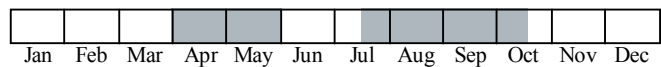


Best Survey Period



Status: Federal candidate species, State special concern

Global and state rank: G3G4T3T4/S3S4

Family: Viperidae (pit vipers and vipers)

Range: The eastern massasauga occurs from southeastern Minnesota, eastern Iowa, and northeastern Missouri east to southern Ontario, western New York, and northwestern Pennsylvania (Harding 1997). This species was once common across its range, but has declined drastically since the mid-1970s (Szymanski 1998). Massasaugas now mainly occur in disjunct, isolated populations, and have been afforded some level of legal protection in every state or province in which this subspecies occurs (Szymanski 1998).

State distribution: Michigan appears to be the last U.S. stronghold for this species relative to other states within its range. Historically, eastern massasaugas were found throughout the Lower Peninsula and on Bois Blanc Island. Within the last decade, eastern massasaugas have been reported from about 150 sites in 50 counties. These sightings appear to cluster in several regions across the Lower Peninsula, indicating areas where massasaugas may be concentrated (Legge and Rabe 1994). These include Oakland, Livingston, Jackson and Washtenaw counties in southeast Michigan, Allegan, Barry and Kalamazoo counties in southwest Michigan, and Iosco, Crawford and Kalkaska counties in northern Michigan. Nearly one-third of the historical occurrences in the state has not

been reconfirmed in the past ten years (Legge 1996). Massasaugas have not been reported from Branch, Ingham, Shiawassee, Macomb, Huron, Clare, Oscoda, Montmorency and Emmet counties since prior to 1980 (some since the early 1900's) (Legge and Rabe 1994, Legge 1996). It is important to note, however, that a statewide, systematic field survey for this species has not been conducted. Also, massasaugas are highly cryptic and difficult to observe in its natural habitat. Therefore, massasaugas may still be present in areas that lack recent, as well as historical, records.

Recognition: Several characteristics readily identify this species from all other snakes in Michigan. The massasauga is a medium-sized (18.5 to 39.5 inches in length), thick-bodied snake (Harding 1997). It has a distinctive color pattern of **dark brown rectangular blotches** down the back with two or three additional rows of **dark spots along the sides**, and **alternating dark and light bands along the tail**. The **background color is gray, gray-brown or brown**. The belly or underside of the snake is usually black with gray, white or yellowish mottling (Harding 1997). The massasauga is a rattlesnake, and therefore has a **segmented rattle** at the end of its tail. It also has a **triangular-shaped head** (i.e., widens at the back of the head and narrows at the neck), **vertical slit-shaped pupils**, and **large, heat-sensing pits or openings** between the nostrils and the eyes. The scales are keeled (i.e., have a raised ridge), and the anal plate (i.e., enlarged scale partly covering the anal opening) is divided into two parts. It is the only **venomous** snake found in the state. Newborn massasaugas range



in length from 7 to 10 inches and look similar to adults except are lighter in color (Harding 1997). They have only a single button at the end of their tails, and are unable to produce the sound of a rattle.

Several snakes in Michigan are frequently mistaken for eastern massasaugas. These include the eastern fox snake (*Elaphe vulpina gloydi*, State threatened), northern water snake (*Nerodia sipedon*), eastern milk snake (*Lampropeltis triangulum triangulum*), and eastern hog-nosed snake (*Heterodon platirhinos*). Although these snakes have a similar pattern of dark blotches on the back, these snakes usually have a lighter background color. They also lack the rattle, head shape, and pupil shape of the massasauga. Eastern fox snakes generally have a more slender and longer body than the massasauga (total adult lengths of 35 – 67 inches) (Harding 1997). The eastern hog-nosed snake has an upturned snout and is able to flatten and spread its neck out when threatened. Also, several of these snakes often will mimic the eastern massasauga and vibrate their tails rhythmically when threatened. If the snake is located in dry leaf litter, it can produce a buzzing sound similar to the massasauga's rattle.

Best survey time: Massasaugas typically are active between April and late October (Seigel 1986), and can be seen anytime during the active period. However, the best times to survey for this species are during spring emergence (i.e., April and May) for all age classes and during the basking and birthing period in mid- to late summer (i.e., late July, August and early September) for gravid females (Szymanski 1998, Casper et al. *in prep.*). Massasaugas are presumed to be most active during these time periods. Another survey window for this species is during fall ingress (i.e., mid-September through October) when snakes are moving to hibernacula (Seigel 1986, Johnson 1995, Szymanski 1998).

The recommended survey method currently is visual searches (Casper et al. *in prep.*). Optimal weather conditions for visual surveys include greater than 50% cloud cover, less than 15 mph wind speed, and air temperatures between 50 and 80° F (Casper et al. *in prep.*). Casper et al. (*in prep.*) recommend morning and evening surveys. However, although daily activity cycles vary among populations, Seigel (1986) found that during the spring and fall, massasaugas tend to be most active during the warmest parts of the day (e.g., 1200 – 1600 h). During the summer, they tend to be more active in late afternoon during cooler temperatures and may even become nocturnal.

Habitat: Eastern massasaugas have been found in a variety of wetland habitats, including bogs, fens, shrub swamps, wet meadows, marshes, moist grasslands, wet prairies, and floodplain forests (Hallock 1990, Harding 1997). Populations in southern Michigan are typically

associated with open wetlands, particularly prairie fens, while those in northern Michigan are better known from lowland coniferous forests, such as cedar swamps (Legge and Rabe 1996). Massasaugas also generally occupy wetland habitats in the spring, fall, and winter, but in the summer, snakes migrate to drier, upland sites, ranging from forest openings to old fields, agricultural lands and prairies. In general, structural characteristics of a site appear to be more important than vegetative characteristics for determining habitat suitability (Beltz 1992). Specifically, all known sites appear to be characterized by the following: (1) open, sunny areas intermixed with shaded areas, presumably for thermoregulation; (2) presence of the water table near the surface for hibernation; and (3) variable elevations between adjoining lowland and upland habitats (Beltz 1992).

Ecology: Massasaugas usually are active between April and late October. Spring emergence typically starts in late March and early April as groundwater levels rise and ground temperature approaches air temperature (Harding 1997, Szymanski 1998). Massasaugas spend most of the time in the spring basking on elevated sites such as sedge and grass hummocks, muskrat and beaver lodges, or dikes and other embankments. Individuals may spend up to several weeks in the wetlands near their hibernation sites before moving to their summer habitats (Johnson 1995). This seasonal shift in habitat use appears to vary regionally and among populations (Szymanski 1998). In Wisconsin, King (1997) documented only gravid females dispersing to the drier uplands to have their young, while the males and non-gravid females remained in the wetlands.

Mating occurs in the spring, summer and fall (Reinert 1981, Vogt 1981, Harding 1997). The females give birth to litters of 5 to 20 live young in August or early September in mammal burrows or fallen logs in the uplands (Vogt 1981, Harding 1997). Female massasaugas reach sexual maturity at three or four years of age, after which they have been reported to reproduce both annually and biennially in different parts of their range (Reinert 1981, Seigel 1986, Harding 1997).

Massasaugas usually hibernate in the wetlands in crayfish or small mammal burrows. They also have been known to hibernate in tree roots and rock crevices as well as submerged trash, barn floors, and basements (Johnson and Menzies 1993). Hibernation sites are located below the frost line, often close to groundwater level. The presence of water that does not freeze is critical to hibernaculum suitability (Johnson 1995). Individuals tend to return to the same hibernation site each year (Prior 1991) and tend to hibernate singly or in small groups of two or three (Johnson and Menzies 1993).



Massasauga home ranges and movement distances can be quite variable. King (1997) reported mean home ranges of approximately 5 to 7 acres for neonates and gravid females, 17 acres for non-gravid females and 398 acres for males. Other studies have reported mean home ranges of less than 2.5 acres (Reinert and Kodrich 1982) to 64 acres (Johnson 1995). Reported maximum movements range from 0.1 mile in Michigan (Hallock 1990) to 2 miles in Wisconsin (King 1997). King (1997) recorded average movement distances of 0.03 mile for neonates, 0.2 mile for non-gravid females, 0.4 mile for gravid females, and 0.8 mile for males.

Massasaugas feed primarily on small mammals such as voles, moles, jumping mice, and shrews. They also will consume other snake species and occasionally birds and frogs. Natural predators for the massasauga, particularly the eggs and young, include hawks, skunks, raccoons, and foxes (Vogt 1981).

When they are threatened, eastern massasaugas will typically remain motionless, relying on their cryptic coloration to blend into their surroundings. They sound their rattle when alarmed but will occasionally strike without rattling when surprised. This species is generally considered unaggressive; it is unusual for the species to strike unless it is directly disturbed (Johnson and Menzies 1993). Although the venom is highly toxic, fatalities are very uncommon because the species' short fangs can inject only a small volume (Klauber 1972). Small children and people in poor health are thought to be at greatest risk.

Conservation/management: The greatest threats to eastern massasauga populations are habitat loss and degradation due to human activities, including the draining of wetlands for agriculture, residential development, roads and pollution (Szymanski 1998). In addition to the loss of wetlands, essential upland habitat has been destroyed and fragmented. Vegetative succession also has reduced habitat availability (Beltz 1992, Johnson 1995). Current land use practices, hydrological changes and fire suppression have altered or eliminated the natural disturbance regimes necessary for maintaining the early successional structure with which massasaugas are associated (Szymanski 1998). Vehicle-caused mortality and injury also pose a significant threat to populations as suitable habitat becomes fragmented by roads (Szymanski 1998).

Overcollection for commercial, recreational, scientific, or educational purposes has greatly reduced massasauga numbers at many sites, particularly collection for the pet trade and bounty hunting in states other than Michigan (Szymanski 1998). The lack of uniform protection for the massasauga across its range can create loopholes for illegal take and trade (Szymanski 1998), and lead to increased collecting

pressure in states where take is not prohibited. Indiscriminant persecution by humans also has contributed to this species' decline. In Michigan, the eastern massasauga is protected under the Director's Order No. DFI-166.98, Regulations on the Take of Reptiles and Amphibians, which is administered by the Michigan Department of Natural Resources' Fisheries Bureau. It is unlawful to take an eastern massasauga from the wild except as authorized under a permit from the Director (legislated by Act 165 of the Public Acts of 1929, as amended, Sec.302.1c (1) and 302.1c (2) of the Michigan Compiled Laws). Public land managers and the general public should be informed that this species is protected and should not be collected or harmed. Any suspected illegal collection of eastern massasaugas should be reported to local authorities, conservation officers or wildlife biologists. The eastern massasauga also was listed as a federal candidate species by the U.S. Fish and Wildlife Service in 1999, and may be proposed for listing as threatened or endangered under the Endangered Species Act in the future.

Habitat protection of suitable wetlands and associated uplands is crucial for successful conservation of the eastern massasauga. Where populations are concentrated on public lands, land management practices need to be sensitive to protecting massasauga habitat. For instance, potential adverse impacts of land management practices such as timber harvesting, mowing, or prescribed burning can be avoided or minimized if these activities are conducted in late fall, winter, or early spring (i.e., November through early March) when the snakes are hibernating. Hydrological alterations such as winter drawdowns should be conducted prior to the initiation of hibernation to reduce the potential for causing winter mortality due to desiccation or freezing (Szymanski 1998). Viable massasauga populations in the state should be identified and targeted for long-term conservation and management efforts. Finally, people need to be educated about the biology and ecology of the eastern massasauga in order to reduce direct harassment and harm to individual snakes. This is especially important in areas where human-massasauga interactions are frequent (e.g. state and local parks).

Research needs: Currently, the greatest obstacle to effective conservation and management of the eastern massasauga in Michigan is incomplete knowledge of the distribution and abundance of the species. While recent sightings have been summarized (Legge and Rabe 1994), additional and systematic field surveys are needed. Additional work is needed to obtain long-term data on selected populations to identify healthy or viable massasauga populations. A reliable and efficient protocol or methodology for surveying and monitoring this species and estimating population size needs to be developed. Continued research is needed to improve our understanding of the specific biology



and ecology of Michigan massasaugas as well as potential impacts of various management practices. The genetic diversity of extant populations needs to be examined. Effective methods to educate the public about how to co-exist with massasaugas also need to be researched and implemented.

Related abstracts: prairie fen, rich conifer swamp, Mitchell's satyr butterfly, spotted turtle, Blanchard's cricket frog, eastern fox snake, wood turtle, Blanding's turtle, small white lady's-slipper, mat muhly, prairie dropseed, prairie Indian-plantain, red-legged spittlebug.

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