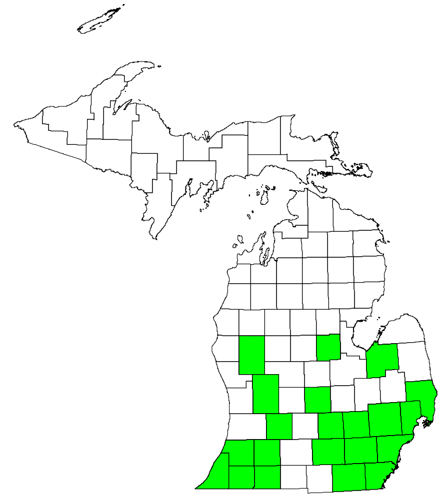
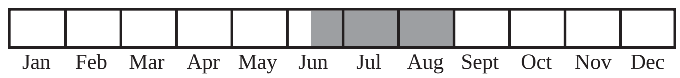
Asclepias purpurascens L. purple milkweed

Photo by Michael R. Penskar

State Distribution



Best Survey Period



Legal status: State threatened

Global and state rank: G4G5/S3

Family: Asclepiadaceae (milkweed family)

Total range: *Asclepias purpurascens* is found principally in eastern North America, occurring from New Hampshire south to Virginia and ranging west to Wisconsin, Iowa, Kansas, and Oklahoma.

State distribution: Purple milkweed is known from more than 60 occurrences in southern Michigan; thirty-four of these records are derived from collections made prior to 1930. This species is concentrated primarily in southeastern and southwestern Lower Michigan, where it is known from 19 counties, with most counties tallying only a single occurrence. Counties with the most occurrences are Washtenaw (10), St. Clair (9), and Jackson (8). The most northern location is Midland County.

Recognition: *Asclepias purpurascens* stands erect on **stout**, **puberulent (short-hairy) stems**, ranging to about 1 meter in height. Like other species of milkweed, the sap is a milky latex that readily bleeds from bruised or cut foliage and stems. The 10-15 cm long leaves are **opposite** and **elliptic** to **ovate-oblong**, **hairy beneath,** and **end in acute tips**. At their base, the leaves are **broadly tapered** to petioles that range from about 1-2.5 cm. The inflorescence consists of a **tight umbel of purplish-red flowers** borne terminally; occasionally, one or two additional umbels are present in the upper leaf axils. The individual flowers, which are usually from 13-17 mm long, bear **reflexed, purplish corolla lobes that are glabrous (smooth)**, **pale purple hoods** (forming the corona) **5-7 mm long**, and **incurved flat horns** that are shorter than the hood. The reproductive parts (filaments, anthers, and style) are fused into a structure called the **gynostegium**. The fruit is a smooth follicle (a pod) filled with seeds attached to downy hairs (coma**)** that aid in wind dispersal.

Asclepias purpurascens is often difficult to distinguish from the very similar looking common milkweed, *Asclepias syriaca*, which despite its unfortunate Latin epithet is also a native milkweed. Overall, the **leaves** of *A. purpurascens* are **more acute** and **less predominately pinnately–veined** (i.e. more strongly net-veined) than *A. syriaca.* In addition, *A. syriaca* bears **umbels in three or more leaf axils**, with flowers that have **hairy corolla lobes** and **hoods 3.5-5 mm long**. There have been collections from St. Clair and Jackson counties that suggest the possibility of hybridization between these two species.

Best survey time/phenology: Surveys are best conducted during the flowering and fruiting periods, which occur from late June to August.

Habitat: This species is found primarily in dry soils in prairies, including lakeplain prairies, and within open woodlands (especially oak and oak-pine), shrub thickets, and on shores. Commonly associated species

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include such plants as big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparius*), blazing star (*Liatris spicata*),ironweed (*Vernonia missurica*), culver's root (*Veronicastrum virginicum*), Indian grass (*Sorghastrum nutans*), tall coreopsis (*Coreopsis tripteris*), yellow loosestrife (*Lysimachia ciliata*), mountain mint (*Pycnanthemum virginianum*), Riddell's goldenrod (*Solidago riddellii*), field milkwort (*Polygola sanguinea*), Seneca snakeroot (*Polygala polygama*), creeping cinquefoil (*Potentilla simplex*), riverbank grape (*Vitis riparia*), red ash (*Fraxinus pennsylvanica*), gray dogwood (*Cornus foemina*), and dogbane (*Apocynum cannabinum*). In lakeplain prairie regions, purple milkweed may grow with such rare species as Sullivant's milkweed (*Asclepias sullivantii*), Clinton's bulrush (*Scirpus clintonii*), Gattinger's gerardia (*Agalinis gattingeri*), and Skinner's agalinis (*Agalinis skinneriana*).

Biology: *Asclepias purpurascens* is a perennial arising from a stout root. It flowers in June and July and fruit development occurs through August. As in other species of *Asclepias*, the flowers are highly modified for insect pollination. Adjacent anthers are joined together by two arms (translators) to a gland known as the corpusculum. Each half-anther contains pollen grains united into a waxy mass termed the pollinium. The pollinia are situated behind the hood, with the translator arms and gland visible between the corona. During pollination an insect removes a pair of pollinia by snagging them – via the sticky corpusculum — on a spur of its leg as it visits the milkweed flower. The pollinia must be reinserted in a precise fashion in vacant slots behind the hood of another flower in order to effect pollination.

Conservation/management: Purple milkweed is found in numerous counties in southern Lower Michigan, yet its status at many sites is unknown. Surveys to determine the status of this species at historical sites would enable a more reliable statewide assessment to be made, in order to determine if elevation to threatened or endangered status has merit. The primary conservation strategy for this species at the present time, in addition to status surveys, is the protection of prairie remnants and other dry open sites, as well as prairie restoration management, and prescribed burns to perpetuate suitable habitat in known sites.

Comments: Milkweed floss was used throughout World War II for stuffing life-preserver jackets. The amount of milkweed harvest in 1943 in Emmet Co MI, was almost 200 tons of pods (Voss 1996). Milkweed has other commercial uses such as latex (rubber), fiber, or even fuel.

Research needs: Perhaps the principal need at the present is experimental restoration management of prairies and oak savannas to determine the most appropriate treatments (e.g. prescribed burning regimes) for perpetuating habitat. Demographic work on populations and life history studies would also assist land managers.

Related abstracts: Lakeplain wet prairie, lakeplain wet-mesic prairie, appressed bog clubmoss, eastern prairie fringed-orchid, purple milkweed, Sullivant's milkweed, blazing star borer, culver's root borer, red-legged spittlebug.

Selected references:

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Abstract Citation:

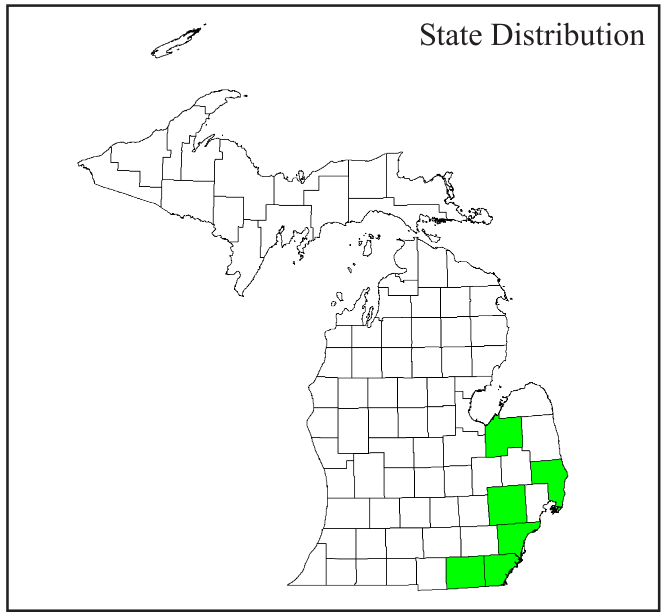
Choberka, E.G., M.R. Penskar, and P.J. Higman. 2000. Special plant abstract for *Asclepias purpurascens* (purple milkweed). Michigan Natural Features Inventory, Lansing, MI. 2 pp.

Updated April 2009.

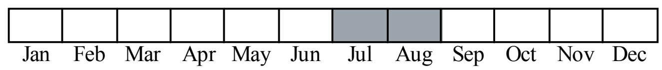
Funding for abstract provided by Michigan Department of Natural Resources-Forest Management Division and Wildlife Division.

Asclepias sullivantii Engelm. — Sullivant's milkweed


Photo by Michael R. Penskar



Best Survey Period



Legal status: State threatened

Global and state rank: G5/S2

Other common names: smooth milkweed, prairie milkweed

Family: Asclepiadaceae (milkweed)

Total range: This prairie species is concentrated in the Midwest, ranging north to Minnesota, east to southern Ontario and Ohio, west to Nebraska, Kansas, and south to Oklahoma. It is considered rare in Minnesota, Wisconsin, and Ontario, and is known only from historical records in North Dakota.

State distribution: Sullivant's milkweed is known from a total of 16 sites, with the majority of localities occurring in Monroe and St. Clair counties. Oakland, Wayne, Lenawee, and Tuscola counties all tally a single occurrence each. Although this species was reported by Davis (1906) to be "very abundant" in the lakeplain prairies of Tuscola County, extensive surveys there in recent years have failed to discover a single surviving colony. A Berrien County report (M. Kohring, pers. comm.) remains unconfirmed. Several of Michigan's colonies consist of small numbers of individuals persisting in highly disturbed sites, such as roadsides and railroad rights-of-way.

Recognition: Stems of *A. sullivantii*, which arise from deep, fleshy rhizomes, reach 4-11 dm in height. This species strongly resembles common milkweed, *A. syriaca* (also a native species but mistakenly considered exotic), both having broadly **ovate, opposite leaves, milky sap,** and dense, **globe-like clusters of flowers** borne from upper leaf axils. However, mature leaves of *A. sullivantii* are distinguished by their **reddish midveins, slightly undulate margins, somewhat acute tips, and complete lack of hair on the leaf underside**. In addition, the leaves of Sullivant's milkweed are usually **strongly upswept (see photo)**. In contrast, common milkweed has relatively blunt-tipped leaves that are densely pubescent beneath and remain roughly perpendicular to the stem. The flowers of *A. sullivantii* are also **larger, fewer**, and **pale to strongly pink-purple in color**, whereas those of *A. syriaca* are pink to dark purple, markedly smaller, and tend to be much more numerous in very dense inflorescences. The fruit of Sullivant's milkweed, a greenish-capsule termed a **follicle,** is relatively smooth in contrast to the warty follicle produced by common milkweed.

Sullivant's milkweed could be confused with stems of common dogbane (*Apocynum*), especially the species known as Indian hemp (*A. cannabinum*). Dogbane can be distinguished by its less robust growth habit, narrower leaves, dark stem, and especially its fruit, which consists of pairs of long, dangling, skinny follicles joined at their apex.

Habitat: Michigan colonies of this plant occur primarily in disturbed habitats such as old-fields with secondary prairies, and moist, grassy rights-of-way. At one St. Clair county locality, *Andropogon scoparius* (little bluestem) and *Hypericum kalmianum* (shrubby cinquefoil) dominate a secondary prairie with *Scleria triglomerata* (tall nut-rush), *Calopogon tuberosus* (grass pink), *Baptisia tinctoria* (yellow wild indigo), *Polygala sanguinea* (milkwort), *Aletris farinosa* (colic root), and *Aster dumosus*. Sullivant's milkweed also grows in an undisturbed habitat is a small lakeplain wet prairie remnant of the St. Clair River delta, dominated by *Andropogon gerardii* (big bluestem), *A. scoparius*, and *Panicum virgatum* (switchgrass). (Hayes 1964). A large population of this species – perhaps the state's biggest — was recently discovered on the outskirts of the city of Monroe, when a disturbed lakeplain prairie remnant was inventoried. Common associates at several sites include *Spartina pectinata* (prairie slough grass), *Pycnanthemum virginianum* (mountain mint), *Liatris spicata* (blazing star), *Solidago riddellii* (Riddell's goldenrod), *Coreopsis tripteris* (tall coreopsis), *Rudbeckia hirta* (black-eyed Susan), and many other typical prairie species. Soils are typically moist sandy clay or sandy loam.

Elsewhere in its range, *A. sullivantii* is primarily a plant of moist prairies. In the Chicago region, it grows with such species as *Andropogon gerardii*, *Aster ericoides* (heath aster), *Eryngium yuccifolium* (rattlesnake master), *Ratibida pinnata* (yellow coneflower), *Silphium laciniatum* (compass plant), and *Spartina pectinata* (Swink and Wilhelm 1979).

Biology: This species is a perennial from deep, fleshy rhizomes, and vegetative reproduction is common. Flowers are produced by mid-July with fruits maturing through August. As in other species of *Asclepias*, the flowers are highly modified for insect pollination. Sullivant's milkweed may hybridize with common milkweed, these two species having been isolated in presettlement times by habitat specificity. However, the highly disturbed condition of remaining prairie remnants has allowed the opportunistic common milkweed to colonize, bringing these two taxa into greater contact. One Michigan population of over 100 *A. sullivantii* stems appears to have been genetically degraded through hybridization and introgression (i.e. backcrossing) with common milkeed.

Conservation/management: Small populations that persist in degraded, disturbed, and/or marginal habitats are difficult to manage. Also, the low numbers of individuals present at these sites may not be enough to maintain viable populations. Possible hybridization with *A. syriaca* may further genetically erode and diminish poorly insulated populations in disturbed habitats. However, small surviving colonies may be valuable as a source of stock for establishment or enhancement of sustainable populations.

Michigan's most viable colonies lie on State Park and Game Area lands in St. Clair County. A large set of colonies occurs within a state park that is being actively managed for prairie restoration. Prescribed burning is probably the best way to favorably manage habitat for this species. Applications of herbicides should be avoided along rights-of-way where this milkweed grows, although this species appears to be persisting along heavily maintained road rights-of-way.

Comments: This species of milkweed has been reputed to have a particulary high content of rubber in its milky latex, and has been investigated for usefulness in rubber production (Fox 1944).

Research needs: The principal need at present is the identification of viable colonies and the implementation of restoration management programs to perpetuate and maintain this species. Demographic and breeding systems studies

Related abstracts: eastern prairie fringed-orchid

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Abstract citation

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Funding for abstract provided by Michigan Department of Natural Resouces - Parks and Recreation Division and Wildlife Division.

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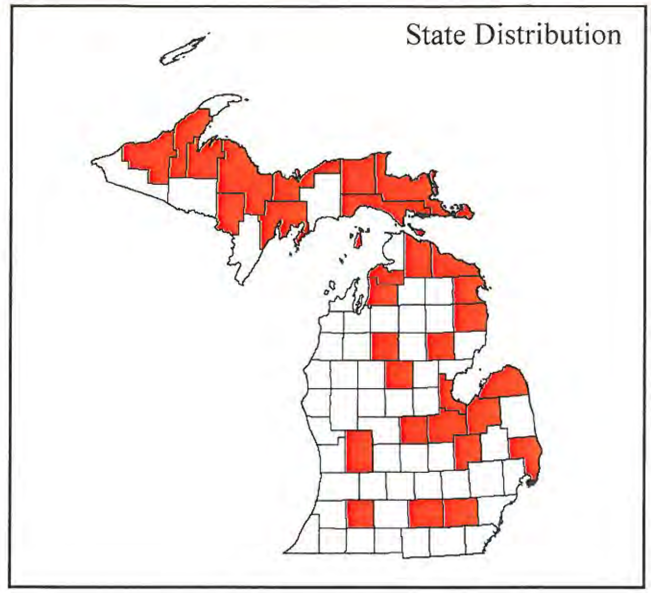
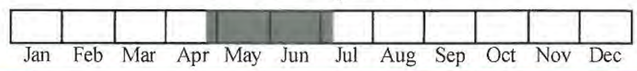
Botaurus lentiginosus (Rackett) American Bittern



Best Survey Period



Status: State special concern

Global and state ranks: G4/S3S4

Family: Ardeidae – Herons, Egrets, and Bitterns

Total Range: The American bittern breeds from the mid – U.S. to northern Canada (AOU 1983). Its breeding range runs from British Columbia east to southern Quebec and Newfoundland. Breeding in the U.S. is discontinuous south of Pennsylvania, Ohio, Indiana, Illinois, Missouri, Kansas, Colorado, Utah, Nevada, and California (AOU 1983). Only local breeding is found in Wyoming and surrounding states (Findholt 1984) and in Texas, Louisiana, Florida, and Mexico (Hancock and Kushlan 1984). The winter range includes the west coast from southern British Columbia south through California, the southern U.S. to the east coast, south through Mexico and the Caribbean, and rarely to Central America (AOU 1983). Wintering concentrations occur along the southern Atlantic coast, Gulf Coast, and southern California (Root 1988).

State Distribution: Barrows (1912) commented that the American bittern was one of the most abundant of our waders, and the species was listed as a common summer resident by Wood (1951). Currently, the American bittern breeds throughout the state but is more common in the Upper Peninsula (UP) and northern Lower Peninsula (LP) (Adams 1991). In recent years, breeding has been confirmed or suspected in 30 counties in the state (Adams 1991, Michigan Natural Features Inventory 2003). Michigan Breeding Bird Atlas (Atlas) records of American bitterns were widely scattered, but did reveal concentrations of observations in the northeastern LP and in Jackson, Barry, Van Buren, Oakland, and Tuscola Counties and near Saginaw Bay in the southern LP (Adams 1991). Intensive bird surveys at coastal wetland sites on Saginaw Bay upgraded American bittern breeding status to probable in one township and added a possible breeding record in a second township from what was observed during Atlas surveys (Whitt and Prince 1998). Distribution in the UP was generally more uniform with fewer birds recorded near the lakeshores and in some central counties (Adams 1991). Monfils and Prince (2003) confirmed nesting in coastal wetlands on Munuscong Bay (Chippewa County). Ewert (1999) identified several important bird sites for the American bittern: Houghton Lake marshes (Roscommon and Missaukee Cos.), Lower Manistee River wetlands (Manistee Co.), Seney National Wildlife Refuge (Schoolcraft Co.), Munuscong Bay wetlands, Lake Stella (Alger Co.), and Scott's Marsh (Schoolcraft Co.). The figure above indicates counties with confirmed breeding during Atlas surveys or known occurrences from the Michigan Natural Features Inventory database at the time of writing.

Recognition: This **brown, medium sized heron** is 23 – 33 inches (60 – 85 cm) in length with a **stout body and neck and relatively short legs** (Cramp and Simmons 1977, Hancock and Kushlan 1984). Gibbs et al. (1992) described adults as dark brown above, **heavily streaked brown and white below**, having a rusty crown and white throat, and possessing a **long, black patch extending from below the eye down the side of the neck**, which is a character unique among the herons. American bitterns are sometimes confused with immature black-crowned night-herons (*Nycticorax nycticorax*), which are darker brown, lack the contrast between the dark wingtips and paler coverts and body, and have no black neck patch (Gibbs et al. 1992). Males and females are similar, with the males slightly larger, and juveniles lack the black neck patches. Vernacular names such as "stake-driver" and "thunder-pumper" allude to the resounding call of the American bittern (Gibbs et al. 1992). Previous authors have best described the American bittern's **low, resounding song** as a deep, gulping, pounding ***"BLOONK-Adoonk"***, which is repeated one to 10 times in succession (Gibbs et al. 1992, Sibley 2000). This species **assumes the "bittern" stance when alarmed** by larger animals: **bill pointed skyward, body stretched vertically, contour feathers compressed, and body swayed with the breeze** (Gibbs et al. 1992).

Best survey time: Because the American bittern is most often concealed in dense herbaceous wetlands, the best time to survey for this species is during the breeding season when it is more apt to call to mark its territory or advertise for a mate. Singing is most often crepuscular and nocturnal, but American bitterns can be heard throughout the day and night early in the breeding season (Gibbs et al. 1992). The best survey period is between their arrival on the breeding grounds and egg laying, which Gibbs et al. (1992) noted is the time when males are most territorial and actively solicit copulations from females. In Michigan, this period ranges from late April to early July depending on latitude. Conspecific call-response techniques have been used successfully to improve the effectiveness of surveys for American bitterns and other waterbirds (Lor and Malecki 2002, Gibbs and Melvin 1993, 1997). Huschle et al. (2002) evaluated a variety of techniques for capturing adult American bitterns, and found mirror traps to be the most efficient method for trapping males and mist nets to be a versatile means of capturing both males and females.

Habitat: American bitterns most often breed in shallow wetlands dominated by tall emergent vegetation, including cattail (*Typha* spp.) marshes, wet meadows, bogs, and shrubby marshes, and occasionally hayfields (Adams 1991). In Maine, American bitterns were observed to use all wetland sizes, but were more abundant on larger wetlands, and preferred impounded and beaver-created wetlands to those of glacial origin (Gibbs et al. 1992). Brown and Dinsmore (1986) only found the species on wetlands > 10 ha, indicating that American bittern may be a wetland area-dependent species. In a study of wet meadows along the northern Lake Huron shoreline, Riffle et al. (2001) found the American bittern to be area-sensitive, with abundance positively related to wet meadow area. When compared to the sympatric least bittern (*Ixobrychus exilis*), the American bittern uses a wider variety of wetland types, less densely vegetated sites, shallower water depths, and exclusively freshwater habitats (Gibbs et al. 1992).

During spring and fall migration, Reid (1989) observed the species using wetlands dominated by river bulrush (*Schoenoplectus fluviatilis*), burreed (*Sparganium eurycarpum*), cattail, and water smartweed (*Polygonum coccineum*) in Missouri. American bitterns winter in areas where temperatures stay above freezing and waters remain open, especially in coastal regions where oceans moderate the climate (Root 1988). Gibbs et al. (1992) noted that although a wider range is used, wintering habitat is similar to breeding habitat. Managed wetlands, such as impoundments at wildlife refuges, are also important to American bitterns (Root 1988). This species will occasionally use brackish coastal marshes (Hancock and Kushlan 1984), and sometimes forage in large numbers in terrestrial habitats such as dry grasslands (Gibbs et al. 1992).

Biology: American bitterns return to southern Michigan during the first two weeks of April and rarely in late March (Wood 1951, Kelley 1978, Walkinshaw 1978), and by late April and early May occur throughout the state (Adams 1991). Adams (1991) stated that nests are placed on elevated platforms constructed of emergent vegetation, such as cattails, sedges (*Carex* spp.), and grasses (Poaceae), above shallow water or sometimes on land in tall grass. Nests are placed singly, however, males may be polygamous, with several females nesting within a single territory (Baicich and Harrison 1997). Egg dates ranged from May 6 (Wood 1951) to July 11 (Pettingill 1974) and clutch size ranged from 2 to 7, but is typically 3 to 5 (Gibbs et al. 1992). Baicich and Harrison (1997) described the eggs as unmarked and plain buffy brown to deep olive-buff. Incubation is done by the female alone, beginning with the first egg and lasting 24 – 29 days. Although renesting by American bitterns has been suspected, Azure et al. (2000) recently documented renesting for the first time. The young hatch over several days, differ in size, and are semi-altricial with yellowish-olive down at hatching (Baicich and Harrison 1997). Brood rearing and feeding is apparently done by the female alone, and chicks are given partially digested, regurgitated food (Gibbs et al. 1992). Gibbs et al. (1992) stated that the young leave the nest after one to two weeks, but remain near the nest to receive supplemental feedings until two to four weeks of age. Age at fledging is unknown, but occurs at 50 to 55 days in the similar Eurasian bittern (*Botaurus stellaris*) (Gibbs et al. 1992). Little information is available on departure dates, but fall migration is thought to begin in September and continue well into October (Wood 1951, Kelley 1978, Adams 1979). This bittern is a solitary feeder that is most active during dim light and relies on stealth to capture its prey (Gibbs et al. 1992). Kushlan (1978) noted that only four of the recognized heron feeding behaviors are used by this species: standing in place, neck swaying, walking slowly, and walking quickly. Analysis of American bittern specimens collected throughout North America revealed an array of food items, including insects (23%), fish (21%), crayfish (19%), frogs and salamanders (21%), small mammals (10%), and snakes (5%) (Cottam and Uhler 1945).

Conservation/Management: Although North American Breeding Bird Survey (BBS) data should be viewed with caution, they can be useful in elucidating trends in bird populations. Recent analyses of BBS data indicate significant ($P<0.01$) declines in American bittern observations of 14.3 and 5.7 percent/year in the Great Lakes Plain (includes southern Michigan) and Great Lakes Transition (includes northern Lower Michigan) physiographic regions, respectively (Sauer et al. 2003). Adams (1991) noted that the results of Atlas surveys confirmed that American bittern had declined in the State, especially in the southern Lower Peninsula. Habitat loss is cited most often as the likely cause of American bittern declines. Dahl (2000) estimated that less than half of the original wetlands present in the conterminous U.S. at the time of European settlement remain today. Approximately 50% of Michigan's original wetlands have been destroyed since European settlement, which includes about 70% of the State's coastal wetlands (Cwikiel 1998). Many of our remaining wetlands have been severely degraded from their original condition. Gibbs et al. (1992) noted that eutrophication, siltation, chemical contamination, and human disturbance can reduce habitat quality by impacting the prey base. The spread of exotic and nuisance species, such as purple loosestrife (*Lythrum salicaria*), reed canary grass (*Phalaris arundinacea*), and common reed (*Phragmites australis*), has also degraded wetlands used by this species, but the overall impact of these changes has not been evaluated. Acid precipitation has been listed as a potential threat to American bitterns due to their dependence on wetlands vulnerable to acidification, the importance of amphibians to their diet, and the large proportion of their breeding range that receives acid rain; however, the emergent wetlands used by this species tend to be circumneutral in pH and chemically buffered against strong shifts in acidity (Gibbs et al. 1992). Although the effects of contamination on American bitterns are largely unknown, Gibbs et al. (1992) believe that agricultural chemicals could have significant indirect effects on the species by entering wetlands through runoff. Should prey items that are vulnerable to pesticides, such as aquatic insects, crayfish, and amphibians, be impacted by contamination, American bittern populations could in turn suffer (Gibbs et al. 1992).

Gibbs et al. (1992) stated that preservation of freshwater wetlands, especially large shallow wetlands with dense growth of robust emergent vegetation, is the most urgent management need for this species. Programs that provide funds for wetland restoration and protection on private and public lands can effectively conserve habitat for this species and need to continue. Such initiatives include Farm Bill programs like the

Wetlands Reserve Program and Conservation Reserve Program, and the North American Waterfowl Management Plan, which uses funding appropriated through the North American Wetlands Conservation Act. Existing wetlands also need to be protected from chemical contamination, siltation, eutrophication, and other forms of pollution that could harm the birds or their prey (Gibbs et al. 1992). Encouraging best management practices, such as filter strips, no-till farming, and conservation tillage, in surrounding watersheds would help protect priority habitats from pollution. Gibbs et al. (1992) also noted that concentrations of nesting and wintering birds on protected and managed wetlands, such as state and federal wildlife areas and refuges, indicate the need to develop and implement management plans that benefit American bitterns.

Research needs: Previous authors have noted that much about the basic biology and ecology of this species remains unknown (Gibbs et al. 1992, Hands et al. 1989). Although survey methodologies have been developed to monitor populations of American bittern and other waterbirds (Lor and Malecki 2002, Gibbs and Melvin 1993, 1997), no large scale surveys or monitoring programs have been implemented. Such surveys are needed to assess the status and trends of this species in North America. Gibbs et al. (1992) indicated that detailed studies of American bittern breeding biology have been lacking, including investigations of diet, home range, habitat requirements, mating systems, ability to renest, sources and rates of mortality in adults, juveniles, nestlings, and eggs, and juvenile dispersal patterns and philopatry. Little work has been done during the migration and wintering periods of this species' life cycle. Research is needed to identify migration routes, major stopover and wintering sites, food habits, and habitat needs (Gibbs et al. 1992, Hands et al. 1989). Several authors have highlighted the need to develop effective strategies for wetland and associated upland management that will conserve habitat for this species during breeding, migration, and wintering (Gibbs et al. 1992, Adams 1991, Hands et al. 1989). A variety of other topics should be explored, including the examination of factors that regulate populations, impact of weather on populations, and the effects of chemical contamination (Gibbs et al. 1992, Adams 1991, Hands et al. 1989).

Related abstracts: least bittern, king rail, black tern, Great Lakes marsh.

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Funding provided by the National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center via the Great Lakes Commission.

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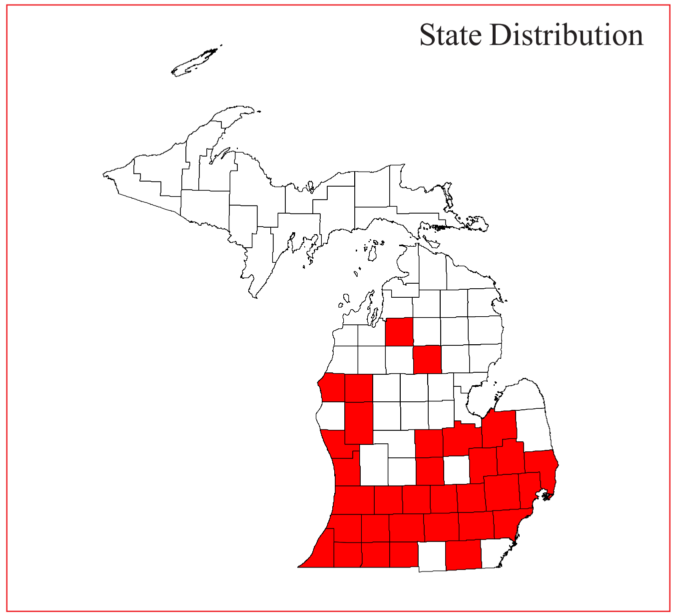
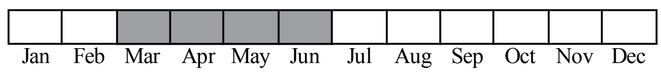
Clemmys guttata Schneider spotted turtle

Photo by James H. Harding



Best Survey Period



Status: State threatened

Global and state rank: G5/S2

Family: Emydidae (pond and box turtle family)

Range: Spotted turtles range from northeastern Illinois east through Michigan, northern Indiana, central Ohio, Pennsylvania and New York to southeastern Ontario and southern Maine, and south along the Atlantic coast to northern Florida (Ernst et al. 1994). Isolated populations occur in central Illinois, the western Carolinas, northern Vermont and southeastern Quebec (Harding 1997).

State distribution: Spotted turtles historically have been known from primarily the southern and western portions of Michigan's Lower Peninsula. Today, spotted turtles are uncommon to rare in Michigan, and tend to occur in isolated populations surrounded by unsuitable habitat (Harding 1997). Michigan Natural Features Inventory (2000) has compiled documentation of this species from 32 counties in the state, including isolated populations in north central Michigan in Roscommon County. This species has not been reconfirmed in Kalkaska, Lake, Clinton, Eaton, Ingham, Jackson and Branch counties within the last 20 years (Michigan Natural Features Inventory 2000). However, it is important to note that this species has not been systematically surveyed throughout the state, and may still occur in additional counties as well as those in which it has not been recently confirmed.

Recognition: The spotted turtle is a small turtle with adult carapace (i.e., top shell) lengths ranging from 3.5 to 5.4 inches. This turtle can be easily identified by the **round yellow spots** on its **broad, smooth, black or brownish black carapace.** Spots may fade in older individuals, and some individuals are spotless (Ernst et al. 1994). **The plastron (i.e., bottom shell) is hingeless,** and is usually **yellow or orange with a black blotch along the outer margin of each scute or scale;** in some males or older individuals, the black blotches cover the entire plastron. Their **heads are black** and typically have at least a few **spots on top and one or more irregular yellow or orange blotches on the sides near the eardrum.** Males have tan chins, brown eyes, and concave (i.e., curved inward) plastrons, with the vent or anal opening beyond the edge of the carapace when the tail is fully extended (Harding 1997). Females have yellow chins, orange eyes, broader, higher carapaces, and flat or convex (i.e., curved outward) plastrons, with the vent under the edge of the carapace when the tail is fully extended. Hatchlings average about 1.14 inches in carapace length, and usually have a single spot on each plate of their carapace. The plastron is yellowish orange with a central dark blotch.

Best survey time: The best time to survey for this species is early in the spring during the mating season, from March through May, before the vegetation gets too tall and dense (Conant 1951, Ernst 1976). In parts of its range, spotted turtles also are fairly visible in June during the nesting season when females will leave their drying pools to migrate to nest sites (Ernst 1976). The

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best way to survey for this species is to first search suitable habitat from a distance with binoculars or a spotting scope, scanning for individuals swimming in the water or basking in or along the river. This should be followed by slowly walking through the habitat, looking for turtles in the water or basking in the vegetation. Search efforts should concentrate on shallow pools of water or transitional areas from deeper water (Mauger pers. comm.). Optimal weather conditions for observing spotted turtles are sunny or partly sunny days above 60^{o} F (Mauger pers. comm.). Spotted turtles are not very active on overcast or rainy days (Ernst 1976). Some studies have indicated a tendency for more observations during the morning hours from 7 am to 1 pm (Mauger pers. comm.), although this will vary with weather conditions.

Habitat: Spotted turtles require clean, shallow, slow-moving bodies of water with muddy or mucky bottoms and some aquatic and emergent vegetation (Ernst et al. 1994, Harding 1997). Spotted turtles utilize a variety of shallow wetlands including shallow ponds, wet meadows, tamarack swamps, bogs, fens, sedge meadows, wet prairies, shallow cattail marshes, sphagnum seepages, small woodland streams and roadside ditches (Ernst et al. 1994, Harding 1997, Mauger pers. comm.). Although spotted turtles are considered fairly aquatic, they are frequently found on land in parts of its range and during certain times of the year (i.e., during the mating and nesting seasons and during the summer) (Ward et al. 1976). Terrestrial habitats in which spotted turtles are found include open fields and woodlands and along roads.

Biology: Spotted turtles become active in early spring as soon as the ice and snow melt, usually in late March to mid-April. This species appears to tolerate and prefer cooler water and air temperatures than do other related turtles, initiating activity at water temperatures as low as 37^{o}F (Ernst et al. 1994). In early spring, spotted turtles spend a great deal of time basking on logs, muskrat houses, and grass or sedge hummocks. Spotted turtles are generally difficult to find in the summer due to decreased activity levels and dense vegetation. Spotted turtle activity levels generally peak in May, or when mean monthly air temperatures are between 56 and 64^{o}F, and start to decline in June, or when mean monthly air temperatures are between 64 and 72^{o}F (Ernst et al. 1994). They become dormant or aestivate by late June or early July (Ernst 1982). In the spring, spotted turtles are active throughout the day, beginning at sunrise. At night, they burrow into the muddy bottoms of the wetland or crawl into mammal burrows or under vegetation (Ernst et al. 1994). In the summer, individuals are active primarily in the morning, and become dormant in the afternoon. Some individuals aestivate in muskrat burrows or lodges or dig into mud or submerged root systems, while others leave the water and burrow into soil or leaf litter (Harding 1997). Only nesting females are active in the evening.

Spotted turtles typically enter hibernation in mid-October (Harding 1997). They hibernate in shallow water in the mud or in muskrat burrows or lodges (Ernst et al. 1994). These sites are deep enough to not freeze completely, but are shallow enough to thaw quickly in the spring (Ernst 1982). Spotted turtles have been found to hibernate in congregations of up to 12 individuals (Bloomer 1978).

Spotted turtles reach sexual maturity at about 7 to 10 years of age (Ernst 1970). Mating occurs from March to May, and generally takes place in the water. Nesting usually occurs in the evening in early to mid-June in the Great Lakes region (Harding 1997). Nests are placed in well-drained areas with sandy or loamy soils exposed to full sunlight. Nest sites include grassy tussocks, hummocks of grass, sedge or sphagnum moss, marshy pastures and edges of roads (Hunter et al. 1992, Ernst et al. 1994). Females appear to nest near their core activity or foraging habitat (Mauger pers. comm.). The females dig a 2- to 2.5-inch deep flask-shaped cavity into which two to seven eggs are laid (Harding 1997). The hatchlings emerge in August or September, but may overwinter in the nest.

Spotted turtles have small home ranges of about 1.2 to 8.6 acres, although this may simply be an artifact of the amount of habitat available at many of the sites (Harding 1997). A study in Pennsylvania documented typical daily movements of less than 0.01 mile (65 feet); these mostly consisted of trips from evening retreats to daytime basking or foraging areas (Ernst 1976). Foraging turtles may move up to 0.03 mile. During the mating season, males in search of females may move up to 0.16 mile from water, while nesting females in search of a suitable nest site may travel up to 0.03 mile from water (Ernst 1976). In Maine, individuals readily travelled as much as 0.30 miles overland between wetlands to take advantage of available food sources (Hunter et al. 1992).

The spotted turtle is omnivorous, feeding primarily underwater. Their diet ranges from aquatic vegetation to larval amphibians, slugs, snails, crayfish, insects, worms and carrion (Harding 1997). Spotted turtles and their eggs are preyed upon by bald eagles, raccoons, skunks and muskrats (Ernst et al. 1994, Harding 1997). Wild spotted turtles have lived over 30 years, and can probably live up to 50 years (Hunter et al. 1992, Ernst et al. 1994).

Conservation/management: Similar to other turtle species, spotted turtles are characterized by relatively late sexual maturity and low reproductive potential. These life history traits suggest that high annual survivorship of adults and juveniles is particularly crucial for maintaining a stable population. Mortality or removal of adults and juveniles at a rate faster than they can be replaced can lead to population declines and potential local extinctions over time. Small, fragmented populations also tend to be highly susceptible to extinction as a result of catastrophic or chance events.

The primary threats to this species are habitat destruction and degradation and illegal collection for the pet trade (Harding 1997). In the last few decades, much of the shallow wetlands preferred by the spotted turtle has been drained or filled and converted to agricultural, residential and commercial land uses (Harding 1997). Many of the remaining populations occupy small, isolated, remnant wetlands (i.e., <10 acres) that continue to be threatened by development and pollution. Spotted turtles are highly valued by reptile hobbyists because of their small size and bright coloration, and collectors have severely reduced or eliminated populations throughout the species' range (Harding 1997). Increased nest predation due to large small mammal predator populations, particularly raccoons, represents a substantial threat to spotted turtles and turtle populations in Michigan in general. Increased urbanization and associated increase in road density and traffic have resulted in higher road mortality of spotted turtles, and have further fragmented their habitat and isolated populations. Vandalistic shooting of spotted turtles also occurs (Harding 1997).

Protection of extant populations and suitable wetland and nesting habitats is crucial for conserving this species. Providing connectivity among populations to allow for genetic exchange also is vital for preserving the long-term viability of this species. Increased protection of small, wetland complexes is important for maintaining sufficient habitat. In general, implementing minimum development setback distances, leaving buffer zones during agricultural and land management operations, maintaining good water quality and hydrologic integrity, minimizing the delivery of pollutants into the wetlands, and minimizing the construction of roads in or near suitable wetlands would be beneficial to this species. Maintaining open upland nesting areas through woody vegetation management also would benefit this species. Altering the timing of land use activities (e.g., working in upland habitat during the winter from November through February when spotted turtles are hibernating in the water) could help minimize the potential for adversely impacting this species. Predator control and on-site protection of nest sites may be warranted in some instances. Stream channelization and water impoundments should be avoided in areas with suitable habitat.

This species has been given various levels of legal protection throughout its range, however, protection needs to be consistent across its range to completely eliminate commercial trade of this species (Harding 1997). In Michigan, the spotted turtle is listed as state threatened and is protected under the state's Endangered Species Act and the Director's Order No. DFI-166.98, Regulations on the Take of Reptiles and Amphibians. It is unlawful to take a spotted turtle from the wild except as authorized under an endangered species permit from the Michigan Department of Natural Resources. "Take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect or attempt to engage in any such conduct. 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 spotted turtles should be reported to local authorities, conservation officers or wildlife biologists.

Research needs: An assessment of the species' current distribution and status throughout the state is needed. Spotted turtles have been documented from a fairly large number of sites in Michigan, but intensive surveys and monitoring are needed at these sites to determine whether they contain viable populations and to document population structure and trends. Nesting and wintering areas at these sites also need to be identified. Although the general life history and ecology of the spotted turtle are fairly well known, more information specific to spotted turtles in Michigan would be useful (e.g., movement and dispersal distances, home range, habitat use, reproductive success, long-term survivorship, potential carrying capacity). Impacts of various land uses and management activities on spotted turtle populations and habitat should be further investigated. The genetic diversity of extant populations needs to be examined. The impact of illegal collecting on spotted turtles in Michigan needs to documented and quanitified. Finally, effective strategies for ensuring the long-term viability of spotted turtles need to be investigated and developed.

Related abstracts: Prairie fen, mat muhly, prairie dropseed, prairie Indian plantain, small white lady's-slipper, Blanchard's cricket frog, Blanding's turtle, eastern box turtle, eastern massasauga, Kirtland's snakewood turtle, Mitchell's satyr butterfly.

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Funding for abstract provided by Michigan Department of Natural Resources-Forest Management Division and Wildlife Division.

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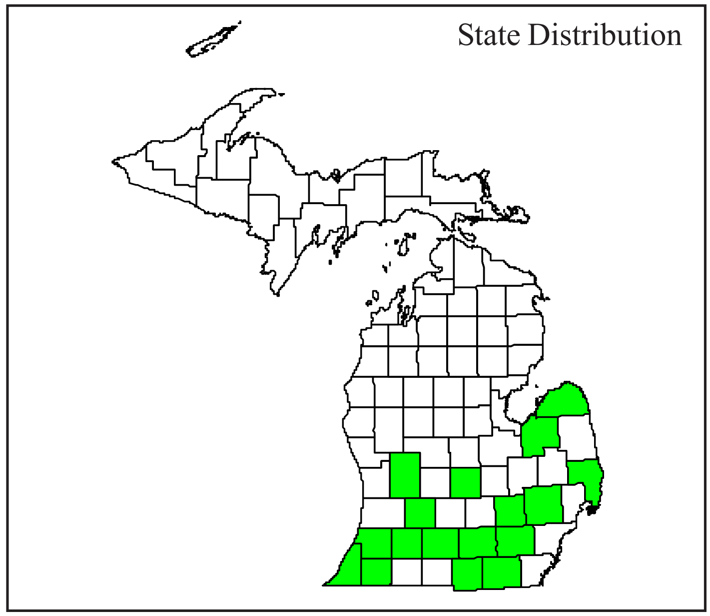
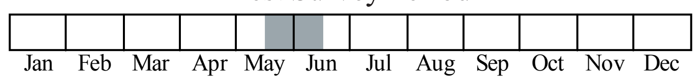
Cypripedium candidum Muhl. ex Willd. — small white lady's-slipper


Photo by Susan R. Crispin



Best Survey Period



Status: State threatened

Global and state rank: G4/S2

Other common names: white lady-slipper

Family: Orchidaceae (orchid family)

Total range: This principally upper Midwestern species ranges eastward to New Jersey and New York, extending west through southern Michigan to Minnesota, the eastern Dakotas, and southern Manitoba and Saskatchewan. To the south it ranges to Nebraska, Missouri, and Kentucky. It is considered rare in Iowa (S1), Illinois (S3), Indiana (S2), Kentucky (S1), Michigan (S2), Minnesota (S3), North Dakota (S2S3), New York (S1), Ohio (S1), South Dakota (S1), Wisconsin, and Manitoba. In Pennsylvania and Saskatchewan, it is considered extirpated and is known only from historical records in Missouri and New Jersey.

State distribution: Small white lady's-slipper is restricted to southern Michigan, occurring primarily within a narrow band from Berrien and Kalamazoo counties in the southwest to southeastern Michigan, were it is concentrated in Livingston, Oakland, Washtenaw, and Jackson counties. Two localities in the thumb region constitute the northernmost occurrences in the state. About one-third of approx. 81 recorded occurrences have succumbed to ecological succession or loss of habitat due to development pressures. Of the remaining extant populations, several are quite large, consisting of over 100-200 individuals.

Recognition: Although *Cypripedium candidum* produces solitary stems, mature plants commonly form small, dense, clonal clumps. This relatively small lady's-slipper averages about 20 cm in height, each stem producing **several strongly-ribbed, sheathing leaves that are densely short-hairy**. Stems are usually terminated by **a single flower (occasionally there may be two) characterized by its ivory-white pouch** (the lip or lower petal) which may be **faintly streaked with purple veins** toward the bottom and slightly purple-spotted around the pouch opening. The **lateral petals**, which are similar to the sepals, are **pale yellow-green and spirally twisted**. *Cypripedium candidum* is known to hybridize with two well-known varieties of yellow lady's-slipper, *C. calceolus* var. *pubescens* and *C. calceolus* var. *parviflora*, producing *C.* X*favillianum* and *C.* X*andrewsii*, respectively. These hybrids are the only taxa that small white lady-slipper is likely to be confused with. However, *Cypripedium* X*favillianum* can be distinguished by its larger size and very pale yellow pouch, and *C.* X*andrewsii*, which produces a white pouch like *C. candidum* can be distinguished by the dark, strongly spiralling petals and sepals more characteristic of var. *parviflorum*.

Best survey time/phenology: Surveys for this species should be conducted from late May to early June, when it typically flowers. It is fairly difficult to confirm the identity of non-flowering specimens.

Habitat: In Michigan, small white lady's-slipper occurs primarily in prairie fens and other marly, alkaline sites with groundwater seepage. These graminoid-dominated peatlands are commonly found adjacent to lake and stream systems. It also occurs in wet prairie communities of the clay lakeplain regions of southwestern Michigan and the thumb. These wet prairies are similar to tallgrass prairies, the typical habitat of this species outside of Michigan. Case (1987) also reports that it has been found in damp depressions in limestone barrens in Kentucky. Typical prairie fen soils in Michigan are Houghton mucks, often forming deep organic deposits. Common associates of white lady's-slipper include *Andropogon gerardii* (big bluestem), *Sorghastrum nutans* (Indian grass), *Potentilla fruticosa* (shrubby cinquefoil), *Carex stricta* (sedge), *Betula pumila* (bog birch), *Thelypteris palustris* (marsh fern), *Valeriana uliginosa* (valerian) and *V. edulis* var. *ciliata* (edible valerian, state threatened), *Sporobolus heterolepis* (prairie dropseed, state special concern), *Muhlenbergia richardsonis* (mat muhly, state threatened), *Solidago ohioensis* (Ohio goldenrod), *S. riddellii* (Riddell's goldenrod), *Pycnanthemum virginianum* (mountain mint), *Rhamnus alnifolia* (alder-leaved buckthorn), *Hierochloe odorata* (sweet grass), and numerous other species typical of southern Michigan fens, including several additional listed taxa.

Biology: Flowering occurs in late May to early June. Case (1987) and Luer (1975) both report that this perennial species develops rapidly, often blooming before the leaves have fully flushed and unwrapped the stems. Curtis (1943) estimated that at least 12 years or more are necessary for maturation following germination, and observed that clones are formed through the production of small plants from adventitious buds on 2 to 3-year-old roots. Curtis (1954) also documented the marked variation in flower and fruit production from year to year, and found no correlation between avg. flower and fruit production and the relative abundance of this species in the vegetation in comparison to other lady-slipper species. In a pollination study in southern Ontario, Catling and Knerer (1980) found small halictine and andrenid bees to be the principal pollinators. These bees were dependent on the availability of nectar from a variety of other flowering species whose blooming period coincided with *C. candidum*.

Conservation/management: Exemplary occurrences are protected and managed by several conservation organizations, including The Nature Conservancy and the Michigan Nature Association. However, many sites have been severely disturbed or destroyed through agricultural activities, peat or marl mining, land drainage, and other human activities. Others have succumbed to the invasion of woody shrubs due to ecological succession, while still others are threatened by the invasion of exotic species, the most notable pests being *Rhamnus frangula* (glossy-leaved buckthorn) and *Lythrum salicaria* (purple loosestrife). Prevention of hydrological changes and maintenance of a farily open condition are necessary for maintaining viable fen habitat. Careful fire management has been recommended for both shrub control and the healthy maintenance of populations (Bowles 1983). Kohring (1981) observed the favorable response of a population following a planned burn in a railroad right-of-way, noting that the number of blooming plants tripled and plant vigor increased. The use of prescribed burns should be carefully studied before, during and after their use in order to determine if and how burning can best be employed to maintain and/or enhance small white lady's-slipper populations. Since at least one Federal and State threatened insect species, (Mitchell's satyr), is known to inhabit prairie fens in southwest Michigan, any burn strategy employed should consider the presence of rare insects, mollusks, and herptiles.

Research needs: Due to the significant development pressure in southern Michigan where this species is most common, research regarding compatible development activities is of highest priority. Specific precautions that must be taken in order to maintain fen hydrology should be determined and proposed as policy. The role of fire as a management tool to minimize succession or the invasion of exotic species should also be investigated. Research on the breeding biology and genetic diversity of this species will provide a sounder basis for making management decisions.

Related abstracts: prairie fen, lakeplain wet prairie, lakeplain wet-mesic prairie, edible valerian, English sundew, mat muhly, prairie dropseed, prairie Indian-plantain, eastern massasauga, Mitchell's satyr

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Funding for abstract provided by Michigan Department of Natural Resources - Wildlife Division.

7-99/pjh

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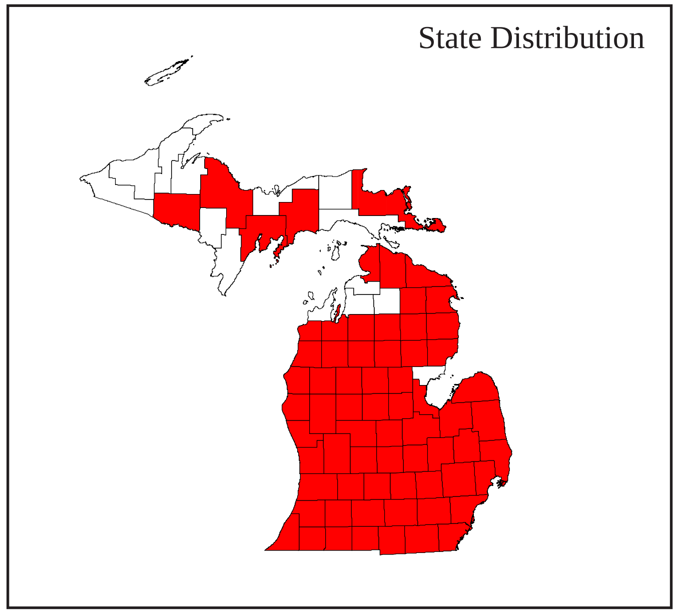
Emydoidea blandingii Holbrook **Blanding's turtle**



Best Survey Period

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec

Status: State special concern

Global and state rank: G4/S3

Family: Emydidae (pond and box turtles)

Range: Blanding's turtles occur from southwestern Quebec and southern Ontario south through the Great Lakes region to central Illinois and west to central Nebraska, including parts of Missouri, Iowa, South Dakota, and Minnesota (Ernst et al. 1994). Disjunct populations occur in Maine, New Hampshire, Massachusetts, New York, and Nova Scotia. Within the Great Lakes region, Blanding's turtles are found throughout southern Ontario, Michigan and Wisconsin, and in northern Ohio, northern Indiana and northern Illinois (Harding 1997).

State distribution: Michigan Natural Features Inventory (1999) has compiled documentation of Blanding's turtles from 36 counties in Michigan's Lower Peninsula. However, a statewide systematic survey for this species has never been conducted, and this species has been reported, at least historically, from almost every county in the Lower Peninsula and four counties in the central Upper Peninsula (i.e., Marquette, Dickinson, Delta, and Schoolcraft) (Harding and Holman 1990, Harding pers. comm.). It also has been reported anecdotally from Alger and Menominee counties in the Upper Peninsula (Harding pers. comm). Blanding's turtles are fairly common in parts of the Lower Peninsula, but are generally rare and have a fairly localized distribution in the Upper Peninsula (Harding and Holman 1990).

Recognition: The Blanding's turtle is a medium to large turtle with adult carapace (upper part of shell) length ranging from 6 to 11 inches, a **bright yellow chin and throat**, and a **very long neck** (Harding 1997). The elongated, dome-like, and smooth carapace is neither keeled nor serrated (i.e., not having raised ridges or pointed projections). The **carapace** is usually **black with yellowish spots and streaks**. The head also is dark with brown or yellow spots, and is relatively flat with a short, rounded snout and a **notched upper jaw, giving the appearance of a permanent "smile,"** according to Harding (1997). The **plastron** (underside of shell) typically is **yellow with a dark blotch at the outer corner of each scute, or scale**. Most adults have a **flexible hinge in the plastron**. Males have a slightly concave plastron, and the vent or anal opening is located beyond the end of the carapace when the tail is fully extended. Females have a flat plastron, and the vent is located under the end of the carapace (Ernst et al. 1994, Harding 1997). Hatchlings have a gray, brown, or black carapace, 1.2 to 1.4 inches long, with a low keel, and a plastron with a large, black central blotch and yellow or cream color along the edge (Harding 1997).

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Best survey time: Although Blanding's turtles are active and can be seen from early April to late October or early November, the best time to survey for this species is in May and June during the mating and nesting seasons when the turtles are most active (Harding 1997, Harding pers. comm.). During this time period, the easiest way to survey for this species is to conduct visual surveys for basking turtles, particularly on cool, sunny days. Also, this species is primarily diurnal and most active in the morning, although this may vary with temperature (Ernst et al. 1994). In addition to visual surveys, Blanding's turtles can be trapped throughout the active season using baited aquatic traps (e.g., hoop and net traps) and terrestrial drift fences (Congdon et al. 1983, Kofron and Schreiber 1985, Congdon and van Loben Sels 1991).

Habitat: Blanding's turtles inhabit productive, clean, shallow waters with abundant aquatic vegetation and soft muddy bottoms over firm substrates (Ernst et al. 1994). This species is found in ponds, marshes, swamps, bogs, wet prairies, river backwaters, embayments, sloughs, slow-moving rivers, protected coves, and lake shallows and inlets (Harding and Holman 1990, Van Dam 1993, Harding 1997). Blanding's turtles also occupy terrestrial habitats in the spring and summer, during the mating and nesting seasons, and in the fall, to a lesser extent. They prefer to nest in open, sunny areas with moist but well-drained sandy or loamy soil. They also will use lawns, gardens, plowed fields or even gravel road edges if suitable natural nesting habitat is not available (Harding 1997).

Biology: Blanding's turtles are active as early as April in Michigan. During the active season, they are often seen basking on muskrat lodges, stumps, logs, sedge or cattail clumps, or steep banks of dikes and ditches (Ernst et al. 1994). Blanding's turtles also are often seen along roads. At night, these turtles are found in or under aquatic vegetation. During the summer and fall, when shallow water habitats start to dry, some Blanding's turtles migrate overland to new bodies of water, while others aestivate on land, burrowing under roots, mud, or plant debris (Van Dam 1993, Harding 1997). Blanding's turtles generally are active during the day, however, in the summer, they may limit their activities to early morning and evening, or even become nocturnal (Harding 1997). Blanding's turtles typically enter overwintering sites in late October to early November. They usually hibernate underwater in deeper waterbodies, often buried in organic substrate. Mating can occur anytime during the active season but occurs most frequently in the spring (Harding 1997). Mating occurs in shallow to deep water in wetland habitats. Males may travel considerable distances overland during the mating season to locate females. Nesting occurs from late May to early or mid-June with most nesting occurring in June. On average, only about half of the sexually mature females in a population reproduce in a given year (Congdon et al. 1983). Females leave the wetlands to excavate nests in upland, open sandy areas adjacent to marshes. Females may travel up to 1,200 m to find suitable nesting sites, and typically exhibit nest site fidelity (Congdon et al. 1983). Nesting usually occurs at night. Clutch size ranges from 6 to 21 eggs (Harding 1997). Eggs hatch in 50 to 75 days, with most hatchlings emerging in August or early September (Harding 1997). Blanding's turtles in Michigan reach sexual maturity in 14 to 20 years (Congdon and van Loben Sels 1993).

Blanding's turtles are omnivorous. They feed predominantly on crayfish and aquatic insects, but also consume mollusks, small fish, earthworms, tadpoles, and aquatic plants (Kofron and Schreiber 1985, Harding 1997). They feed primarily under water, and generally forage along the substrate (Harding 1997).

Raccoons, foxes, and skunks are the primary predators of Blanding's turtle eggs, hatchlings and juveniles (Congdon et al. 1983, Harding 1997). Fish, frogs, snakes, wading birds, crows and other animals also will consume hatchling and juvenile Blanding's turtles. Nest predation rates can be high, ranging from 42 to 93 percent in Michigan (Congdon et al. 1983). However, adult turtles have few natural predators (Harding 1997). Annual survival rates of adult Blanding's turtles have exceeded 93% in the past, and are among the highest reported for freshwater turtles (Congdon et al. 1993).

Conservation/management: Blanding's turtles are characterized by delayed sexual maturity, small clutch size, low reproductive success, high adult survival rates, and long adult lives. Given these life history traits, this species requires high annual survivorship of adults and juveniles to maintain stable populations (Congdon et al. 1993). For example, Congdon et al. (1993) found that a Blanding's turtle population in southern Michigan had to have annual adult and juvenile survivorship of at least 93% and 72%, respectively, to maintain population stability.

The primary threat to Blanding's turtles is habitat loss and degradation (Van Dam 1993, Harding 1997). Blanding's turtles require clean, shallow water with abundant aquatic vegetation, and appear to be sensitive to habitat alteration (Kofron and Schreiber 1985). Sources of habitat loss and alteration include drainage or inundation of wetlands, river channelization, water impoundments, agricultural activities along edges of sloughs and ponds, herbicide and pesticide use, and development of upland nesting areas (Kofron and Schreiber 1985). Habitat fragmentation can pose a significant threat since nest predation, primarily by raccoons, skunks, and opossums, was found to increase near habitat edges (Temple 1987). Road mortality also is a substantial threat to Blanding's turtles because of their tendencies to migrate long distances over land (Harding pers. comm.). This species' docile nature makes it highly vulnerable to collection for the pet trade; however, this issue has not been a major concern because there currently is little demand for this species (Harding 1997).

The most critical conservation need for this species is protection and management of suitable wetland and nesting habitat. Maintaining large and small wetland systems connected to suitable upland habitat is crucial for this species (Harding 1997). In addition, maintaining good water quality, restricting herbicide and pesticide use in or near wetlands, implementing minimum development set-back distances, leaving buffer zones during timber harvest, grazing and agricultural operations, and minimizing the construction of roads in or near suitable wetlands would be beneficial to this species. Management of woody vegetation (e.g., through timber harvesting) may benefit this species by maintaining open nesting areas. Timber harvesting during the winter (i.e., late November through March) would minimize the potential for harming this species during logging operations. In some cases, active management in terms of on-site protection of nest sites and predator control may be necessary (Van Dam 1993). Stream channelization and water impoundments should be avoided in areas with suitable habitat.

The general public should be informed that this species is protected, and should not be collected or harmed. In Michigan, the Director's Order No. DFI-166.98, Regulations on the Take of Reptiles and Amphibians, states that it is unlawful to take a Blanding's turtle 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). This regulation is implemented by the Michigan Department of Natural Resources' Bureau of Fisheries. Any suspected illegal collection or trade of Blanding's turtles should be reported to local authorities, conservation officers or wildlife biologists.

Research needs: Nesting and wintering sites and healthy populations in the state need to be identified (Harding pers. comm.). Long-term studies are needed to monitor population sizes and trends in representative habitats throughout the species' range in Michigan. Information on the amount of habitat required to sustain a population needs to be obtained (Van Dam 1993). Terrestrial habitat use and daily and seasonal movements need to be better defined. Information on nest site fidelity, overland migrations, and population recruitment, especially of juvenile turtles, also needs to be gathered. Impacts of land uses and management practices, such as drawdowns, on Blanding's turtle populations and habitat should be further investigated. Effective methods to educate the public about the turtle's status and conservation also need to researched (Harding pers. comm.).

Related abstracts: Eastern box turtle, wood turtle, prairie fen, wooded dune and swale,

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Funding for abstract provided by Michigan Department of Natural Resources - Wildlife Division and Non-Game Program.

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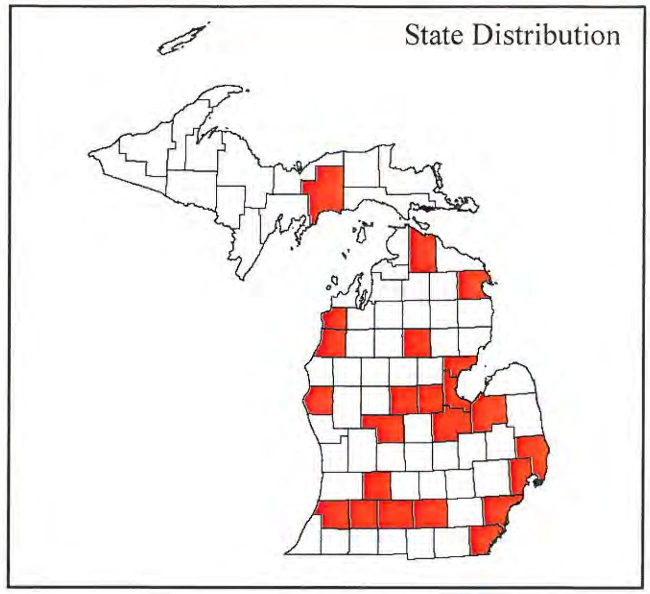
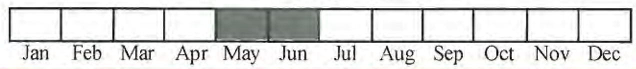
Ixobrychus exilis (Gmelin) — Least Bittern

Copyright The Otter Side



Best Survey Period



Status: State threatened

Global and state rank: G5/S2

Family: Ardeidae – Herons, Egrets, and Bitterns

Total range: Five subspecies of least bittern are found throughout much of North, Central, and South America (Gibbs et al. 1992). In North America, this species is primarily restricted to the eastern U.S., ranging from the Great Plains states eastward to the Atlantic Coast and north to the Great Lakes region and the New England states (Evers 1994). Western populations are concentrated in low-lying areas of the Central Valley and Modoc Plateau of California, the Klamath and Malheur basins of Oregon, and along the Colorado River in southwest Arizona and southeast California (Gibbs et al. 1992). U.S. populations are migratory and overwinter along the Atlantic coastal plain and U.S. Gulf Coast south through Mexico and the Caribbean islands into northern South America (Gibbs et al. 1992, Evers 1994). The northern limit of overwintering least bitterns is considerably farther south than that of the hardier American bittern (*Botaurus lentiginosus*) (Gibbs et al. 1992).

State distribution: Barrows (1912) listed the least bittern as "an abundant bird in all suitable places in the state." Wood (1951) identified the species as a summer resident and common in southern tiers of counties and Cheboygan County, but rare and local in the Upper Peninsula. Least bittern was later described by Payne (1983) as an uncommon transient and summer resident, with nesting confirmed in 27 counties. Michigan Breeding Bird Atlas (Atlas) surveys conducted in the 1980s confirmed breeding in 20 survey blocks in 17 counties (Adams 1991). All of these observations occurred in the Lower Peninsula, with the number of blocks and counties with confirmed breeding nearly split between the northern (9 blocks in 8 counties) and southern (11 blocks in 9 counties) Lower Peninsula (Adams 1991). Researchers confirmed nesting at several sites on Saginaw Bay and observed possible breeding in Munuscong Bay wetlands (Chippewa County) during avian studies conducted in the mid-1990's (Whitt and Prince 1998, Monfils and Prince 2003). Evers (1994) noted that least bittern has declined dramatically in all of its former strongholds in Michigan. The figure above indicates the counties with confirmed breeding during Atlas surveys or known occurrences from the Michigan Natural Features Inventory database at the time of writing.

Recognition: Least bitterns average 11 – 14 inches (28 – 36 cm) in length and have a wingspan of 16 – 18 inches (41 – 46 cm) (Evers 1994). Gibbs et al. (1992)

noted that the **crown, back, and tail** are a **vivid greenish black**, while the neck, sides, and underparts are brown and white. Diagnostic characters include **chestnut wings with contrasting pale patches** and **white lines bordering the scapular feathers** (Gibbs et al. 1992, Evers 1994). Sexes are similar in size but have **dimorphic plumage**, with the **crown and back of the female being purple-chestnut** compared to **black in the male** (Gibbs et al. 1992). The female also has a darkly streaked neck. Gibbs et al. (1992) described juveniles as similar to females, but having a paler and browner crown and heavier streaking in the neck and breast. In the rare dark color morph known as Cory's Bittern, the pale areas of the typical plumage are chestnut colored (Gibbs et al. 1992). Least bitterns can be confused with green herons (*Butorides virescens*); however, according to Gibbs et al. (1992) the green heron is easily separated by its larger size and dark wings and scapular feathers. Because of the secretive nature and dense cover used by this species, it is often easier to identify by its **low dovelike call.** Males give a fast series of **three to five "*coo*" notes**, reminiscent of the black-billed cuckoo (*Coccyzus erythropthalmus*). Females have been reported to respond with ticking calls, and the species will utter various cackles and "*tut-tut-tut*" calls when agitated or alarmed (Gibbs et al. 1992, Evers 1994). Similar to the much larger American bittern, this species will assume a frozen position with its bill pointed upward, feathers compressed, and eyes directed forward when threatened (Gibbs et al. 1992).

Best survey time: Surveys are most successful when conducted during the early breeding season prior to incubation, which generally occurs from early to mid May through the end of June. Whitt and Prince (1998) suggested that the most effective method to determine presence and breeding status for this species is to search emergent breeding habitat for nests and adults between mid-June and late July. As with many secretive marsh bird species, broadcasting conspecific calls can increase the effectiveness of surveys (Lor and Malecki 2002, Gibbs and Melvin 1993, 1997). In New York, least bitterns were most responsive to call-response surveys conducted between mid May and mid June (Swift et al. 1988). Bogner and Baldassarre (2002) found that responsiveness was higher near nest initiation when compared to incubation and hatching stages. Least bitterns can be heard during the early morning and evening hours; however, Swift et al. (1988) indicated that responsiveness to call-response surveys may be higher in the morning. The species is usually silent during midday and afternoon (Gibbs et al. 1992).

Habitat: Range-wide this species uses a variety of freshwater and brackish marshes with dense, tall growths of aquatic or semiaquatic vegetation, especially cattail (*Typha* spp.), sedge (*Carex* spp.), bulrush (*Schoenoplectus* spp.), and arrow-head (*Sagittaria* spp.), interspersed with clumps of woody vegetation and open water (Gibbs et al. 1992). Weller (1961) found least bittern nests in the north-central states most often associated with marshes dominated by cattail and/or bulrush. When compared to the American bittern, the least bittern is more prevalent in deeper water marshes (Weller 1961, Weller and Spatcher 1965). In their study of Iowa marshes, Weller and Spatcher (1965) recorded the species in the greatest abundance during years when ratios of emergent vegetation to open water were approximately equal (the hemi-marsh stage), and the species was not observed in areas of dense vegetation until opened up by muskrats. Brown and Dinsmore (1986) found that least bitterns were observed more often on Iowa wetlands larger than 12 acres (5 ha), suggesting that the species may be area sensitive. While Bogner and Baldassarre (2002) observed a mean home range size of 9.7 ha (11.4 ha for females, 8.1 for males) in their study in western New York, they suggested that vegetation type and cover ratios are likely more important than marsh size to least bittern populations.

Biology: Spring arrival usually occurs in late April and early May in the southern Lower Peninsula and shortly thereafter in northern Michigan (Evers 1994). Males give their low calls frequently during the breeding season, presumably to advertise their presence to females, and are known to defend their territories (Gibbs et al. 1992, Weller 1961). Weller (1961) indicated that nests are almost always placed above standing water and are constructed primarily by the male. The nest consists of a platform located 0.15 to 0.75 m above the water in clumps of dense emergent vegetation (Adams 1991), and is formed by bending down live and dead stalks and adding short stems and sticks on top (Weller 1961). Usually a clutch of 4 – 5, and rarely up to 7, pale bluish to pale greenish eggs are laid at one day intervals (Baicich and Harrison 1997).

Least bittern young remain at the nest for about a week after hatching, where they are brooded by both parents.

Weller (1961) found that incubation begins with either the first or second egg and lasts for 17 – 20 days. While both sexes participate in incubation, Weller (1961) felt the female may incubate more than the male. Renesting and double brooding has been observed; however, Bogner and Baldassarre (2002) indicated that more information is needed to determine the proportion of birds that renest or have second broods. Young are semi-altricial and downy and are brooded by both parents until they leave the nest as early as the 6th day, but usually leave permanently by the 13th – 15th day (Gibbs et al. 1992, Nero 1950). The young are fed minnows and frog legs by regurgitation (Nero 1950, Weller 1961). Young are typically able to begin foraging on their own within 1 – 2 weeks after hatching; however, the parents may continue providing food for up to 30 days (Nero 1950, Palmer 1962). First flight is usually attained by about 25 days after hatching (Baicich and Harrison 1997), although Bogner and Baldassarre (2002) observed a mean age of 29 days at first flight (n = 4) in western New York. Adams (1991) stated that little is known about the timing of the southward migration in Michigan, but it probably begins in August and continues well into September. Gibbs et al. (1992) noted that least bitterns use only four of the 28 known feeding behaviors used by herons: standing in place, walking slowly, neck swaying, and wing-flicking. Foraging occurs almost exclusively in emergent wetlands, most often at the edges of open water and emergent vegetation (Evers 1994). The least bittern's small size and compressed trunk allow it to easily move through dense emergent vegetation (Gibbs et al. 1992). Weller (1961) found that least bitterns stalk along branches or reeds when feeding, or by clinging to clumps of vegetation above the water level, aided by its short outer toes and long curved claws. Prey consists primarily of aquatic species, such as small fish, large insects, tadpoles and other amphibians, and crayfish, with small mammals and birds taken occasionally (Evers 1994). Foraging platforms of bent vegetation are frequently constructed at productive feeding sites, which are used during the late-incubation and brood-rearing periods (Weller 1961, Evers 1994).

Conservation/Management: Analysis of North American Breeding Bird Survey data did not reveal significant population trends for the least bittern; however, these and other large-scale surveys are known to not adequately survey secretive marsh birds (Adams 1991, Gibbs et al. 1992). While listed as abundant to common in Michigan through the late 1950s (Barrows 1912, Wood 1951, Zimmerman and Van Tyne 1959), Adams et al. (1981) indicated least bitterns apparently declined in the state between the late 1950s and early 1980s. Habitat destruction and degradation are likely the most important threats facing this species. Dahl (2000) estimates that less than half of the original wetlands estimated to be present in the conterminous U.S. at the time of European settlement remain today. An estimated 50% of Michigan's original wetlands have been destroyed overall since European settlement, including about 70% of the State's coastal wetlands (Cwikiel 1998). Many of our remaining wetlands have been severely degraded from their original condition by sedimentation, eutrophication, and chemical contamination. Gibbs et al. (1992) noted that changes in water quality could adversely affect the least bittern's prey base and increase the potential impacts from a nematode parasite (*Eustrongilides* spp.), which can devastate wading bird populations. Acid precipitation could be a potential threat due to possible affects to their food supply; however, the emergent wetlands used by this species tend to be circumneutral in pH and may provide chemical buffering against acidification (Gibbs et al. 1992). Invasive species such as purple loosestrife (*Lythrum salicaria*) and common reed (*Phragmites australis*) have degraded many wetlands and have the potential to impact the availability of suitable nesting habitat. Alterations to the hydrology of wetlands, such as drainage or channelization, can reduce breeding success by drying or flooding potential nest sites (Evers 1994). Collisions with motor vehicles, barbed-wire fences, transmission lines, and airboats can be a significant mortality factor due to least bitterns flying low to the ground (various sources cf. Gibbs et al. 1992). Although least bitterns are generally less vulnerable to land predators because they tend to nest over water and away from shore, there are many potential predators of young and eggs, including American crows (*Corvus brachyrhynchos*), raptors, blackbirds, blue jays (*Cyanocitta cristata*), snakes, turtles, mink (*Mustela vison*), and raccoons (*Procyon lotor*) (Bent 1926, Weller 1961, Bogner and Baldassarre 2002). Bogner and Baldassarre (2002) suspected marsh wrens (*Cistothorus palustris*) of predating least bittern eggs.

The protection, management, and improvement of large shallow wetlands with robust growth of emergent vegetation is seen as the most urgent conservation need of this species (Gibbs et al. 1992, Evers 1994). Several authors have indicated that marshes with a 50:50 ratio of open water to emergent vegetation, often termed hemi-marshes, attract the highest densities and diversities of wetland birds (Weller and Spatcher 1965, Kaminski and Prince 1984, Gibbs et al. 1991). Managing wetlands for the hemimarsh stage would improve conditions for least bittern and other wetland birds. Gibbs et al. (1992) suggested that wetlands also be protected from chemical contamination, siltation, eutrophication, and other forms of pollution. Best management practices, such as filter strips, no-till farming, and conservation tillage, are valuable tools in protecting wetlands from pollution. Initiatives that encourage wetland restoration and protection on private and public lands have been effective at conserving habitat for this and other wetland-dependent birds. Federal programs funded by the Farm Bill, such as the Wetlands Reserve Program and Conservation Reserve Program, and the North American Wetlands Conservation Act are good examples of efforts that have had positive benefits for an array of wetland species.

Research needs: Although call-response surveys are useful assessing the status and trends of this and other waterbird species in North America (Hands et al. 1989, Adams 1991, Gibbs et al. 1992), no large-scale monitoring programs have been implemented. Such a monitoring program is needed to track the populations of this and other secretive wetland bird species, and would allow agencies and organizations to work more effectively for their conservation. More study of least bittern breeding biology is needed, including investigations of movements, causes, and rates of juvenile and adult mortality, causes of nest failure, renesting, juvenile dispersal patterns, mating systems and philopatry, and diet (Gibbs et al. 1992). Gibbs et al. (1992) also suggested examining the species' habitat associations in the nesting, migration, and overwintering periods. Major habitats used as least bittern migration stopovers and for overwintering need to be identified, and techniques for wetland enhancement and restoration need to be developed (Gibbs et al. 1992). Other topics that should be explored include determining the factors that regulate populations, investigating the effects of chemical contamination, identifying the effects of disease and parasites, and determining the impacts of weather on populations (Gibbs et al. 1992, Hands et al. 1989).

Related abstracts: American bittern, Forster's tern, yellow-headed blackbird, Great Lakes marsh.

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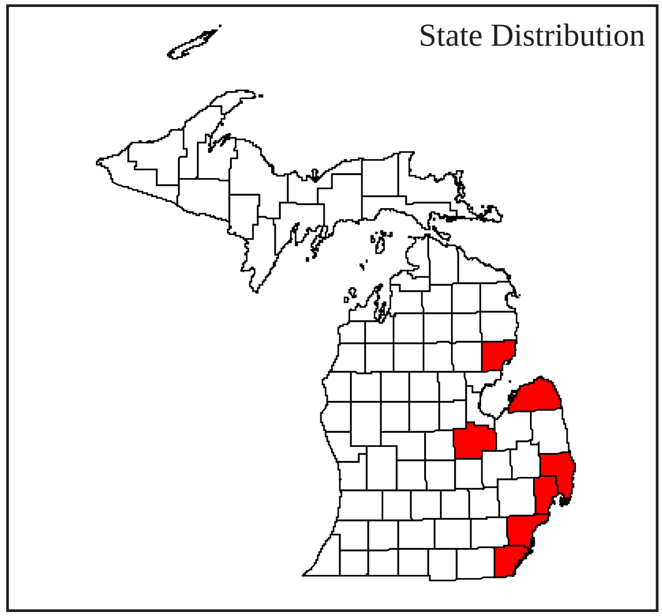
Abstract citation:

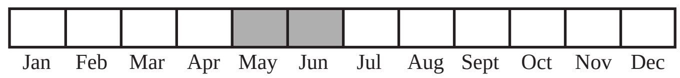
Monfils, M.J. 2003. Special animal abstract for *Ixobrychus exilis* (least bittern). Michigan Natural Features Inventory, Lansing, MI. 6 pp.

Funding provided by the National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center via the Great Lakes Commission.

Pantherophis gloydi Conant — eastern fox snake



Best Survey Period



Status: State threatened

Global and state rank: G5T3/S2

Family: Colubridae

Range: The eastern fox snake resides entirely within the Great Lakes basin. This species is restricted to the shoreline and near shore areas along southern Lake Huron from Saginaw Bay, Michigan and Georgian Bay, Ontario south to the Detroit River and Lake St. Clair, and along western Lake Erie from Monroe and Wayne counties in Michigan to Norfolk County, Ontario and Erie County, Ohio (Harding 1997). Eastern fox snakes also have been documented from Pelee Island and some of the smaller islands in Lake Erie. The more common western subspecies (*Elaphe vulpina vulpina*) occurs in the western Great Lakes basin from the central Upper Peninsula in Michigan west and south through Wisconsin, southeastern Minnesota and Iowa to northwestern Indiana, northern Illinois and eastern portions of South Dakota, Nebraska and Missouri.

State distribution: Historically, eastern fox snakes have been known to occur in seven counties in southern Michigan. However, the species has not been reported from Huron County since 1936, and the report from Iosco County is outside the species' historical range and needs to be verified. These snakes have been documented along the shoreline of lakes Erie, St. Clair and Huron, as well as along the Raisin, Detroit, Clinton and Shiawassee rivers and their tributaries. A survey for the eastern fox snake in 1986 documented four main, isolated populations in southern Michigan, two in Monroe County along Lake Erie, one in St. Clair County along Lake St. Clair, and one in Saginaw County associated with the Shiawassee River and its tributaries (Weatherby 1986).

Recognition: The eastern fox snake is boldly patterned with a row of **large dark brown or black blotches down the middle of the back** and **smaller, alternating blotches on the sides** on a **yellowish to light brown background**. The head varies in color from yellow or light brown to reddish brown, usually with a **dark band between the eyes**, a **band extending downward from the eye to the mouth**, and a **band extending backwards from the eye to the corner of the mouth** (Harding 1997). The **underside** is **yellowish with irregular rows of dark squarish spots**. The scales are keeled (i.e., have a raised ridge), and the anal plate (i.e., enlarged scale that partly covers the anal or cloacal opening) is divided. Adults range in length from 3 to 5.5 feet (Harding 1997). Juvenile eastern fox snakes are paler in color than the adults, and have gray or brown blotches bordered in black on the back and more distinctive head markings.

Several snakes in Michigan are similar in appearance and may be confused with the eastern fox snake. Western fox snakes do not overlap in range, although they are similar in size and have a greater number of smaller blotches on the back (range 32 to 52, average 41, as opposed to 28 to 43, average 34 on the eastern fox snake) (Harding 1997). Juvenile black rat snakes (*Elaphe obsoleta obsoleta*, State special concern) are

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strongly patterned and have a very similar body pattern and coloration to the eastern fox snake (see Harding 1997); the only way to distinguish the juveniles of the two species is by counting the scales on the underside of the snake (Evers 1994) (216 or fewer in eastern fox snake and 221 or more in black rat snake) (Conant and Collins 1998). Young blue racers (*Coluber constrictor foxi*) also have dark blotches but they have smooth scales and no line from the eye to the corner of the mouth (Harding 1997; see Conant and Collins 1998). Several species have similar-looking adults. The adult northern water snake *(Nerodia sipedon*) has crossbands instead of blotches. The adult eastern hog-nosed snake (*Heterodon platyrhinos*) has an upturned snout and occurs in sandy environments. Eastern milk snakes (*Lampropeltis triangulum triangulum*) have smooth scales and undivided anal plates. Eastern massasaugas (*Sistrurus catenatus catenatus*, state special concern) have a rattle at all ages.

Best survey time: The best time to survey for this species is May and June when the snakes are most active and most visible. Eastern fox snakes are active during all hours of the day, with peak activity from 1100 to 1900 hours (Kraus and Schuett 1982). Currently, the best way to survey for this species is to conduct visual surveys for basking or dispersing individuals. They are often found basking on artificially created dikes, muskrat houses, road embankments or other elevated sites (Conant 1938, Weatherby 1986). They also are often found along the edge of marshes. Following exceptionally hot days, eastern fox snakes can be found at night on roads (Weatherby 1986).

Habitat: The eastern fox snake inhabits emergent wetlands along Great Lakes shorelines and associated large rivers and impoundments (Evers 1994). They prefer habitats with herbaceous vegetation such as cattails (*Typha* spp). Although primarily an open wetland species, eastern fox snakes also occupy drier habitats such as vegetated dunes and beaches, and occasionally wander along ditches and into nearby farm fields, pastures, and woodlots (Harding 1997). Eastern fox snakes on Lake Erie islands occupy rocky areas and open woodlands.

Biology: Fox snakes are the least known of the North American snakes in its genus (Ernst and Barbour 1989). Little is known about the life history of the eastern fox snake; much of it is presumed to be similar to that of the better known western fox snake and other snakes in its genus (Evers 1994). Eastern fox snakes typically are active from mid-April to late October with peak activity in May and June (Evers 1994, Harding 1997). Eastern fox snakes are active throughout the day, but during intense heat, may become more nocturnal (Evers 1994). Eastern fox snakes are seldom found far from water, and are capable of swimming long distances over open offshore waters and between islands (Harding 1997). Limited home range studies have indicated individual movements of up to several hundred feet (Rivard 1976, Freedman and Catling 1979). This species hibernates in abandoned mammal burrows, muskrat lodges or other suitable shelters (Ernst and Barbour 1989, Harding 1997). These snakes may congregate and share overwintering sites.

Eastern fox snakes probably breed annually, beginning at two (Evers 1994) or three to four years of age (Harding 1997). Mating occurs in June and early July (Ernst and Barbour 1989). Eggs are usually laid in late June or July, and possibly into August. Eggs are deposited in the soil, hollow logs, rotting stumps, sawdust piles and mammal burrows, as well as under logs, boards and mats of decaying vegetation. Clutch size averages 15 to 20 eggs per clutch (Ernst and Barbour 1989). Hatching occurs from mid-August to early October (Harding 1997).

Eastern fox snakes feed primarily on small mammals, particularly meadow voles (*Microtus*) and deer mice (*Peromyscus*) (Harding 1997). They also will eat bird eggs and nestlings, earthworms, insects and frogs. Natural predators include egrets, herons, hawks, raccoons, foxes and mink. Juvenile fox snakes have additional predators such as large fish and frogs, turtles, shrews, weasels, and even rodents (Harding 1997). Young-of-the-year fox snakes experience high mortality, and generally remain under cover. When disturbed, young fox snakes may strike and bite, but older snakes rarely bite, even when handled; instead they shake or “rattle” their tail vigorously and may spray a musky-smelling anal secretion (which is supposedly foxlike and hence its name).

Conservation/management: The eastern fox snake has drastically declined in many areas where it was once abundant but can be locally common in areas where extensive habitat is still available (Harding 1997). The primary threats to this species are continued habitat loss and degradation of Great Lakes coastal marshes, human persecution and illegal collection for the pet trade (Evers 1994, Harding 1997). Much of this species’ habitat has been ditched and drained for agriculture, residential and industrial development. The remaining suitable wetlands and waterways are currently threatened by the same factors as well as pollution and other forms of degradation. Although the four known populations in Michigan occupy sites that are partially owned and protected by state or federal government, public access and use of these sites are still relatively unrestricted. In addition to habitat loss, this species is often mistaken for venomous species such as the eastern massasauga and copperhead snake (which is not found in Michigan) and many fox snakes are killed as a result. Eastern fox snakes also are threatened by increased road traffic and road density associated with development.

Protection and management of remaining populations and habitat is crucial for conservation of this species in Michigan. Management of emergent wetlands should include limiting disturbance on dike areas (e.g., restricting mowing between mid-June and mid-October) and microhabitat enhancement such as providing adequate nesting sites as well as refugia for young snakes by maintaining, creating or transporting woody debris (e.g., hollow logs) at/to a site (Weatherby 1986). Prescribed burning of suitable habitat should be conducted before the snakes emerge from hibernation (i.e., typically before mid-April) or on days when the snakes are unlikely to be basking or above ground (e.g., on cloudy/overcast days with air temperatures below 55°F). In addition to habitat protection, public education is needed to help facilitate proper identification of this snake, to demonstrate the value and benefits of maintaining this species (e.g., its consumption of rodents makes it useful in agricultural areas) and to discourage illegal persecution and harassment (Evers 1994). In Michigan, the eastern fox snake is protected by the Michigan Endangered Species Act and 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' Bureau of Fisheries. It is unlawful to take an eastern fox snake 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 fox snakes should be reported to local authorities, conservation officers, or wildlife biologists.

Research needs: An assessment of the species' current distribution and abundance in the state is needed. More information on this species' life history, particularly its habitat requirements, activity patterns, home range, dispersal capability and reproductive biology, should be obtained to develop appropriate management recommendations. The species' distribution and associated habitat should be analyzed at a landscape-scale to help determine habitat requirements and assess connectivity among populations. Long-term population studies including viability analyses are needed to better understand fox snake population dynamics and to identify parameters that determine and indicate population viability. This information would be useful for developing effective monitoring protocols and assessing this species' status in the state. The effectiveness of current methods for detecting and monitoring this species should be evaluated, and alternative survey methods investigated if current methods are not effective or yield inconsistent or unreliable results. Impacts of management and land use practices such as mowing, prescribed burning and residential development should be further investigated. The need and potential for successfully relocating, reintroducing or headstarting individuals in order to conserve or increase wild populations of this species should be investigated. The genetic diversity of extant populations needs to be examined. Effective methods to educate the public also need to be researched and implemented.

Related abstracts: eastern massasauga, Great Lakes marsh, eastern prairie fringed orchid

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Abstact citation

Lee, Y. 2000. Special animal abstract for *Pantherophis gloydi* (eastern fox snake). Michigan Natural Features Inventory, Lansing, MI. 3 pp.

Updated April 2009.

Funding for abstract provided by Michigan Department of Natural Resources - Parks and Recreation Division and Wildlife Division.

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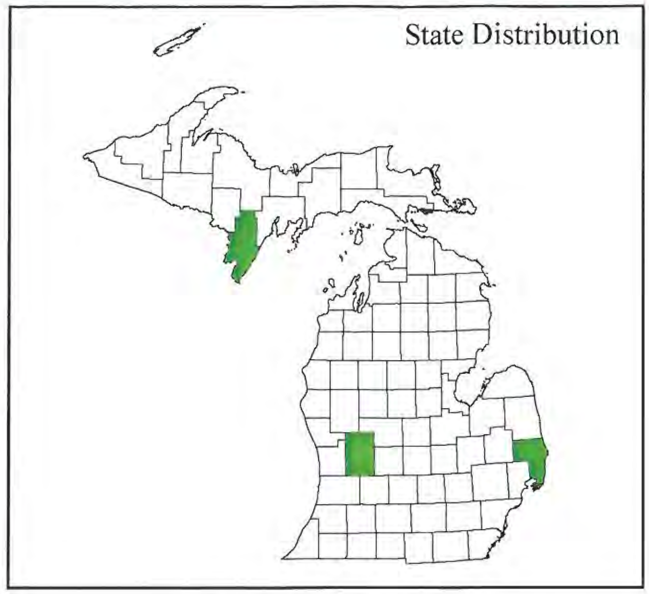
Penstemon calycosus Small — smooth beard-tongue

U.S. EPA @ Native Plants of the Great Lakes



Best Survey Period

Status: State threatened

Global and state rank: G5/S2

Other common names: eastern beard-tongue, long-sepal beard-tongue, beard-tongue, penstemon

Synonym: *Penstemon laevigatus* Aiton

Family: Scrophulariaceae (snapdragon family)

Taxonomy: This species is merged by some into *P. laevigatus* Aiton. According to the treatment by Bennett (1963) Michigan plants would be referred to ssp. *calycosus* (Small) R.W. Benn.

Total range: Smooth beard-tongue occurs primarily in the eastern United States, distributed from Maine to Michigan in the northern portion of its range and occurring south to Georgia and Alabama and reaching its western range edge from Illinois through Missouri and Arkansas. It is considered rare in Virginia and is known only from historical records in Georgia (NatureServe 2003).

State distribution: This species is known only from three localities in Michigan, consisting of an 1891 collection in Kent County, a 1985 collection in Menominee County, and a 1961 collection in St. Clair County.

Recognition: Smooth beard-tongue is an erect forb that ranges from ca. 6-12 dm in height, the stems usually hairless, though occasionally these may be finely hairy (puberulent) below the inflorescence. The leaves are opposite, lanceolate, stalkless, and finely saw-toothed (serrate), tapering to an acute tip. Terminating the stem is a narrowly branched inflorescence of stalked, tubular, **pinkish-purple flowers**. Unlike some species of beard-tongue, the **throat of the corolla is abruptly inflated and wider than the tube of the flower**, and the lower lobes of the corolla are distinctly longer than the upper lobes. The **anthers lack hairs and the calyx lobes are narrowly lanceolate to linear** and markedly longer than wide. Smooth beard-tongue is most similar to the common and wide-ranging *P. digitalis* (foxglove beard-tongue), which can be distinguished by its white to at best very pale violet flowers that have at least slightly hairy anthers (these are best examined by looking at their attachment with the filament) and calyx lobes that are lanceolate-ovate and not markedly longer than broad.

Best survey time/phenology: Flowering specimens of this species have been collected from approximately mid-June to mid-July.

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Habitat: Michigan collections provide very limited information about this species. In Kent County, it was only noted as occurring near a lake, whereas in Menominee County it was merely recorded as growing "in an open area" along US-2, a corridor known to support several prairie remnants and rare plant species. In St. Clair County, this species occurred at the edge of a prairie fragmented by a golf course, and likely grew in a remnant lakeplain prairie community. Elsewhere in its range smooth beard-tongue is cited as occurring in meadows, moist to dry woods, and alkaline rocky slopes. In the Chicago region, this species occurs on sparsely vegetated slopes in woodlands where it is associated with such species as *Anemonella thalictroides* (rue anemone), *Claytonia virginica* (spring beauty), *Cornus foemina* (gray dogwood), *Osmorhiza claytonii* (sweet cicely), *Toxicodendron radicans* (poison ivy), *Smilacina racemosa* (false Solomon's seal), and other common forbs and woody plants; it is also reported from pastures at woodland edges and grassy areas undergoing woody plant succession (Swink and Wilhelm 1994).

Biology: Smooth beard-tongue is a perennial forb. Fernald (1950) noted that this species has weedy tendencies and can be very aggressive, an observation corroborated by the classification of this plant in several regions as an exotic species, including New Jersey, Rhode Island, and the province of Ontario (NatureServe 2003).

Conservation/management: Little can be done for this species until much more thorough data have been obtained concerning the status of documented localities, thus dedicated inventories for both known and potential new sites are the primary need at this time. Restoration management including prescribed fire would likely be required to perpetuate the prairie communities inhabited by this species.

Related abstracts: Lakeplain wet prairie, lakeplain wet-mesic prairie, Gattinger's gerardia, Skinner's gerardia, three-awned grass, chestnut sedge, short-fruited rush, few-flowered nut-rush, pink milkwort, purple milkweed, Sullivant's milkweed, northern appressed clubmoss, eastern prairie fringed-orchid, meadow-beauty, eastern box turtle, eastern fox snake, red-legged spittlebug, blazing star borer, culver's root borer, silphium borer

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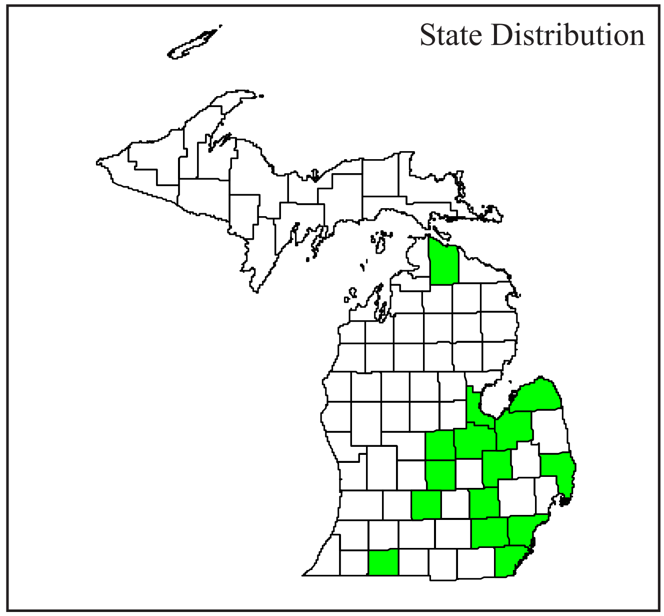
Abstract citation

Penskar, M.R. 2004. Special plant abstract for *Penstemon calycosus* (smooth beard-tongue). Michigan Natural Features Inventory. Lansing, MI. 2 pp.

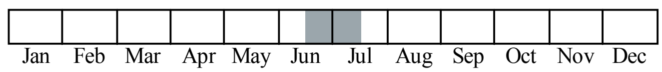
Funding for abstract provided by the National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center via the Great Lakes Commission.

Platanthera leucophaea (Nutt.) Lindley eastern prairie fringed-orchid

Photo by Susan R. Crispin



Best Survey Period



Legal status: State endangered, Federal threatened

Global and state rank: G2/S1

Other common names: White fringed-orchid, prairie white fringed-orchid.

Family: Orchidaceae (orchid)

Synonyms: *Habenaria leucophaea* (Nutt.) A. Gray

Taxonomy: Formerly included within the genus *Habenaria* by Correll (1950), this species, in addition to several other Michigan taxa, is widely recognized as appropriately belonging to *Platanthera* (Case 1987). Western populations of what had once been considered *P. leucophaea*, comprising most populations west of the Mississippi River, have been distinguished by Sheviak and Bowles (1986) as *P. praeclara* (western prairie fringed-orchid) based on significant differences in morphology, pollination mechanism, and geographic distribution.

Total range: Centered about the Great Lakes, *P. leucophaea* occurs east to Virginia and along the St. Lawrence drainage to Maine, ranging west into the Great Plains to the Dakotas and Iowa, and south in the Mississippi drainage to Missouri and Oklahoma. Now near extinction throughout much of its range, most populations are concentrated in the southern Great Lakes region, occurring primarily in southern Wisconsin, Illinois, Ohio, and southern Lower Michigan. This species is considered rare in Illinois, Iowa, Maine, Missouri, Ohio, Oklahoma, Virginia, Wisconsin, and Ontario. It is considered extirpated in Indiana, New Jersey, and Pennsylvania, and is known only from historical records in New York and South Dakota.

State distribution: *Platanthera leucophaea* was once known from more than 20 counties, primarily in southern Lower Michigan, with one anomalous disjunct locality documented in Cheboygan County. Extensive habitat modification and destruction has caused this species to severely decline. It is now extant in fewer than 10 counties, persisting mostly in the remnant lakeplain prairies of Saginaw Bay and western Lake Erie. The relatively high numbers of plants observed in 1984 declined markedly following years of high lake levels and drought. An exhaustive 1990 inventory of this species' remaining strongholds in Michigan found approximately 1100 plants total, with few populations supporting large numbers of plants in good quality, viable habitat. In recent years, only a fraction of the plants tallied before have been observed in many habitats, apparently due to highly droughty growing seasons.

Recognition: Prairie fringed-orchid is a tall, striking plant. It produces single stems that range from approximately 20 cm to 1 m or more in height, bearing long, narrow, sharp-pointed leaves that become progressively reduced upward. The leaves are strongly sheathing, becoming bract-like beneath the inflorescence. The stems are terminated by relatively **wide, showy racemes of up to 40 or more creamy white, stalked flowers**. Each flower has a long (2-5 cm), slender, downward-curving nectar spur behind and a **three-parted, prominently fringed lower lip, the fringe up to about half the length of the lip**. The small, wedge-shaped upper petals are rounded with **toothed or ragged margins**, forming a loose bonnet arching over the column. *Platanthera blephariglottis* and *P. lacera* are superficially similar species that can be easily distinguished. *Platanthera blephariglottis*, which occurs only in sphagnum bogs in Michigan, bears white flowers with fringed lower lips that are tongue-shaped and undivided. *Platanthera lacera* is a more common, widespread species of a variety of habitats; it bears white to greenish-white flowers with three-parted lower lips deeply divided into slender, often irregular, thread-like segments, and has upper petals that are linear.

Habitat: *Platanthera leucophaea* occurs in two distinct habitats in Michigan--wet prairies and bogs. It thrives best in the lakeplain wet or wet-mesic prairies that border Saginaw Bay and Lake Erie. These communities have relatively alkaline, lacustrine soils, and are dominated by *Carex aquatilis, C. stricta*, and *Calamagrostis canadensis*, as well as several prairie grasses and forbs. Common associates include *Andropogon scoparius* (little bluestem) and *A. gerardii* (big bluestem), *Spartina pectinata* (prairie slough grass), *Potentilla fruticosa* (shrubby cinquefoil), *Liatris spicata* (blazing star), *Linum medium* (flax), *Cornus stolonifera* and *C. amomum* (dogwoods), *Pycnanthemum virginianum* (mountain mint), *Gentianopsis crinita* (fringed gentian), *Solidago riddellii* (Riddell's goldenrod), *Cladium mariscoides* (twig-rush), *Typha latifolia* (cat-tail), *Juncus* spp. (rushes), and *Scirpus acutus* (hardstem bulrush). Prairie fringed-orchid frequently persists in degraded prairie remnants, and will frequently colonize ditches, railroad rights-of-way, fallow agricultural fields, and similar habitats where artificial disturbance creates a moist mineral surface conducive to germination.

Open or semi-open bog mats of *Sphagnum* and *Carex*, with slightly acidic, neutral, or somewhat alkaline lake water also support small populations of this orchid. Associates in these sites include *Thelypteris palustris* (marsh fern), *Sarracenia purpurea* (pitcher-plant), *Chamaedaphne calyculata* (leatherleaf), *Drosera rotundifolia* (sundew), *Potentilla fruticosa* (shrubby cinquefoil), *Larix laricina* (tamarack), *Betula pumila* (bog birch), and *Toxicodendron vernix* (poison sumac). Farther west and to the south, Eastern prairie fringed-orchid occurs in mesic and wet mesic black soil prairies, or rich, wet, sandy prairies, while to the east of Michigan, occurrences are generally restricted to bogs or sandy or peaty lakeshores.

Biology: Unlike many other *Platanthera* species, *P. leucophaea* is long-lived, with individuals documented to live more than 30 years (Case 1987). According to Case (1987), this perennial produces a bud on one of its roots that develops a new set of roots or tubers, becoming next season's new plant. The development and viability of this bud is highly dependent on the vigor of the old plant. In Michigan, flowering occurs during late June through early July. Case reports that the white blossoms produce a heavy fragrance at dusk and attract many moths, including the large Sphinx moths responsible for pollination. Sphinx moths are probably co-adapted pollinators, since their tongues are long enough to reach the nectar that lies deep in the spur of the flower (M. Bowles, pers. comm.). Prior to 1998, only three hawk moth species had been positively identified as pollinators. However, in 1998, during an MNFI study by Cuthrell et al. (1999), a previously unknown hawkmoth pollinator was documented. Capsules mature in September, releasing hundreds of thousands of airborne seeds. Plants do not flower every year, frequently producing only a single leaf above ground (M. Bowles, pers. comm) and possibly even becoming dormant when conditions are unsuitable, such as the onset of drought. Fire is thought to help break dormancy and stimulate flowering (Sheviak 1974), although its role in Michigan *Platanthera* sites is highly uncertain and controversial among some botanists.

Conservation/management: Competitive encroachment by native shrubs, especially dogwoods and willows, and pernicious exotics such as *Lythrum salicaria* (purple loosestrife) pose one of the greatest threats to Michigan's remaining prairie fringed-orchids. The large-scale destruction of lakeplain prairie habitat, primarily through alteration by ditching and diking, the conversion of areas for agricultural use, and other land settlement activities have rendered this species particularly vulnerable to extinction. In its last remaining viable sites, eastern prairie fringed-orchid is best protected by maintaining the natural hydrological cycles of the lakeplain wet prairies. Protection can only be adequately afforded when sufficient refugia are available during periods of high lake levels. Unfortunately, few natural areas are left that provide the necessary landward habitat. Where refugia are available, this species is able to seed inland during high water cycles, advancing shoreward again as lake levels recede (Case1987). This natural fluctuation along the Great Lakes shores maintains the necessary open, wet prairie habitat, preventing closure and shading by highly competitive woody plants such as dogwoods (*Cornus* spp).

In sites where active management may be required, shrub removal is of primary importance. Although fire is frequently recommended as a management tool (Bowles 1983), its role in Michigan's prairie fringed-orchid habitat is poorly understood. Case (pers. comm.) recommends great caution with the consideration of fire management, noting that the orchid's shallow subterranean buds can be easily damaged during spring or fall burns. At present, fire should be employed only as a very selective experimental tool, to be used in testing alongside other approaches, such as mechanical brush removal and soil disking. Prescribed burns may be desirable when brush removal and soil scarification enhance the vulnerability of populations to exotics such as purple loosestrife and other invasives.

Lastly, one of the greatest recognized threats to this elegant species is poaching and trampling by orchid enthusiasts, photographers, and others. At least one Michigan colony has been obliterated by poachers, and thus great caution must be taken with regard to remaining sites. Based on the aforementioned threats and the great vulnerability of this species, Case (1987) considers Eastern prairie fringed-orchid to be possibly the most "severely endangered orchid of our region".

Comments: According to an early report, *P. leucophaea* once grew so abundantly near the bath houses on Belle Isle Park, Detroit, that visitors there gathered it in bouquets (Foerste 1882). Several decades ago, this species also grew in abundance along Saginaw Bay. These are, however, scenarios unlikely to be witnessed again.

Research needs: Important research areas include pollination and breeding system studies, and especially the role of various management techniques required to sustain viable populations and restore functioning lakeplain prairie communities and landscapes.

Related abstracts: lakeplain prairie, lakeplain wet prairie.

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Abstract citation

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Funding for abstract provided by Michigan Department of Natural Resouces - Parks and Recreation Division and Wildlife Division.

3-00/mrp

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