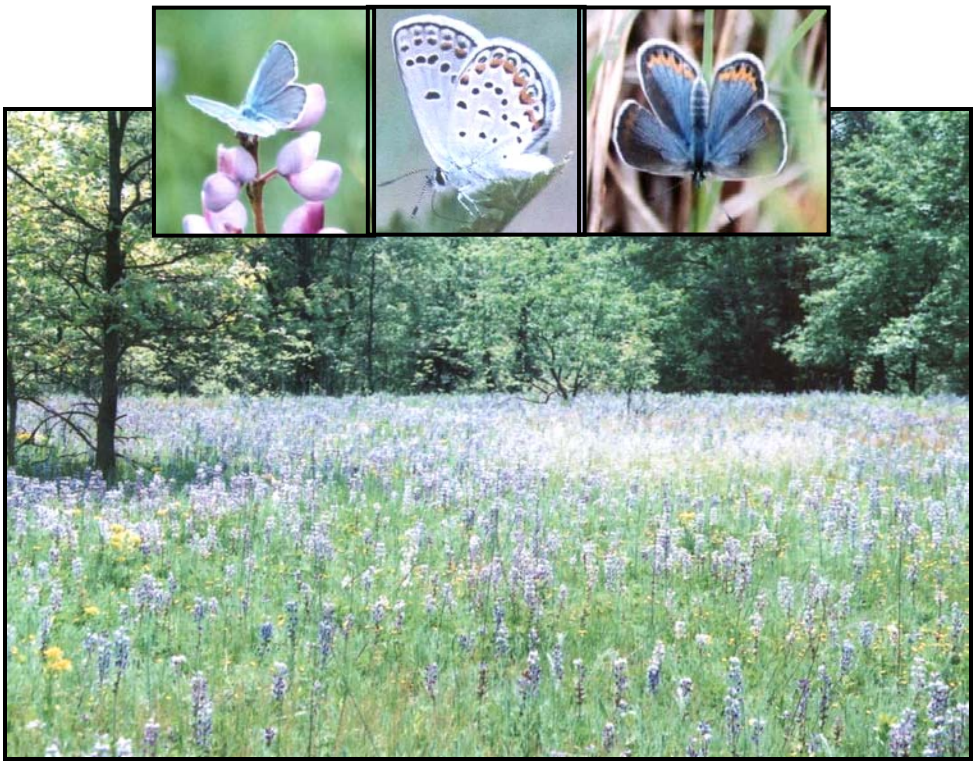
Comprehensive Population and Habitat Surveys for the Karner Blue (*Lycaeides melissa samuelis*) in Michigan: Year One Progress Report



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Karner blue male, side view, female, and *Lupinus perennis* at
Cannonsburg State Game Area.
Photos by the author.

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INTRODUCTION

The Karner blue butterfly (*Lycaeides melissa samuelis*) was listed as endangered by the U.S. Fish and Wildlife Service (USFWS) in 1992. The butterfly was once known from 12 states and the Canadian province of Ontario, but currently occurs in just seven states - Indiana, Michigan, Minnesota, New Hampshire, New York, Ohio, and Wisconsin. Michigan and Wisconsin contain the greatest numbers of butterflies and populated sites. In Michigan, the species is present in 10 western Lower Peninsula counties, half of which support just 1 to 5 small, isolated sites at risk for extinction from habitat degradation.

Declines in Karner blue populations are driven by the loss of open barrens and savanna habitat that support wild lupine (*Lupinus perennis* Linneaus), the butterfly's sole larval food source. Karner blue habitat historically was maintained by fires, which inhibited woody encroachment and encouraged lupine growth. However, fire suppression coupled with the conversion of lands to agriculture, pine plantations, residential areas, and other uses have reduced available habitats to small pockets of remnant oak and oak-pine barrens, managed openings, old fields, and utility rights-of-way (Evers 1994). As a result, Karner blue populations are now found only in remnant barrens or human produced habitats created by timber harvest, road and utility right-of-way construction, or direct management aimed at maintaining an open canopy.

A variety of factors influence whether Karner blues inhabit or persist in an area. The presence and density of larval and adult food sources, mutualistic ant species presence, annual or seasonal climate extremes, and habitat patch characteristics all affect Karner blue presence. Field surveys are the only way to determine whether Karner blues are present in an area. Michigan Natural Features Inventory (MNFI) has been documenting Karner blue occurrences since the early 1990s, with surveys aimed at locating new extant sites, reconfirming historical occurrences, and monitoring the butterfly's presence at known locations (Sferra et al. 1993, Cuthrell and Rabe 1996, Cuthrell and Rabe 1998). In addition, the Michigan Department of Natural Resources (MDNR), U. S. Forest Service (Forest Service), and The Nature Conservancy (TNC) have conducted surveys, restored habitat, and monitored populations on State Game Areas, in State Parks, within the Huron-Manistee National Forest, and on other managed areas (Bess 1989, Sferra et al. 1993, Lawrence 1994, Michigan Department of Natural Resources 1994, Wilsmann 1994, Cuthrell and Rabe 1996, Schuetz 1996). With the exception of The Nature Conservancy and a few non-profit groups, the vast majority of survey and management efforts for Karner blues in Michigan have been focused on public lands. Many sites are thought to occur on private lands, and these private lands may have important impacts on population dynamics. However, private lands are sometimes difficult to access, and some occupied sites may be going undetected.

In an effort to protect occupied sites, increase habitat availability, and increase population levels of the butterfly to recovery goal levels, the USFWS and MDNR have set out to develop a statewide Habitat Conservation Plan (HCP) for the Karner blue. The first step in developing a HCP is to determine the extent and threats to populations in Michigan. In 2002, MNFI began a three-year project with funding from the MDNR to determine the status and distribution of the Karner blue butterfly through surveys on private and public land, habitat modeling, and database support. At

the end of the project, we will have identified the locations and extent of the most significant populations of Karner blues in Michigan, their current condition, threats to existing populations and habitat, and areas of high quality natural communities suitable for habitat protection, enhancement, and possible reintroduction or translocation. This report summarizes the first year of activities conducted by MNFI.

Project Objectives

1. Complete comprehensive population and habitat surveys for the Karner blue in Michigan.
2. Transcribe and digitize new occurrence data.
3. Provide information on butterfly distribution and abundance.
4. Model potential habitat.
5. Document and survey other rare species that occur in association with Karner blue and are most likely to be affected by management activities.
6. Participate in meetings and conferences with HCP partners and the federal recovery team as needed.
7. Provide updates to regulatory agencies, ecoregion planning teams, landowner contact and private lands management programs and any other appropriate management, protection, and conservation efforts.

METHODS

Habitat and Population Surveys

As stated in the Draft Karner Blue Butterfly Recovery Plan (U.S. Fish and Wildlife Service 2001), the distribution and extent of the butterfly populations within the Muskegon and Newaygo Recovery Units (RU) are the most poorly understood in the state due to fragmentation of public lands. For that reason, population and habitat surveys during the first year of this project were concentrated in those RUs. Survey locations in the Muskegon and Newaygo Recovery Units were selected using data from past surveys, leads from Forest Service employees, and Geographic Information System (GIS) data layers including circa 1800 land cover data, current land cover data, soil types, and average minimum January temperatures.

Survey forms were completed by surveyors in the field to document site location, vegetation, threats, and Karner blue presence or absence at the time of the survey. Field packets containing field forms and maps (topographic, ownership, and aerial) of survey locations were created by MNFI seasonal staff for each site to be visited. Potential survey locations on private lands were identified, and attempts were made to contact landowners for permission to survey their lands. Depending on the circumstances, landowners were either telephoned prior to or visited at the time of field surveys to gain permission to survey. Landowner contact forms were created and completed for each landowner contacted and for those landowners that could not be reached.

Surveys during the first flight of the Karner blue (late May to mid June) were focused on visiting known Karner blue sites to train surveyors in the identification of the species and habitat, locating areas containing lupine, and conducting presence or absence surveys. Priority was placed on visiting sites where the species has been observed in the past but that had either not been surveyed or the species was not found in two or more years. Second flight (mid July – early August) survey efforts were aimed at visiting as many potential sites as possible within the Muskegon and Newaygo RUs at least once, documenting habitat conditions, and

determining Karner blue presence or absence.

Data Transcription and Digitizing
Data were classified as one of the following: (1) new Karner blue occurrences – sites where Karner blues were present in 2002 but had not been previously documented (2) present updates – sites where the species was present in 2002 and had been previously documented, (3) absent updates – sites where Karner blues were not found in 2002, but had been previously documented, or (4) new absence occurrences – sites where Karner blues were not present in 2002, were not previously documented, but contained lupine or habitat appeared suitable. An occurrence or site is defined as an occupied habitat patch greater than 200m from the nearest known occupied habitat patch (U.S. Fish and Wildlife Service 2001).

New occurrences were transcribed into the Natural Heritage Biological and Conservation Datasystem (BCD 2002). Occurrence updates (present and absent) were also entered into the BCD in an effort to maintain up-to-date records of Karner blue locations. Karner blue occurrences were also ranked in the BCD using element occurrence (EO) rank specifications for the species in order to represent the relative conservation value of each.

The spatial attributes of Karner blue sites were likewise updated using BioTICS software. All occupied habitat patches were digitized as polygons or points according to Natural Heritage Methodology. Aerial photographs, GPS points, and topographical maps aided in creating an accurate spatial representation of the occupied habitat. Karner blue sites not visited in 2002 were also re-digitized as polygons when possible using field forms and maps from past surveys.

Distribution and Abundance Information
Digitized polygons are being used to explore the various aspects of present and past Karner blue distribution in Michigan. EO specifications are being used to delineate EO boundaries and rank populations. The resulting information will be valuable in guiding management and reaching recovery goals.

Habitat Modeling
Biologically significant habitat variables for use in a predictive habitat model were identified for both the site level and landscape scale using the literature as a guide. Site level variable data were collected at the time of field surveys and represent site conditions at one point in time at each location. Site level variables included lupine presence and distribution, nectar species presence and diversity, woody species encroachment (representing structure and site heterogeneity), exotic species presence, presence of mutualistic ant species, presence of predators, light intensity (as a measure of canopy closure), and habitat patch size. Landscape scale variable data were determined or derived using GIS data layers in ArcView GIS 3.2. GIS layers included historic (circa 1800) barrens and savanna community presence, history of glaciation, disturbance history, current (1993) land cover, soil types, and soil moisture. Derived variables included distance to nearest occupied habitat patch, distance to nearest historically occupied habitat patch, average annual number of degree days above 55^{o} F, and average minimum temperatures for January.

Associated Species Surveys
Surveys, although focused on Karner blues, included several other rare barrens-associated species as targets. First flight surveys included other lupine-obligate Lepidoptera species – the frosted elfin

(*Incisalia irus*), and Persius duskywing (*Erynnis persius*). Frosted elfin is classified as threatened in Michigan, dependant on lupine as the only larval food source, and occurs in oak savannas, open areas, and wooded edges where blueberry (*Vaccinium* spp.) is used as an adult nectar source (Nielsen 1999). Persius duskywing is also state threatened, and very similar to other members of the Hesperiidae family. *Erynnis persius* lay eggs on lupine in Michigan, and commonly feed on several barrens and prairie associated flowering species (Nielson 1999). Second flight surveys included the state threatened Ottoe skipper (*Hesperia ottoe*), a large yellow skipper that depends on native prairie grasses such as big bluestem (*Schizachyrium scoparium*), fall witchgrass (*Leptoloma cognatum*), and nectars on prickly pear cactus (*Opuntia humifusa*) and other flowering species characteristic of dry sand prairies and oak barrens communities (Cuthrell 2001). State special concern eastern box turtles (*Terrapene carolina carolina*) were also observed during surveys, usually crossing roads near wet areas or in uplands with sandy soils, presumably searching for a suitable elevated area in which to lay eggs (Hyde 1999). Later in the field season, the state special concern Great Plains spittlebug (*Lepyronia gibbosa*), associated with native prairie grasses, was also recorded at Flat River State Game Area and Camp Owassipe Boy Scout Reservation in Muskegon County.

RESULTS

Habitat and Population Surveys

Eleven MNFI employees participated in the 2002 presence or absence surveys between July 15 and August 9. These surveys were conducted throughout portions of 11 counties. The majority of sites surveyed were located in seven counties within the Newaygo and Muskegon RUs: Lake, Mason, Mecosta, Montcalm, Muskegon, Newaygo, and Oceana (Figure 1). Survey teams completed 235 hours of surveys and visited 113 potential Karner blue sites, some on more than one occasion. Most of the surveys took place on federal lands within the Huron-Manistee National Forest (Figure 2). Other lands surveyed included power line and gas pipeline rights of way (utility ROW), city, county, or township-owned lands, and privately owned parcels.

Eleven new Karner blue occurrences were discovered. In addition, surveys verified Karner blue presence at 57 known occurrences (present updates), and failed to find Karner blues at 45 known occurrences (absent updates). The Newaygo RU had the most new occurrences while the Muskegon RU had the most present updates (Figure 3). Private lands yielded a majority of new location,s and most updates (both presence and absence) occurred on US Forest Service lands (Figure 2).

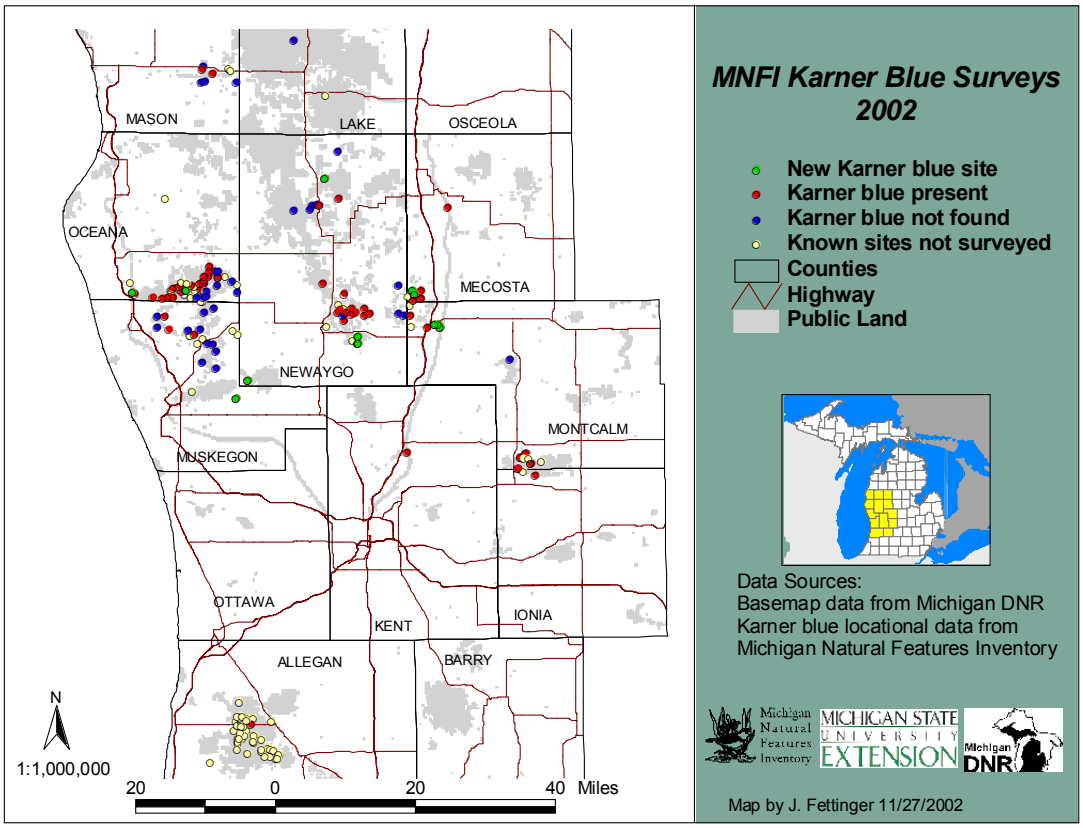

Figure 1. Results of Karner blue butterfly surveys conducted by MNFI in western Michigan counties, 2002.

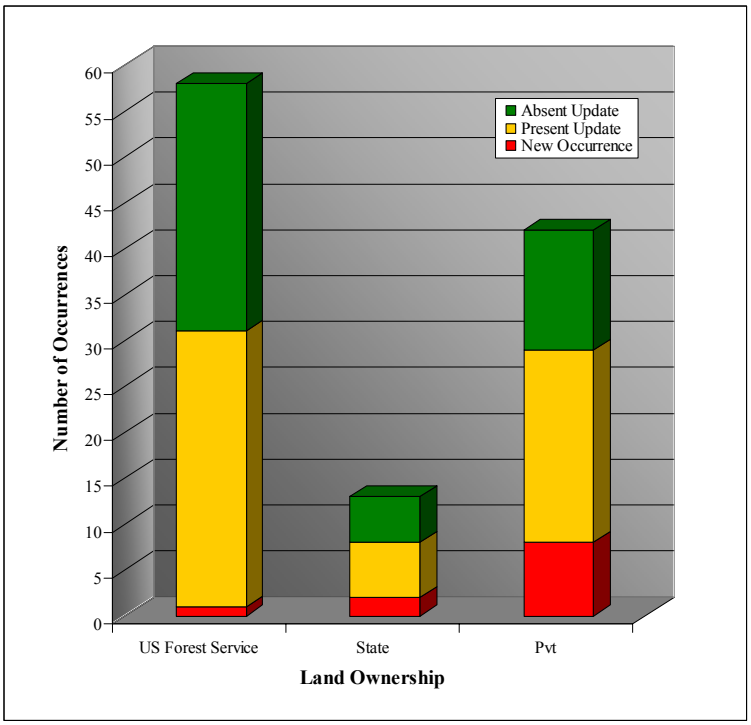

Figure 2. Proportions of new and updated Karner blue butterfly occurrences, based on a 200m separation distance, from 2002 MNFI surveys by landowner type.

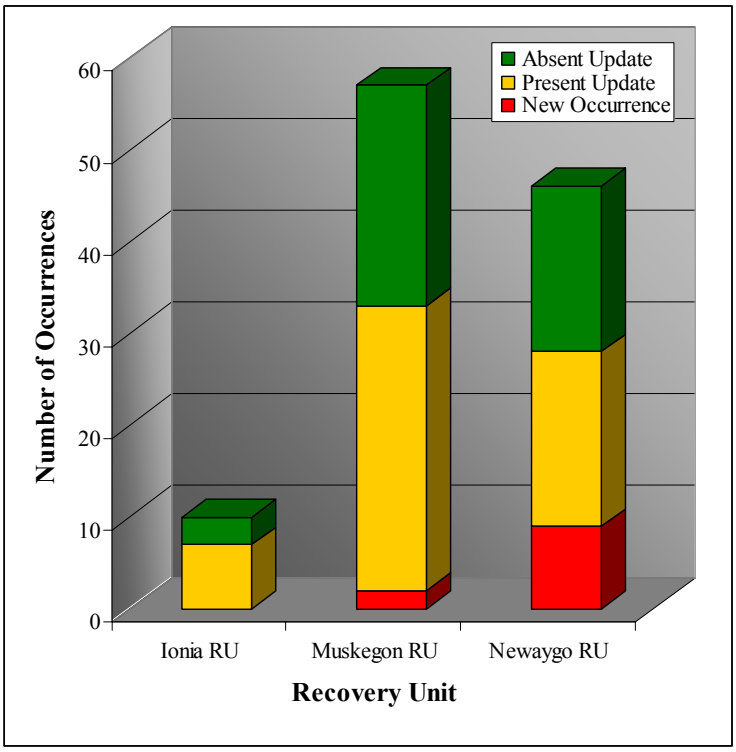

Figure 3. Proportions of new and updated Karner blue butterfly occurrences, based on a 200m separation distance, from 2002 MNFI surveys by Recovery Unit (USFWS 2001).

Data Transcription and Digitizing

All new and updated occurrences from 2002 MNFI surveys were entered into the BCD and digitized in BioTICS. In addition, 2 new occurrences and 12 updates from U.S. Forest Service surveys between 1994 and 2002 were entered into the BCD and digitized. Karner blue sites not visited in 2002 are currently being re-digitized in BioTICS using field forms from past surveys.

Habitat Modeling

Preliminary data exploration compared micro-habitat characteristics at occupied and unoccupied sites. Results suggest that sites with Karner blues contained greater densities of lupine, and absent sites were more likely to contain no or only scattered lupine (Figure 4). In addition, many nectar species were found more frequently within present sites than where Karner blues were not found (Figure 5). Additional analysis of the data is ongoing, and a predictive habitat model will be created.

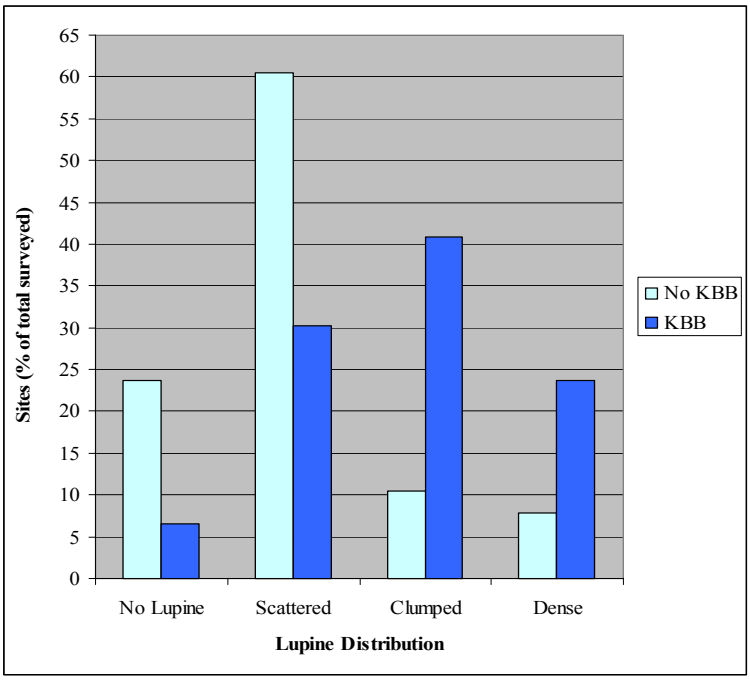

Figure 4. Karner blue butterfly presence and absence related to lupine distribution within survey sites during 2002 MNFI surveys. Most Karner blues found in areas without lupine were males, presumably dispersing to areas with lupine.

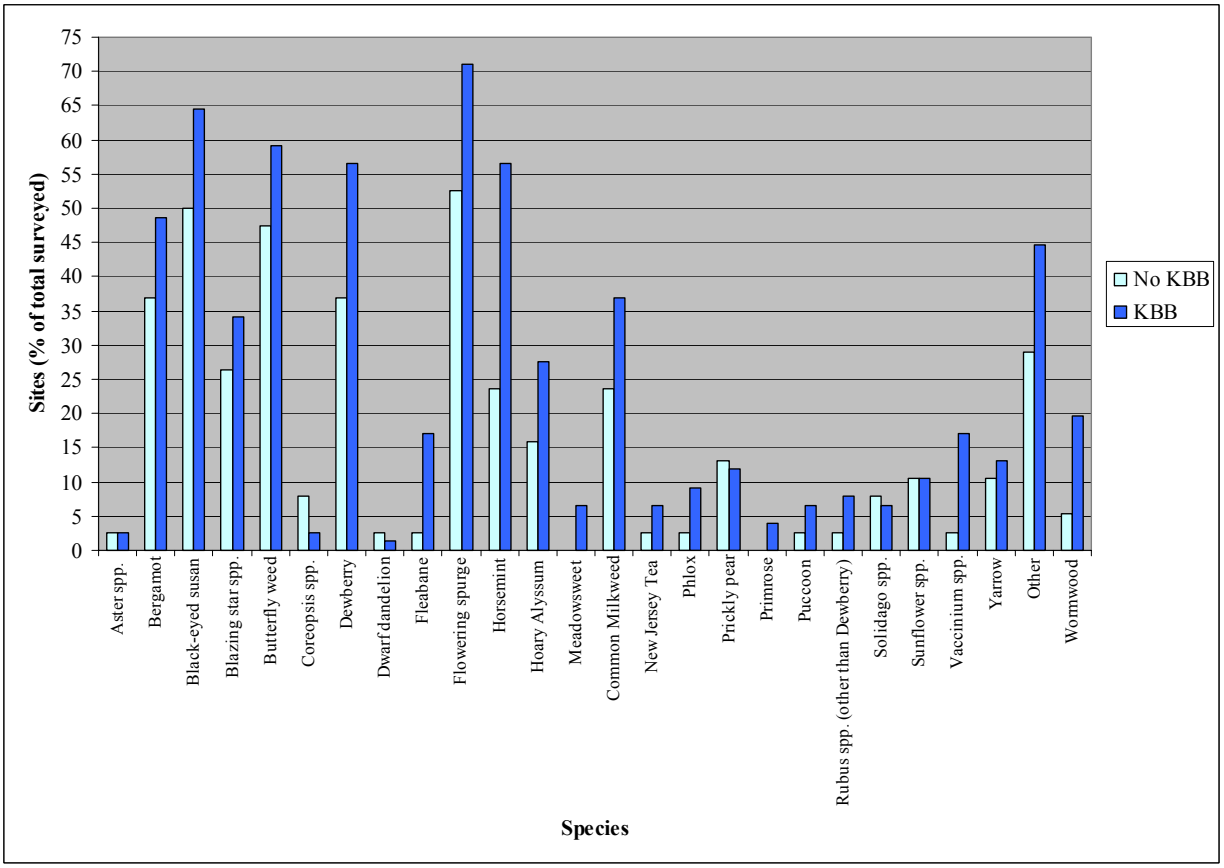

Figure 5. Karner blue butterfly presence and absence related nectar species presence within survey sites during 2002 MNFI surveys.

Associated Species Surveys
Surveys yielded a total of nine new locations for barrens- and prairie-associated rare species. Frosted elfin was located for the first time at Cannonsburg State Game Area in Kent County (1 site), Ottoe skipper was found at Flat River State Game Area (1 site), and Eastern box turtles were found in four counties (4 sites). Targeted surveys for Great Plains spittlebug resulted in the species being located at Flat River State Game Area (1 site) in Montcalm County and at Camp Owassipi Boy Scout Reservation (2 sites) in Muskegon County.

Meetings and Conferences
Several meetings were attended during the first year of the project. The informal Karner blue working group meeting at Flat River SGA was attended in June of 2002. Interested parties from MNFI, MDNR, USFWS, Forest Service, TNC, Consumer's Energy, Howard Christensen Nature Center, Grand Valley State University, and Michigan Nature Association attended. The meeting contained an overview of the HCP process, summary of spring surveys, discussion of Karner blue recovery goals, management and restoration topics and issues, and updates on management and monitoring.

An education and outreach meeting at John Ball Zoo was also attended in November 2002. Working group members and other stakeholders met at to discuss plans goals and actions needed to enhance knowledge of and participation in Karner blue recovery and the HCP process. Attendees included personnel from MNFI, MDNR, USFWS, Forest Service, Grand Valley State University, Grand Rapids Community College, the West Michigan Land Conservancy, Consumers Energy, John Ball Zoo, Binder Park Zoo, and the Detroit Zoo. Several products will be produced as a result of this meeting. Fact sheets, a poster, audio and visual materials for presentations, and a lupine planting or habitat management program are being developed and will be completed between January 2003 and October 2004.

Other meetings attended include the southeast Michigan Prescribed Fire Council meeting in August 2002, The Nature Conservancy's BioBlitz at Camp Owassipe Boy Scout Reservation in August 2002, The Wildlife Society's national conference in September 2002, and Core Natural Heritage Training in October 2002.

Inter-Agency Cooperation
Results of Karner blue surveys were provided to a variety of interested parties. Maps of digitized locations were provided to the MDNR to provide a visual representation of the Karner blue distribution in the state. These maps can be used in presentations and to provide information to stakeholders. Maps were also provided to the Forest Service in an effort to exchange information. The maps will be used to determine what, if any, discrepancies exist between the two (MNFI and Forest Service) databases. Forest Service staff will provide comments on known extents of sites, possible dispersal barriers that may separate sites, and share locations of sites unknown to MNFI. In exchange, MNFI maps will help the Forest Service determine where Karner blues occur near their lands, locate possible corridors, expose management opportunities, and learn locations of newly discovered sites. Tables outlining the numbers of sites within the Muskegon, Newaygo, and Ionia recovery units by ownership and county were provided to the USFWS, thereby equipping the Service with the most accurate and up-to-date information available regarding

numbers of occurrences in those recovery units for Recovery Plan updates.

DISCUSSION

Over half of the known Karner blue butterfly occurrences in the state were visited in 2002, with presence or absence data recorded. Butterfly presence or absence surveys provided a great deal of information on the current distribution of populations. Survey priorities and possible areas of Karner blue decline have been revealed through exploration of these data. Habitat modeling of presence or absence sites will undoubtedly give insight into possible threats, potential translocation sites, and viability of populations in Michigan once completed.

Initial examination of the data reveals a number of potential extirpations at formerly known Karner blue sites. Although several sites are obviously unsuitable and no longer harbor Karner blue populations (e.g., Lands converted to pine plantations with no lupine, conversion to agriculture, or residential development), several appear to contain suitable habitat. Interpreting a failure to find butterflies at such sites as population extirpation from the site is premature because most occurrences were visited just once during the flight period. Butterfly absence at one point in time does not necessarily indicate extirpation from a site because the probability of observing Karner blues depends on timing of the survey during the flight period, weather conditions, amount of time spent in the area, and other variables. As a result, unfavorable conditions at the time of survey may result in "false absence" or the determination of no Karner blues where they actually exist. Further survey of absence locations where habitat still exists or conditions were unfavorable during survey in 2002 is needed, and will be a priority in 2003.

Further survey is also needed on private lands that contain potential habitat, especially in the Newaygo Recovery Unit where Forest Service land is highly fragmented. Private lands yielded the most new Karner blue occurrences in 2002, and will likely reveal additional populations in 2003. In particular, private lands within 1km of known occurrences, within the range of historical barrens communities, or that are known to contain lupine, will be surveyed where possible. Letters or phone calls will go out to landowners in early 2003 inquiring about suitable habitat and seeking permission to survey lands.

Karner blue occurrences are currently separated by 200m in the BCD and in the Recovery Plan (USFWS 2001). However, there is evidence that the butterflies are capable of dispersing over 1km through unsuitable habitat, and up to 2km through suitable habitat, thereby exchanging genetic information (Bidwell 1994, King 1998). As a result, NatureServe has changed EO specifications to better delineate metapopulations based on a 1km separation distance. In order to comply with the new specifications and ensure uniform definition of an occurrence of Karner blue across the Natural Heritage Network, MNFI will be working to re-define EO boundaries in Michigan based on the 1km separation distance. This will change (decrease) the total number of EOs in the state, possibly significantly. It is therefore strongly recommended that other groups tracking Karner blues define sites using the specifications outlined by NatureServe to ensure uniformity and comparability of data. In an effort to track population trends and guide management at the local level, MNFI will retain data associated with each

occupied area (deme) that is currently in the database.

The data gathered in 2002, when combined with past and future survey efforts by MNFI, will provide a more complete understanding of Karner blue distribution in Michigan. In particular, surveys on private lands and resulting relationships with landowners have great potential not only to fill in distributional gaps, but to create partners in the HCP process, and advance species recovery. Habitat data gathered during surveys on private and public lands will provide valuable micro-site information, and a means by which current and potential sites may be ranked in terms of suitability. In addition, micro-habitat variables and those at the landscape level will be used to produce a predictive habitat model, providing insight into current threats to populations while identifying areas with the greatest potential for habitat restoration or translocation. Surveys, landowner contacts, and modeling of habitat are all valuable strides toward the recovery of the Karner blue butterfly in Michigan and for the species throughout its range.

ACKNOWLEDGMENTS

This project was funded by the Michigan Department of Natural Resources, Wildlife Division (WD). WD staff contributed significantly to the project by helping train surveyors in Karner blue identification, survey methods, conducting surveys, helping organize volunteers, and providing valuable on-the-ground insight about state-owned lands. The following WD staff have been an ongoing part of inventory efforts: Maria Albright, John Lerg, Steve Beyer, John Niewoonder, and Donna Jones. Pat Lederle contributed significantly to the project by helping identify high priority areas for survey and providing valuable insight concerning survey methods.

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The Nature Conservancy staff also contributed to the survey efforts. John Legge, Jessica Jeffries, and Jack McGowan-Stinski provided site leads, data, survey help, and insight into management techniques.

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