHER CONSERVATION PLANS?

There has been a multitude of relevant planning efforts across the state and country over the past ten years. Bracketed superscripts throughout the Wildlife Action Plan indicate where the conservation action, goal, or monitoring strategy aligns with those from another plan. For conservation plans with distinct objectives, the objective or strategy number is also included. This linking of plans is meant to facilitate the expansion of partnerships.

[IB] Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision (USFWS 2007)

[MWNS] Michigan Department of Natural Resources and Environment White-Nose Syndrome (WNS) Response Plan (DNR 2010)

[NWNS] A National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats (Coleman et al. 2011)

[NAB] A Plan for the North American Bat Monitoring Program (NABat) (Loeb et al. 2015)

FOR MORE INFORMATION/REFERENCES

Allender, M.C., M. Dreslik, S. Wylie, C. Phillips, D. Wylie, C. Maddox, M.A. Delaney, and M.J. Kinsel. 2011. An unusual mortality event associated with Chrysosporium in eastern massasauga rattlesnakes (Sistrurus catenatus catenatus). Emerging Infectious Disease. 17: 2383-2384.

Allender, M.C., A.N. Miller, and D.B. Raudabaugh. 2015. The natural history, ecology, and epidemiology of Ophidiomyces ophiodiicola and its potential impact on free-ranging snake populations. Fungal Ecology, dx.doi.org/10.1016/j.funeco.2015.05.003.

Blehart, D. S., A. C. Hicks, M. Behr, C. U. Meteyer, B. M. Berlowski-Zier, E. L. Buckles, et al. 2009. Bat white-nose syndrome: an emerging fungal pathogen. Science, 323:227.

Boyles, J.G. and C.K.R. Willis. 2010. Could localized warm areas inside cold caves reduce mortality of hibernating bats affected by white-nose syndrome? Frontiers in Ecology and the Environment 8(2): 92–98.

Clark, R.W., M.N. Marchand, B.J. Clifford, R. Stechert, and S. Stephens. 2011. Decline of an isolated timber rattlesnake (Crotalus horridus) population: interactions between climate change, disease, and loss of genetic diversity. Biological Conservation. 144: 886-891.

Coleman, J., A. Ballmann, L. Benedict, E. Britzke, K. Castle, W. Cottrell, P. Cryan, T. DeLiberto, A. Elliot, R. Ewing, A. Hicks, R. Reynolds, J. Rubado, B. Slack, and L. Williams. 2011. A National plan for assisting states, federal agencies, and tribes in managing white-nose syndrome in bats, accessed at: www.whitenosesyndrome.org/sites/default/files/whitenose_syndrome_national_plan_may_2011.pdf

Cryan, P. M., C. U. Meteyer, J. G. Boyles, and D. S. Blehert. 2010. Wing pathology associated with white-nose syndrome in bats suggests life-threatening disruption of physiology. BMC Biology, 8:135.

Frick, W. F., J. F. Pollock, A. C. Hicks, K. E. Langwig, D. S. Reynolds, G. S. Turner, et al. 2010. An emerging disease causes regional population collapse of a common North American bat species. Science, 329:679–682.

Humphrey, S. R., and J. B. Cope. 1976. Population ecology of the little brown bat, Myotis lucifugus, in Indiana and north-central Kentucky. Special Publications, American Society of Mammalogists, 4:1-81.

Kunz, T.H., and J.D. Reichard. 2010. Status review of the little brown myotis (Myotis lucifugus) and determination that immediate listing under the Endangered Species Act is scientifically and legally warranted. www.bu.edu/cecb/files/2010/12/Final-Status-Review.pdf. Accessed 15 September 2014.

Kurta, A. 2008. Bats of Michigan. Indiana State University Center for North American Bat Research and Conservation, Terre Haute, IN. 72 pp.

Kurta, A., and S. M. Smith. 2014. Exploration of bat hibernacula, population monitoring, and surveillance for white-nose syndrome. An annual report to the Michigan Department of Natural Resources on activities performed in winter 2013–2014. Unpublished report. Michigan Department of Natural Resources, Lansing, Michigan.

Kurta, A., and S.M. Smith. 2015. Exploration of bat hibernacula, population monitoring, and surveillance for white-nose syndrome. An annual report to the Michigan Department of Natural Resources on activities performed in winter 2014–2015. Unpublished report. Michigan Department of Natural Resources, Lansing, Michigan.

Kurta, A., L. Winhold, J. O. Whitaker, Jr., and R. Foster. 2007. Range expansion and changing abundance of the eastern pipistrelle (Chiroptera: Vespertilionidae) in the central Great Lakes region. American Midland Naturalist, 157:404–411.

Langwig, K. E., W. F. Frick, J. T. Bried, A. C. Hicks, T. H. Kunz, and A. M. Kilpatrick. 2012. Sociality, density-dependence, and microclimates determine the persistence of populations suffering from the novel fungal disease, white-nose syndrome. Ecology Letters, 15:1050–¬1057.

Langwig, K. E., J. R. Hoyt, K. L. Parise, J. T. Foster, W. F. Frick, and A. M. Kilpatrick. 2014. Transmission of Pseudogymnoacus destructans: insights from the invasion front. Abstract. Program, 7th Annual White-nose Syndrome Workshop. Available at: www.whitenosesyndrome.org/sites/default/files/wns_2014-abstracts-final.pdf.

Lee, Y. and J. T. Legge. 2000. Special animal abstract for Sistrurus catenatus catenatus (eastern massasauga). Michigan Natural Features Inventory, Lansing, MI. 8 pp.

Loeb, S.C., T.J. Rodhouse, L.E. Ellison, C.L. Lausen, J.D. Relchard, K.M. Irvine, T.E. Ingersoll, J.T.H. Coleman, W.E. Thogmartin, J.R. Sauer, C.M. Francis, M.L. Bayless, T.R. Stanley, and D.H. Johnson. 2015. A Plan for the North American Bat Monitoring Program (NABat). U.S. Forest Service, General Technical Report SRS-208, Asheville, NC. Pg. 100. www.srs.fs.usda.gov/pubs/gtr/gtr_srs208.pdf

Mammal Technical Advisory Committee. 2014. Proposal to List the Northern Long-eared Bat (Myotis septentrionalis), Little Brown Bat (Myotis lucifugus), and Eastern Pipistrelle (Perimyotis subflavus) as Threatened in Michigan, due to White-nose Syndrome. Unpublished report to Michigan Dept. of Natural Resources, Lansing, Michigan.

Michigan Department of Natural Resources and Environment. White-Nose Syndrome (WNS) Response Plan. Lansing, MI. 20 pp.

Mellos, J., L. Denys, C. Johnson, C. Rockey, and A. Kurta. 2014. Long-term philopatry on Indiana Bat in St. Joseph County, Michigan. Michigan Birds and Natural History, 21(3): 222-226.

Reeder, D. M., C. L. Frank, G. G. Turner, A. Kurta, E. R. Britzke, S. R. Darling, C. W. Stihler, A. C. Hicks, C. U. Meteyer, R. Jacob, L. A. Grieneisen, S. A. Brownlee, M. E. Vodzak, L. K. Muller, and D. S. Blehert. 2012. Frequent arousal from hibernation linked to severity of infection and mortality in bats with white-nose syndrome. PLoS ONE, 7(6): e38920. doi:10.1371/journal.pone.0038920.

Rockey, C. D., J. Stumpf, and A. Kurta. 2013. Additional winter records of Indiana bats (Myotis sodalis) banded during summer in Michigan. Northeastern Naturalist, 20:N8–N13.

Tetzlaff, S, M. Allender, M. Ravesi, J. Smill, and B. Kingsbury. 2015. First report of snake fungal disease from Michigan, USA involving Massasaugas, Sistrurus catenatus (Rafinesque 1818).). Herpetology Notes, 8:31-33.

Thogmartin, W.E., R. A. King, P.C. McKann, J.A. Szymanski, and L. Pruitt. 2012. Population-level impact of white-nose syndrome on the endangered Indiana Bat. Journal of Mammalogy, 93:1086-1098.

Turner, G.G., D.M. Reeder, and J.T.H. Coleman. 2011. A five-year assessment of mortality and geographic spread of white-nose syndrome in North American bats and a look to the future. Bat Research News, 52:13–27.

Unger, C. A., and A. Kurta. 1998. Status of the eastern pipistrelle (Mammalia: Chiroptera) in Michigan. Michigan Academician, 30:423–437.

U.S. Fish and Wildlife Service (USFWS). 2007. Indiana Bat (Myotis sodalis) Draft Recovery Plan: First Revision. U.S. Fish and Wildlife Service, Fort Snelling, MN. 258 pp.

U.S. Fish and Wildlife Service (USFWS). 2011. A national plan for assisting states, federal agencies, and tribes in managing white-nose syndrome in bats.

U.S. Fish and Wildlife Service (USFWS). 2012. North American bat death toll exceeds 5.5 million from white-nose syndrome. Available at www.fws.gov/whitenosesyndrome/pdf/wns_mortality_2012_nr_final.pdf (accessed 15 September 2014).

U.S. Fish and Wildlife Service (USFWS). 2013. U.S. Fish and Wildlife Service proposes endangered status for the Northern Long-eared Bat; Listing not warranted for eastern Small-footed Bat. Available online at: www.fws.gov/midwest/endangered/mammals/nlba/pdf/FRpropListNLBA2Oct2013.pdf. Accessed 15 September 2014.

U.S. Fish and Wildlife Service (USFWS). 2015a. Myotis septentionalis fact sheet. Accessed August 26, 2015 at www.fws.gov/midwest/endangered/mammals/nleb/nlebFactSheet.html.

U.S. Fish and Wildlife Service (USFWS). 2015b. 2015 population estimates for the Indiana Bat (Myotis sodalist) by USFWS Region. Accessed 2015: www.fws.gov/midwest/Endangered/mammals/inba/pdf/2015IBatPopEstimate25Aug2015v2.pdf

Willis, C. K. R., A. K. Menzies, J. G. Boyles, and M. S. Wojciechowski. 2011. Cutaneous water loss is a plausible explanation for mortality of bats from white-nose syndrome. Integrative and Comparative Biology, 53:364–373.

Photo Credits

Eastern Massasauga with SFD (pages 3, 7, 9) - Danielle Bradke

Little Brown Bat with WNS (pages 3, 8, 9) - USFWS, Marvin Moriarty

Eastern Massasauga (page 4) - Jennifer Moore

Tricolored Bat - Allen Kurta

Indiana Bat - USFWS, Adam Mann

Little Brown Bat (page 6) - Allen Kurta

Northern Long-eared Bat – USFWS, Steve Taylor

Recommended Citation

Derosier, A.L., S.K. Hanshue, K.E. Wehrly, J.K. Farkas, and M.J. Nichols. 2015. Michigan's Wildlife Action Plan. Michigan Department of Natural Resources, Lansing, MI. www.michigan.gov/dnrwildlifeactionplan

ABOUT THE WILDLIFE ACTION PLAN

Today's Priorities, Tomorrow's Wildlife

Every state has a Wildlife Action Plan, which taken together create a national conservation strategy for safeguarding wildlife and their habitats for current and future generations. Each state's action plan is uniquely designed to serve the needs of that state. These plans provide a framework for proactive conservation and management of fish and wildlife before they become imperiled, which is more straightforward, cost-efficient, and effective.

Michigan's Wildlife Action Plan was developed by conservation partners across the state. It provides information about those species in greatest conservation need. The plan is organized by chapters or mini-plans. Each mini-plan outlines priorities for the next 10 years. The mini-plans detail priority habitats and focal species of greatest conservation need, status of species and habitats, critical threats, needed conservation actions, places for partnerships, monitoring needs, and goals. This is one of 15 mini-plans. For more information about how the plan was built and to read other mini-plans, please visit: www.michigan.gov/dnrwildlifeactionplan.