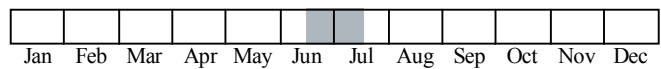


Best Survey Period



Status: Federally endangered, State endangered

Global and state rank: G1G2T1T2/S1

Family: Nymphalidae

Range: Mitchell's satyr is known historically from approximately 30 sites in four states including southern Michigan, northern Indiana, northern Ohio, and northern New Jersey (USFWS 1997). An additional historical population has been reported from central Maryland, but this record has never been verified and remains questionable (USFWS 1997). Most of the historical sites are known from Michigan, possibly indicating the former core of this species' range (Szymanski 1999). Today, Mitchell's satyr occurs primarily in southern Michigan and at only two sites in northern Indiana. The species is considered extirpated in Ohio and New Jersey due to habitat loss and overcollecting (Evers 1994, USFWS 1997).

State distribution: Mitchell's satyr has been documented from at least 22 sites in 11 counties, extending as far north as Kent County (Wilsman and Schweitzer 1991, USFWS 1997). Surveys from 1995 to 2000 of known sites and potential habitat have confirmed extant populations at only 16 sites in 9 counties, primarily in southwest Michigan (Hyde et al. 2001). Of the 22 historical populations, five are believed to be extirpated (i.e., satyrs have not been seen at the site for over a decade) (USFWS 1997, Hyde et al. 2001). Two counties (Kent and Lenawee) are no longer thought to contain extant satyr populations.

However, it is important to note that recent systematic surveys have reconfirmed satyr at several sites previously considered extirpated. Of the extant populations, only nine are considered high quality sites with potential for containing viable satyr populations (i.e., sites which consistently support higher densities of adults, and contain adequate habitat to maintain healthy populations of the butterfly) (USFWS 1997).

Recognition: Mitchell's satyr is a **dark, chocolate brown**, medium-sized butterfly with a wing span that ranges from 1.5 to 1.75 inches (Opler and Malikul 1992). **The ventral surface, or underside, of the forewing and hindwing contains a row of four to five black, yellow-ringed ocelli, or eyespots, with the central three eyespots on the hindwing being the largest. Two orange bands encircle the eyespots. The dorsal, or upper, wing surface is unmarked but thinly scaled so that the ventral pattern often shows through (USFWS 1997). Males are darker and slightly smaller than females (Opler and Krizek 1984). Mature larvae are pale green with pale, longitudinal stripes and a bifurcate tail (McAlpine et al. 1960).**

Other Michigan species that may be confused with the Mitchell's satyr butterfly because they are similar in appearance and habitat use include the Appalachian brown (*Satyrodes appalachia*), eyed brown (*Satyrodes eurydice*), large wood nymph (*Cercyonis pegala*), and little wood satyr (*Megisto cymela*) butterflies. The Appalachian brown and eyed brown butterflies are larger and lighter brown or more tan in color than Mitchell's satyr, and have very different eyespot



patterns. The wood nymph is much larger with only one or two large eyespots on the forewing. The little wood satyr is similar in size, but has only two black eyespots on each wing. The Mitchell's satyr butterfly also can be distinguished from these species by its slow, bobbing flight pattern. It also typically flies closer to the tops of sedges and shrubs than do the other four species.

Best survey time: The best time to survey for this species is during the peak flight period which typically occurs during the first two weeks in July, but can occur as early as the last week in June (USFWS 1997). The best way to survey for this species is to conduct visual surveys while meandering through suitable habitat, particularly along the interface of open wetland habitat and shrubby/forested vegetation. This species' behavior and activity appear to be strongly influenced by ambient temperatures and solar radiation. Mitchell's satyr are most active and easiest to observe on warm (80-90°F), overcast days, and their activity is significantly reduced during hot (>90°F), sunny days (Shuey 1997). At some sites, Mitchell's satyrs also have exhibited a diurnal activity pattern in which individuals are active during the cooler parts of the day (i.e., early morning and late afternoon) and appear to rest during the warmest part of the day (i.e., midday) (Clampitt pers. comm.).

Habitat: Although this species' habitat requirements are not yet fully understood, this butterfly appears to be restricted to calcareous wetlands that range along a continuum from open fen, wet prairie, prairie fen, and sedge meadow to shrub-carr and tamarack savanna (Shuey 1997, Szymanski 1999). Despite the range of ecological communities occupied by Mitchell's satyr, several attributes appear constant among known satyr sites: (1) peat soil, (2) a herbaceous community dominated by sedges, which always include *Carex stricta*, (3) scattered deciduous shrubs or coniferous trees, most often poison sumac (*Toxicodendron vernix*), tamarack (*Larix laricina*) or red cedar (*Juniperus virginiana*), and (4) groundwater seeps (MacKinnon and Albert 1996, Shuey 1997, Szymanski 1999). Mitchell's satyr habitat also appears to exhibit large variability in vegetative structure and composition at the habitat patch scale, suggesting the importance of habitat heterogeneity (Szymanski 1999).

Biology: Little is known about the ecology of this species. Mitchell's satyr is single-brooded throughout its range (USFWS 1997). Adults fly in late June through mid-July. Adults usually are active at a given site for two to three weeks. Males generally emerge a few days before the females. During the flight period, the butterflies mate, lay eggs, and die. McAlpine et al. (1960) found, under caged conditions, that the eggs hatch within 7 to 11 days, and the larvae feed through the summer until the fourth instar. The larvae then

diapause, resume feeding the following spring and complete the fifth instar. However, this species' larval phenology has not yet been confirmed under natural field conditions.

The primary hostplant for this species is believed to be *Carex stricta*, based on laboratory experiments (McAlpine et al. 1960) and the close association between adult Mitchell's satyr and dense stands of *C. stricta* in the field (Shuey 1997). The larvae feed on *C. stricta* and other fine-leaved sedges in the fens. However, Legge and Rabe (1996) documented oviposition on the undersurface of leaves of five different herbaceous plant species. Other researchers have observed females ovipositing *in situ* on the underside of tiny forbs (<5 cm) (Szymanski 1999, Hyde et al. 2001).

Mitchell's satyr also seems to be associated with woody vegetative structure as researchers have encountered adult satyrs most often at the interface between open fen or sedge meadow and woody vegetation (McAlpine et al. 1960, Rogers et al. 1992, Szymanski 1999). Shuey (1997) observed that during warm, sunny conditions, adults seek out shaded resting areas under shrubs or sedges, and fly only in response to disturbance. Szymanski (1999) found that Mitchell's satyrs tend to be very sedentary, and utilize only a small proportion of the available habitat at a site, generally moving a total distance of less than 50 meters.

Conservation/management: Mitchell's satyr is one of the most endangered butterflies in North America (USFWS 1997). The primary threat to the continued survival of this species is habitat loss and modification (Shuey 1997, Szymanski 1999). Many of the wetland complexes occupied currently have been altered or drained for agriculture or development. Wetland alteration is responsible for extirpating the single known satyr population in Ohio and several populations in Michigan (USFWS 1997). Wetland alteration also can lead to invasion by exotic plant species such as glossy buckthorn (*Rhamnus frangula*), purple loosestrife (*Lythrum salicaria*), common buckthorn (*Rhamnus cathartica*), and the common reed (*Phragmites australis*) (USFWS 1997). In addition, landscape-scale processes that may be important for maintaining suitable satyr habitat and/or creating new habitat, such as wildfires, fluctuations in hydrologic regimes, and flooding from beaver (*Castor canadensis*) activity, have been virtually eliminated or altered throughout the species' range (USFWS 1997). As a result, suitable satyr habitat and extant populations have become fairly isolated. Dispersal among populations, colonization of new sites and recolonization of extirpated sites have become increasingly unlikely (USFWS 1997). Finally, this species is vulnerable to collection for commercial exploitation, although the impact on a population varies with the timing, frequency, and number collected



(Evers 1994, USFWS 1997). Currently, this does not appear to be a significant threat to satyr populations in Michigan (Shuey 1997).

Successful conservation and recovery of this species will require protection of existing populations and habitat, protection of suitable unoccupied habitat, development of appropriate habitat management techniques, possible reintroduction into historical and suitable unoccupied sites, protection from collection, and an active research program (Evers 1994, USFWS 1997). Many populations of this species occur on private land. These sites need to be acquired or protected through management agreements or conservation easements (Shuey 1997, USFWS 1997). At known sites, it is necessary to maintain existing habitat and restore additional habitat throughout the wetland. It also is important to minimize inter-patch distance and provide corridors of suitable habitat between patches for dispersal (Szymanski 1999). Satyr sites should be managed to maintain a mosaic of woody and sedge cover, and habitat heterogeneity in general. If fire is to be used as a management tool, it should be done so carefully and at a small scale initially. The Mitchell's satyr working group should be consulted before any burns are scheduled for occupied sites. Invasive species should be monitored and removed. Natural hydrologic regimes need to be maintained or restored. Since so few viable populations of this species are known, re-introduction of Mitchell's satyr into historical sites that appear to still contain suitable habitat and introduction of satyr into suitable unoccupied sites should be implemented to help ensure long-term viability of this species (USFWS 1997).

Research needs: Gaining a better understanding of the biology and ecology of Mitchell's satyr is crucial for developing effective long-term protection strategies for this species. Research is needed on this species' life history, especially larval ecology, habitat use and requirements, response to habitat disturbance, and population structure and dynamics. Aspects of larval ecology that need to be examined in the field include oviposition substrates, hostplant use, feeding patterns, larval resting and diapause locations, and rates of growth and development (USFWS 1997). This species' primary hostplant needs to be verified in the field. A detailed assessment of vegetation structure and composition at occupied and unoccupied sites needs to be conducted to document the range of habitats used by this species (USFWS 1997). Information on within-site dispersal, distribution and habitat use can help identify important areas within a site (e.g., areas for reproduction) and help guide protection and management of wetland complexes occupied by Mitchell's satyr (USFWS 1997). Natural processes and disturbances essential for maintaining satyr habitat and compatible with the Mitchell's satyr as well as associated species need to be identified (USFWS

1997). Studies are needed to to develop effective population monitoring techniques as well as appropriate methodology for selecting sites for reintroductions. Finally, surveys of known and suitable unoccupied sites should continue in order to monitor existing populations and habitat, and to identify new populations.

Related abstracts: prairie fen, eastern massasauga, spotted turtle, Blanchard's cricket frog, small white lady's-slipper, mat muhly, red-legged spittlebug, swamp metalmark

Selected references

- Clampitt, C. Personal communication. Michigan Chapter of The Nature Conservancy, East Lansing, MI.
- Evers, D.C. 1994. Endangered and Threatened Wildlife in Michigan. The Univ. of Mich. Press, Ann Arbor, MI. 412 pp.
- Hyde, D.A., M.L. Rabe, D.L. Cuthrell, and M.A. Kost. 2001. Surveys for the recovery of Mitchell's satyr butterfly (*Neonympha m. mitchellii*) in Michigan: Final report – 2000. Rep. No. 2001-05. Report to the U.S. Fish and Wildlife Service - Region 3 Office, Fort Snelling, MN. 36 pp + app.
- Legge, J.T. and M.L. Rabe. 1996. Observations of oviposition and larval ecology in caged Mitchell's satyr butterflies (*Neonympha mitchellii mitchellii*) (Lepidoptera: Nymphalidae). Report to the U.S. Fish and Wildlife Service - Region 3 Office, Fort Snelling, MN. 17 pp.
- MacKinnon, W.A. and D.A. Albert. 1996. Mitchell's satyr historical habitat analysis. Report to the U.S. Fish and Wildlife Service - East Lansing Field Office, Ecological Services, Michigan. 21 pp.
- McAlpine, W.S., S.P. Hubbell, and T.E. Pliske. 1960. The distribution, habits, and life history of *Euptychia mitchellii* (Satyridae). J. of the Lepidopterists' Society 14(3):209-226.
- Opler, P.A. and G.O. Krizek. 1984. Butterflies East of the Great Plains. Johns Hopkins Univ. Press, Baltimore, MD. 294 pp.
- Opler, P.A. and V. Malikul. 1992. Eastern Butterflies. Houghton Mifflin Co., New York, NY. 396 pp.
- Rogers, E., J.A. Shuey, A. Reznicek, D. Premo, J.H. Harding, B. Premo, and T. Minzey. 1992. Ecological survey and evaluation of Blue Creek Fen for impacts of proposed road construction. White Water Associates, Inc. Unpubl. Rep. Michigan Dept. of Trans., Lansing, MI. 41 pp. plus appendices and maps.



- Shuey, J.A. 1997. Conservation status and natural history of Mitchell's satyr, *Neonympha mitchellii mitchellii* French (Insecta: Lepidoptera: Nymphalidae). Nat. Areas J. 17(2):153-163.
- Szymanski, J.A. 1999. Population and spatial ecology of the Mitchell's satyr butterfly, *Neonympha m. mitchellii* French, in southwestern Michigan. Master's Thesis. Univ. of Minn., Minneapolis-St. Paul, MN. 78 pp.
- U.S. Fish and Wildlife Service. 1997. Recovery plan for Mitchell's satyr butterfly (*Neonympha mitchellii mitchellii* French). Ft. Snelling, MN. viii + 71 pp.
- Wilsman, L.A. and D. Schweitzer. 1991. A rangewide status survey of Mitchell's satyr *Neonympha mitchellii mitchellii* (Lepidoptera: Nymphalidae). Report to the U.S. Fish and Wildlife Service. 20 pp.

Abstract citation

- Lee, Y. 2000. Special animal abstract for *Neonympha mitchellii mitchellii* (Mitchell's satyr butterfly). Michigan Natural Features Inventory, Lansing, MI. 4 pp.

Updated March 2001.

Copyright 2004 Michigan State University Board of Trustees.

Michigan State University Extension is an affirmative-action, equal-opportunity organization.

Funding for this abstract is a contribution of Federal Aid in Endangered Species, Michigan Project E-1-29.

