

U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Sistrurus catenatus catenatus*

COMMON NAME: eastern massasauga

LEAD REGION: Region 3

INFORMATION CURRENT AS OF: June 2004

STATUS/ACTION

- Initial 12-month Petition Finding: not warranted
 warranted
 warranted but precluded (also complete (c) and (d) in section on petitioned candidate species- why action is precluded)
- Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status
- New candidate
- Continuing candidate
- Non-petitioned
- Petitioned - Date petition received: May 11, 2004_____
- 90-day positive - FR date: _____
- 12-month warranted but precluded - FR date: _____
- Is the petition requesting a reclassification of a listed species? No
- Listing priority change
- Former LP: _____
- New LP: _____
- Latest Date species became a Candidate: October 25, 1999_____
- Candidate removal: Former LP: _____
- A - Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.
- F - Range is no longer a U.S. territory.
- I - Insufficient information exists on biological vulnerability and threats to support listing.
- M - Taxon mistakenly included in past notice of review.
- N - Taxon may not meet the Act's definition of "species."
- X - Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Reptiles, Family Viperidae, Subfamily Crotalinae

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, New York, Ohio, Pennsylvania, Wisconsin, and Ontario.

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE:

Illinois - Clinton, Cook, Fayette, Knox, Lake, Madison, Piatt, Warren, and Will counties.

Indiana - Allen, Carroll, Elkhart, Fulton, Kosciusko, Lagrange, LaPorte, Marshall, Noble, Porter, Pulaski, St. Joseph, Steuben, and Tippecanoe counties

Iowa - Black Hawk, Bremer, Buchanan, Chickasaw, Clinton, Louisa, Muscatine, Pottawattamie, and Scott counties

Michigan - Alcona, Allegan, Alpena, Arenac, Barry, Berrien, Calhoun, Cass, Cheboygan, Clinton, Crawford, Eaton, Genesee, Grand Traverse, Hillsdale, Iosco, Jackson, Kalamazoo, Kalkaska, Kent, Lapeer, Lake, Lenawee, Livingston, Mackinac, Macomb, Manistee, Mason, Midland, Missaukee, Montcalm, Muskegon, Newaygo, Oakland, Presque Isle, Roscommon, Saginaw, St. Joseph, Van Buren, Washtenaw, and Wayne counties

Minnesota - Goodhue, Houston, Wabasha, and Winona counties

Missouri - Chariton, Holt, Linn, and Livingston counties

New York - Genesee and Onondago counties

Ohio - Ashtabula, Champaign, Clark, Erie, Fairfield, Greene, Licking, Montgomery, Trumbull, Warren, Wayne, and Wyandot counties

Ontario - Bruce, Essex, Grey, Manitoulin, Middlesex, Muskoka, Niagara, Parry Sound, Simcoe, and Sudbury districts

Pennsylvania - Butler, Mercer, and Venango counties

Wisconsin - Buffalo, Chippewa, Columbia, Crawford, Jackson, Juneau, LaCrosse, Monroe, Pepin, Rock, Trempealeau, Walworth, and Wood counties

LEAD REGION CONTACT: Jennifer Szymanski, 612/713-5342

LEAD FIELD OFFICE CONTACT: Bloomington, Indian Ecological Services Field Office, Andy King, 812/334-4261

BIOLOGICAL INFORMATION: See the 1998 Status Assessment for further information (available on the Web at: <http://midwest.fws.gov/endangered/reptiles/mass.pdf>).

Species Description – Massasaugas are small snakes with thick bodies, heart-shaped heads and vertical pupils. The average length of an adult is about two feet. Adult massasaugas are gray or light brown with large, light-edged chocolate brown blotches on the back and smaller blotches on the sides. The snake's belly is marbled dark gray or black and there is a narrow, white stripe on its head. Its tail has several dark brown rings and is tipped by gray-yellow horny rattles. Young snakes have the same markings as adults, but are paler than adults and the rattle is represented by a single "button."

Taxonomy – *Sistrurus catenatus* is one of three species of rattlesnake within the genus *Sistrurus*. Three subspecies of *S. catenatus* are recognized, *S. c. catenatus* (eastern massasauga), *S. c. tergeminus* (western massasauga), and *S. c. edwardsii* (desert massasauga) (Gloyd 1940, Minton 1983, Conant and Collins 1991, Johnson 1995). *S. c. catenatus* was described by Rafinesque in 1818. Although *S. c. catenatus* is commonly known as the eastern massasauga, its other synonyms include prairie rattlesnake, spotted rattler, and swamp rattler (Minton 1972).

Different researchers have indicated different zones of intergradation between *S. c. catenatus* and *S. c. tergeminus* as occurring in Missouri, southwestern Iowa, Kansas, and Oklahoma (Szymanski 1998). Previous analyses of venom proteins, morphological traits, and genetics have further confounded the subspecies delineations and morphological diagnosis among the different subspecies and their populations is not possible. Recently, however, some preliminary molecular analyses, using both nuclear and mitochondrial genes, indicate a deep division between the *S. c. catenatus* and the remaining two subspecies (i.e., *S. c. tergeminus* and *S. c. edwardsii*). Patterns in both nuclear and mitochondrial genes are concordant, and genetic distances between the two groups are on the order of those observed between separate species. Thus, the preliminary data indicate not only that the existing taxonomy may not accurately reflect the existing evolutionary patterns and diversity within this group, but also that *S. c. catenatus* may warrant separate recognition at the species level rather than at the subspecies level.

Unless additional genetic studies prove differently, the Service will continue to follow the distribution described in published literature (as described in Conant and Collins 1991) and will consider all *Sistrurus catenatus* populations found north and east of the Missouri River to be *S. c. catenatus* or the eastern massasauga subspecies as the candidate listing entity.

Habitat - *S. c. catenatus* occupies shallow wetlands and adjacent upland habitat. Suitable wetland habitat includes peatlands, marshes, sedge meadows, and swamp forest; typical upland habitat includes open savannas, prairies, and old fields. Seasonal use of these habitats varies across the range of the subspecies.

Historic vs Current Range - Although the current range of *S. c. catenatus* resembles the subspecies' historical range, the geographic distribution has been restricted by the loss of the subspecies from much of the area within the boundaries of that range. Approximately 40 percent of the counties that were historically occupied by *S. c. catenatus* no longer support the subspecies. *S. c. catenatus* is currently considered imperiled in every state and province it occupies. Recent information indicates that *S. c. catenatus*' range extends throughout all of Missouri and likely Iowa, too. This is evidence that the previously published accounts of the subspecies' range, which identified an intergradation zone in Missouri and Iowa, are not accurate.

Population Estimates/Status - Complete demographic information is not available across the range of the subspecies; however, information regarding the historical and current number of populations, recruitment potential, distribution and proximity of subpopulations, and quantity and quality of habitat provide indices of the subspecies' long-term viability. Each state and Canadian province across the range of *S. c. catenatus* has lost more than 30 percent, and for the majority more than 50 percent, of their historical populations. Furthermore, less than 35 percent

of the remaining populations are considered secure.

THREATS: See the 1998 Status Assessment for further information.

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

Habitat loss is an important factor in the decline of *S. c. catenatus*. The effects of past, widespread wetland loss continue to impact *S. c. catenatus* populations. Development and agriculture practices continue to perpetuate habitat loss, although to a lesser degree than in the past. Habitat loss increases the distance between populations and can isolate seasonally used habitats within individual populations. Consequently, *S. c. catenatus* populations become more susceptible to road mortality, predation, and persecution as snakes disperse from populations or make their seasonal movements between habitat types.

Destruction or modification of habitat is affecting at least 50 populations rangewide. A few examples are as follows. In Illinois, the Des Plaines River Valley population continues to be fragmented into smaller subpopulations isolated by development or otherwise unsuitable habitat (Mierzwa 1993). In Michigan, a major residential development, at the Green/Union Lakes site in Oakland County, recently eliminated much of the existing habitat and severely degraded the remaining habitat (Legge 1996). At Wixom, Michigan, both wetland and upland habitat were recently degraded by agricultural practices and highway construction (Legge 1996). Similarly, in Bremer County, Iowa, a golf course is encroaching upon massasauga habitat (Christiansen 1993). In Wisconsin, cranberry operations are potential threats to massasauga populations (Cathy Carnes, U.S. Fish and Wildlife Service, *in litt.* 1997). In Pennsylvania, four companies applied for sand and gravel mining permits in areas supporting massasauga populations in the same year (Andrew Shiels, Pennsylvania Fish & Boat Commission, *in litt.* 1997). One of Ohio's largest populations (Killdeer Plains) was bulldozed and plowed under in 1994.

In addition, urban encroachment has disrupted the natural disturbance processes (such as hydrological cycles and fire frequency), and subsequently, changes in habitat structure and vegetative composition have occurred. For example, in Pennsylvania increasing woody vegetation was cited as a threat at 75 percent of the massasauga sites surveyed (Reinert and Bushar 1993).

B. Overutilization for commercial, recreational, scientific, or educational purposes.

The over-harvesting of massasaugas is well documented, and the pernicious effects of past anti-rattlesnake campaigns are still visible today. Several populations have been harvested beyond a recoverable threshold, and thus, are functionally extinct. Intentional killing and illegal collection continue. Recent law enforcement actions involving individuals from several states revealed the immediacy and magnitude of this threat. An Indiana Department of Natural Resources law enforcement investigation in 1998 uncovered a well-organized, multi-state effort to launder State-protected reptile species (including eastern massasauga). The investigation concluded with the indictment of 40 defendants.

C. Disease or predation.

Predation under natural conditions is not a notable threat for *S. c. catenatus*. However, due to habitat loss as described under Factor A, *S. c. catenatus* populations are extremely vulnerable to predators and as a result they experience abnormally high predation rates. Further, the biology of the species makes the female cohort most susceptible, which exacerbates the impacts of predation.

D. The inadequacy of existing regulatory mechanisms.

S. c. catenatus is listed as endangered in Illinois, Indiana, Iowa, Minnesota, Missouri, New York, Ohio, Pennsylvania, and Wisconsin; as threatened in Ontario; and as special concern in Michigan. Although the subspecies is afforded some level of state protection across its range, protection of its habitat is nearly nonexistent. Given the significance and pervasiveness of habitat loss, the decline of *S. c. catenatus* will continue unabated without additional protections.

E. Other natural or manmade factors affecting its continued existence.

The thermo-regulatory needs of the gravid cohort render female massasaugas most vulnerable to collection and predation. This implies that *S. c. catenatus* populations occurring at low densities are particularly sensitive to collection or predation (i.e., predation/collection of just a few individuals could greatly diminish the population's reproductive potential). Similarly, a Population Viability Analysis (PVA) indicated that *S. c. catenatus* populations are most sensitive to adult mortality. Given the species' low biological replacement rate, even small increases in adult mortality can precipitate irreversible declines. These biological traits and the threat factors identified above interact synergistically, which exacerbates the effect of individual factors and can lead to an extinction vortex for those populations affected by one or more factors.

SUMMARY OF REASONS FOR ADDITION, REMOVAL OR LISTING PRIORITY CHANGE:

For removals:

___ Is the removal based on a Policy for Evaluation of Conservation Efforts When Making Listing Decisions (PECE) finding? If "Yes", summarize the specific PECE evaluation criteria that were met in determining that the conservation effort is sufficiently certain to be implemented and effective so as to have contributed to the elimination or adequate reduction of one or more threats to the species identified through the section 4(a)(1) analysis.

FOR PETITIONED CANDIDATE SPECIES (also complete c and d for initial 12-month petition findings):

- a. Is listing warranted? Yes ___
- b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? Yes _
- c. Is a proposal to list the species as threatened or endangered in preparation? No ___
- d. If the answer to c. above is no, provide an explanation of why the action is precluded.

We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be,

precluded by higher priority listing actions (including candidate species with lower LPNs). During the past 12 months, almost our entire national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, emergency listings, and essential litigation-related, administrative, and program management functions. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the 12 months, see the discussion of “Progress on Revising the Lists,” in the current CNOR, which can be viewed on our Internet website (<http://endangered.fws.gov/>).

LAND OWNERSHIP: *Sistrurus catenatus catenatus*, throughout the range of the subspecies, is found on both public and private land (approximately 59 percent of the populations occur wholly or in part on public land). The majority of public land is State managed, although populations also occur on county and U.S. Army Corps of Engineers lands. Squaw Creek National Wildlife Refuge (NWR), Swan Lake NWR, Trempealeau NWR, and possibly the LaCrosse District of the Upper Mississippi National Wildlife and Fish Refuge support massasauga populations. Necedah NWR is conducting a study of reintroduction techniques.

PRELISTING: Management and monitoring guidelines for *S. c. catenatus* were developed under Region 3 guidance and made available as *The Eastern Massasauga Rattlesnake: A Handbook for Land Managers* in 2000. This handbook was broadly distributed and is currently being used by public land managers to assist them in developing candidate conservation agreements. As population data are limited at most sites, these conservation efforts are in the initial stages of information gathering. In Wisconsin, for example, limited resources were dedicated to completing exhaustive surveys and a telemetry study in the lower Chippewa River area in Buffalo County. Continued survey efforts are planned at this site and others. Within the next year, we expect to gather status information at several priority sites rangewide and efforts will focus on developing and implementing Candidate Conservation Agreements (CCAs) for these populations. State-wide and/or site-specific CCAs and Candidate Conservation Agreements with Assurances (CCAAs) are currently being developed in Iowa, Illinois, Michigan, Missouri, Ohio, and Wisconsin. These CCAs should be implemented in 2004-2006. The following, is a brief listing of ongoing actions being taken as part of the region-wide massasauga conservation initiative.

Illinois Carlyle Lake Project:

- Conducting surveys and radio-telemetry work at Carlyle Lake (Clinton County) to determine spatial & temporal habitat use.
- Assessing private landowner attitudes toward massasauga conservation and CCAs.
- Contacting pertinent private landowners adjacent to the Carlyle Lake population.
- Developing a CCA for the Carlyle Lake population.

Northeast Illinois Project:

- Conducting surveys and habitat management assessments in Lake (Ryerson Forest Preserve), Cook [Potawatami Woods, Dam Number 1 Woods (two areas to include the Willow/Sanders tract), Plumb Creek Forest Preserve, and Jurgenson Woods Forest Preserve], and Will (Goodenow Grove Forest Preserve) counties.
- Initiating habitat management actions as needed at the sites in Lake, Cook and Will counties.
- Contacting private landowners adjacent to Elm's Court Forest Preserve.
- Developing CCAs for three County Forest Preserves.

Indiana

- Developed and is distributing education/outreach materials (including brochure and recommendations of how to approach landowners) for region-wide use.

Iowa

Sweet Marsh Project:

- Conducting radio telemetry studies at Sweet Marsh Wildlife Management Area (WMA) in Bremer County.
- Contacting pertinent private landowners adjacent to Sweet Marsh WMA.
- Developing a CCA for Sweet Marsh population.

Michigan

- Conducting ongoing surveys in known and potential massasauga areas to identify "core" protected properties in the following counties: Alcona, Allegan, Alpena, Barry, Benzie, Berrien, Calhoun, Cass, Cheboygan, Clinton, Crawford, Emmet, Huron, Iosco, Jackson, Kalamazoo, Kalkaska, Lapeer, Lenawee, Livingston, Mackinac, Manistee, Missaukee, Montcalm, Montmorency, Muskegon, Newaygo, Oakland, Oceana, Ogemaw, Presque Isle, Roscommon, Sanilac, St. Joseph, Van Buren, and Washtena.
- Conducting a habitat characterization for massasauga in Michigan.
- Developing a state-wide umbrella CCA document.

Minnesota

- Conducting surveys along the Mississippi River floodplains in Houston, Wabasha, and Winona counties to determine eastern massasauga presence in this area.

Missouri

- Contacting pertinent private landowners adjacent to the three core massasauga populations in Missouri; Pershing State Park (Linn County), Swan Lake NWR (Chariton County), and Squaw Creek NWR (Holt County).
- Investigating receptivity of Pershing State Park and pertinent adjacent landowners, and if receptive, developing CCA documents.
- Conducting surveys in other areas in the State to further define massasauga presence in Missouri.
- Developing CCA documents if important populations are discovered and landowners are receptive.

Ohio

- Conducting relative abundance surveys at Rome and Pallister Nature Preserves in Ashtabula County.
- Developing CCA documents for Rome and Pallister Nature Preserves.

Wisconsin

- Conducting a vegetation and hydrological analysis of Chippewa River Bottoms to determine the extent of change that has occurred since 1939.
- Conducting a 4-year status survey and telemetry study to aid in the development of a CCA for Chippewa River Bottoms and Black River populations in Buffalo, LaCrosse, Pepin, and Trempealeau counties.

Because subspecific boundaries in the Massasauga are poorly defined and morphological variation appears clinal, these factors are of little use in diagnosing subspecies. This inability to morphologically diagnose populations has direct implications for the Endangered Species Act listing process and, subsequently, for management of the species and the enforcement of state and federal laws relating to collection and take. To address this problem, Region 3 has recently agreed (June 8, 2004) to provide Candidate Conservation flex funding towards a definitive genetic study comparing *S. c. catenatus* and *S. c. tergeminus*. Preliminary molecular analyses, using both nuclear and mitochondrial genes, indicate a deep division between the *S. c. catenatus* and the remaining two subspecies [i.e., western massasauga (*S. c. tergeminus*) and desert massasauga (*S. c. edwardsii*)]. Patterns in both nuclear and mitochondrial genes are concordant, and genetic distances between the two groups are on the order of those observed between separate species. Thus, the preliminary data indicate not only that the existing taxonomy may not accurately reflect the existing evolutionary patterns and diversity within this group, but also that *S. c. catenatus* may warrant separate recognition at the species level. While the taxonomic question posed above should be answered by the newly funded genetic study, the funded researchers believe they can say with some authority that the levels of differentiation found in their preliminary data clearly suggest *S. c. catenatus* is a distinct and diagnosable evolutionary

lineage.

Environmental awareness and public outreach efforts are being implemented throughout the massasauga's eastern range. In 2003, Region 3 of the Service published and helped to distribute a 10-page, full-color, educational brochure entitled "*Live and Let Live: People and the Eastern Massasauga Rattlesnake*," which was developed in conjunction with the Indiana Department of Natural Resource's Wildlife Diversity Section. Because demand for these brochures has been high, Region 3 is currently making arrangements to have additional copies printed. In addition, multiple fact sheets about massasaugas remain available on the Region 3 internet site (<http://midwest.fws.gov/Endangered/lists/candidat.html>).

DESCRIPTION OF MONITORING:

Throughout the year, Service biologists informally coordinate with other Service biologists within Regions 3 and 5, as well as with numerous state & provincial biologists and state endangered species program staff and other species experts throughout the range of the subspecies. See *Sistrurus c. catenatus* Rangewide Status Assessment (1998) for a list of individuals frequently contacted.

In addition, the Service's Endangered Species Program Coordinators from each state in Region 3 join their counterparts from the state wildlife agencies each fall for a 3-day coordination meeting. During this annual meeting, recently completed and/or ongoing monitoring efforts, survey results, and conservation activities and concerns regarding massasaugas are discussed.

Because the Service has provided funding to several states for gathering baseline data and for investigating and developing CCAs, new and updated data are being generated for many populations. The Service is receiving this information in the form of annual/interim reports and population updates from these recent and/or ongoing regional survey efforts. Another source of information has been from the scientific literature, especially now that the Service has on-line access to numerous scientific journals.

We believe this level of monitoring is appropriate, given the biology of the species and the threats it faces.

REFERENCES

Szymanski, J. 1998. Rangewide Status Assessment. Unpublished report for U.S. Fish and Wildlife Service, Region 3, Fort Snelling, MN.

See literature cited within above referenced rangewide status assessment.

LISTING PRIORITY

Note: Listing Priority Number is unchanged from previous submission and 2003 CNOR.

THREAT

Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9*
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

YES Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Rationale for listing priority number:

Magnitude:

The magnitude of threats are considered as “moderate” at this time. We don’t view the magnitude of threats as being high, because about 59 percent of extant populations occur wholly or in part on public lands, many of which are currently preparing CCAs that will protect the snakes in perpetuity. As land managers are becoming better educated, management practices that conflict with massasauga conservation are being addressed. As a result of public outreach efforts and simple word-of-mouth, many adjacent private land owners are also becoming aware of the need and importance for them also to follow massasauga-friendly management on their properties. Populations soon to be under CCAs and CCAAs have a high likelihood of persisting and remaining viable. Other populations are likely to suffer additional losses in abundance and genetic diversity and some will likely be extirpated unless threats are removed in the near future.

Imminence:

Threats of habitat modification, habitat succession, incompatible land management practices, illegal collection for the pet trade, and human persecution are ongoing and thus remain an imminent threat to many remaining populations, particularly those inhabiting private lands.

Is Emergency Listing Warranted?

No. Emergency listing is not warranted at this time because approximately 59 percent of populations occur wholly or in part on public lands, and many of the land managers are currently preparing CCAs and/or voluntarily practicing massasauga-friendly management practices.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes to the candidate list, including listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all 12-month petition findings, additions of species to the candidate list, removal of candidate species, and listing priority changes.

Approve: Charlie Wooley July 1, 2004
Regional Director, Fish and Wildlife Service Date

Concur: Matt Hogan, Acting 5/2/05
Director, Fish and Wildlife Service Date

Do not concur: _____
Director, Fish and Wildlife Service Date

Director's Remarks: _____

Date of annual review: _____
Conducted by: _____

Comments: _____

