

**Developing Management Plans for  
Core Eastern Massasauga Populations in Michigan – Phase I**



**Annual Progress Report**

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*Center photo* – Eastern Massasauga (*Sistrurus catenatus*). Photo by Joseph Sage.

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## INTRODUCTION

The eastern massasauga (*Sistrurus catenatus*) is a small, thick-bodied rattlesnake that lives in shallow wetlands and adjacent uplands in portions of Illinois, Indiana, Iowa, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and Ontario (Harding 1997, Szymanski 1998). The species was once considered common throughout its range but its populations have severely declined. Most states or provinces within the species' range have lost over 50% of their historical populations, and less than one-third of extant populations are considered secure or self-sustaining (i.e., demographically, genetically, and physiologically robust with a level of persistence given its habitat conditions and risk or beneficial factors) (Szymanski 1998, Szymanski et al. 2016). As a result, the eastern massasauga was listed as a federally threatened species by the U.S. Fish and Wildlife Service in 2016 (USFWS 2016). The primary threat that has led to the decline of this species has been habitat loss and modification from agricultural, residential, and urban development, vegetative succession, invasive species, habitat fragmentation from roads and bridges, and hydrological alterations (Szymanski 1998, Szymanski et al. 2016). Other factors that pose risks to the species include management practices (e.g., prescribed fire, mowing), road mortality, persecution, collection, predation, disease, and climate change (Szymanski 1998, Szymanski et al. 2016).

Michigan is considered to be the last stronghold for this species, with more historical and extant massasauga populations than any other state or province in the species' range (Szymanski 1998). Therefore, the long-term viability and persistence of this species in Michigan has important implications for conservation of this species across its range. However, eastern massasauga populations in Michigan also have declined due to similar threats that have been identified in other states. As a result, the eastern massasauga has been designated a species of special concern and a Species of Greatest Conservation Need (SGCN) in Michigan (Derosier et al. 2015).

The Michigan Department of Natural Resources (MDNR) is interested in maintaining eastern massasaugas in Michigan. Developing an eastern massasauga conservation plan for the state that identifies priority populations and management actions needed to maintain those populations would greatly inform and facilitate efforts to sustain this species in Michigan. Available resources for conservation and management efforts for this species also are limited. Identifying priority populations and management needs at the statewide level would help focus resources and help ensure that a core set of viable massasauga populations are maintained and protected to sustain the species in perpetuity in Michigan.

To assist the MDNR in developing an Eastern Massasauga Conservation Plan for Michigan, this two-year project will identify priority or "core" massasauga populations to manage and conserve in the state, and will develop management plans for a subset of these populations with recommendations for management needed to protect and maintain these populations. This project builds on an earlier effort to identify and delineate known extant massasauga populations in the state, and assess their condition and/or viability (Lee and Enander 2015). This progress report provides a brief summary of project activities and results from this first year of the project, including a list of priority/core massasauga populations, including those proposed for management plans, and an agreed-upon standard format or template for the management plans. Draft management plans for several populations completed to date are provided separately.

## **METHODS**

### **Project Objectives**

This project is assisting the MDNR with next steps in developing an Eastern Massasauga Conservation Plan for Michigan by addressing the following objectives:

- 1) Identify high priority or “core” massasauga populations to conserve to maintain species in perpetuity in Michigan.
- 2) Work with MDNR to determine format and content for management plan for core populations.
- 3) Identify management needed to conserve high priority or “core” populations. Develop a management plan for at least 10 high priority “core” populations over the two years of the project.

### **Identifying High Priority or “Core” Massasauga Populations**

In 2015, eastern massasauga (EMR) populations in Michigan were identified and delineated based on element occurrences (EOs) and best available information in Michigan’s Natural Heritage Database (NHD) and other information sources (which were limited for some populations), population modelling using cost-weighted distance analysis, and expert opinion (Lee and Enander 2015). The goal of the population modeling was to help evaluate and delineate eastern massasauga populations by assessing and mapping how far massasaugas might be able to move from known locations based on available information on the species’ movement distances and home range sizes in Michigan, potential suitable habitat around known locations, and presence of barriers. The population model and cost-weighted distance analysis also were used to help identify where massasaugas might be able to move between known EOs, and thus potentially function as one population.

Lee and Enander (2015) also assessed the condition and estimated the potential viability of each massasauga population that was delineated. The condition and estimated viability of each delineated massasauga population were assessed and ranked based on a number of criteria and expert opinion (Lee and Enander 2015). These criteria included number and frequency of recent observations, evidence of recruitment/reproduction, habitat quantity, landscape context, and number and level of threats. Land ownership also was considered as an indication of the potential for long-term management and protection of the population. Each rank was assigned a numerical score, and an overall viability score for each population was calculated by adding up the scores for all the viability criteria.

These analyses resulted in the identification and delineation of a total of 187 eastern massasauga populations were delineated (Lee and Enander 2015, Appendix 1). Of these, 42 populations are located in the northern Lower Peninsula (NLP), and 145 populations are located in the southern Lower Peninsula (SLP). Of the 187 massasauga populations that were delineated, 110 populations (i.e., 59%) were ranked as having excellent, good, or fair estimated viability or

probability of persistence into the foreseeable future (i.e., at least 20-30 years) (i.e., viability ranks of A, AB, AC, B, BC, or C) (Lee and Enander 2015, Appendix 1).

The 110 massasauga populations that were ranked as having excellent, good, or fair estimated viability were evaluated to identify high priority or “core” populations to manage and conserve to sustain the species in perpetuity in the state. These populations were evaluated based on their estimated population viability rank, overall viability score, individual viability criteria (e.g., number/frequency of massasauga observations, extent and nature of available habitat, landscape context), and other expert knowledge or opinion of the sites. The geographic distribution of potential high priority or “core” populations also was considered to strive for geographic representation and redundancy across the range of the species in the state (e.g., at least 1-2 high priority/core populations across multiple ecoregions within the species’ range).

### **Determining Management Plan Format and Content**

MNFI and MDNR staff worked together to determine the format and content of the management plans for high priority or “core” populations. MNFI and MDNR staff reviewed and discussed management plan formats that had been developed and used for other species and/or programs (e.g., management plans for Mitchell’s satyr and the Landowner Incentive Program). These discussions included identifying the most important or pertinent information needed to help inform and guide management efforts at high priority/core populations and associated sites. Based on these discussions, MNFI staff developed a draft format or template for the management plans. MDNR staff reviewed the draft format/template and suggested changes or edits to the template. MNFI staff revised the management plan template, incorporating these changes, and an agreed-upon format/template for the management plans was finalized.

### **Developing Management Plans for High Priority/Core Populations**

Draft management plans for five high priority/core eastern massasauga populations were developed this year. These populations were proposed and selected for plan development based on available information and knowledge of these sites and land ownership (i.e., on state- or federally-owned lands). These populations also have been the focus of recent and/or upcoming research or survey efforts conducted by MNFI and/or other researchers, including an eastern massasauga landscape genetics and connectivity project that was initiated this year. Results from these studies will help inform development and future revisions of the management plan and recommendations.

To develop the management plans, MNFI staff examined the status, condition, extent, landscape context, and threats facing the selected high priority/core populations to identify priority management needs to conserve these populations. Information related to these factors and other content needed for the management plans were compiled from Michigan’s NHD and other available sources (e.g., past MNFI reports, other researchers’ reports/theses, etc.). Field visits to specific sites within populations were conducted to assess current habitat conditions and management needs. Input from site managers and landowners on site conditions, threats, and management needs and approaches will be solicited and incorporated. Draft management plans will be reviewed and discussed with MDNR staff and state, federal, and other site managers.

Draft management plans will be revised as needed based on discussions with and input from MDNR staff and site managers before finalizing. It is envisioned that management plans will continue to be revised and updated in the future as management recommendations are implemented, as population and habitat conditions change on the ground, and as new information becomes available.

## **RESULTS / DISCUSSION**

### **Identifying High Priority or “Core” Massasauga Populations**

A total of 43 populations have been identified as high priority or “core” populations to maintain and protect to sustain eastern massasaugas in perpetuity in Michigan (Appendix 1). These populations have estimated population viability ranks ranging from A (excellent estimated viability) to BC (good to fair estimated viability), and estimated viability scores ranging from 12 to 28 (Appendix 1). These populations are distributed throughout the state and across multiple ecoregions (Appendices 2 and 3). Some populations with lower estimated viability ranks and/or scores were included as high priority/core populations due to connectivity to other high priority/core populations and/or presence of seemingly extensive habitat complexes, both of which could potentially lead to larger and more connected habitat complexes and populations. Some populations also were included to address geographic representation and/or redundancy across the state.

In addition to the 43 high priority/core populations, 38 populations were identified as potential or back-up priority populations (Appendices 1 and 2). These populations look like they have extensive habitat but are generally a little smaller or more isolated than the high priority/core populations. These populations also don’t have very much information about massasauga presence, extent, and/or relative abundance. With additional massasauga and/or site/habitat information, some of these sites could be added as priority populations in the future or could serve as back-up priority populations, if additional populations are needed.

It is important to note that these high priority or core populations and potential priority populations were identified based on available information at this time. Ideally, these designations should be revisited in the future if new and additional information about these populations become available. Additionally, while geographic representation and redundancy were considered in the analysis and identification of the high priority/core populations, representation and/or redundancy based on other factors were not explicitly considered and analyzed (e.g., genetic representation and/or redundancy). The landscape genetics study will provide information on genetic representation and/or redundancy for some of the high priority populations. However, we may want to consider other factors and potentially add some high priority populations in the future to address this issue. The identification of high priority/core populations also currently does not take into account human dimensions and the social, political, and economic context within which the populations are situated (e.g., local community support and/or capacity for massasauga conservation, available or potential resources for management at a given site/population, etc.). These factors can significantly impact the long-term prospects for successfully conserving massasauga populations, and should be discussed in the future.

## **Determining Management Plan Format and Content**

The management plan format, content, and template that was developed and agreed upon by MNFI and MDNR staff for this project is provided in Appendix 4. In addition to MNFI staff using this template for developing management plans for a subset of the high priority/core massasauga populations, this template will be shared with the site managers and landowners of other high priority populations to encourage and facilitate development of similar management plans for these populations. This template may be revised during the second year of this project, if needed, based on input from other MDNR staff, site managers, and/or partners.

## **Developing Management Plans for High Priority/Core Populations**

Draft management plans for five high priority/core massasauga populations were developed this year. These high priority populations included the following populations: 1) EMRPOP176 in the Barry State Game Area and Yankee Springs State Recreation Area in Barry County; 2) EMRPOP140 in the Pinckney State Recreation Area in Livingston and Washtenaw counties; 3) EMRPOP113 in the Holly State Game Area/State Recreation Area in Oakland County; 4) EMRPOP029 in the Grayling and Traverse City Forest Areas in Kalkaska and Crawford counties; and EMRPOP022 in the Huron National Forest and Grayling State Forest Areas in Iosco County (see Appendix 1 for specific names of these populations). These draft management plans need to be completed, and reviewed and discussed with MDNR staff and other land managers associated with these sites before they are finalized. Draft management plans for these populations are provided in Appendix 5. Additional high priority populations for which management plans will be developed will be identified and agreed upon by MNFI and MDNR staff during the second year of this project.

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