

Minnesota State Wildlife Grant Final Report
September 3, 2013 revision. Additions to the Project 3, Information Management section, shown in underline.

Project: Minnesota’s Wildlife Resources and Habitat Surveys and Information Management

Grant Number: T-5-R-3 / F10AF00231

Project Period: September 1, 2010 – September 30, 2012

Project Leader: Wendy Crowell, Ecological and Water Resources

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Project 1. MINNESOTA BIOLOGICAL SURVEY

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Need: Little is known about the distribution and abundance of most of Minnesota’s wildlife resources and their associated ecological systems and habitats. To address this need, the Minnesota Biological Survey (MBS) began in 1987 as a systematic survey of the state’s rare biological features. For the purpose of this project, rare features include wildlife species and the ecological systems, native plant communities and habitats that are known or suspected to support these species such as prairies, high quality hardwood forests, floodplain forests, lakeshores, open peatlands, rock outcrops and cave systems. Prior to MBS, much of the data maintained in the DNR Heritage Information System (NHIS) was based on collections of plant and animal specimens stored in museums and herbaria. Because most previous surveys that contributed information about Minnesota’s significant biological features were conducted for a variety of objectives and were limited in scope, they did not collectively provide a uniform statewide perspective. Increasing pressure for land development and natural resource utilization, coupled with the lack of information to adequately evaluate their impacts to the state’s

wildlife resources and their associated habitats, necessitated the initiation and subsequent acceleration of the survey efforts conducted by MBS to ensure the protection of the state's diversity of wildlife. To date, MBS has completed surveys in 81 of Minnesota's 87 counties and is currently working in the remaining 6 counties (Figure 1). Since 1987, MBS has added 19,591 new records of rare features to the Department of Natural Resource's (MNDNR) information systems. Currently 63,146 polygons of native plant communities and 10,116 MBS sites of biodiversity significance are accessible to customers using MNDNR's "Data Deli".

Funding from the State Wildlife Grant Program (SWG) has enabled MBS to conduct more thorough surveys of a wider range of animal communities in the counties surveyed since 2002. Also, since the completion of Minnesota's State Wildlife Action Plan in 2006 -- *Tomorrow's Habitat for the Wild and Rare, An Action Plan for Minnesota Wildlife* -- additional animal species were added as Species of Greatest Conservation Need (SGCN). MBS has identified priority SGCN that need a statewide reexamination of their distribution and status in the state.

OBJECTIVE 1: Continue to identify and collect information throughout the state on the distribution and ecology of rare animals and the habitats and ecological systems supporting these species. During the period from September 2010 to September 2012, surveys for animals, their associated habitats, and native plant communities will continue in the northern portions of Cook, Lake, and St. Louis counties. Preliminary investigations and fieldwork will begin in the remaining unsurveyed portions of St. Louis and Clearwater counties, and begin in Beltrami, Lake of the Woods, and Koochiching counties.

Accomplishments: Initial preparation for field surveys involved hiring temporary field staff, creating contract agreements with zoological experts, and assessing equipment needs. Existing information, maps, and GIS data layers were compiled and reviewed for the target counties or survey areas. MBS ecologists and other area experts were consulted for recommended survey locations, landowner contacts, and access to sites. Field reconnaissance to evaluate potential sites for animal surveys was conducted prior to initiating surveys. For more information on specific survey techniques refer to the DNR-MBS Website: *Procedures/Rare Animal Surveys* (http://www.dnr.state.mn.us/eco/MBS/procedures_animals.html).

At the end of this grant period, field surveys for animals and their associated habitats were completed in Cook and Lake counties and the Nashwauk Uplands ecological subsection of St. Louis County. Animal surveys continue in the Tamarack Lowlands and Littlefork-Vermillion Uplands subsections of St. Louis County, and limited surveys were begun in Beltrami and Koochiching counties. Surveys of native plant communities were completed in Clearwater County and the Nashwauk Uplands subsection of St. Louis County. Vegetation surveys are ongoing in Lake, St. Louis, Beltrami and Koochiching counties. Animal survey efforts and findings are summarized below.

MBS ANIMAL SURVEYS IN NORTHERN MINNESOTA
(Beltrami, Cook, Koochiching, Lake, St. Louis counties)
 September 2010 – September 2012

During the grant period, animal surveys focused on the Border Lakes ecological subsection in Lake and Cook counties and the Nashwauk Uplands, Littlefork-Vermillion Uplands, Tamarack Lowlands and Laurentian Uplands subsections in St. Louis County (Figures 1, 2; special projects shown in Figure 2 refer to Objectives 2 - 5). Limited small mammal and lepidoptera surveys were conducted in Beltrami and Koochiching counties when helicopter transport was available to move surveyors to remote areas. Animal surveys conducted during this period included mammals, breeding-season birds, herpetofauna, nongame fish, lepidoptera and jumping spiders. Summaries of findings from these surveys are presented, below. Table 1 lists the animal species of conservation concern that were the focus of survey efforts in these counties.

MAMMAL SURVEYS

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Mammal survey activities included small mammal trap grids, game cameras and acoustic bat surveys (Figure 3 shows the locations of these surveys).

Small mammal surveys -- Trap grids were operated from late July through September each year, targeting open peatland and rocky habitats (Figure 4). In addition, game cameras were set up at 22 of the trapping sites in an effort to document species not detected by standard trapping techniques (Figure 5). Voucher specimens were prepared for each species collected from the grids.

Summary of small mammal trapping effort

County	# of Grids
St. Louis	27
Lake	2
Cook	2
Beltrami	2
Koochiching	6
TOTAL	39

Acoustic bat surveys -- Anabat II bat detectors were set at 15 sites to record activity of foraging bats. Most of these were set near mammal trap grids and operated for three nights. One detector ran continuously from May through September 2010 at the newly-established Lake Vermillion State Park, St. Louis County (Figure 5). Bat calls were recorded digitally, downloaded onto computers and analyzed to determine species and activity patterns. Approximately 7,600 call files were recorded from the Lake Vermillion State Park location; a total of 7,300 call files were recorded from the other sites.

Survey findings -- Thirty-six mammal species were documented during the 2010 – 2012 field seasons, including four new county records, for a total of 47 mammal species that have been documented by MBS in these counties (Table 2). These included five state-listed species -- Northern Bog Lemming, Eastern Heather Vole, Smoky Shrew, Gray Wolf and Tri-colored bat; and two Species of Greatest Conservation Need (SGCN) -- Rock Vole and Franklin's Ground Squirrel.

All seven bat species that occur in Minnesota were documented as foraging in these counties. New locational records, obtained by MBS, have extended the known distribution of Smoky Shrew, Eastern Heather Vole, Rock Vole and Franklin's Ground Squirrel (Figure 6). In contrast, MBS captured only a single specimen of Woodland Jumping Mouse during the 2010 – 2012 field seasons. This species is considered common in northeastern Minnesota, however it has been found at only five locations by MBS. Increased effort to find this species is warranted to determine if its apparent scarcity is due to bias in the habitats selected for surveys or is an actual decline in this species.

BREEDING-SEASON BIRD SURVEYS

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In 2011, bird surveys focused on the Border Lakes and Tamarack Lowlands ecological subsections. In 2012, surveys focused on the Nashwauk Uplands subsection, with additional surveys in the Tamarack Lowlands, Laurentian Uplands, and Toimi Uplands subsections (Figure 1, 7). The vast majority of surveys were conducted in St. Louis County, with limited surveys in Beltrami, Lake, and Lake-of-the-Woods (LOW) counties in 2012.

Summary of bird survey effort

County	Year	Point Counts	Species Lists	Incidental Records
St. Louis	2011	119	496	471
St. Louis	2012	118	520	352
Lake	2012	8	7	2
Beltrami	2012		3	
LOW	2012		2	
Total:		245	1,028	825

Survey findings -- A total of 163 potential breeding bird species were found in St. Louis County in 2011-2012 (Table 3). Eight other species, including two listed and one non-listed SGCN (Lesser Scaup), were found in the county by MBS but presumed to be non-breeding individuals. Two additional species, Solitary Sandpiper and Marbled Godwit, were found only in LOW and Beltrami counties, respectively.

Six state-listed species were observed: Trumpeter Swan, American White Pelican, Bald Eagle, Marbled Godwit, Common Tern, and Peregrine Falcon. American White Pelicans were observed once in St. Louis County and once in Beltrami County – both far outside of breeding areas/habitat. One immature Peregrine Falcon, presumed to be a non-breeding individual, was observed hunting over the Biwabik sewage ponds, St. Louis County, in June 2012.

MBS documented 3,713 records of 40 non-listed SGCN (Table 3). Two species of SGCN, Ovenbird and White-throated Sparrow, made up nearly one-third of records. Five SGCN species (adding Veery, Swamp Sparrow, and Rose-breasted Grosbeak) comprised more than 56% of total SGCN records for 2011-12. St. Louis County’s high bird diversity can be attributed not only to its size, but also to the diversity and extent of important bird habitats. Wetlands, deciduous forest, and coniferous forest were all well-represented in the county. Significant areas of grassland (primarily pastures and hayfields) were present, particularly in the Tamarack Lowlands ecological subsection, although few grassland SGCN were common (Figure 8). Grassland SGCN birds found in the county included Sharp-tailed Grouse, Northern Harrier, Upland Sandpiper, Sedge Wren, Dickcissel, Bobolink, and Eastern Meadowlark. Two species, Sedge Wren and Bobolink, represented 75% of grassland SGCN bird records. In 2012 Dickcissels were found at 13 locations in St. Louis County, which is well north of this species’ normal breeding range. Dickcissels are an irruptive species, and some years breed far north of their normal northern range limits. One state-listed SGCN, the Marbled Godwit, was found in northwestern Beltrami County within the Aspen Parkland ecological subsection.

Wetland SGCN birds included four listed species, Trumpeter Swan, American White Pelican (non-breeding), Bald Eagle, and Common Tern. Trumpeter Swans were relatively widespread in the survey area, found at 17 locations, including seven

instances of documented nesting (adults with cygnets). A Common Tern was observed in the St. Louis River estuary, not far from nesting areas in Duluth. Ten non-listed SGCN typical of wetlands were found, with more than 65% of records represented by one species, Swamp Sparrow (Figure 8). Common Loon was the next most frequently encountered wetland SGCN, with 93 records. Together these two species accounted for 85% of wetland SGCN. A pair of Eared Grebes was observed through most of June on the Biwabik sewage ponds. This location is far to the east of the normal breeding range of Eared Grebes in Minnesota. While actual nesting was not documented, Eared Grebes do nest on wastewater treatment ponds in other regions.

Coniferous forest birds were well represented in the survey area, with 10 non-listed SGCN documented. White-throated Sparrow and Winter Wren accounted for 74% of coniferous forest SGCN, with White-throated Sparrow alone representing nearly 60% of records (Figure 9). Three other coniferous forest SGCN were well-represented: Black-backed Woodpecker, Connecticut Warbler, and Cape May Warbler.

Nine SGCN typical of deciduous and mixed coniferous-deciduous forest were found in the survey area. Six of these species, Ovenbird, Veery, Rose-breasted Grosbeak, Least Flycatcher, and Yellow-bellied Sapsucker, were quite common. Ovenbird alone accounted for 30% of mixed-deciduous SGCN records. Two additional species, Eastern Wood-Pewee and Canada Warbler, were also well-represented. The survey region lies at/near the western edge of the normal breeding range of Black-throated Blue Warblers in Minnesota. Fourteen records of Black-throated Blue Warblers were documented, all in 2011 (Figure 9). Eleven of these were in the Border Lakes ecological subsection, with the remaining three Black-throated Blue Warblers in the Nashwauk Uplands subsection. However, two of the three Nashwauk Upland birds were at Bear Head Lake State Park, within less than 1.5 kilometers of the Border Lakes subsection.

Six SGCN typical of early successional forest, forest edge, or brushland were documented in the survey area. Two species, Black-billed Cuckoo and Golden-winged Warbler, made up nearly 60% of records in this habitat group. Other species less commonly found, in decreasing order of abundance, were American Woodcock, Common Nighthawk, Brown Thrasher, and Northern Rough-winged Swallow. The survey area lies at the northern edge of the breeding range of Golden-winged Warbler (GWWA). Of the 17 GWWA records, 10 were in the Tamarack Lowlands ECS subsection, which is the southwestern-most subsection in St. Louis County. Only two GWWA were documented in the Border Lakes, the northern-most subsection in the county.

AMPHIBIAN AND REPTILE SURVEYS

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Salamander surveys – During May and June 2011 – 2012, searches were conducted in over 200 shallow wetlands in St. Louis County targeting Four-toed Salamanders (*Hemidactylium scutatum*) (Figure 10). This state Special Concern species occupies mature deciduous-coniferous forests on rolling terrain where small wetlands are numerous. Sphagnum hummocks near open water were carefully searched to locate adult females and/or egg clusters. Terrestrial searches were also conducted in adjacent hardwoods where decaying logs and other woody cover was rolled or lifted to locate salamanders and other herpetofauna. Sites were distributed throughout the central and southern portions of the county, with interest in further extending the known range of this species in Minnesota.

Wood Turtle surveys – Two St. Louis River tributaries were surveyed for Wood Turtles between mid-May and early June to locate basking turtles and document potential nest sites (Figure 10). Roughly 11.5 km of the Embarrass River and 6.5 km of the Partridge River were canoed in mid-May to locate basking Wood Turtles. In addition, 2 time-lapse cameras were placed at cut-banks along the Embarrass River to document turtle nesting activity through early June.

Incidental observations and other targeted surveys -- Additional amphibian and reptile records were obtained during other MBS survey activities such as mammal trapping or fish surveys. In addition, through a different funding source, the Northern Ring-neck Snake was targeted to learn more about this secretive subspecies occurring along the North Shore. The final report: Surveys for the Northern Ring-necked Snake (*Diadophis punctatus edwardsii*) in Northeastern Minnesota, by Gary Casper, is available on the DNR research report webpage.

Survey findings -- During 2011-2012, a total of 16 species of herpetofauna were documented during MBS surveys in St. Louis County (Table 4). This effort resulted in new records of three state-listed species: the Four-toed Salamander, Wood Turtle, and Snapping Turtle. The Eastern Red-backed Salamander, a SGCN, was also present in the survey area. Several new subcounty records were obtained for common herpetofauna.

Salamander Surveys—Twelve adult female Four-toed salamanders were documented during this effort. In addition, 1 juvenile and 7 egg clusters were also located (Figure 11). These records occurred in 3 general areas, representing 3 ecological subsections:

Tamarack Lowlands, Toimi Uplands, and the North Shore Highlands. The records included locations north and east of the St. Louis River. Prior to these MBS surveys, the St. Louis River was considered a potential dispersal barrier to this species.

Wood Turtle Surveys – Five Wood Turtles were captured and marked on the Embarrass River during these surveys, one Wood Turtle escaped capture (Figure 12). An additional Wood Turtle was observed basking on the Partridge River but it also escaped capture, by slipping into the river as canoeists approached. Four were captured on a steep cut-bank in late May, this is potentially a significant nesting site along the Embarrass River and would be a good site for future monitoring. Wood Turtles were also documented on the same cut-bank with the use of the time-lapse cameras.

NONGAME FISH SURVEYS

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Survey efforts -- Lake and stream surveys were conducted for nongame fishes in St. Louis County in September 2010, June to October 2011, and April to September 2012. Seventy-five lake and stream sites were sampled (Figure 13). Lake surveys targeted Deepwater Sculpin, Shortjaw Cisco, and Nipigon Cisco using gill nets and minnow traps. Stream surveys focused primarily on Northern Brook Lamprey, using a backpack electroshocker, seines, and kicknets. Near-shore area surveys were conducted in lakes for Longear Sunfish, Least Darters, and Pugnose Shiners using seines and electroshocking equipment.

Survey findings – Forty-eight species of fish were documented (Table 5). Two species of state Special Concern were documented: Shortjaw Cisco and Least Darter. Shortjaw Cisco were netted in Basswood Lake. Least Darters were collected in Long Lake.

Two Species in Greatest Conservation Need (SGCN) were documented: Northern Brook Lamprey and Longear Sunfish. Adult Northern Brook Lamprey are only present in streams for a brief period during the spawn (Figure 14). Survey efforts did not collect transformed adult Northern Brook Lamprey, but larval stage lamprey (ammocoetes) were collected at 5 localities. Species level identification of ammocoetes in the genus *Ichthyomyzon* is problematic as no consistent diagnostic characters are known. Based on distributional information and habitat characteristics of the sample sites, we are confident that these ammocoetes are Northern Brook Lamprey. Longear Sunfish were collected at four localities in three lakes (Figure 15). Two of these lakes represent new distributional records for this species.

BUTTERFLY AND MOTH SURVEYS

Staff: Kyle Johnson, Field Survey Specialist

Survey efforts -- Surveys for Lepidoptera (moths and butterflies), and other insects to a lesser extent, were conducted June through September 2011, and May through August 2012. Surveys for both years covered Cook, Lake, and St. Louis counties (Figure 16); also, in 2011 a single expedition was made to Beltrami County. In 2011, 97 sites were visited, while in 2012 only 38 sites were visited (4 revisits of 2011 sites). Site coverage was more intensive in 2012, however. Survey areas were within the Border Lakes ecological subsection (68 sites), Laurentian Uplands (21 sites), Nashwauk Uplands (14 sites), Toimi Uplands (12 sites), North Shore Highlands (7 sites), Littlefork-Vermillion Uplands (5 sites), Tamarack Lowlands (3 sites) and Agassiz Lowlands (1 site). While previous MBS surveys have covered the subsections outside of the Border Lakes, insect surveys were not included.

Sampling covered a wide variety of habitats, with greatest emphasis on acid peatlands (open and forested). Other habitats included upland coniferous forests/openings, mixed deciduous-coniferous forests/openings, rock outcrops, rich peatlands, lowland coniferous forests, black ash swamps, wet meadows, shrub thickets, and riparian zones. Some sites were identified from aerial imagery prior to the field season while others were selected on the ground during field work.

Sites were surveyed using a variety of techniques, including visual search, a lighted sheet, light traps (Figure 17 upper), fermenting fruit baits painted on vegetation (Figure 17 lower), and bait traps. Survey visits were scheduled to occur during the adult flight periods of targeted lepidopteran species; repeat visits were made to some sites to cover the different flight periods of various target species. Repeat visits, even within a single flight period, were frequently necessary to provide an adequate amount of survey time during favorable weather conditions.

Survey findings -- Sampling efforts in 2011 yielded over 507 Lepidoptera species; 2012 specimens are still being processed and a summary of those records will be included in the subsequent grant report. Twenty-two of the 52 target species were documented, many of these at multiple sites (see Appendix 1). These include one species of Special Concern and one additional Species of Greatest Conservation Need (SGCN). In addition, one state Threatened species of beetle, Laurentian Tiger Beetle (*Cicindela denikei*) was documented at two sites (Figure 18).

Significant discoveries among target species include:

Arctic Fritillary (*Boloria chariclea*, Figure 19 upper): Documented from numerous acid peatlands within the Laurentian Uplands, Littlefork-Vermillion Uplands, Nashwauk Uplands, and Toimi Uplands subsections of Lake and St. Louis counties; also found at a single site on the western edge of the Border Lakes subsection of St. Louis County, and

previously found at the eastern edge of the subsection in Cook County, but nowhere in-between despite substantial effort.

Taiga Alpine (*Erebia mancinus*), Special Concern: Five new localities were found within the Laurentian Uplands and Toimi Uplands subsections of Lake and St. Louis counties, and the Border Lakes of Cook County; positive and negative records continue to unveil extremely selective forested peatland habitat use and complex pattern of even year vs. odd year distribution of this biennial species.

Columbine Duskywing (*Erynnis lucilius*): Documented from two sites within the Border Lakes subsection of Lake County; northeast range extension within Minnesota and first records for the Arrowhead.

A noctuid moth (*Heliothis borealis*): Documented from four acid peatlands within the Tamarack Lowlands and Toimi Uplands subsection of Lake and St. Louis counties; first records from the Arrowhead of this elusive species.

A noctuid moth (*Hypocoena basistriga*): Large population found in a Lake Superior shoreline fen in the North Shore Highlands subsection of Cook County; second documented locality within the state and only record from the Arrowhead; possibly appropriate as a SGCN but more information is needed.

A noctuid moth (*Lasionycta secedens*): Documented from a raised bog with abundant lingonberry (*Vaccinium vitis-idaea*) in the Littlefork-Vermilion Uplands subsection of St. Louis County; eastern range extension within Minnesota.

A noctuid moth (*Lithophane adipel*): Documented from single sites within the Border Lakes subsection of Cook and Lake counties; NEW STATE RECORD.

A noctuid moth (*Xestia mixta*): Documented from a forested bog within the Border Lakes subsection of St. Louis County; new county record which fills a large range gap between Cook County and the Glacial Lake Agassiz region.

Other Survey Highlights and Comments by K. E. Johnson -- One of the most valuable aspects of these surveys is the contribution to our overall understanding of Minnesota's insect biodiversity. Insects represent the bulk of biological diversity but lack of basic knowledge on their distribution and status. The extensive species documentation and associated data from biological surveys such as this one are helping bridge this knowledge gap. SWG-funded Lepidopteran surveys, conducted by K. Johnson in Cook, Lake, and St. Louis, have yielded over 725 species of Lepidoptera (see table below and Figure 19), which does not include a multitude of unidentified species. The 2012 field season specimens will further increase this by a noticeable amount.

Cumulative number of Lepidoptera species documented in northeastern counties (K. Johnson records only). **Identification and specimen preparation currently underway.

Year	St. Louis County	Lake County	Cook County
2010	346	185	447
2011	518	416	506
2012	pending**	pending**	pending**

At present, no county or specific survey site is thoroughly surveyed; insect diversity is tremendous and spreads out both spatially (by habitat) and temporally (some are detectable for only a week or less, and some not every year). As an example, prior to the 2012 field season 416 taxa had been documented by KEJ in Lake County, and 127 taxa at the site of McNair (the best sampled site in the county). A single day/night survey at McNair in May 2012 yielded 149 taxa, of which 121 (81.2%) were new to the site (bringing the site total to 248), and 74 (49.7%) new to the county.

The overwhelming diversity of an insect group as large as Lepidoptera makes survey work a daunting task, yet at the same time rather simple. While a decade or lifetime of survey will probably not uncover all of the species in a given area, a survey at any site at any time (especially at weakly sampled times of year) easily adds valuable knowledge. At present, the best strategy may be to survey a smaller number of sites intensively (especially those with unusual habitats or other biological significance), and larger number of sites sporadically to get the best “overall picture” of insect biodiversity and conservation implications.

JUMPING SPIDER SURVEYS

Staff: William J. Ehmann, Contractor
Student volunteers

Surveys for rare and poorly-documented jumping spiders were conducted 7 - 12 August 2011 and 22 – 27 July 2012 by Dr. William Ehmann and students from Mercy College, New York. Excerpts from the 2011 report is included below and survey locations are displayed in Figure 20. New sites in the vicinity of the 2011 locations were surveyed in 2012, however all data and specimens were lost while Ehmann moved from New York to Washington State. No funds were charged to this grant for 2012 work.

Jumping Spider Surveys – During 7 – 12 August 2011, a field team collected 234 jumping spiders (77adults) representing at least 6 species, from visiting 22 locations in St. Louis and Lake counties, primarily in the Superior National Forest, but also in state parks, cemeteries, heliports, and other public areas (Table 6).

Specimens were collected primarily by sweep net (a non-destructive technique). A typical sampling event involved 100-300 sweeps per person while walking through identifiable habitat patches registered with approximately 5-meter accuracy by hand-

held GPS. Smaller patches were sampled with 50 or 100 sweeps, and/or by hand-searches that included walking exposed ground and outcrops, turning of cover objects such as rocks and wood, and inspecting man-made structures such as signs, picnic tables, fences, and bridges. Hand-searches are time intensive but are necessary to collect ground-dwelling species that can be missed by sweeping. Additionally, limb-beating was applied to saplings, particularly conifers and alders with limbs at or below breast-height.

Survey findings -- A total of 234 specimens representing at least six salticid species were collected, including 77 adults (Table 7). Three additional vials of specimens, containing 5 jumping spiders total, were improperly labeled and discarded. No new county records were obtained and no species of special concern or higher conservation status were collected. A total of 122 specimens were microscopically identified to species level, 109 were identified only to genus level (including 88 immature *Phidippus* sp.), and 12 were unidentified.

All spider specimens were preserved in glass vials containing 95% ethanol to minimize DNA degradation. Archival tags bearing vial number, location, date, collector, habitat, and specimen identification fields were placed in each vial. For the purposes of establishing county or state records, only adult specimens were considered valid. Voucher specimens are delivered to the MBS Animal Survey Supervisor for deposit into the Insect Collection at the University of Minnesota, St. Paul. Voucher specimens were prepared for *Admestina tibialis*, *Eris militaris*, *Evarcha hoyi*, *Neon nelli*, *Pelegrina proterva*, and *Phidippus purpuratus*. A spreadsheet fully documenting each locality with date, time, sampling effort, geographic coordinates, species, age/sex, and habitat information has been submitted to the MBS.

Five of the 62 “representative” North American salticids were collected (Edwards and Hill, 2008): *Evarcha hoyi* (the only *Evarcha* known from eastern North America), *Neon nelli* (a widely-distributed ground-dweller), *Tutelina* sp. (a generalized ant mimic), *Phidippus clarus* (associated with old fields and prairie), and *Phidippus purpuratus*. We noticed an affinity for *P. purpuratus* under rocks at quarry sites, and adult females were typically found in silk retreats.

Pooling all collection techniques, 33% of the catch was comprised of adult spiders, which was much higher than the 13% result from 2010 surveys of the same two counties over nearly exactly the same calendar dates (12,445 sweeps in 2010 and 13,844 in 2011). This result is partly attributed to extra time spent hand searching during 2011, particularly for *Phidippus* spp. underneath small rocks at quarries and parking areas, though weather, sampling crew attributes, and locations are other likely variables.

This effort follows records provided by Levi (1951) and decades of work by Bruce Cutler (University of Kansas) cataloging over 60 species of Minnesota salticids (Cutler, 1977, 1978a, 1978b). A compendium of all known spider occurrences at the county level, from

literature research, including these salticid records, is in preparation by Mr. Chad Heins, Bethany Lutheran College, Mankato, MN.

In Minnesota, the goal has been to build on scattered salticid records by surveying public lands in all counties in the state. This effort is now 51% complete, including 45 of 87 Minnesota counties, though at least some records are known for 66 counties. With the systematic recording of locations and sampling effort, the stage is set for future repeated measures that can provide data on species persistence at a field site as well as some check on species abundance over time (per unit of sampling effort).

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OBJECTIVE 2: Mesomammals

To assess the current distribution and status of selected medium-sized mammals. Targeted species include Richardson's Ground Squirrel (*Urocyon richardsonii*), Franklin's Ground Squirrel (*Poliocitellus franklinii*), Northern Pocket Gopher (*Thomomys talpoides*), Eastern Spotted Skunk (*Spilogale putorius*), and American Badger (*Taxidea taxus*).

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Survey Findings -- During this grant period, observations of target mammals continued to be received and added to a mesomammal, or medium-sized mammal, database. Observations of badgers and badger diggings were recorded as encountered. No field investigations were made for the Northern Pocket Gopher, but are planned for the next grant period.

Ground squirrels: Under a previous State Wildlife Grant, a flyer requesting information on ground squirrels was prepared and circulated to all DNR staff. During the current grant period, the flyer was handed out at local meetings and presentations and was posted in area DNR offices, SWCD offices, nature centers and other locations. Reports continue to be submitted by individuals statewide. The Ely Field Naturalist group has

submitted a substantial number of Franklin's Ground Squirrels records and photos, and they continue to actively search for other Species of Greatest Conservation Need (SGCN) that we have identified as targets. Reports from a variety of sources continue to be sent in via dedicated email (MBS eReport: MBS.report@state.mn.us) and a toll-free MBS report line (1-888-346-1730).

Reports of these species were entered into a mesomammal database and mapped using ArcGIS. Follow-up field visits were made to verify their presence along the North Shore, northwest and west-central portions of the state, using visual observations and listening for calling by squirrels.

Following up on a credible observation of Franklin's Ground Squirrel, live traps were set at Lac Qui Parle WMA/Chippewa Prairie TNC (Figure 21). Experts on trapping Franklin's Ground Squirrels were consulted concerning trap types, set timing and conditions, and types of bait. Twenty Havahart live traps were set in pairs and baited with one or two of the following recommended baits: bacon, cat food, peanut butter/oatmeal, grape jelly, popcorn, commercial bait for skunks and squirrels (Figure 22 upper). Game cameras were set facing the traps to record if animals approached the traps but were not captured. Traps were run from 12 – 14 June 2012, checked three times a day and left open at night. Traps were sprung and other animals were recorded (Figure 22 lower), but no squirrels were captured. Expanded trapping efforts are planned for the next grant period.

Based on the number of reports, alone, Franklin's Ground Squirrels appear to be widely distributed and are particularly common in north-central and northeastern Minnesota. Data need to be analyzed to remove multiple observations of single populations. Richardson's Ground Squirrels remain restricted to the far western portions of the state. Mentor Prairie WMA, near Crookston, has both species of ground squirrels. Reinstating grazing onto portions of the site has enhanced the Richardson's Ground Squirrel population. It is unknown how grazing has impacted the Franklin's Ground Squirrel numbers.

Eastern spotted skunk: April 2011, a road-killed spotted skunk was found in Lac Qui Parle County and collected by a private citizen, who had seen our flyer requesting spotted skunk records. In May 2011, a wildlife intern reported seeing a spotted skunk in Swift County. These observations are 34 miles southeast and 33 miles northwest, respectively, from the spotted skunk specimen collected in Lac Qui Parle County in 2007. These observations suggest that this region may support a population of Eastern Spotted Skunks. A more recent report from Martin County, October 2012, reported a spotted skunk trapped in a citizen's garbage can. The skunk was released. Plans are underway to monitor activity at the farm with game cameras.

OBJECTIVE 3: Large Snakes

Assess the current distribution and status of selected reptiles. Targeted species include Western Hog-nosed Snake (*Heterodon nasicus*), Eastern Ratsnake (*Pantherophis obsoletus*), Gophersnake (*Pituophis catenifer*), and Eastern Racer (*Coluber constrictor*).

Staff: Carol Hall, MBS Herpetologist

Jeff LeClere, MBS Herp Specialist

Dave Crawford, Volunteer

Nick McCabe, Environmental Scientist, I&S Group

Various efforts were undertaken to assess the distribution and status of selected species of large snakes, primarily in southern Minnesota (Figure 23). Such efforts included soliciting reports of sightings, utilizing time-lapse cameras, and conducting targeted searches. Several new records were obtained through these approaches. Due to the relative abundance of Western Foxsnakes and Eastern Hog-nosed Snakes, these two species were not identified as target species in the original Large Snake section of the proposal but are included in the results since they are tracked in the Biotics database.

With assistance from Regional Nongame Wildlife Specialists in Regions 3 and 4, flyers were distributed requesting information about sightings of the North American Racer (previously named Eastern Racer; Crother et. Al, 2012). MBS staff also distributed flyers for Plains Hog-nosed Snake (previously named Western Hog-nosed Snake) and Western Ratsnake (previously named Eastern Ratsnake) in strategic locations. Observers were requested to contact the DNR with details and photographs.

Survey findings -- Time-lapse cameras were installed at potential den sites near Kasota in Le Sueur County where proposed mining activity threatens the viability of a local North American Racer population. Cameras were monitored from April - May 2011. Two Racers were photographed in mid-May moving throughout limestone slabs on a rock outcrop (Figure 24). Unfortunately, frequent camera failure resulted in significant loss of data for lengthy periods. The cause was most likely related to the loss of battery power. Additional Racer records were obtained through reports from local citizens, primarily members of the local Prairie Enthusiasts group and local herpers.

Dave Crawford (retired state park naturalist) has been documenting sightings of Gophersnakes and Eastern Hog-nosed Snakes at Wild River State Park in Chisago County for many years (Figure 25). Although Dave has observed the majority of the sightings himself, Park staff and Park users have also contributed. During this grant period, MBS staff assisted with efforts to learn more about the distribution and abundance of these species in the park. Dave Crawford's database for 2012, alone, included 234 Gophersnake observations and 26 Eastern Hog-nose observations. The totals reflect multiple records of some snakes that were frequently observed. Identification of individual snakes was based on photo documentation or implanted PIT tags. Dr. Todd Arnold's Population Analysis class at the University of Minnesota is working with this

data set (and corresponding track shapefile) to estimate snake abundance and habitat preference. Resource managers associated with Wild River State Park (Paul Kurvers, Park Manager and Virginia Blakesley, Area Resource Specialist) are supportive of efforts that will identify important habitat features on the landscape, such as Gophersnake hibernacula and nesting areas.

Large snake reports were obtained from ten counties : Anoka, Blue Earth, Chisago, Dakota, Le Sueur, Houston, Olmsted, Scott, Swift and Wabasha. Reports frequently included photos, providing confirmation of the species ID. Records collected from a separate SWG-funded project, *Surveys and development of monitoring techniques for reptile species of greatest conservation need in Minnesota* (MN T-31-R-1), will be summarized separately.

Reference:

Crother, B. I. et. al. Scientific and standard English names of amphibians and reptiles of North America north of Mexico, with comments regarding confidence in our understanding. 6th Edition. 2012. SSAR Herpetological Circulars No. 39: 1-101.

OBJECTIVE 4: Loggerhead Shrikes

Assess the current distribution and status of Loggerhead Shrikes (*Lanius ludovicianus*). Information on this species will be compiled, target areas for intensive surveys will be identified, and preliminary surveys will be conducted.

Staff: Steve Stucker, MCBS Ornithologist
Karl Bardon, Field Survey Specialist

Historic Loggerhead Shrike records in the DNR's rare features database (Biotics) were reviewed, and two concentrations of locations were selected for more intensive field surveys. Dakota County, near the southern edge of the Twin Cities metropolitan area, has consistently had the largest concentration of shrike records statewide, while Clay County, in northwestern Minnesota, has the next largest concentration of shrikes. Shrike monitoring routes had been established in both of these areas by the Nongame Wildlife Program, but neither route had been surveyed in nearly a decade.

Surveys entailed driving at slow to moderate speeds along roads through potential shrike habitat, stopping for 5-15 minutes at select locations to scan for shrikes. In addition, in northwestern Minnesota, the observer hiked several of the larger prairie areas that could not be adequately surveyed from roads. GPS waypoints were taken at survey stops, and all bird species seen or heard were recorded.

Results -- West-central Shrikes: In west-central Minnesota, the surveyor drove near, and/or stopped at, nearly all historic shrike locations. In 2011, surveys were conducted in Clay and Wilkin Counties, with these and additional counties surveyed in 2012 (see summary, below and Figure 26, left). GPS waypoints were recorded at 82 stops in 2011,

and 85 in 2012. Only one Loggerhead shrike family group was found in 2011, in Clay County. None were found in the 228 miles surveyed in Wilkin County. In 2012, shrikes were only located at a single location in Wilkin County, despite nearly 315 miles driven through six counties.

South Metro Shrikes: In the southern Twin Cities metropolitan area, surveys focused on Dakota County with a few additional surveys in adjoining Goodhue in 2011 (see summary, below and Figure 26, right). GPS waypoints were recorded at 12 locations in 2011, and 17 in 2012. Only one Loggerhead Shrike was found in Dakota County in 2011, and two shrikes were found in 2012. In 2011, surveys focused on the historic shrike monitoring route run by MN DNR Nongame Wildlife personnel during the late 1980s through early 1990s. In 2012, surveys were shifted to the north of the historic route to cover areas with recent shrike records.

Summary of Loggerhead Shrike road survey effort for 2011, 2012

County	2011_miles	2011_stops	2011_LOSH	2012_miles	2012_stops	2012_LOSH
West-central:						
Clay	~ 250	52	1	87.6	46	0
Wilkin	228	30	0	79.4	19	1
Otter Tail				39.0	9	0
Grant				54.1	6	0
Stevens				42.2	3	0
Pope				12.4	2	0
South Metro:						
Dakota	66.0	10	1	82.3	17	2
Goodhue	13.8	2	0			

Other bird species: MBS documented 1,928 records of 122 potentially-breeding bird species during shrike surveys, including eight state-listed SGCN and 26 non-listed SGCN. Three hundred eighty-one records of the 34 SGCN (352 WC, 29 Metro) were documented. The vast majority of SGCN were species typical of grasslands and open wetlands, as these were the predominant habitat types in areas targeted for shrike surveys. Four species made up more than half of all SGCN records. In decreasing order of abundance these were Sedge Wren (17%), Swamp Sparrow (14%), Bobolink (11%), and Dickcissel (9%).

In the West a total of 115 bird species were documented during shrike surveys (Table 8). In addition to Loggerhead Shrike, 24 other SGCN were found, including eight state-listed species: Trumpeter Swan, Greater Prairie-Chicken, American White Pelican, Bald Eagle, Marbled Godwit, Forster’s Tern, Nelson’s Sparrow, and Chestnut-collared Longspur. SGCN frequently encountered during shrike surveys in the northwest were Northern Harrier, Marsh Wren, Grasshopper Sparrow, Le Conte’s Sparrow, and Upland Sandpiper.

Sixty bird species were documented during shrike surveys in the South Metro (Table 9). In addition to Loggerhead Shrike, the only state-listed SGCN, 12 other SGCN were found: Red-headed Woodpecker, Eastern Wood-Pewee, Willow Flycatcher, Purple Martin, Sedge Wren, Marsh Wren, Brown Thrasher, Field Sparrow, Grasshopper Sparrow, Swamp Sparrow, Dickcissel, and Eastern Meadowlark. Only 7 species found in the South Metro were not detected during West-central shrike surveys, including 3 SGCN: Red-headed Woodpecker, Field Sparrow, and Eastern Meadowlark.

Discussion -- Despite considerable survey effort in two widely-separated regions over two breeding seasons, very few Loggerhead Shrikes were found by MBS (Figure 27). In the South Metro, eighty miles of road surveys in both 2011 and 2012 resulted in one shrike in 2011 and 2 shrikes in 2012. Success was worse in West-central Minnesota, where only one shrike family group was recorded each year during 475 and 315 miles of road surveys in 2011 and 2012, respectively.

MBS surveys roughly followed the protocol used by the Minnesota Nongame Wildlife program, in which early- to mid- July was determined to be optimal for shrike surveys because family groups are most visible at that time. In 2011, shrike surveys were conducted during the last week in July, which was later than optimal due to the 3-week long state shutdown beginning July 1. Surveys were delayed by two weeks, which may have been late enough to reduce the effectiveness of surveys for Loggerhead Shrikes. However, shrike surveys conducted earlier in July in 2012 had similarly poor results.

The MBS survey results do not appear to be representative of the Minnesota shrike population as a whole. During the Minnesota Breeding Bird Atlas from 2009-2012, Loggerhead Shrikes were reported from only 3 blocks in the Northwest, all in Clay County. Higher numbers were reported in the South Metro, with shrikes in 7 blocks in Dakota County.

The Minnesota Ornithologists' Union (MOU) Seasonal Report database was queried for Loggerhead Shrike reports from 2000 through 2011, and the number of shrike reports was quite surprising. In 2010 alone, the MOU had 81 shrike reports from 13 counties, with 132 reports from 20 counties in 2011. The number of shrikes represented by MOU reports is difficult to determine as many are sightings of birds at the same location over time, by different observers. For example, in Dakota County from 2000-2011 there were 291 MOU reports, 116 of which could be mapped to a specific location. These 116 records could be assigned to a total of 33 locations. The number of locations with shrikes in a given year ranged from zero in 2004 to twelve in 2012, with an average of 5-6 for the 11-year period. Five of the twelve 2011 reports were along the route driven by the MBS observer that same year, but only one shrike was encountered by MBS.

Clearly, multiple trips by multiple observers results in far more shrike observations than a single observer following established protocol on a designated monitoring route. Relatively few of the recent Dakota County shrike reports, only three of twelve in 2011,

occurred along the DNR Nongame Wildlife Program's historic shrike monitoring route. It appears that the shrike population in Dakota County may have shifted away from the area of the historic monitoring route, rather than declining significantly. In the case of Dakota County, at least, caution should be exercised in drawing conclusions on shrike populations from monitoring data.

OBJECTIVE 5: Mudpuppy

Assess the current distribution and status of Mudpuppies (*Necturus maculosus*). Information on this species will be compiled, target areas for field surveys will be identified, and preliminary evaluation of survey methodology will be assessed.

Staff: Krista Larson, Nongame Research Biologist
Brett Nagle, MCBS Fish Specialist
Jeff LeClere, MCBS Herp Specialist
Christi Spak, MCBS Zoologist
Bob Fashingbauer, Area Wildlife Supervisor
Tim Pharis, Assistant Area Wildlife Manager
Erica Hoaglund, Regional Nongame Specialist
Amanda Plain, Field Survey Specialist

During the period from September 2010 to September 2012, 43 public mudpuppy sightings across 16 counties were compiled and mapped in a spatial database using ArcGIS (Figure 28). In addition, an evaluation of trapping as a survey technique was assessed, and priority stream reaches within the Minnesota and Lower Mississippi River drainages were targeted for survey effort.

Evaluation of trapping as a survey technique for mudpuppies, St. Croix River, Interstate State Park

Monthly mudpuppy surveys were conducted on the St. Croix River at Interstate State Park in Washington County on seven occasions between October 2010 and April 2011 to examine the seasonal effectiveness of trapping as well as to determine the most effective trap styles and bait types. Traps were set for 24-72 hours in the water along the shoreline and baited with one of five bait types: canned dog food, sardines, fresh beef liver, earthworms, or minnows. Various styles of minnow traps were used including two different lengths of round steel traps, two different lengths of round mesh traps, and square collapsible mesh traps. A waypoint was also taken at each trap location using a handheld GPS unit. When weather permitted, mudpuppies caught in traps were weighed and measured before being released at the site of capture.

The catch per unit effort (number of mudpuppies caught per trap per night) over the seven month survey period ranged from 0.00 - 0.65, with January having the highest yield per trap night and April having the lowest (Table 10). Similarly, the percentage of traps with at least one mudpuppy also peaked in January at 65%, with a low of 0% in

February. While all trap styles and bait types were successful in capturing mudpuppies, their effectiveness varied considerably (Tables 11 and 12).

Our results indicate that mudpuppies can be captured using a variety of bait types and trap styles during cold weather months (both ice-on and ice-off), and that the effectiveness of trapping is somewhat diminished in fall and spring as temperature and photoperiod are increased compared to mid-winter months. This information on bait type and seasonality will assist in designing future survey efforts to assess the abundance, distribution, and status of this species in lakes and rivers in other parts of its range in Minnesota where presence is not known.

Mudpuppy surveys in Minnesota River drainage

Mudpuppy surveys were conducted at 51 sites across 12 counties from May to November 2011 using electroshocking equipment and baited minnow traps. Mudpuppies were targeted at bridge crossings of rivers and streams with abundant rocky substrate (including artificial rip rap). Another 28 sites were evaluated but deemed unsuitable habitat for mudpuppies due to lack of cover for shelter and/or nesting. Mudpuppies were only found at 3 sites: one site in Blue Earth County on the Big Cobb River (a new county record), one site in Chippewa County on the Chippewa River, and one site in Yellow Medicine County on the Yellow Medicine River. Figure 28 shows the locations of the survey sites.

Summary of mudpuppy survey effort

Big Stone County	2 traps / 1 site
Blue Earth County	22 traps / 10 sites
Brown County	9 traps / 3 sites
Chippewa County	8 traps / 4 sites
Lac Qui Parle	20 traps / 7 sites (+ electroshocked at 1 site)
Pope County	5 traps / 2 sites
Redwood County	12 traps / 4 sites
Renville County	21 traps / 7 sites (+ electroshocked at 1 site)
Sibley County	4 traps / 2 sites
Stevens County	7 traps / 4 sites
Swift County	4 traps / 2 sites
Yellow Medicine County	12 traps / 5 sites
TOTAL	126 traps / 51 sites (+ electroshocked at 2 of these sites)

Mudpuppy surveys in Lower Mississippi River drainage

Mudpuppy surveys were conducted at 16 sites across 6 counties from June to September 2012 using electroshocking equipment as well as hand searches with mask and snorkel. Mudpuppies were targeted at bridge crossings of rivers and streams with abundant rocky substrate (including artificial rip rap). Mudpuppies were not detected at any of these survey sites despite presence of apparently suitable habitat. Another 37

sites were evaluated but not surveyed either due to lack of rocky cover or poor visibility. Figure 28 shows the locations of the survey sites.

Summary of mudpuppy survey effort

Fillmore County	5 sites (5 electroshocked, 3 snorkeled)
Goodhue County	1 site (1 electroshocked)
Mower County	3 sites (3 electroshocked)
Olmsted County	4 sites (4 electroshocked, 2 snorkeled)
Rice County	2 sites (2 snorkeled)
Winona County	1 site (1 electroshocked)
TOTAL	16 sites

Project 2. TOPEKA SHINER MONITORING

Need: The development and implementation of long-term population monitoring for the Topeka shiner are recognized as Priority 1 and 2 tasks in USFWS' Draft Topeka Shiner Recovery Plan (Task 2.1, p. 24). Topeka shiner population monitoring has been conducted at random locations within designated critical habitat in a highly replicable fashion within Minnesota since 2004. On-going population monitoring will provide DNR and FWS with a tool for detecting changes in the overall presence/absence of Topeka shiners within the state.

OBJECTIVE: To contribute to the management and recovery of the Topeka shiner (*Notropis topeka*).

Monitoring: Conduct annual presence/absence monitoring within 20 randomly selected 1-mile-length stream reaches within Minnesota's designated critical habitat.

Data Management: Enter and manage all data resulting from this project's monitoring efforts.

Recovery Planning: Serve as a Recovery Team member.

Staff: Brett Nagle, MBS Nongame Fish Specialist
Margaret Edwards, Field Survey Specialist
Tyler Winter, Field Survey Specialist
Krista Larson, Nongame Research Biologist
Rich Baker, Endangered Species Coordinator

Survey efforts – Stream surveys targeted the federally endangered Topeka Shiner along twenty randomly selected one-mile stretches of stream in July, 2012 within Minnesota's designated critical habitat in Lincoln, Pipestone, Rock, and Nobles counties (Figure 29). Surveys were conducted with a 6' x 10' x 1/8" pole seine until either Topeka Shiners were found, or it was concluded that no Topeka Shiners were present within the stream reach. The focus of these surveys was to determine presence/absence of Topeka Shiners within the one-mile segments; survey efforts ceased upon capture of any Topeka Shiners. All captured individuals were returned to their habitat after obtaining voucher photographs. Care was taken to avoid mortality of Topeka Shiners; none was observed. Topeka Shiner monitoring was not conducted in 2011 due to a shutdown of the state government during the survey period.

Survey findings – Thirty-six species of fish, in addition to Topeka Shiner, were documented during the surveys (Table 13). Topeka Shiners were collected at eight of the twenty stream segments. Topeka Shiners were abundant at two of the sites where they were present. All other collections consisted of three or fewer individuals (Figure 30). The state Special Concern (proposed Threatened) Plains Topminnow was collected at three of the sites, and was abundant at two of these. Red Shiners (SGCN) were collected at eight of the twenty stream segments.

Topeka Shiner monitoring conducted in June 2010, found the species to be present at 12 of the 20 sites. Topeka Shiners were abundant at only two of these sites and only one or two individuals were collected at the remaining ten sites where they were present.

Data management -- The 2010 Topeka Shiner monitoring report was finalized in September 2010 and posted on the DNR's Research Reports website. Data were compiled and submitted to MNDNR's Natural Heritage Information System (NHIS) staff for incorporation into the *Biotics* database. Locations of newly documented Topeka shiners were entered as polygons into the *Biotics* database following standard NatureServe protocols.

Recovery planning -- Richard Baker continues to represent Minnesota on the USFWS Topeka Shiner Recovery Team. MNDNR biologists, stream geomorphologists and hydrologists from the Divisions of Ecological and Water Resources (EWR) and Fish and Wildlife are presently developing proposals to characterize Topeka Shiner habitat requirements and investigate habitat recovery actions at the watershed level in Minnesota. In addition to this work, EWR staff have been in contact with Iowa DNR and USFWS staff to develop a collaborative research effort to understand population-level genetic dynamics and develop effective means of habitat restoration in watersheds that span the Minnesota/Iowa border.

Project 3. Information Management

Objectives:

1. To maintain and update MNDNR's Natural Heritage Information System, (NHIS,) databases as survey and other observation information on wildlife populations and their habitats becomes available.
2. To provide data on wildlife, and the plant communities or geologic features that support wildlife populations, in usable formats including GIS technology and the DNR website to aid in the implementation of the State Wildlife Action Plan, and for resource managers, state and federal agency staff, local governments, researchers and citizens for use in planning efforts and to foster a better understanding and conservation of Minnesota's wildlife resources.
3. To continue the conversion of imported NHIS data to the new Biotics spatial standards.
4. To populate the Observation Database to complement information stored in the Biotics database.
5. To manage the technology components of the NHIS to ensure the system is reliable and up-to-date.

Results:

During this reporting period, the Biotics database was maintained in working order and routine maintenance tasks were regularly performed. Data entry staff met regularly to discuss data entry procedures to assure that data are entered/ converted consistently. Selected data fields were scanned for errors or omissions and corrected. Two refresher training sessions were held for approximately 25 Biotics users, and new data entry methodology training was held each fall.

Data from the 2010 field season for several statewide animal monitoring efforts were entered into data management systems. Data from Minnesota's Loon Monitoring Program were entered into an Access database. Data from Minnesota's Frog and Toad monitoring program, which are collected by volunteers using national protocols, were entered into the North American Amphibian Monitoring Program (NAAMP) database via a web interface. Native plant community data was maintained, including changes in the classification, native plant community "official" names, and native plant community statewide ranks (S-ranks).

Data entry and analysis of monitoring information on loons and amphibians continued along with recruitment of volunteers, determination of annual survey routes/locations, updating of the survey websites, preparation and distribution of data collection instructions, and distribution of survey results to the participants of these two surveys. Data from reports on the harvest of turtles, including the SCGN snapping turtle, are reviewed, summarized, and maintained in an Access database. Results of commercial turtle harvest will be used to document SCGN occurrences and harvest pressure on SCGNs.

Specific activities by database:

a. Minnesota Frog and Toad Calling Survey (MFTCS)

- Began entering 2010 volunteer survey datasheets into web-based data interface (USGS North American Amphibian Monitoring Program online database); data entry was not completed nor reviewed
- Created volunteer management, mailing, and database management instructions for coordinating MFTCS
- Collected bullfrog reports from public
- Worked with national NAAMP coordinator and summer intern to update GIS information for all Minnesota frog and toad survey routes

b. Minnesota Loon Monitoring Program (MLMP)

- Did not perform any data management activities during this reporting period

c. Commercial Turtle Harvest

- Completed all harvest data entry for 2008 and 2009 and performed quality control measures; however, data have not yet been analyzed

Maintain and update NHIS

Information about various aspects of the NHIS, including data entry, data conversion and data requests is now maintained on an intranet site where it is available to all Division staff. The web content is maintained by data entry staff and is updated frequently. This intranet site increases the visibility of the data management activities, and serves as a consistent reference for frequently sought information.

Additional research reports that were produced or funded by the Natural Heritage and Nongame Research Program and the Nongame Wildlife Program and received during the reporting period were added to the DNR's public website at (http://www.dnr.state.mn.us/eco/nongame/projects/research_reports/index.html). Reports were compiled, scanned, and converted to pdf format. Digital (pdf) versions of the latest SWG reports were added to both the research reports and the SWG websites.

Entry of new data and conversion/remapping of existing records

The conversion of the NHIS to Biotics involved considerable changes in approach. Under the old data management system, the fundamental unit for tracking location records was the element occurrence (EO). An EO is an area of land and/or water in which a species or native plant community is or was present. In Biotics, the fundamental mapping unit is the source feature. A source feature is the initial mapped spatial component of an EO developed from a discrete observation. Element occurrences may comprise one or more source features. Standard specifications for each rare species or community that are based on the ecological characteristics of the species or community

dictate whether a new observation in the vicinity of an existing observation will become part of an existing EO or a new EO will be created. During the current reporting period, approximately 187 new source features were created for rare animals and animal aggregations, and approximately 1260 additional source features were edited. This involved more than 80 new and 200 reviewed/edited EOs for animals. As of September 30, 2012, the following proportions have been converted or remapped for species tracked in the NHIS: 100% of state-listed endangered animal records 41% of state-threatened animal records, and 2% of state-special concern animal records.

Considerable progress has been made on developing a methodology and tools to allow more rapid, efficient, and error-free entry of animal data into the Biotics database. The new methodology includes data entry templates and web-based data upload. Data entry staff enter observation data in the spreadsheet template. The templates include data entry fields as well as metadata, examples and instructions to the user. Data management staff upload the data templates using a web interface. Data are saved in the NHIS Observation Database. An internal website was created to provide methodology and template information to users.

During the reporting period, templates were developed for colonial waterbirds, mammals, herps, birds, mussels, fish and insects. Database tables were designed and built to hold the data. Data entry procedures and data recording standards were established. Using the new templates and data standards, staff standardized, collated, quality-checked, and uploaded MCBS bird data from 1988 through 2011. The uploaded bird data include 104,855 records with 303,658 spatial locations. MCBS mammal data from 1988 through 2011 were also standardized, collated, quality-checked, and loaded into the database. These data include 30,404 records and spatial locations. (Funding from LCCMR was used to upload the 1988-2010 data to the Observation Database.) Additionally, staff funded by this grant assisted in loading 2010 and 2011 data from the DNR Nongame Program into the Observation Database

This work was further advanced by additional database design and build work which allows data from various taxa and databases to be rolled up into one format for viewing and analysis for various research and analysis projects. A draft “distributed data set” was created to begin to deliver the data to staff and requesters. Essential database components were also built which allow the selection and transfer of listed-species data from the NHIS Observation Database to the Biotics database with reduced staff manipulation time.

Approximately 20 Observation Database and Biotics information requests were filled for DNR staff and cooperators. Data from these systems are available to DNR staff through the department's data resource sites. Use of the data from these sites is not tracked.

Minnesota Biological Survey

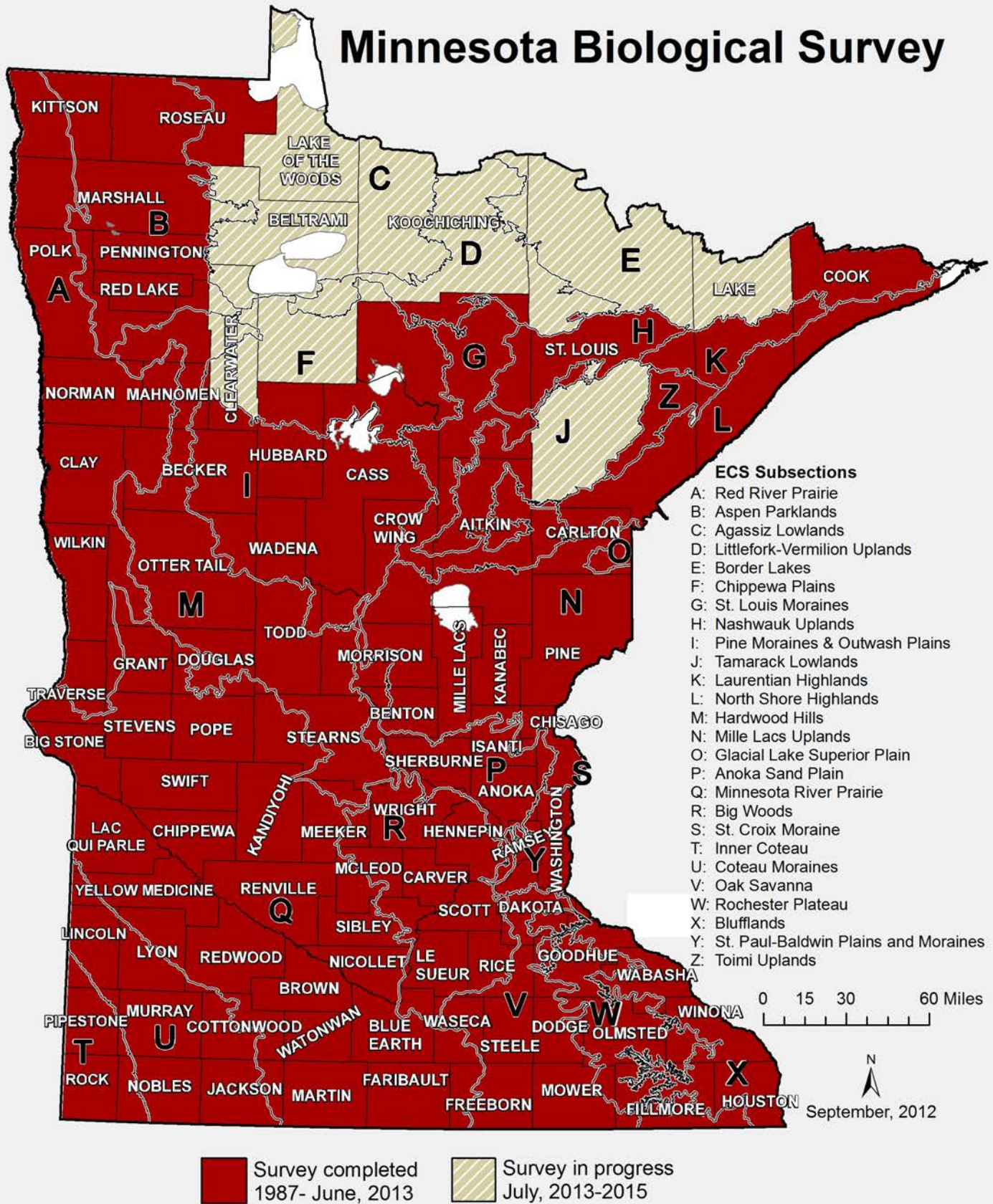


Figure 1. Survey progress of the Minnesota Biological Survey.

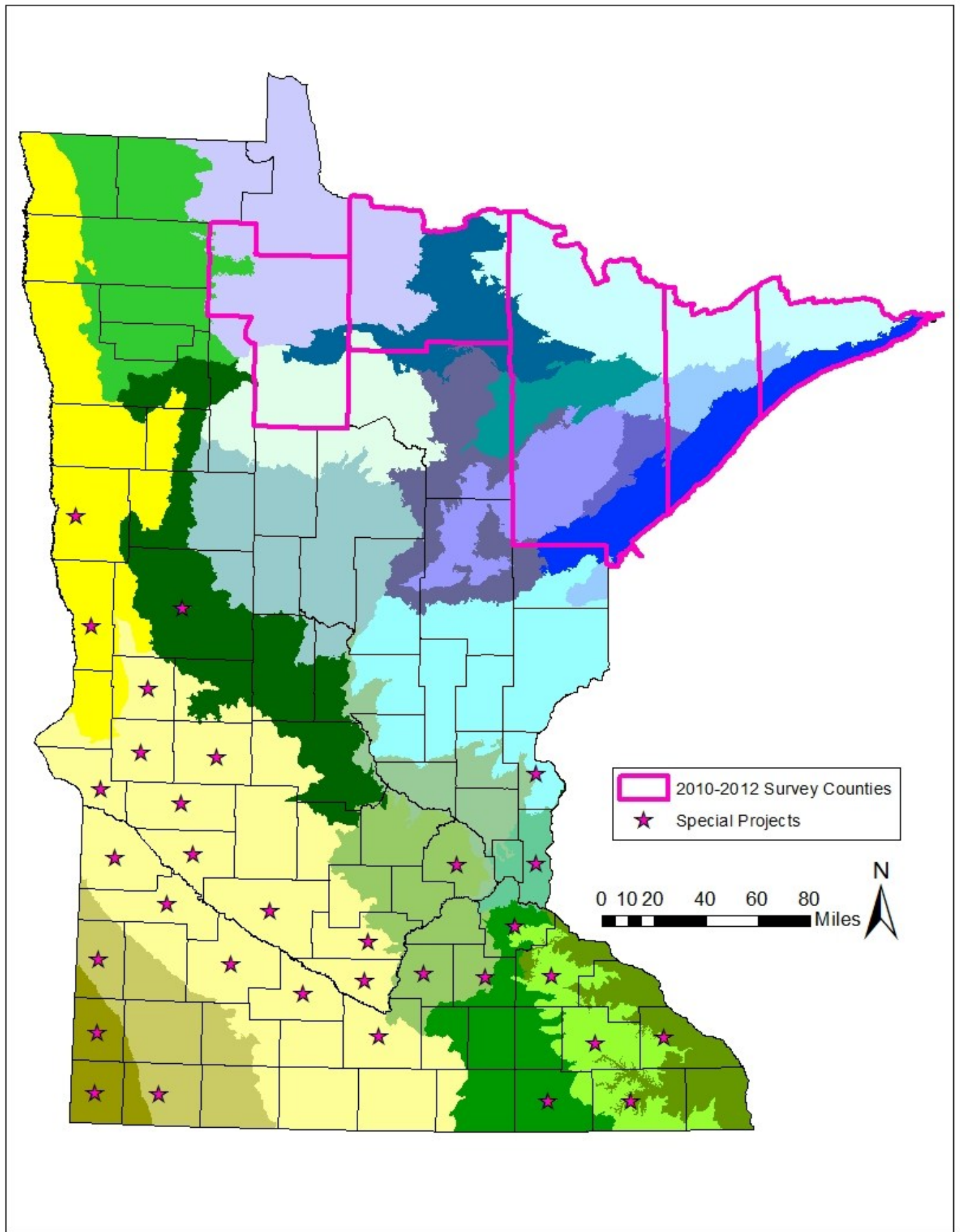


Figure 2. Locations of MBS animal surveys, including county surveys and special projects.

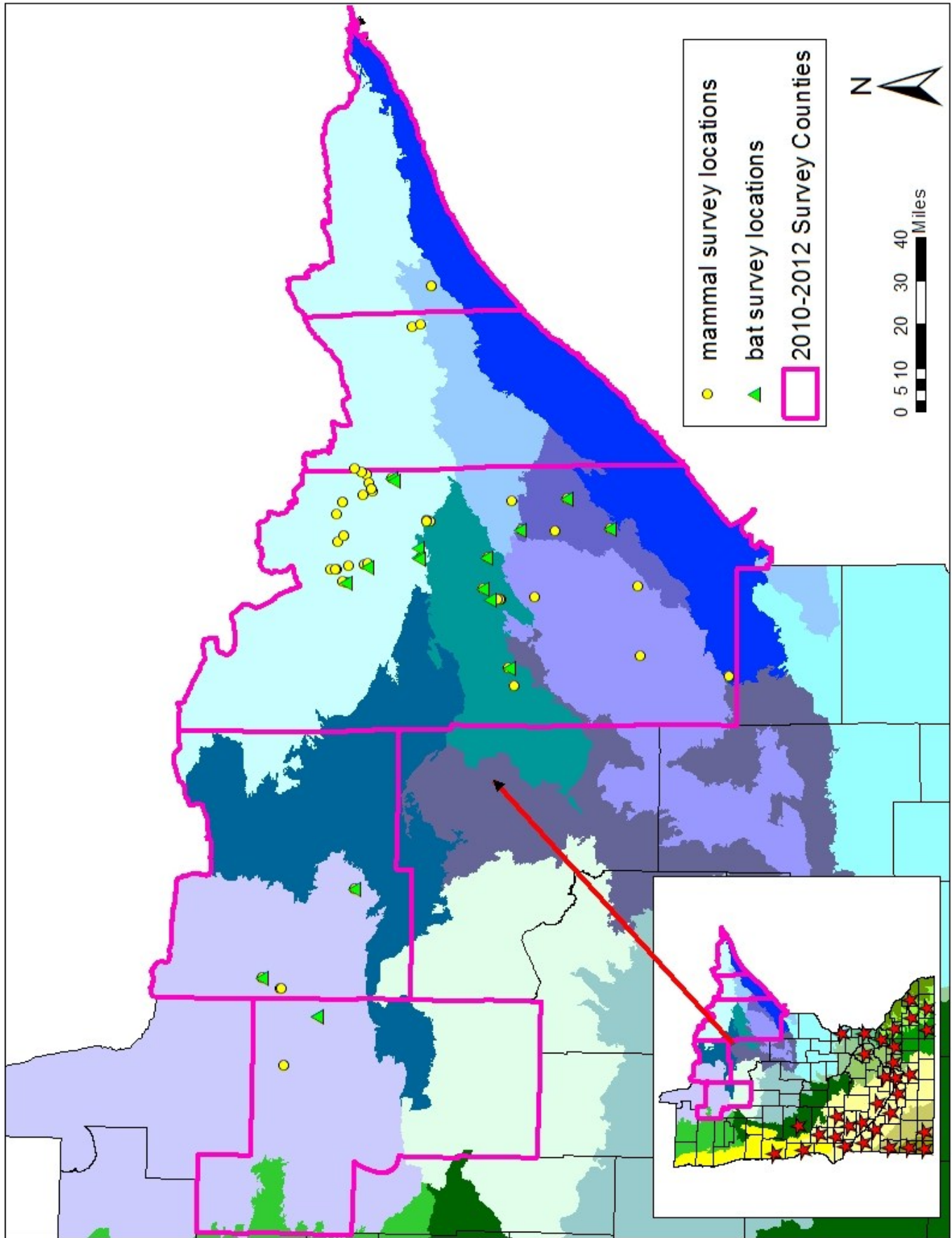


Figure 3. Locations of MBS mammal surveys in northern Minnesota.



Figure 4. Examples of habitats targeted for rare mammal surveys: mossy boulder field at Bear Head Lake State Park (above); open ericaceous peatland near Little Trout Lake (left); both in St. Louis County.

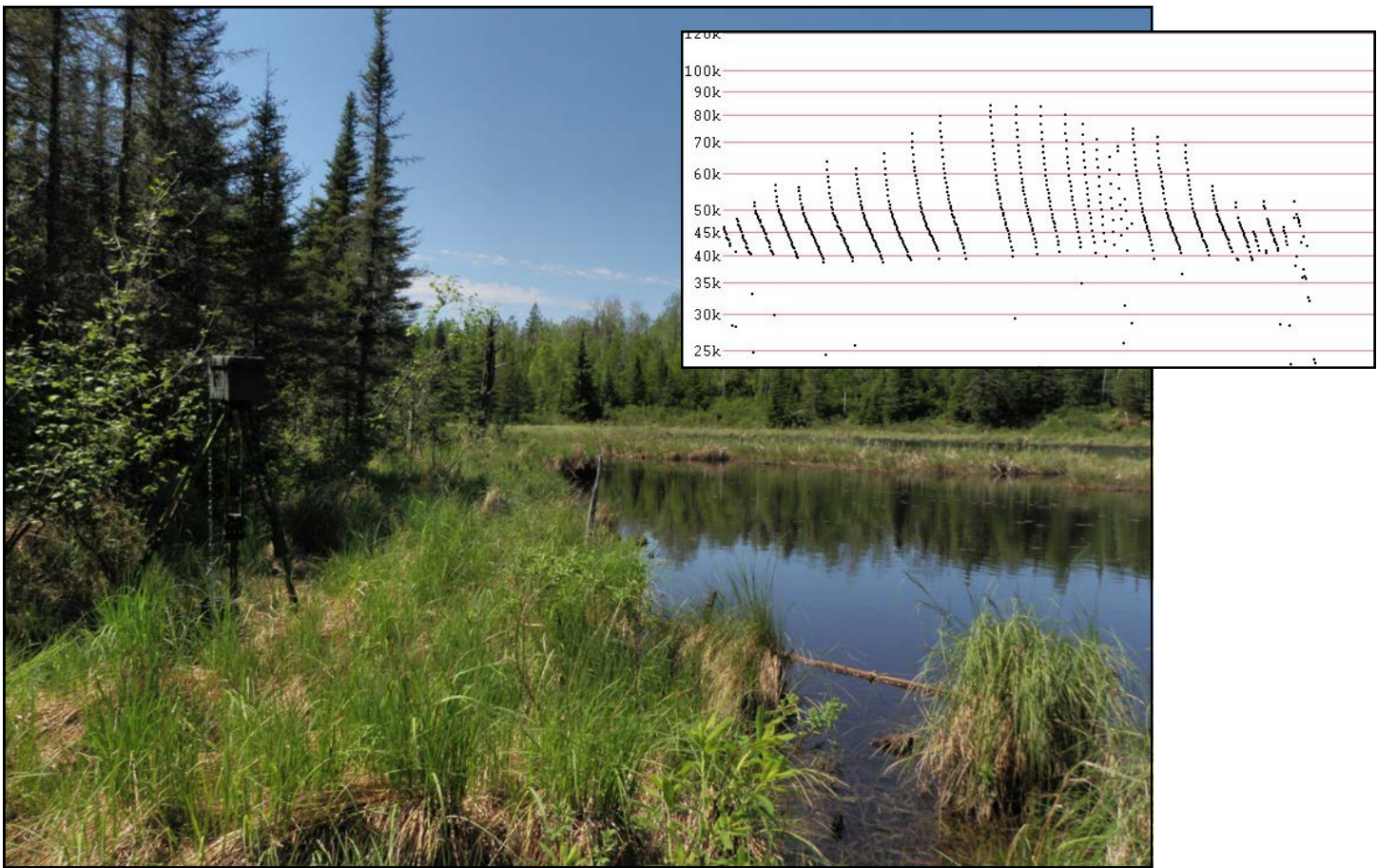


Figure 5. Marten photographed by game camera set off the Echo Trail (upper); bat detector set at Lake Vermillion State Park (lower); (inset) call file of a Little Brown Myotis.



Figure 6. Rock Vole (*Microtus chrotorrhinus*; upper); comparison between Arctic Shrew (*Sorex arcticus*, lower top) and Smoky Shrew (*Sorex fumeus*, lower bottom); all taken from Bear Head Lake State Park.

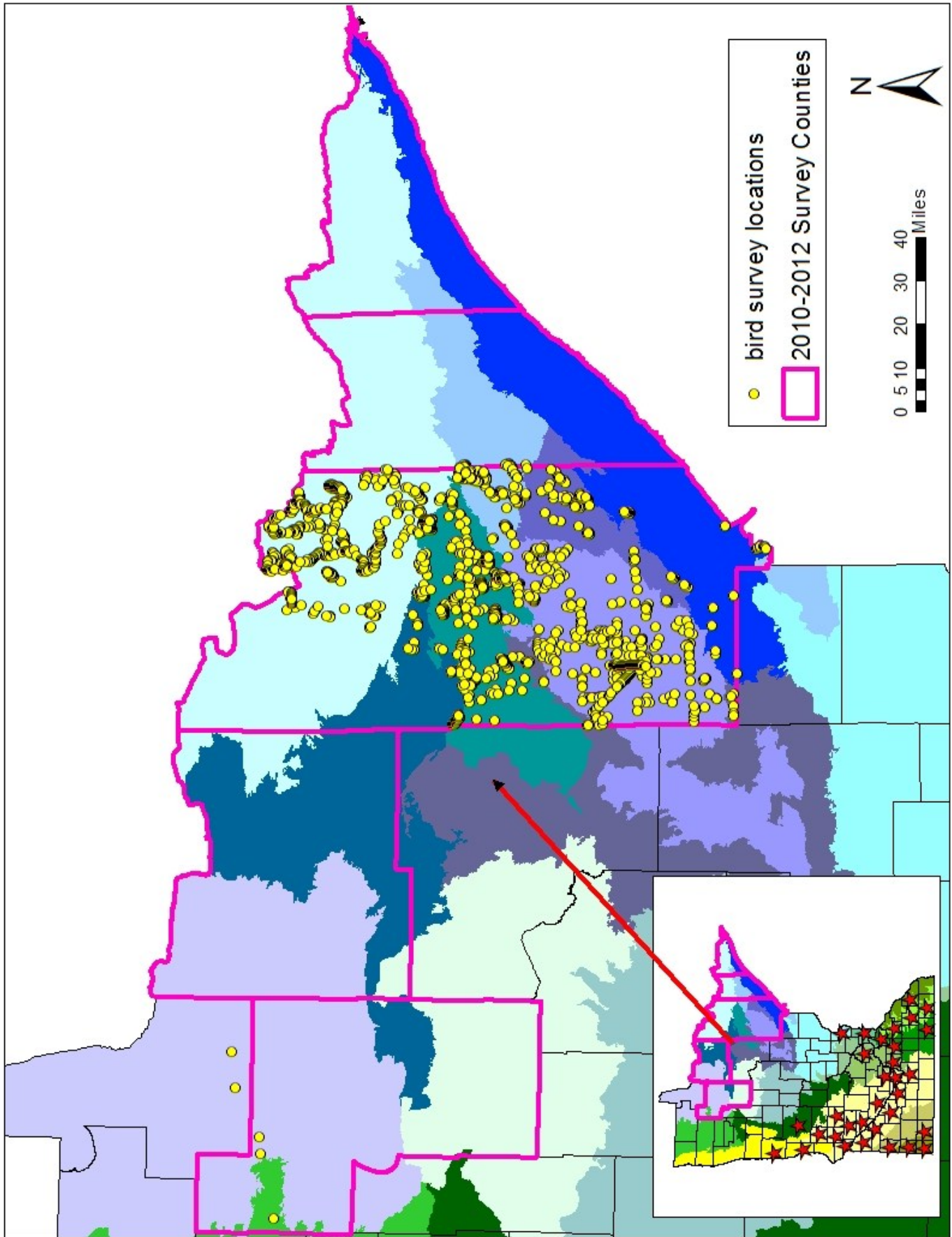


Figure 7. Locations of MBS breeding-season bird surveys in northern Minnesota.



Figure 8. Grassland bird habitat where SGCN Dickcissel, Bobolink and Eastern Meadowlark were found (upper); shrub swamp where wetland SGCN American Bittern and Swamp Sparrow were found (lower).



Figure 9. Lowland black spruce (upper), habitat for Spruce Grouse, Winter Wren and Connecticut Warbler; (inset) Spruce Grouse (*Falcipennis canadensis*); Black-throated Blue Warbler habitat (lower) with typical dense shrub layer on steep, forested slope.

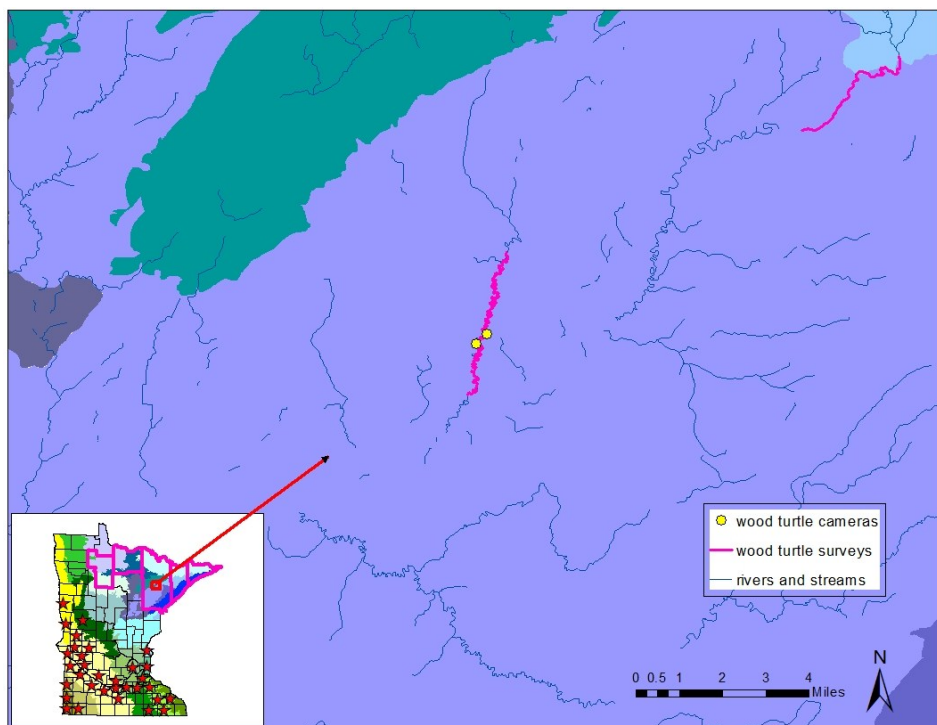
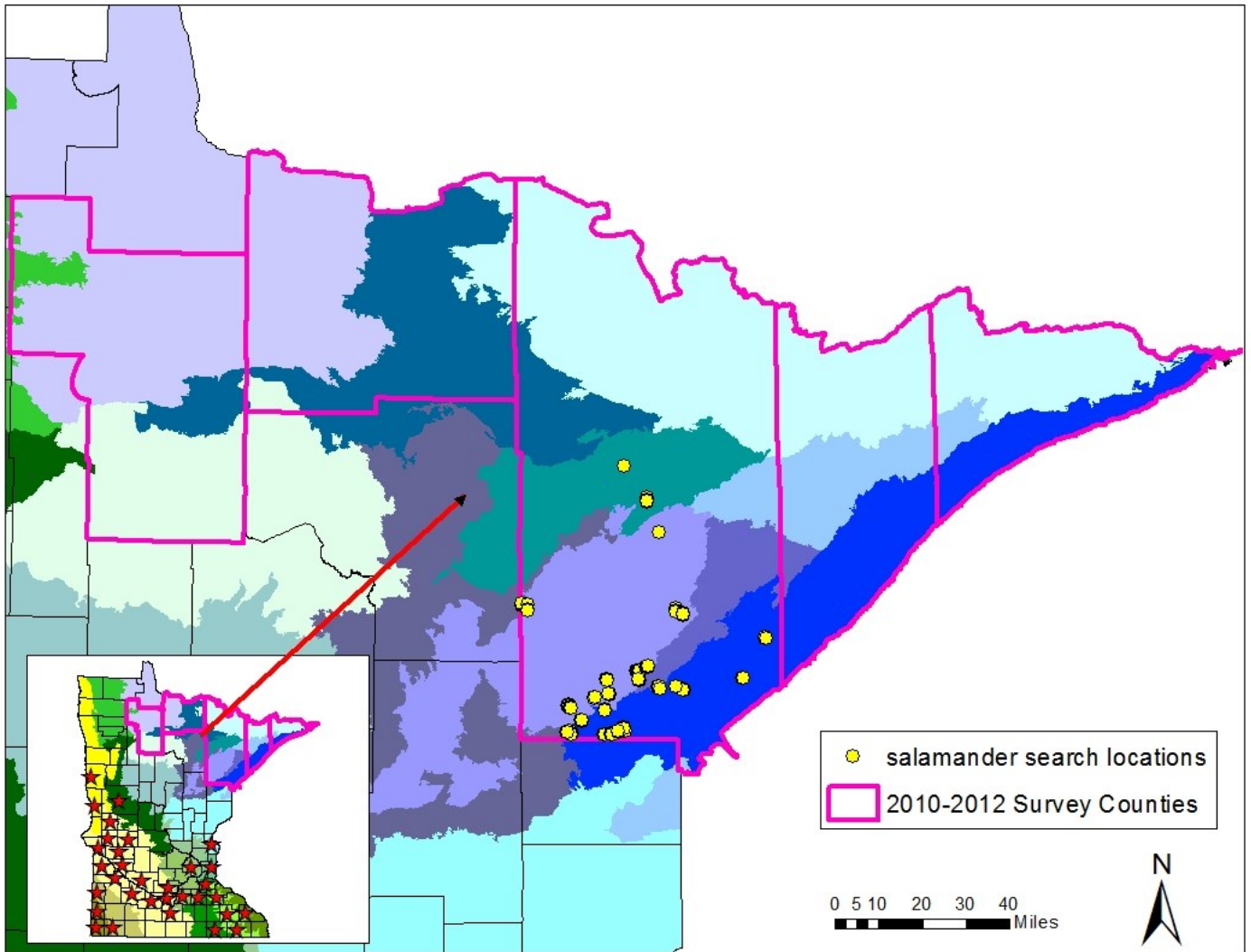


Figure 10. Locations of MBS salamander surveys (upper) and Wood Turtle surveys (lower).



Figure 11. Wetland habitat targeted for Four-toed Salamander searches (upper); female Four-toed Salamander guarding eggs (lower).



Figure 12. Wood Turtle captured from the Embarrass River and marked (upper); game camera image of Wood Turtle using cut-bank (arrow, lower).

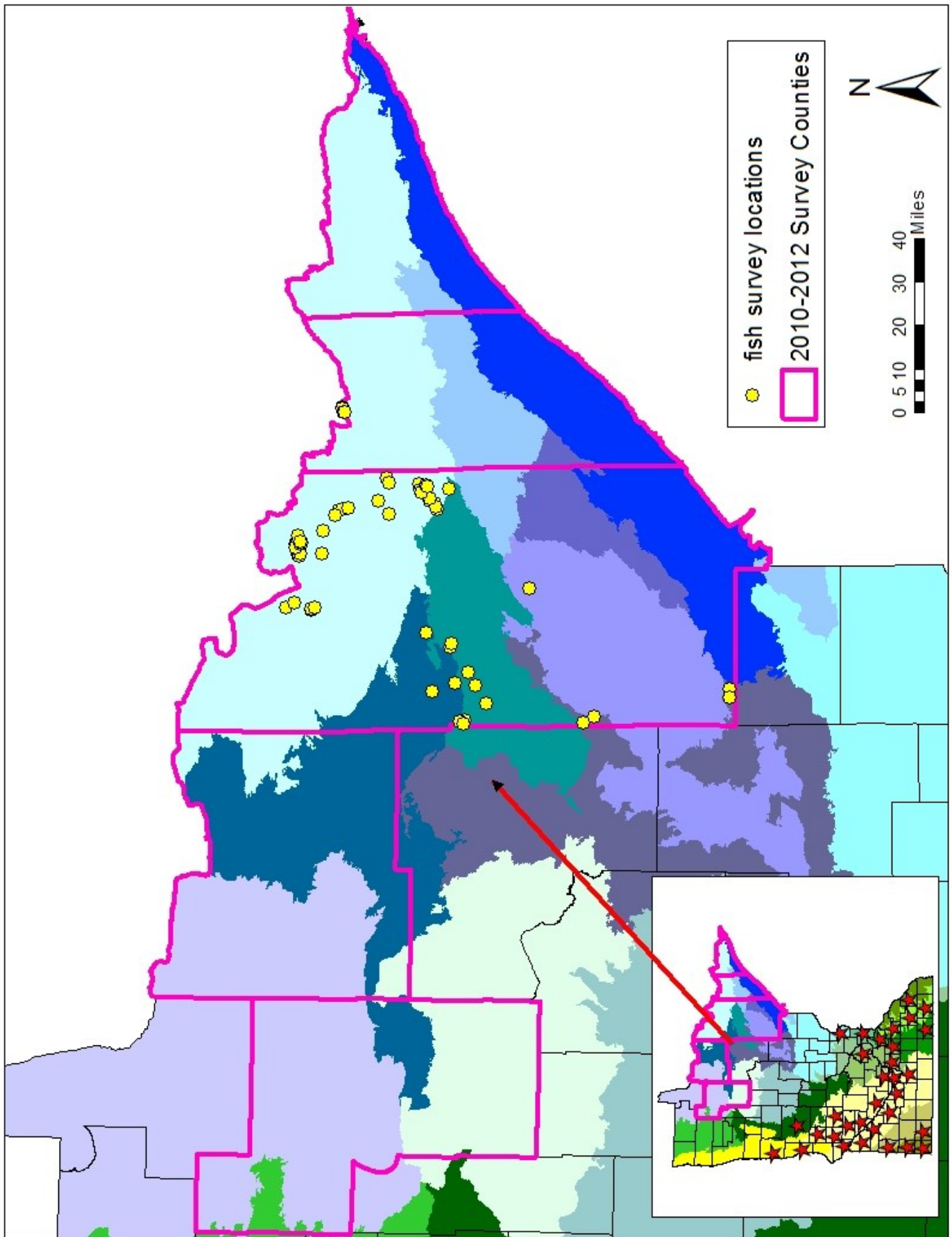


Figure 13. Locations of MBS fish surveys in northern Minnesota.



Figure 14. Using a pole seine to collect stream fishes in Rice River, St. Louis County (upper); Northern Brook Lamprey (left).



Figure 15. Longear Sunfish (lower); sunfish habitat at Hustler Lake, St. Louis County (upper).

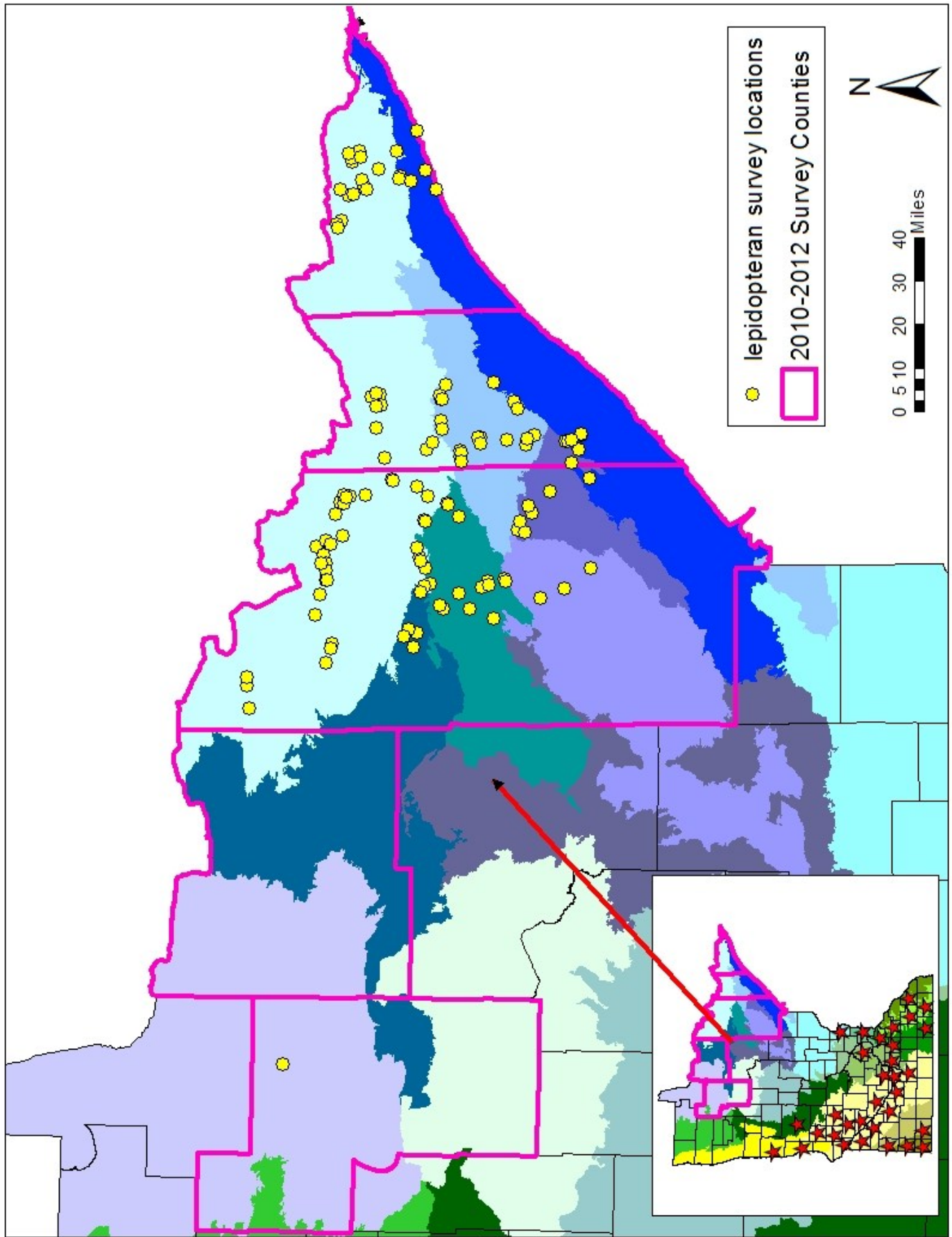


Figure 16. Locations of butterfly and moth surveys in northern Minnesota.



Figure 17. Ultraviolet (UV) light trap used in surveying moths and other nocturnal insects, Red Lake Peatland, Beltrami County (upper); moths feeding on rotten banana-brown sugar bait pasted on sapling, McNair, Lake County (lower).



Figure 18. Laurentian Tiger Beetle on granite outcrop in St. Louis County (upper); deer flies surveying an insect surveyor, Spruce Lake Peatlands, Lake County (lower).

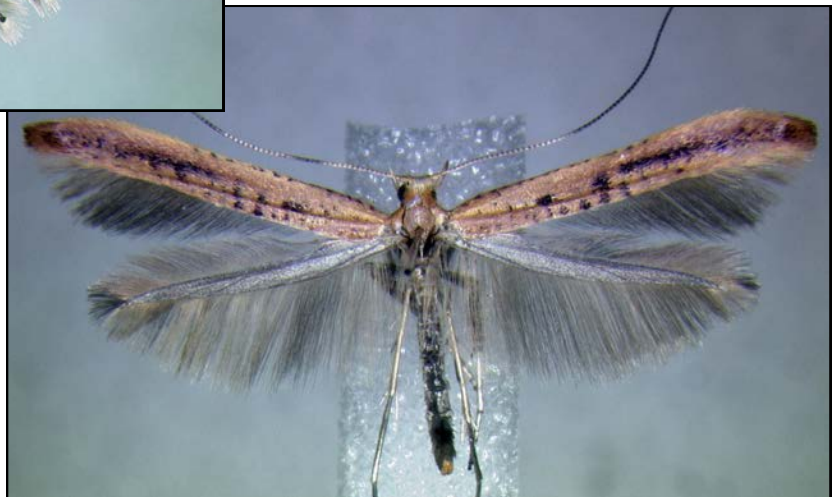


Figure 19. Arctic Fritillary at Britt Bog, St. Louis County (upper); a many-plumed moth from Chorus Lake Bog, St. Louis County (lower left) and a gracillariid moth from Mink Lake, Cook County (lower right) are both probable new records to Minnesota.

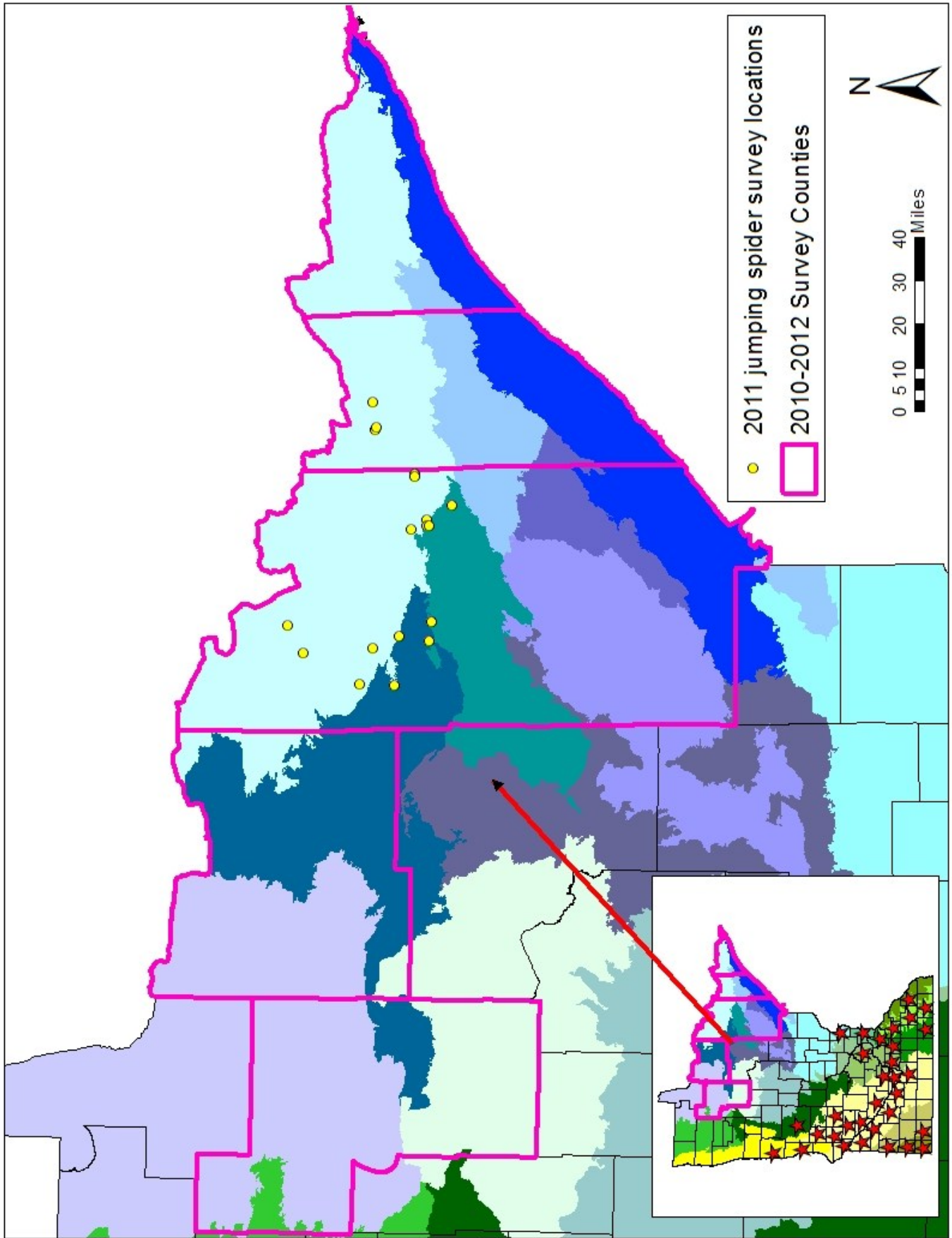


Figure 20. Locations of jumping spider survey locations for 2011 in northern Minnesota.

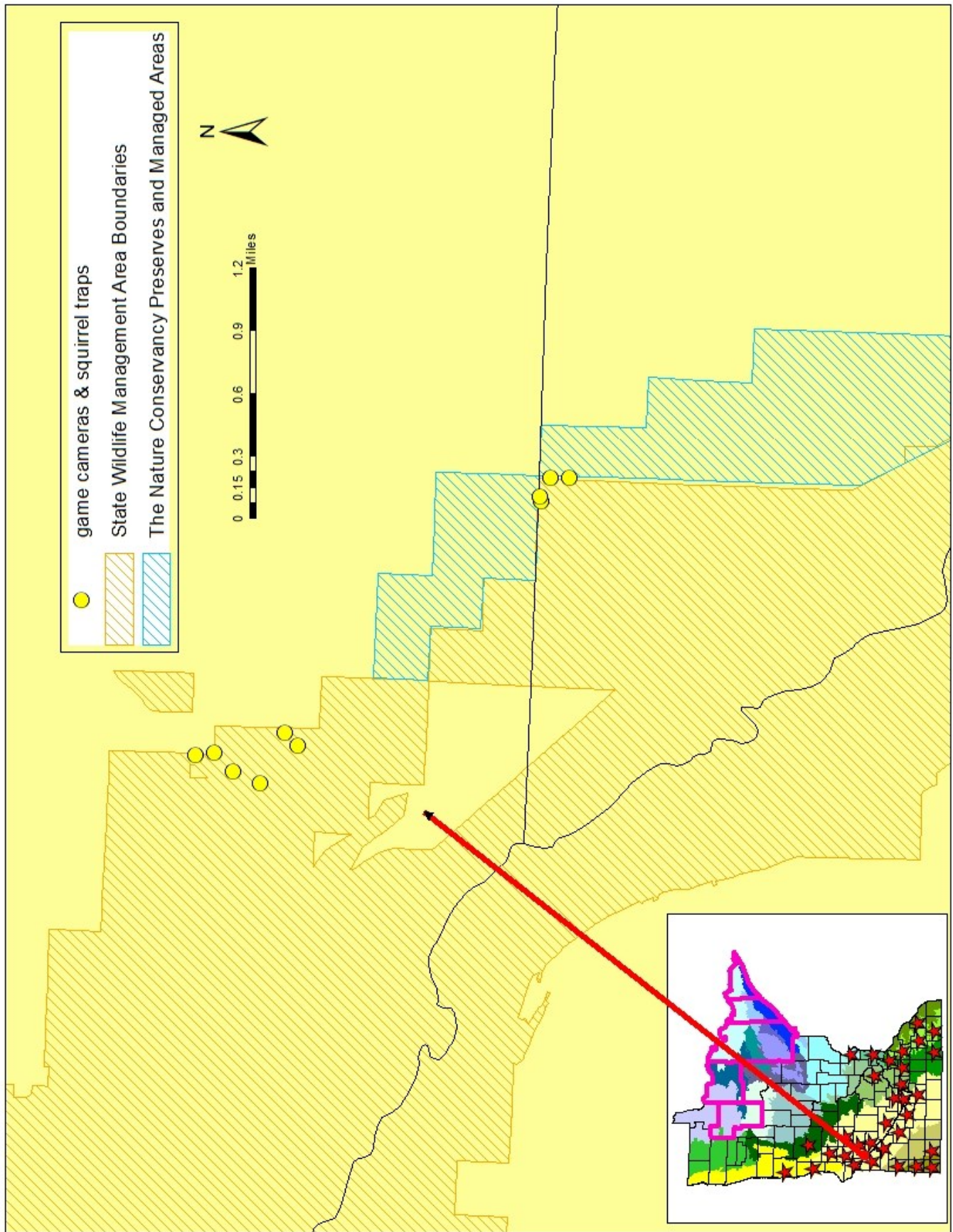


Figure 21. Locations of live trap sets for Franklin's Ground Squirrels in Lac Qui Parle WMA/Chippewa Prairie TNC, Chippewa and Swift counties.



Figure 22. Live trap set at Lac Qui Parle WMA, baited with popcorn (upper); deer investigating live trap (lower).

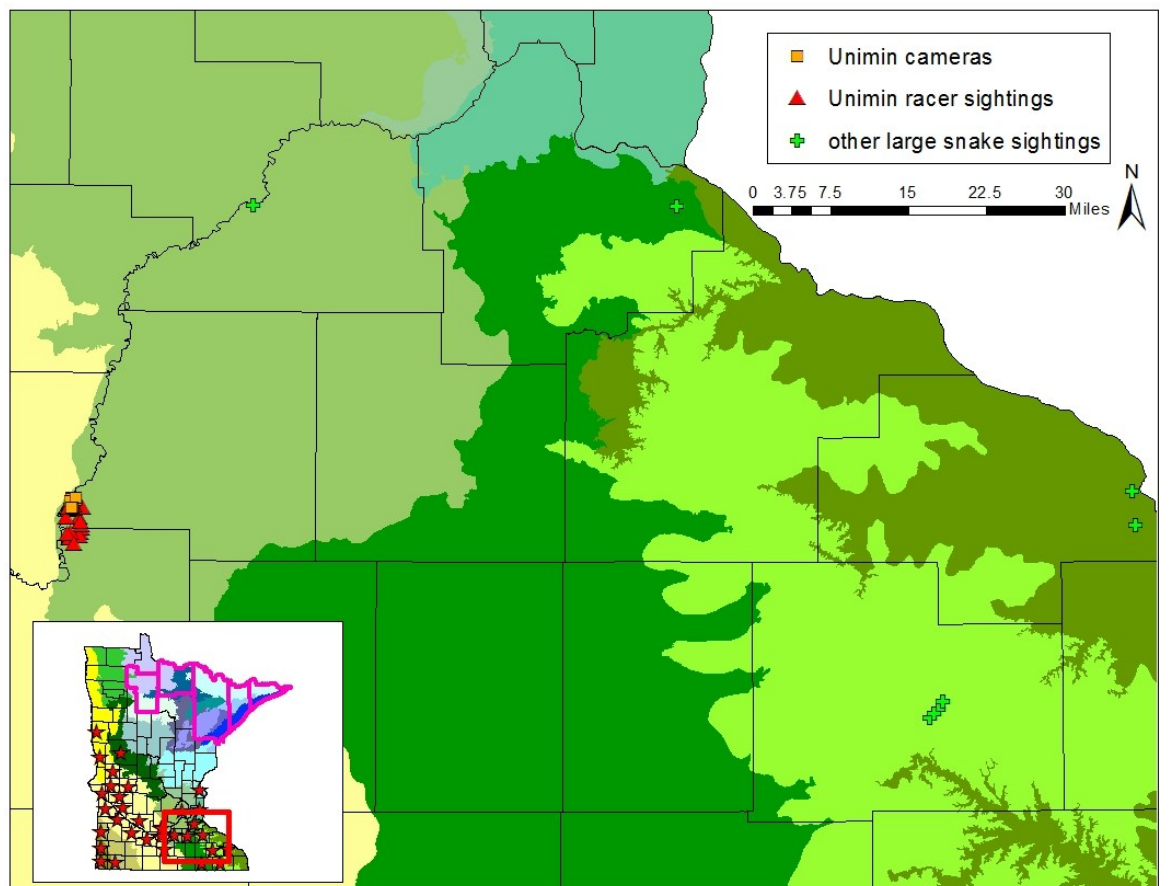
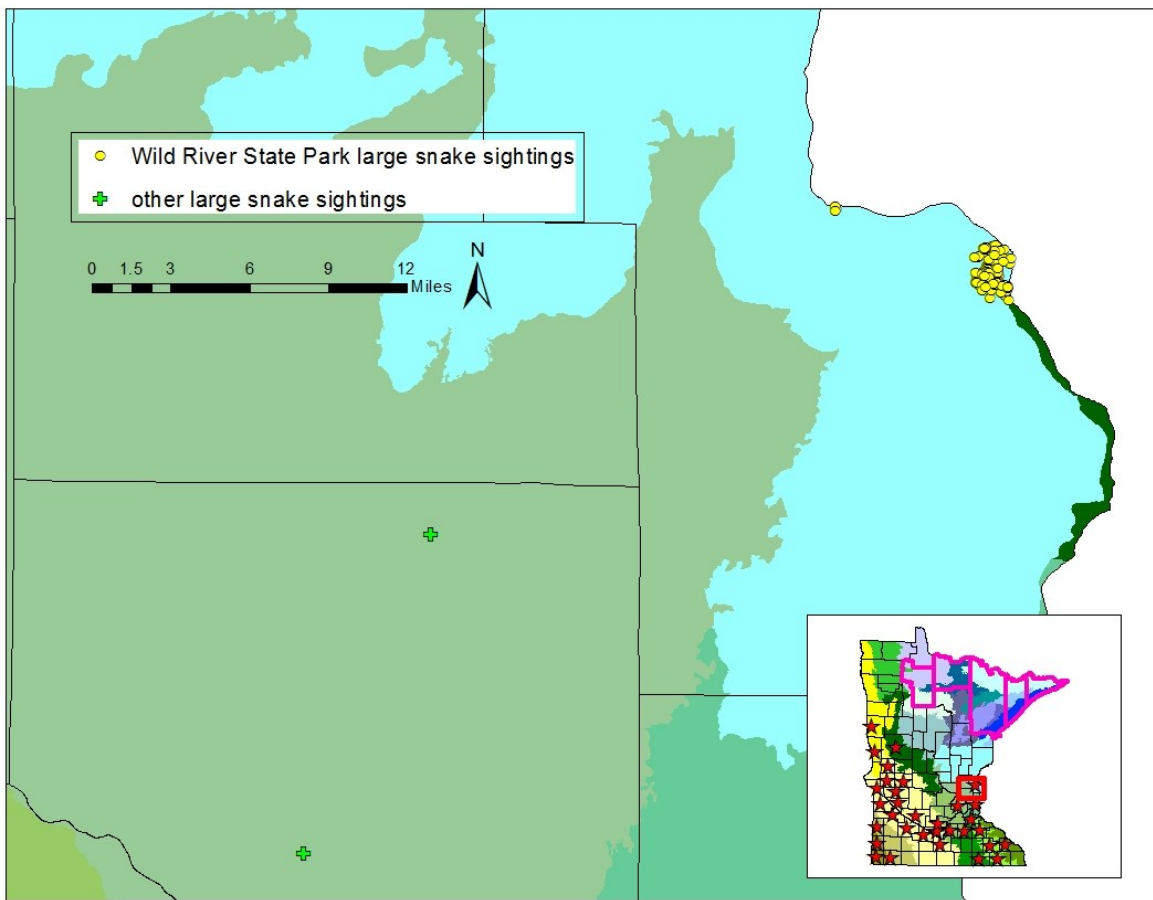


Figure 23. Locations of large snake surveys, including focal areas: Wild River State Park, Chisago County (upper) and Unimin Corporation property, Le Sueur County (lower).



30 SECONDS UNIMIN20 MAY.17,11 05:15 PM

Figure 24. Time-lapse camera set at potential snake den site in Le Sueur County (upper); North American Racer recorded moving among limestone slabs (lower, arrow).



Figure 25. Mating Gophersnakes in Chisago County. Photo taken by Dave Crawford.

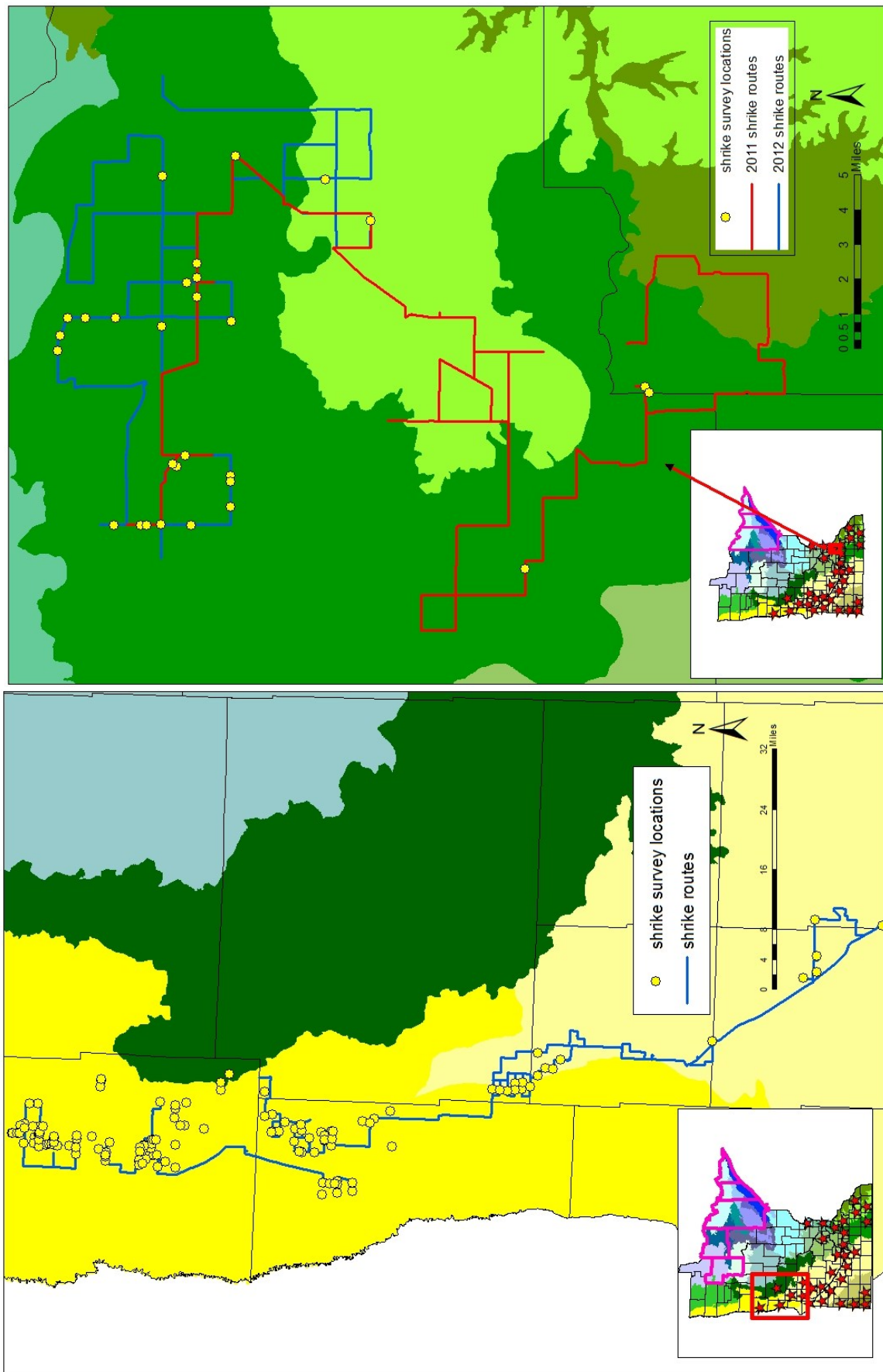


Figure 26. Loggerhead Shrike survey routes and stops in west-central Minnesota (left) and Dakota and Goodhue counties (right).

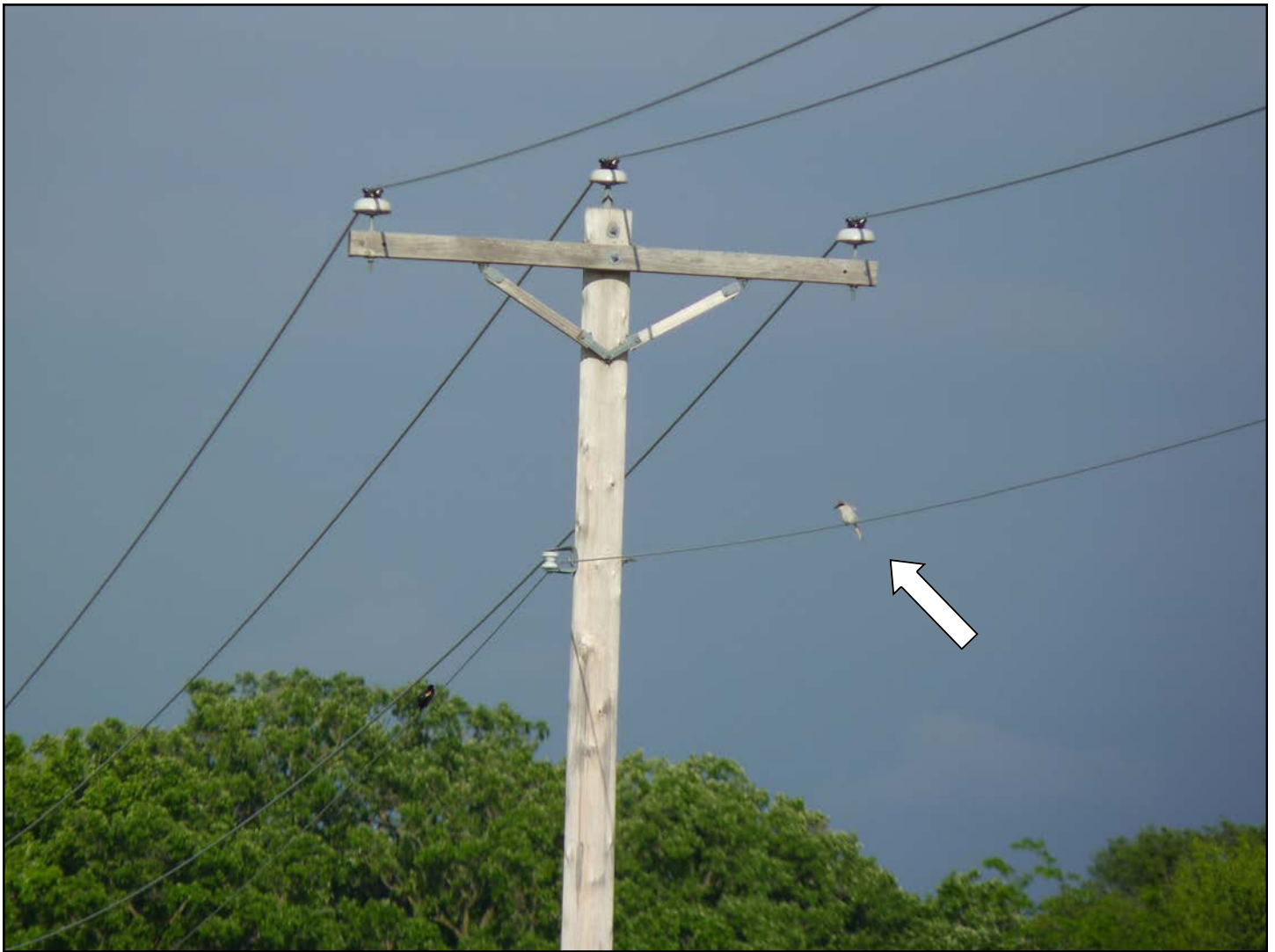


Figure 27. Loggerhead Shrike (arrow) hunting from roadside wire.

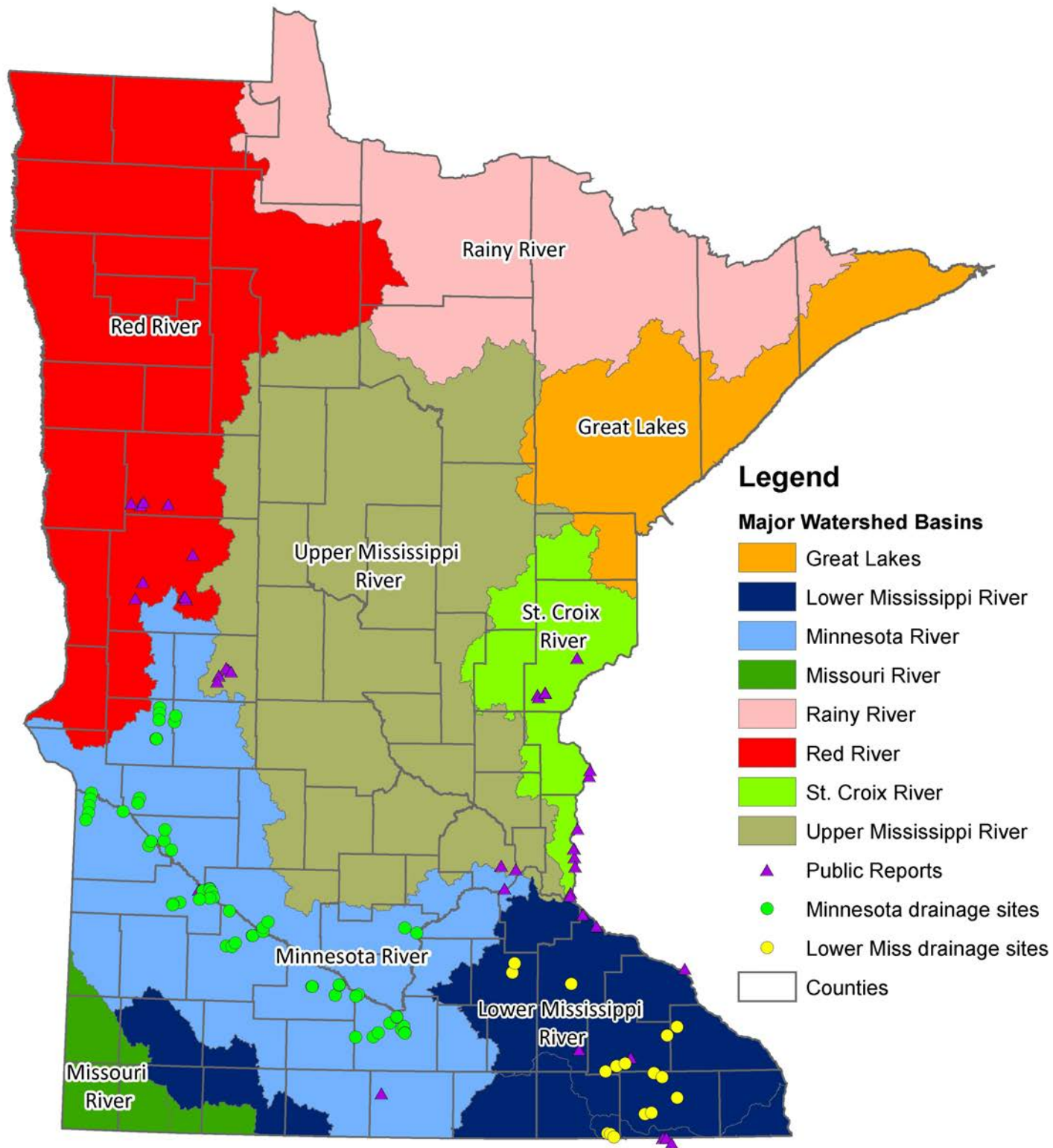


Figure 28. Locations of mudpuppy survey sites in the Minnesota and Lower Mississippi River drainages as well as public reports of mudpuppy observations. Public reports were compiled from DNR staff and citizens from September 2012 through September 2012.

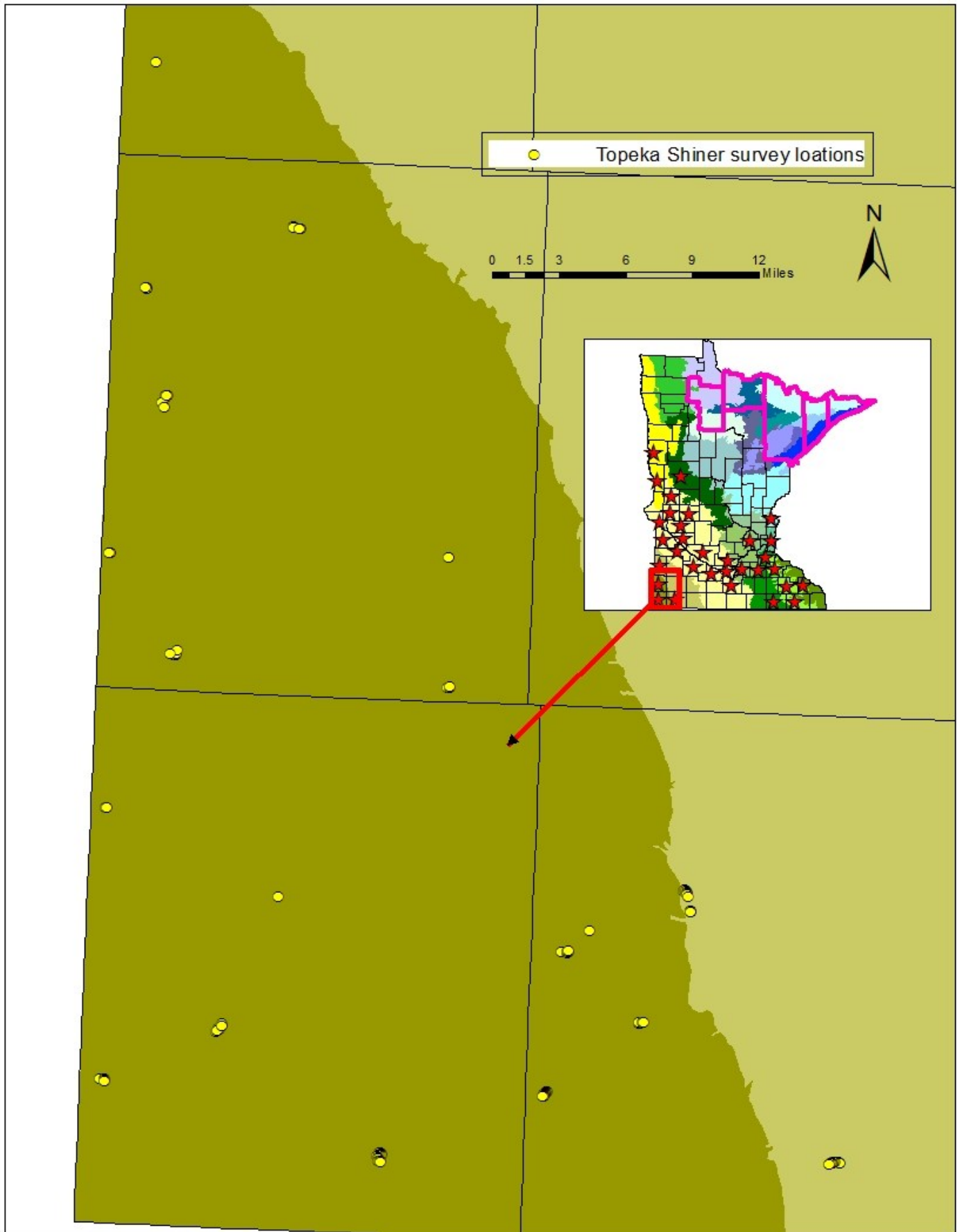


Figure 29. Locations of 2012 Topeka Shiner monitoring locations.



Figure 30. Topeka Shiner habitat, Medary Creek, Lincoln County (above); Topeka Shiner (lower, left) and Plains Topminnow (lower, right), both from Rock River, Jackson County.

Table 1. Animals of conservation concern in Cook, Lake, and St. Louis counties, Minnesota. Minnesota Biological Survey – Animal Surveys 2010 - 2012.

Animals of conservation concern include those species that are listed as endangered (END), threatened (THR), or of Special Concern (SPC) on state or federal lists and species that have been identified as of greatest conservation need in Minnesota (SGCN). Proposed status changes, effective in 2013, are indicated. Also listed are species that need additional documentation in this region. † (dagger) indicates species listed as USFS Regional Forester Sensitive Species on Superior National Forest (2012).

Species	State Status
Mammals	
Eastern Spotted Skunk (<i>Spilogale putorius</i>)	THR
Heather Vole (<i>Phenacomys ungava</i>)†	SPC
Northern Bog Lemming (<i>Synaptomys borealis</i>)	SPC
Smokey Shrew (<i>Sorex fumeus</i>)	SPC
Northern Myotis (<i>Myotis septentrionalis</i>)	SPC
Tri-colored Bat (<i>Perimyotis subflavus</i>)†	SPC
Cougar (<i>Puma concolor</i>)	SPC
Eastern Gray Wolf (<i>Canus lupus</i>)†	SPC proposed delisted
Least Weasel (<i>Mustela nivalis</i>)	SPC
Big Brown Bat (<i>Eptesiscius fuscus</i>)†	proposed SPC
Little Brown Myotis (<i>Myotis lucifugus</i>)†	proposed SPC
Moose (<i>Alces americanus</i>)	proposed SPC
Canada Lynx (<i>Lynx canadensis</i>)	SGCN proposed SPC
American Badger (<i>Taxidea taxus</i>)	SGCN proposed SPC
Franklin’s Ground Squirrel (<i>Spermophilus franklinii</i>)	SGCN
Rock Vole (<i>Microtus chrotorrhinus</i>)	SGCN
Other mammals of regional interest	
Virginia Opossum (<i>Didelphis virginiana</i>)	
Least Chipmunk (<i>Neotamius minimus</i>)	
Woodland Jumping Mouse (<i>Napaeozapus hudsonius</i>)	
Eastern Red Bat (<i>Lasiurus borealis</i>)	
Hoary Bat (<i>Lasiurus cinereus</i>)	
Silver-haired Bat (<i>Lasionycteris noctivagans</i>)	
Gray Fox (<i>Urocyon cinereoargenteus</i>)	
Long-tailed Weasel (<i>Mustela frenata</i>)	

Species	State Status
Breeding-Season Birds (not all SGCN species are included)	
Trumpeter Swan (<i>Cygnus buccinator</i>)	THR proposed SPC
Peregrine Falcon (<i>Falco peregrinus</i>)†	THR proposed SPC
Wilson's Phalarope (<i>Phalaropus tricolor</i>)	THR
Bald Eagle (<i>Haliaeetus leucocephalus</i>)†	SPC proposed delisted
Red-shouldered Hawk (<i>Buteo lineatus</i>)	SPC
Yellow Rail (<i>Coturnicops noveboracensis</i>)	SPC
Northern Goshawk (<i>Accipiter gentilis</i>)†	SGCN proposed SPC
Boreal Owl (<i>Aegolius funereus</i>)†	SGCN proposed SPC
American Black Duck (<i>Anas rubripes</i>)	SGCN
Spruce Grouse (<i>Falcipennis canadensis</i>)	SGCN
Sharp-tailed Grouse (<i>Tympanuchus phasianellus</i>)	SGCN
American Bittern (<i>Botaurus lentiginosus</i>)	SGCN
Northern Harrier (<i>Circus cyaneus</i>)	SGCN
Upland Sandpiper (<i>Bartramia longicauda</i>)	SGCN
Eastern Whip-poor-will (<i>Antrostomus vociferus</i>)	SGCN
Black-backed Woodpecker (<i>Picoides arcticus</i>)	SGCN
Olive-sided Flycatcher (<i>Contopus cooperi</i>)†	SGCN
Golden-winged Warbler (<i>Vermivora chrysoptera</i>)	SGCN
Cape May Warbler (<i>Setophaga tigrina</i>)	SGCN
Black-throated Blue Warbler (<i>Setophaga caerulescens</i>)	SGCN
Bay-breasted Warbler (<i>Setophaga castanea</i>)†	SGCN
Connecticut Warbler (<i>Oporornis agilis</i>)†	SGCN
LeConte's Sparrow (<i>Ammodramus leconteii</i>)	SGCN
Rusty Blackbird (<i>Euphagus carolinus</i>)	SGCN
Other birds of regional interest	
Osprey (<i>Pandion haliaetus</i>)	
Merlin (<i>Falco columbarius</i>)	
Sandhill Crane (<i>Grus canadensis</i>)	
Solitary Sandpiper (<i>Tringa solitaria</i>)	
Great Gray Owl (<i>Stix nebulosa</i>)†	
Long-eared Owl (<i>Asio otus</i>)	
American Three-toed Woodpecker (<i>Picoides dorsalis</i>)†	
Philadelphia Vireo (<i>Vireo philadelphicus</i>)	
Tennessee Warbler (<i>Oreothlypis peregrina</i>)	
Wilson's Warbler (<i>Cardellina pusilla</i>)	
Red Crossbill (<i>Loxia curvirostra</i>)	
White-winged Crossbill (<i>Loxia leucoptera</i>)	

Species	State Status
Amphibians and Reptiles	
Blanding's Turtle (<i>Emydoidea blandingii</i>)	THR
Wood Turtle (<i>Glyptemys insculpta</i>)†	THR
Four-toed Salamander (<i>Hemidactylium scutatum</i>)	SPC
Snapping Turtle (<i>Chelydra serpentina</i>)	SPC
Spotted Salamander (<i>Ambystoma maculatum</i>)	SGCN proposed SPC
Mudpuppy (<i>Necturus maculosus</i>)	SGCN proposed SPC
Eastern Red-backed Salamander (<i>Plethodon cinereus</i>)	SGCN
Other herpetofauna of regional interest	
Blue-spotted Salamander (<i>Ambystoma laterale</i>)	
Unisexual Ambystomatids (<i>Ambystoma laterale x jeffersonianum</i>)	
Spiny Softshell (<i>Apalone spinifera</i>)	
Prairie Skink (<i>Plestiodon septentrionalis</i>)	
Ring-necked Snake (<i>Diadophis punctatus</i>)	
Fishes	
Pugnose Shiner (<i>Notropis anogenus</i>)	SPC proposed THR
Northern Brook Lamprey (<i>Ichthyomyzon fossor</i>)†	SPC
Lake Sturgeon (<i>Acipenser fulvescens</i>)†	SPC
Kiyi (<i>Coregonus kiyi</i>)	SPC
Shortjaw Cisco (<i>Coregonus zenithicus</i>)†	SPC
Least Darter (<i>Etheostoma microperca</i>)	SPC
Nipigon Cisco (<i>Coregonus nipigon</i>)†	SGCN proposed SPC
Pygmy Whitefish (<i>Prosopium coulteri</i>)	SGCN proposed SPC
Lake Chub (<i>Couesius plumbeus</i>)	SGCN proposed SPC
Longear Sunfish (<i>Lepomis megalotis</i>)	SGCN proposed SPC
Bloater (<i>Coregonus hoyi</i>)	SGCN
Greater Redhorse (<i>Moxostoma valenciennesi</i>)	SGCN
Spoonhead Sculpin (<i>Cottus ricei</i>)	SGCN
Deepwater Sculpin (<i>Myoxocephalus thompsoni</i>)	SGCN
Other fishes of regional interest	
Blacknose Shiner (<i>Notropis heterolepis</i>)	
Round Whitefish (<i>Prosopium cylindraceum</i>)	
Hornyhead Chub (<i>Nocomis biguttatus</i>)	
Blackchin Shiner (<i>Notropis heterodon</i>)	
Longnose Sucker (<i>Catostomus catostomus</i>)	
Stonecat (<i>Noturus flavus</i>)	
Ninespine Stickleback (<i>Pungitius pungitius</i>)	

Species	State Status
Butterflies and Moths	
Grizzled Skipper (<i>Pyrgus centaureae freija</i>)†	SPC
Leonard's Skipper (<i>Hesperia leonardus</i>)	SPC
Nabokov's Blue (<i>Plebejus idas nabokovi</i>)†	SPC
Taiga Alpine (<i>Erebia mancinus</i>)†	SPC
Two-spotted Sedge Skipper (<i>Euphyes bimacula</i>)	SGCN
Tawny Crescent (<i>Phyciodes batesii</i>)	SGCN
Macoun's Arctic (<i>Oeneis macounii</i>)	SGCN
Other lepidoptera of regional interest	
Sleepy Dusky-wing (<i>Erynnis brizo</i>)	
Mottled Dusky-wing (<i>Erynnis martialis</i>)	
Columbine Dusky-wing (<i>Erynnis lucilius</i>)	
Laurentian Skipper (<i>Hesperia comma laurentina</i>)	
Indian Skipper (<i>Hesperia sassacus</i>)	
Broad-winged Skipper (<i>Poanes viator</i>)	
Dion Skipper (<i>Euphyes dion</i>)	
Black Dash (<i>Euphyes conspicua</i>)	
Old World Swallowtail (<i>Papilio machaon hudsonianus</i>)	
Large Marble (<i>Euchloe ausonides</i>)	
Olympia Marble (<i>Euchloe olympia</i>)	
Giant Sulphur (<i>Colias scudderi gigantea</i>)	
Western Pine Elfin (<i>Callophrys eryphon</i>)	
Bog Fritillary (<i>Boloria eunomia</i>)	
Freija Fritillary (<i>Boloria freija</i>)	
Frigga Fritillary (<i>Boloria frigga</i>)	
Purple Lesser Fritillary (<i>Boloria chariclea grandis</i>)	
Baltimore (<i>Euphydryas phaeton</i>)	
Satyr Anglewing (<i>Polygonia satyrus</i>)	
Hoary Comma (<i>Polygonia gracilis</i>)	
Appalachian Eyed Brown (<i>Satyrodes appalachia</i>)	
Red-disked Alpine (<i>Erebia discoidalis</i>)†	
Jutta Arctic (<i>Oeneis jutta ascerta</i>)†	
Manchester Treble-bar (<i>Carsia sororiata</i>)	
Slender Clearwing (<i>Hemaris gracilis</i>)	
Yellow-banded Sphinx (<i>Proserpinus flavofasciata</i>)	
Wood Tiger Moth (<i>Parasemia plantaginis</i>)	
Shadowy Arches (<i>Drasteria adumbrata</i>)	
Pitcher Plant Moth (<i>Exyra fax</i>)	
Small Gamma Looper (<i>Syngrapha microgamma</i>)	
A Noctuid moth (<i>Syngrapha montana</i>)	

Species	State Status
A Noctuid moth (<i>Brachioynycha borealis</i>)	
Boreal Gem (<i>Heliothis borealis</i>)	
A Noctuid moth (<i>Hypocoena basistriga</i>)	
A Noctuid moth (<i>Lithophane adipel</i>)	
A Noctuid moth (<i>Lithophane georgii</i>)	
A Noctuid moth (<i>Coranarta luteola</i>)	
A Noctuid moth (<i>Papestra cristifera</i>)	
A Noctuid moth (<i>Lasionycta secedens</i>)	
A Noctuid moth (<i>Lasionycta taigata</i>)	
A Noctuid moth (<i>Xestia mixta</i>)	
Dragonflies	
Elusive Clubtail (<i>Gomphus notatus</i>)	SGCN
Skillet Clubtail (<i>Gomphus ventricosus</i>)	SGCN
Green-faced Clubtail (<i>Gomphus viridifrons</i>)	SGCN
Quebec Emerald Dragonfly (<i>Somatochlora brevicincta</i>) †	
Ebony Boghaunter (<i>Williamsonia flecheri</i>) †	
Tiger Beetles	
Laurentian Tiger Beetle (<i>Cincindela denikei</i>)†	THR proposed SPC
Hairy-necked Tiger Beetle (<i>Cincindela hirticollis rhodensis</i>)	SPC proposed END
Caddisflies	
Headwaters Chilostigman Caddisfly (<i>Chilostigma itascaae</i>) †	END proposed THR
Jumping Spiders	
<i>Marpissa grata</i>	SPC proposed delisted
<i>Paradamoetas fontana</i>	SPC
Other jumping spiders of regional interest	
<i>Euophrys monadnock</i>	
<i>Habronattus americanus</i>	
<i>Habronattus calcaratus maddisoni</i>	proposed SPC
<i>Naphrys pulex</i>	
<i>Neon nelli</i>	
<i>Phidippus borealis</i>	
<i>Phidippus cryptus</i>	
<i>Phidippus purpuratus</i>	
<i>Phidippus whitmani</i>	
<i>Talavera minuta</i>	
<i>Tutelina similis</i>	
<i>Zygoballus rufipes</i>	

Table 2. Mammals records from Beltrami, Cook, Koochiching, Lake and St. Louis counties.

X = documented by MBS (2010 - 2012); **x** = documented by MBS (pre-2010); **o** = records from other sources

Common Name	Scientific Name	Status	County Records				
			Beltrami	Cook	Koochiching	Lake	St. Louis
Virginia Opossum	<i>Didelphis virginiana</i>						o
Eastern Gray Squirrel	<i>Sciurus carolinensis</i>		o	x		o	o
Eastern Fox Squirrel	<i>Sciurus niger</i>		o				o
Red Squirrel	<i>Tamiasciurus hudsonicus</i>		o	x	o	X	X
Northern Flying Squirrel	<i>Glaucomys sabrinus</i>		o	X	o	X	X
Plains Pocket Gopher	<i>Geomys bursarius</i>		o				
Woodchuck	<i>Marmota monax</i>		o	x	o	o	X
Thirteen-lined Ground Squirrel	<i>Ictidomys tridecemlineatus</i>		o		o		o
Franklin's Ground Squirrel	<i>Poliocitellus franklinii</i>	SGCN	X			x	X
Eastern Chipmunk	<i>Tamias striatus</i>		o	x	o	x	X
Least Chipmunk	<i>Neotamias minimus</i>		o	X	o	X	X
American Beaver	<i>Castor canadensis</i>		o	x	o	o	o
Woodland Jumping Mouse	<i>Napaeozapus insignis</i>	RI		x		x	X
Meadow Jumping Mouse	<i>Zapus hudsonius</i>		o	x	o	x	X
Rock Vole	<i>Microtus chrotorrhinus</i>	SGCN		X		X	X
Meadow Vole	<i>Microtus pennsylvanicus</i>		X	X	X	X	X
Southern Red-backed Vole	<i>Myodes gapperi</i>		X	X	X	X	X
Common Muskrat	<i>Ondatra zibethicus</i>		o	o	o	o	X
Eastern Heather Vole	<i>Phenacomys ungava</i>	SPC		X		X	X
Southern Bog Lemming	<i>Synaptomys cooperi</i>		o	X		X	X
Northern Bog Lemming	<i>Synaptomys borealis</i>	SPC	o		X		X
Prairie Deer Mouse	<i>Peromyscus maniculatus bairdii</i>		o				
White-footed Deermouse	<i>Peromyscus leucopus</i>		o			X	X
Woodland Deermouse	<i>Peromyscus maniculatus gracilis</i>		o	X	o	X	X
House Mouse	<i>Mus musculus</i>		o		o		o
Brown Rat	<i>Rattus norvegicus</i>		o	o	o	o	o
North American Porcupine	<i>Erethizon dorsatum</i>		o	x		o	o
Snowshoe Hare	<i>Lepus americanus</i>		o	X	o	x	X
Eastern Cottontail	<i>Sylvilagus floridanus</i>		o				o
Northern Short-tailed Shrew	<i>Blarina brevicauda</i>		o	X	o	X	X

Table 2. continued.

Common Name	Scientific Name	Status	County Records				
			Beltrami	Cook	Koochiching	Lake	St. Louis
Arctic Shrew	<i>Sorex arcticus</i>		o	X	X	X	X
Cinereus Shrew	<i>Sorex cinereus</i>		X	X	X	X	X
Smoky Shrew	<i>Sorex fumeus</i>	SPC		x		x	X
American Pygmy Shrew	<i>Sorex hoyi</i>		X	x	o	X	X
American Water Shrew	<i>Sorex palustris</i>		o	x	o	x	x
Star-nosed Mole	<i>Condylura cristata</i>		o	x	o	x	o
Big Brown Bat	<i>Eptesicus fuscus</i>			x		x	X
Eastern Red Bat	<i>Lasiurus borealis</i>	RI	X	x	X	x	X
Hoary Bat	<i>Lasiurus cinereus</i>	RI	X	x	X	x	X
Tri-colored Bat	<i>Perimyotis subflavus</i>	SPC				x	X
Silver-haired Bat	<i>Lasionycteris noctivagans</i>	RI		x			x
Little Brown Myotis	<i>Myotis lucifugus</i>		X	x	X	x	X
Northern Myotis	<i>Myotis septentrionalis</i>	SPC		x		x	x
Canadian Lynx	<i>Lynx canadensis</i>	SGCN	o	o		o	
Bobcat	<i>Lynx rufus</i>		o	o	o	o	o
Coyote	<i>Canis latrans</i>		o	x	o	o	o
Wolf	<i>Canis lupus</i>	SPC	o	x	o	x	X
Gray Fox	<i>Urocyon cinereoargenteus</i>		o	x	o		o
Red Fox	<i>Vulpes vulpes</i>		o	x	o	o	X
American Black Bear	<i>Ursus americanus</i>		o	x		X	X
North American River Otter	<i>Lontra canadensis</i>		o	o	o	o	o
American Marten	<i>Martes americana</i>			x	o	o	X
Fisher	<i>Martes pennanti</i>		o	o	o	o	X
Ermine	<i>Mustela erminea</i>		o	x	o	x	X
Long-tailed Weasel	<i>Mustela frenata</i>		o		o		o
American Mink	<i>Neovison vison</i>		o	x	o	o	o
American Badger	<i>Taxidea taxus</i>	SGCN	o	o	o	x	o
Striped Skunk	<i>Mephitis mephitis</i>		o	o	o	o	
Eastern Spotted Skunk	<i>Spilogale putorius</i>	THR					o
Raccoon	<i>Procyon lotor</i>		o		o		o
Moose	<i>Alces americanus</i>		o	x		X	X
White-tailed Deer	<i>Odocoileus virginianus</i>		o	x	o	x	X

Table 2. continued.

Common Name	Scientific Name	Status	County Records				
			Beltrami	Cook	Koochiching	Lake	St. Louis
Caribou	<i>Rangifer tarandus</i>			0			

Status categories:

END state endangered

THR state threatened

SPC state special concern

SGCN species of greatest conservation need

RI regional interest

Table 3. MBS bird species documented during 2011 and 2012 breeding seasons from St. Louis, Lake, Beltrami and Lake of the Woods counties.

*Records = number of survey locations where species was detected.

Common name	Scientific name	Status	Primary Habitat	Number of Survey Locations by County				Total Records*
				St. Louis	Lake	Beltrami	LOW	
Spruce Grouse	<i>Falcipennis canadensis</i>	SGCN	conifer	3				3
Black-backed Woodpecker	<i>Picoides arcticus</i>	SGCN	conifer	42				42
Olive-sided Flycatcher	<i>Contopus cooperi</i>	SGCN	conifer	26				26
Boreal Chickadee	<i>Poecile hudsonicus</i>	SGCN	conifer	20				20
Winter Wren	<i>Troglodytes hiemalis</i>	SGCN	conifer	145				145
Connecticut Warbler	<i>Oporornis agilis</i>	SGCN	conifer	52	1			53
Cape May Warbler	<i>Setophaga tigrina</i>	SGCN	conifer	76				76
Bay-breasted Warbler	<i>Setophaga castanea</i>	SGCN	conifer	6				6
Canada Warbler	<i>Cardellina canadensis</i>	SGCN	conifer	158	2			160
White-throated Sparrow	<i>Zonotrichia albicollis</i>	SGCN	conifer	540	6	1		547
Wood Thrush	<i>Hylocichla mustelina</i>	SGCN	deciduous	19				19
Sharp-tailed Grouse	<i>Tympanuchus phasianellus</i>	SGCN	grassland	4				4
Northern Harrier	<i>Circus cyaneus</i>	SGCN	grassland	24	1			25
Upland Sandpiper	<i>Bartramia longicauda</i>	SGCN	grassland	6				6
Marbled Godwit	<i>Limosa fedoa</i>	SPC	grassland			1		1
Dickcissel	<i>Spiza americana</i>	SGCN	grassland	13				13
Bobolink	<i>Dolichonyx oryzivorus</i>	SGCN	grassland	78				78
Eastern Meadowlark	<i>Sturnella magna</i>	SGCN	grassland	4				4
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>	SGCN	mixed	218	1			219
Eastern Wood-Pewee	<i>Contopus virens</i>	SGCN	mixed	114				114
Least Flycatcher	<i>Empidonax minimus</i>	SGCN	mixed	237	2	2	1	242
Veery	<i>Catharus fuscescens</i>	SGCN	mixed	365	4	1	1	371
Ovenbird	<i>Seiurus aurocapilla</i>	SGCN	mixed	625	5		1	631
Black-throated Blue Warbler	<i>Setophaga caerulescens</i>	SGCN	mixed	14				14
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	SGCN	mixed	264	3			267
American Woodcock	<i>Scolopax minor</i>	SGCN	shrub/edge	15				15
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	SGCN	shrub/edge	37				37
Eastern Whip-poor-will	<i>Caprimulgus vociferus</i>	SGCN	shrub/edge	8				8
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	SGCN	shrub/edge	5				5
Brown Thrasher	<i>Toxostoma rufum</i>	SGCN	shrub/edge	8				8

Table 3. continued.

Common name	Scientific name	Status	Primary Habitat	Number of Survey Locations by County				Total Records*
				St. Louis	Lake	Beltrami	LOW	
Golden-winged Warbler	<i>Vermivora chrysoptera</i>	SGCN	shrub/edge	17				17
Trumpeter Swan	<i>Cygnus buccinator</i>	THR	wetland	17				17
American Black Duck	<i>Anas rubripes</i>	SGCN	wetland	7	1			8
Common Loon	<i>Gavia immer</i>	SGCN	wetland	93				93
Eared Grebe	<i>Podiceps nigricollis</i>	SGCN	wetland	1				1
American Bittern	<i>Botaurus lentiginosus</i>	SGCN	wetland	24				24
Bald Eagle	<i>Haliaeetus leucocephalus</i>	SPC	wetland	22				22
Virginia Rail	<i>Rallus limicola</i>	SGCN	wetland	2				2
Common Tern	<i>Sterna hirundo</i>	THR	wetland	1				1
Sedge Wren	<i>Cistothorus platensis</i>	SGCN	wetland	80				80
Marsh Wren	<i>Cistothorus palustris</i>	SGCN	wetland	4				4
Le Conte's Sparrow	<i>Ammodramus leconteii</i>	SGCN	wetland	23				23
Swamp Sparrow	<i>Melospiza georgiana</i>	SGCN	wetland	286	6	2		294
Canada Goose	<i>Branta canadensis</i>			29				29
Wood Duck	<i>Aix sponsa</i>			37	1		1	39
American Wigeon	<i>Anas americana</i>			1				1
Mallard	<i>Anas platyrhynchos</i>			67				67
Blue-winged Teal	<i>Anas discors</i>			6				6
Northern Shoveler	<i>Anas clypeata</i>			2				2
Green-winged Teal	<i>Anas crecca</i>			5				5
Ring-necked Duck	<i>Aythya collaris</i>			52				52
Common Goldeneye	<i>Bucephala clangula</i>			27				27
Hooded Merganser	<i>Lophodytes cucullatus</i>			30				30
Common Merganser	<i>Mergus merganser</i>			16				16
Ruffed Grouse	<i>Bonasa umbellus</i>			57				57
Wild Turkey	<i>Meleagris gallopavo</i>			1				1
Pied-billed Grebe	<i>Podilymbus podiceps</i>			8				8
Double-crested Cormorant	<i>Phalacrocorax auritus</i>			5				5
Great Blue Heron	<i>Ardea herodias</i>			27				27
Green Heron	<i>Butorides virescens</i>			5				5
Turkey Vulture	<i>Cathartes aura</i>			31				31

Table 3. continued.

Common name	Scientific name	Status	Primary Habitat	Number of Survey Locations by County				Total Records*
				St. Louis	Lake	Beltrami	LOW	
Osprey	<i>Pandion haliaetus</i>			16				16
Sharp-shinned Hawk	<i>Accipiter striatus</i>			7				7
Cooper's Hawk	<i>Accipiter cooperii</i>			2				2
Broad-winged Hawk	<i>Buteo platypterus</i>			44				44
Red-tailed Hawk	<i>Buteo jamaicensis</i>			14				14
Sora	<i>Porzana carolina</i>			6				6
Sandhill Crane	<i>Grus canadensis</i>			15		1		16
Killdeer	<i>Charadrius vociferus</i>			22				22
Spotted Sandpiper	<i>Actitis macularius</i>			17				17
Solitary Sandpiper	<i>Tringa solitaria</i>						1	1
Wilson's Snipe	<i>Gallinago delicata</i>			68	3	2		73
Ring-billed Gull	<i>Larus delawarensis</i>			15				15
Herring Gull	<i>Larus argentatus</i>			38				38
Rock Pigeon	<i>Columba livia</i>			10				10
Mourning Dove	<i>Zenaida macroura</i>			33				33
Northern Hawk Owl	<i>Surnia ulula</i>			2				2
Barred Owl	<i>Strix varia</i>			5				5
Great Gray Owl	<i>Strix nebulosa</i>			2				2
Northern Saw-whet Owl	<i>Aegolius acadicus</i>			2				2
Common Nighthawk	<i>Chordeiles minor</i>	SGCN		9				9
Chimney Swift	<i>Chaetura pelagica</i>			6				6
Ruby-throated Hummingbird	<i>Archilochus colubris</i>			31				31
Belted Kingfisher	<i>Megaceryle alcyon</i>			21				21
Red-bellied Woodpecker	<i>Melanerpes carolinus</i>			1				1
Downy Woodpecker	<i>Picoides pubescens</i>			20				20
Hairy Woodpecker	<i>Picoides villosus</i>			74	1	1		76
Northern Flicker	<i>Colaptes auratus</i>			170				170
Pileated Woodpecker	<i>Dryocopus pileatus</i>			139				139
American Kestrel	<i>Falco sparverius</i>			35				35
Merlin	<i>Falco columbarius</i>			20				20
Yellow-bellied Flycatcher	<i>Empidonax flaviventris</i>			167	3			170

Table 3. continued.

Common name	Scientific name	Status	Primary Habitat	Number of Survey Locations by County				Total Records*
				St. Louis	Lake	Beltrami	LOW	
Alder Flycatcher	<i>Empidonax alnorum</i>			242	2	1		245
Eastern Phoebe	<i>Sayornis phoebe</i>			37				37
Great Crested Flycatcher	<i>Myiarchus crinitus</i>			40				40
Eastern Kingbird	<i>Tyrannus tyrannus</i>			79				79
Yellow-throated Vireo	<i>Vireo flavifrons</i>			3			1	4
Blue-headed Vireo	<i>Vireo solitarius</i>			93	3			96
Warbling Vireo	<i>Vireo gilvus</i>			11				11
Philadelphia Vireo	<i>Vireo philadelphicus</i>			8				8
Red-eyed Vireo	<i>Vireo olivaceus</i>			731	5	1		737
Gray Jay	<i>Perisoreus canadensis</i>			142				142
Blue Jay	<i>Cyanocitta cristata</i>			324	6		1	331
Black-billed Magpie	<i>Pica hudsonia</i>			23				23
American Crow	<i>Corvus brachyrhynchos</i>			197		2		199
Common Raven	<i>Corvus corax</i>			144		1		145
Tree Swallow	<i>Tachycineta bicolor</i>			54		2		56
Bank Swallow	<i>Riparia riparia</i>			7				7
Cliff Swallow	<i>Petrochelidon pyrrhonata</i>			17				17
Barn Swallow	<i>Hirundo rustica</i>			34		1	1	36
Black-capped Chickadee	<i>Poecile atricapillus</i>			152	1			153
Red-breasted Nuthatch	<i>Sitta canadensis</i>			266	2			268
White-breasted Nuthatch	<i>Sitta carolinensis</i>			26				26
Brown Creeper	<i>Certhia americana</i>			42				42
House Wren	<i>Troglodytes aedon</i>			16		1		17
Golden-crowned Kinglet	<i>Regulus satrapa</i>			57				57
Ruby-crowned Kinglet	<i>Regulus calendula</i>			126	1			127
Eastern Bluebird	<i>Sialia sialis</i>			18				18
Swainson's Thrush	<i>Catharus ustulatus</i>			66	1			67
Hermit Thrush	<i>Catharus guttatus</i>			344	10			354
American Robin	<i>Turdus migratorius</i>			403	6			409
Gray Catbird	<i>Dumetella carolinensis</i>			53		1		54
European Starling	<i>Sturnus vulgaris</i>			51				51

Table 3. continued.

Common name	Scientific name	Status	Primary Habitat	Number of Survey Locations by County				Total Records*
				St. Louis	Lake	Beltrami	LOW	
Cedar Waxwing	<i>Bombycilla cedrorum</i>			88	1			89
Northern Waterthrush	<i>Parkesia noveboracensis</i>			45	1			46
Black-and-white Warbler	<i>Mniotilta varia</i>			158				158
Tennessee Warbler	<i>Oreothlypis peregrina</i>			78	1			79
Nashville Warbler	<i>Oreothlypis ruficapilla</i>			576	8			584
Mourning Warbler	<i>Geothlypis philadelphia</i>			169				169
Common Yellowthroat	<i>Geothlypis trichas</i>			426	4	1	1	432
American Redstart	<i>Setophaga ruticilla</i>			52		1		53
Northern Parula	<i>Setophaga americana</i>			110				110
Magnolia Warbler	<i>Setophaga magnolia</i>			156	3			159
Blackburnian Warbler	<i>Setophaga fusca</i>			133				133
Yellow Warbler	<i>Setophaga petechia</i>			112		2		114
Chestnut-sided Warbler	<i>Setophaga pensylvanica</i>			304	4		1	309
Palm Warbler	<i>Setophaga palmarum</i>			104	6		1	111
Pine Warbler	<i>Setophaga pinus</i>			103				103
Yellow-rumped Warbler	<i>Setophaga coronata</i>			161	2			163
Black-throated Green Warbler	<i>Setophaga virens</i>			198				198
Wilson's Warbler	<i>Cardellina pusilla</i>			5				5
Chipping Sparrow	<i>Spizella passerina</i>			134	1			135
Clay-colored Sparrow	<i>Spizella pallida</i>			53	1			54
Vesper Sparrow	<i>Pooecetes gramineus</i>			3				3
Savannah Sparrow	<i>Passerculus sandwichensis</i>			7				7
Song Sparrow	<i>Melospiza melodia</i>			355	4	2	1	362
Lincoln's Sparrow	<i>Melospiza lincolni</i>			117	7	1		125
Dark-eyed Junco	<i>Junco hyemalis</i>			31	2			33
Scarlet Tanager	<i>Piranga olivacea</i>			77				77
Northern Cardinal	<i>Cardinalis cardinalis</i>			1				1
Indigo Bunting	<i>Passerina cyanea</i>			140	4			144
Red-winged Blackbird	<i>Agelaius phoeniceus</i>			225		3		228
Western Meadowlark	<i>Sturnella neglecta</i>			3				3
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>			27				27

Table 3. continued.

Common name	Scientific name	Status	Primary Habitat	Number of Survey Locations by County				Total Records*
				St. Louis	Lake	Beltrami	LOW	
Common Grackle	<i>Quiscalus quiscula</i>			64				64
Brown-headed Cowbird	<i>Molothrus ater</i>			13		2		15
Baltimore Oriole	<i>Icterus galbula</i>			7				7
Purple Finch	<i>Carpodacus purpureus</i>			121	1			122
House Finch	<i>Carpodacus mexicanus</i>			1				1
Red Crossbill	<i>Loxia curvirostra</i>			9				9
White-winged Crossbill	<i>Loxia leucoptera</i>			2	1			3
Pine Siskin	<i>Spinus pinus</i>			14				14
American Goldfinch	<i>Spinus tristis</i>			99		1	1	101
Evening Grosbeak	<i>Coccothraustes vespertinus</i>			52	1			53
House Sparrow	<i>Passer domesticus</i>			17				17
Total				173	48	29	18	13,652

Table 4. Amphibians and reptiles documented by MBS during 2011-2012 surveys in St. Louis County

Common Name	Scientific Name	Status
Blue-spotted Salamander	<i>Ambystoma laterale</i>	
Four-toed Salamander	<i>Hemidactylium scutatum</i>	SPC
Eastern Red-backed Salamander	<i>Plethodon cinereus</i>	SGCN
Eastern Newt	<i>Notophthalmus viridescens</i>	
American Toad	<i>Anaxyrus americanus</i>	
Gray Treefrog	<i>Hyla versicolor</i>	
Spring Peeper	<i>Pseudacris crucifer</i>	
Boreal Chorus Frog	<i>Pseudacris maculata</i>	
Green Frog	<i>Lithobates clamitans</i>	
Northern Leopard Frog	<i>Lithobates pipiens</i>	
Mink Frog	<i>Lithobates septentrionalis</i>	
Wood Frog	<i>Lithobates sylvaticus</i>	
Snapping Turtle	<i>Chelydra serpentina</i>	SPC
Painted Turtle	<i>Chrysemys picta</i>	
Wood Turtle	<i>Glyptemys insculpta</i>	THR
Common Gartersnake	<i>Thamnophis sirtalis</i>	

Status categories:

END state endangered

THR state threatened

SPC state special concern

SGCN species of greatest conservation need

Table 5. Fish species documented during MBS surveys in St. Louis County.

Common Name	Scientific Name	Status
Northern Brook Lamprey	<i>Ichthyomyzon fossor</i>	SPC
Northern Redbelly Dace	<i>Chrosomus eos</i>	
Common Shiner	<i>Luxilus cornutus</i>	
Pearl Dace	<i>Margariscus margarita</i>	
Hornyhead Chub	<i>Nocomis biguttatus</i>	
Golden Shiner	<i>Notemigonus crysoleucas</i>	
Blackchin Shiner	<i>Notropis heterodon</i>	
Blacknose Shiner	<i>Notropis heterolepis</i>	
Spottail Shiner	<i>Notropis hudsonius</i>	
Mimic Shiner	<i>Notropis volucellus</i>	
Bluntnose Minnow	<i>Pimephales notatus</i>	
Blacknose Dace	<i>Rhinichthys atratulus</i>	
Longnose Dace	<i>Rhinichthys cataractae</i>	
Creek Chub	<i>Semotilus atromaculatus</i>	
White Sucker	<i>Catostomus commersoni</i>	
Golden Redhorse	<i>Moxostoma erythrurum</i>	
Shorthead Redhorse	<i>Moxostoma macrolepidotum</i>	
Black Bullhead	<i>Ameiurus melas</i>	
Yellow Bullhead	<i>Ameiurus natalis</i>	
Stonecat	<i>Noturus flavus</i>	
Tadpole Madtom	<i>Noturus gyrinus</i>	
Central Mudminnow	<i>Umbra limi</i>	
Northern Pike	<i>Esox lucius</i>	
Cisco	<i>Coregonus artedii</i>	
Lake Whitefish	<i>Coregonus clupeaformis</i>	
Shortjaw Cisco	<i>Coregonus zenithicus</i>	SPC
Brook Trout	<i>Salvelinus fontinalis</i>	
Lake Trout	<i>Salvelinus namaycush</i>	
Burbot	<i>Lota lota</i>	
Trout Perch	<i>Percopsis omiscomaycus</i>	
Mottled Sculpin	<i>Cottus bairdi</i>	
Slimy Sculpin	<i>Cottus cognatus</i>	
Rock Bass	<i>Ambloplites rupestris</i>	
Green Sunfish	<i>Lepomis cyanellus</i>	
Pumpkinseed	<i>Lepomis gibbosus</i>	
Bluegill	<i>Lepomis macrochirus</i>	
Longear Sunfish	<i>Lepomis megalotis</i>	SGCN
Hybrid Sunfish	<i>Lepomis sp. x Lepomis sp.</i>	

Table 5. continued

Common Name	Scientific Name	Status
Smallmouth Bass	<i>Micropterus dolomieu</i>	
Largemouth Bass	<i>Micropterus salmoides</i>	
Black Crappie	<i>Pomoxis nigromaculatus</i>	
Iowa Darter	<i>Etheostoma exile</i>	
Least Darter	<i>Etheostoma microperca</i>	SPC
Johnny Darter	<i>Etheostoma nigrum</i>	
Yellow Perch	<i>Perca flavescens</i>	
Logperch	<i>Percina caprodes</i>	
Blackside Darter	<i>Percina maculata</i>	
Walleye	<i>Sander vitreus</i>	

Status categories:

END state endangered

THR state threatened

SPC state special concern

SGCN species of greatest conservation need

Table 6. Areas sampled for jumping spiders by W.J. Ehmann and crew during 2011.

Area	County
Armstrong Lake	St. Louis
Arrowhead Trail (near Wakemup Bay)	Lake
Bear Head State Park	St. Louis
Bug Creek Trail	St. Louis
Cook Area Transfer Station	Lake
Cub Lake Trail	St. Louis
Fernberg Trail	Lake
Hillside Cemetery (near Angora)	St. Louis
Orr Regional Airport	St. Louis
Rookie Lake Overlook	Lake
Snowbank Trail (near Birch Island)	Lake
Superior National Forest	Lake
Superior National Forest	St. Louis
Vermillion Falls	St. Louis
Willow Valley Cemetery	St. Louis

Table 7. Jumping spiders collected during 2011 surveys.

Species	Count
<i>Admestina tibialis</i> (C.L. Koch, 1846)	1
<i>Attidops</i> sp.	1
<i>Eris militaris</i> (Hentz, 1845)	15
<i>Evarcha hoyi</i> (Peckham & Peckham, 1883)	52
<i>Habronattus</i> sp.	3
<i>Neon nelli</i> Peckham & Peckham, 1888	44
<i>Pelegrina proterva</i> (Walckenaer, 1837)	4
<i>Pelegrina</i> sp.	3
<i>Phidippus clarus</i> Keyserling, 1885	1
<i>Phidippus purpuratus</i> Keyserling, 1884	5
<i>Phidippus</i> sp.	88
<i>Tutelina</i> sp.	5
Unidentified (see database for notes)	12
Total	234

Table 8. Bird species documented during breeding-season shrike surveys (June-July), 2011-2012 in west-central Minnesota.

Common name	Scientific name	Status	Primary habitat	Clay	Grant	Otter Tail	Pope	Stevens	Wilkin	Total Records
Canada Goose	<i>Branta canadensis</i>			4				1	4	9
Trumpeter Swan	<i>Cygnus buccinator</i>	THR	wetland	2		1				3
Wood Duck	<i>Aix sponsa</i>							1	4	5
Gadwall	<i>Anas strepera</i>			1	2					3
American Wigeon	<i>Anas americana</i>			1						1
Mallard	<i>Anas platyrhynchos</i>			4	5	1		2	4	16
Blue-winged Teal	<i>Anas discors</i>			2	4				3	9
Green-winged Teal	<i>Anas crecca</i>				2					2
Canvasback	<i>Aythya valisineria</i>			1					1	2
Redhead	<i>Aythya americana</i>			1	1					2
Ring-necked Duck	<i>Aythya collaris</i>			1	1	1			1	4
Ring-necked Pheasant	<i>Phasianus colchicus</i>			1					1	2
Greater Prairie-Chicken	<i>Tympanuchus cupido</i>	SPC	grassland	1						1
Common Loon	<i>Gavia immer</i>	SGCN	wetland	2		1				3
Pied-billed Grebe	<i>Podilymbus podiceps</i>			1					1	2
Red-necked Grebe	<i>Podiceps grisegena</i>	SGCN	wetland	1						1
Double-crested Cormorant	<i>Phalacrocorax auritus</i>			1		1			1	3
American White Pelican	<i>Pelecanus erythrorhynchos</i>	SPC	wetland		2		1			3
Least Bittern	<i>Ixobrychus exilis</i>	SGCN	wetland						1	1
Great Blue Heron	<i>Ardea herodias</i>			4	2				4	10
Great Egret	<i>Ardea alba</i>				3	1			4	8
Green Heron	<i>Butorides virescens</i>			3					1	4
Turkey Vulture	<i>Cathartes aura</i>			2						2
Bald Eagle	<i>Haliaeetus leucocephalus</i>	SPC	wetland	2					1	3
Northern Harrier	<i>Circus cyaneus</i>	SGCN	grassland	11		3			14	28
Cooper's Hawk	<i>Accipiter cooperii</i>			1						1
Red-tailed Hawk	<i>Buteo jamaicensis</i>			22				2	10	34
Sora	<i>Porzana carolina</i>								1	1
American Coot	<i>Fulica americana</i>							1		1
Sandhill Crane	<i>Grus canadensis</i>			8					1	9
Killdeer	<i>Charadrius vociferus</i>			14	3	1	1	1	16	36
Spotted Sandpiper	<i>Actitis macularius</i>				1				2	3
Willet	<i>Tringa semipalmata</i>				1					1

Table 8. continued.

Common name	Scientific name	Status	Primary habitat	Clay	Grant	Otter Tail	Pope	Stevens	Wilkin	Total Records
Upland Sandpiper	<i>Bartramia longicauda</i>	SGCN	grassland	14						14
Marbled Godwit	<i>Limosa fedoa</i>	SPC	grassland						1	1
Wilson's Snipe	<i>Gallinago delicata</i>			3						3
Ring-billed Gull	<i>Larus delawarensis</i>			2	1				1	4
Black Tern	<i>Chlidonias niger</i>	SGCN	wetland	5	1			1	1	8
Forster's Tern	<i>Sterna forsteri</i>	SPC	wetland	1						1
Rock Pigeon	<i>Columba livia</i>			5					2	7
Mourning Dove	<i>Zenaida macroura</i>			41		5	2	1	12	61
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	SGCN	shrub/edge	1						1
Great Horned Owl	<i>Bubo virginianus</i>				1					1
Chimney Swift	<i>Chaetura pelagica</i>								1	1
Belted Kingfisher	<i>Megaceryle alcyon</i>			2						2
Red-bellied Woodpecker	<i>Melanerpes carolinus</i>			1						1
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>	SGCN	deciduous	1						1
Downy Woodpecker	<i>Picoides pubescens</i>			3						3
Hairy Woodpecker	<i>Picoides villosus</i>			3						3
Northern Flicker	<i>Colaptes auratus</i>			17				1	2	20
American Kestrel	<i>Falco sparverius</i>			19			1		2	22
Eastern Wood-Pewee	<i>Contopus virens</i>	SGCN	deciduous	2			1			3
Alder Flycatcher	<i>Empidonax alnorum</i>			4					1	5
Willow Flycatcher	<i>Empidonax traillii</i>	SGCN	shrub/edge	5					3	8
Least Flycatcher	<i>Empidonax minimus</i>	SGCN	deciduous	12					1	13
Eastern Phoebe	<i>Sayornis phoebe</i>								1	1
Great Crested Flycatcher	<i>Myiarchus crinitus</i>			2						2
Western Kingbird	<i>Tyrannus verticalis</i>			5					1	6
Eastern Kingbird	<i>Tyrannus tyrannus</i>			30				2	16	48
Loggerhead Shrike	<i>Lanius ludovicianus</i>	THR	grassland	1					1	2
Yellow-throated Vireo	<i>Vireo flavifrons</i>			1						1
Warbling Vireo	<i>Vireo gilvus</i>			6					1	7
Red-eyed Vireo	<i>Vireo olivaceus</i>			2						2
Blue Jay	<i>Cyanocitta cristata</i>			4						4
Black-billed Magpie	<i>Pica hudsonia</i>			1						1
American Crow	<i>Corvus brachyrhynchos</i>			22				2	5	29
Horned Lark	<i>Eremophila alpestris</i>			4					2	6

Table 8. continued.

Common name	Scientific name	Status	Primary habitat	Clay	Grant	Otter Tail	Pope	Stevens	Wilkin	Total Records
Purple Martin	<i>Progne subis</i>			2						2
Tree Swallow	<i>Tachycineta bicolor</i>			8	4	5		3	21	41
Bank Swallow	<i>Riparia riparia</i>			17	2	2			1	22
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>			34	1	4			22	61
Barn Swallow	<i>Hirundo rustica</i>			21		4			23	48
Black-capped Chickadee	<i>Poecile atricapillus</i>			5						5
White-breasted Nuthatch	<i>Sitta carolinensis</i>			3						3
House Wren	<i>Troglodytes aedon</i>			27				2	6	35
Sedge Wren	<i>Cistothorus platensis</i>	SGCN	grassland	28	1	3			29	61
Marsh Wren	<i>Cistothorus palustris</i>	SGCN	wetland	9	3				8	20
Eastern Bluebird	<i>Sialia sialis</i>			3						3
Veery	<i>Catharus fuscescens</i>	SGCN	deciduous	9						9
American Robin	<i>Turdus migratorius</i>			23		1		1	6	31
Gray Catbird	<i>Dumetella carolinensis</i>			7						7
Brown Thrasher	<i>Toxostoma rufum</i>	SGCN	shrub/edge	3						3
European Starling	<i>Sturnus vulgaris</i>			17	2		1	1	5	26
Cedar Waxwing	<i>Bombycilla cedrorum</i>			2		1			1	4
Chestnut-collared Longspur	<i>Calcarius ornatus</i>	END	grassland	1						1
Ovenbird	<i>Seiurus aurocapilla</i>	SGCN	deciduous	1						1
Common Yellowthroat	<i>Geothlypis trichas</i>			44	4	6	2	2	39	97
American Redstart	<i>Setophaga ruticilla</i>			2						2
Yellow Warbler	<i>Setophaga petechia</i>			5	1			1	1	8
Chipping Sparrow	<i>Spizella passerina</i>			3			1	1		5
Clay-colored Sparrow	<i>Spizella pallida</i>			36	1	2		2	15	56
Vesper Sparrow	<i>Pooecetes gramineus</i>			13		1	1	1	2	18
Lark Sparrow	<i>Chondestes grammacus</i>			1						1
Savannah Sparrow	<i>Passerculus sandwichensis</i>			26	1	6		1	33	67
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	SGCN	grassland	14		2				16
Le Conte's Sparrow	<i>Ammodramus leconteii</i>	SGCN	wetland	6					10	16
Nelson's Sparrow	<i>Ammodramus nelsoni</i>	SPC	wetland	1					1	2
Song Sparrow	<i>Melospiza melodia</i>			36	5	3		1	17	62
Swamp Sparrow	<i>Melospiza georgiana</i>	SGCN	wetland	28	2	3	1	1	19	54
Scarlet Tanager	<i>Piranga olivacea</i>			1						1
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	SGCN	deciduous					1		1

Table 8. continued.

Common name	Scientific name	Status	Primary habitat	Clay	Grant	Otter Tail	Pope	Stevens	Wilkin	Total Records
Indigo Bunting	<i>Passerina cyanea</i>			1					1	2
Dickcissel	<i>Spiza americana</i>	SGCN	grassland	7	3	8		1	11	30
Bobolink	<i>Dolichonyx oryzivorus</i>	SGCN	grassland	19		4		1	19	43
Red-winged Blackbird	<i>Agelaius phoeniceus</i>			57	6	9	1	1	33	107
Western Meadowlark	<i>Sturnella neglecta</i>			46		1		1	16	64
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>			2	1		1	1	6	11
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>			10	1	1				12
Common Grackle	<i>Quiscalus quiscula</i>			18		3	1		7	29
Brown-headed Cowbird	<i>Molothrus ater</i>			7		1			2	10
Orchard Oriole	<i>Icterus spurius</i>			11	1		1	1	2	16
Baltimore Oriole	<i>Icterus galbula</i>			5	1					6
House Finch	<i>Haemorhous mexicanus</i>			1		1				2
American Goldfinch	<i>Spinus tristis</i>			58	2	4	1	2	19	86
House Sparrow	<i>Passer domesticus</i>			3			1	1	1	6
species/county:				101	34	32	16	32	68	

Table 9. Bird species documented during breeding-season shrike surveys in south metro counties.

Common name	Scientific name	Status	Primary habitat	Dakota	Goodhue	Total Records
Wood Duck	<i>Aix sponsa</i>			1		1
Hooded Merganser	<i>Lophodytes cucullatus</i>			1		1
Wild Turkey	<i>Meleagris gallopavo</i>			1		1
Turkey Vulture	<i>Cathartes aura</i>			1		1
Cooper's Hawk	<i>Accipiter cooperii</i>			1		1
Red-tailed Hawk	<i>Buteo jamaicensis</i>			7		7
Killdeer	<i>Charadrius vociferus</i>			1		1
Spotted Sandpiper	<i>Actitis macularius</i>			1		1
Rock Pigeon	<i>Columba livia</i>			2		2
Eurasian Collared-Dove	<i>Streptopelia decaocto</i>			1		1
Mourning Dove	<i>Zenaida macroura</i>			9		9
Belted Kingfisher	<i>Megaceryle alcyon</i>			1		1
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	SGCN	shrub/edge	1		1
Northern Flicker	<i>Colaptes auratus</i>			4		4
American Kestrel	<i>Falco sparverius</i>			3		3
Eastern Wood-Pewee	<i>Contopus virens</i>	SGCN	deciduous	1		1
Willow Flycatcher	<i>Empidonax traillii</i>	SGCN	shrub/edge	2		2
Eastern Phoebe	<i>Sayornis phoebe</i>			1		1
Great Crested Flycatcher	<i>Myiarchus crinitus</i>			1		1
Eastern Kingbird	<i>Tyrannus tyrannus</i>			4		4
Loggerhead Shrike	<i>Lanius ludovicianus</i>	THR	grassland	3		3
Blue Jay	<i>Cyanocitta cristata</i>			6		6
American Crow	<i>Corvus brachyrhynchos</i>			7		7
Horned Lark	<i>Eremophila alpestris</i>			3		3
Purple Martin	<i>Progne subis</i>			1		1
Tree Swallow	<i>Tachycineta bicolor</i>			3		3
Bank Swallow	<i>Riparia riparia</i>			1		1
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>			2		2
Barn Swallow	<i>Hirundo rustica</i>			10		10
Black-capped Chickadee	<i>Poecile atricapillus</i>			1	1	2

Table 9. continued.

Common name	Scientific name	Status	Primary habitat	Dakota	Goodhue	Total Records
White-breasted Nuthatch	<i>Sitta carolinensis</i>			2		2
House Wren	<i>Troglodytes aedon</i>			6		6
Sedge Wren	<i>Cistothorus platensis</i>	SGCN	grassland	3		3
Marsh Wren	<i>Cistothorus palustris</i>	SGCN	wetland	1		1
Eastern Bluebird	<i>Sialia sialis</i>			4		4
American Robin	<i>Turdus migratorius</i>			9		9
Gray Catbird	<i>Dumetella carolinensis</i>			3		3
Brown Thrasher	<i>Toxostoma rufum</i>	SGCN	shrub/edge	4		4
European Starling	<i>Sturnus vulgaris</i>			7		7
Cedar Waxwing	<i>Bombycilla cedrorum</i>			1		1
Common Yellowthroat	<i>Geothlypis trichas</i>			7		7
Chipping Sparrow	<i>Spizella passerina</i>			2		2
Clay-colored Sparrow	<i>Spizella pallida</i>			6		6
Field Sparrow	<i>Spizella pusilla</i>	SGCN	shrub/edge	2	1	3
Vesper Sparrow	<i>Poocetes gramineus</i>			7		7
Savannah Sparrow	<i>Passerculus sandwichensis</i>			3		3
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	SGCN	grassland	1	1	2
Song Sparrow	<i>Melospiza melodia</i>			10		10
Swamp Sparrow	<i>Melospiza georgiana</i>	SGCN	wetland	1		1
Northern Cardinal	<i>Cardinalis cardinalis</i>			4		4
Indigo Bunting	<i>Passerina cyanea</i>			4		4
Dickcissel	<i>Spiza americana</i>	SGCN	grassland	3	1	4
Red-winged Blackbird	<i>Agelaius phoeniceus</i>			6		6
Eastern Meadowlark	<i>Sturnella magna</i>	SGCN	grassland	1		1
Common Grackle	<i>Quiscalus quiscula</i>			5		5
Brown-headed Cowbird	<i>Molothrus ater</i>			6		6
Baltimore Oriole	<i>Icterus galbula</i>			1		1
House Finch	<i>Haemorhous mexicanus</i>			2		2
American Goldfinch	<i>Spinus tristis</i>			8	1	9

Table 9. continued.

Common name	Scientific name	Status	Primary habitat	Dakota	Goodhue	Total Records
House Sparrow	<i>Passer domesticus</i>			5		5
				species/county:	60	5

Table 10. Seasonal effectiveness of trapping for the mudpuppy, *Necturus maculosus* (NEMA).

Month	# traps	# NEMA caught	Percent of traps with NEMA	# trap nights	Catch per unit effort (#/trap/night)
Oct-10	11	16	36.4	14*	0.104
Nov-10	20	6	25.0	2	0.150
Dec-10	10	7	30.0	3	0.233
Jan-11	20	39	45.0	3	0.650
Feb-11	20	10	20.0	3	0.167
Mar-11	20	8	30.0	1	0.400
Apr-11	20	0	0.0	3	0.000

* The flood control mechanism on a dam immediately upstream of the study site failed in October, resulting in major flooding of our site; water levels rose approximately 18 feet after traps were set, and it took a total of 14 days before the site was accessible to retrieve the traps.

Table 11. Effectiveness of different types of bait in surveying for NEMA.

Bait Type	# traps	# NEMA caught	Percent of traps with NEMA	Catch per unit effort (#/trap/night)
Minnows	24	36	33.3	0.367
Worms	24	22	29.2	0.224
Liver	23	10	26.1	0.119
Dog food	26	11	23.1	0.087
Sardines	24	9	16.7	0.092

Table 12. Effectiveness of different trap styles in surveying for NEMA.

Trap Type	# traps	# NEMA caught	Percent of traps with NEMA	Catch per unit effort (#/trap/night)
Small collapsible mesh	40	23	20.0	0.142
Medium collapsible mesh	10	5	40.0	0.104
Large collapsible mesh	20	15	15.0	0.161
Small steel	40	40	32.5	0.278
Long steel	11	5	27.3	0.088

Table 13. Fish species documented during Topeka Shiner surveys, 2012.

Common Name	Scientific Name	Status
Central Stoneroller	<i>Campostoma anomalum</i>	
Southern Redbelly Dace	<i>Chrosomus erythrogaster</i>	
Red Shiner	<i>Cyprinella lutrensis</i>	SGCN
Common Carp	<i>Cyprinus carpio</i>	
Brassy Minnow	<i>Hybognathus hankinsoni</i>	
Common Shiner	<i>Luxilus cornutus</i>	
Bigmouth Shiner	<i>Notropis dorsalis</i>	
Sand Shiner	<i>Notropis stramineus</i>	
Topeka Shiner	<i>Notropis topeka</i>	Fed. END
Bluntnose Minnow	<i>Pimephales notatus</i>	
Fathead Minnow	<i>Pimephales promelas</i>	
Blacknose Dace	<i>Rhinichthys atratulus</i>	
Creek Chub	<i>Semotilus atromaculatus</i>	
Quilback	<i>Carpionodes cyprinus</i>	
White Sucker	<i>Catostomus commersoni</i>	
Bigmouth Buffalo	<i>Ictiobus cyprinellus</i>	
Shorthead Redhorse	<i>Moxostoma macrolepidotum</i>	
Black Bullhead	<i>Ameiurus melas</i>	
Yellow Bullhead	<i>Ameiurus natalis</i>	
Channel Catfish	<i>Ictalurus punctatus</i>	
Tadpole Madtom	<i>Noturus gyrinus</i>	
Central Mudminnow	<i>Umbra limi</i>	
Northern Pike	<i>Esox lucius</i>	
Trout Perch	<i>Percopsis omiscomaycus</i>	
Plains Topminnow	<i>Fundulus sciadicus</i>	SPC
Brook Stickleback	<i>Culaea inconstans</i>	
Green Sunfish	<i>Lepomis cyanellus</i>	
Orangespotted Sunfish	<i>Lepomis humilis</i>	
Bluegill	<i>Lepomis macrochirus</i>	
Smallmouth Bass	<i>Micropterus dolomieu</i>	
Largemouth Bass	<i>Micropterus salmoides</i>	
Black Crappie	<i>Pomoxis nigromaculatus</i>	
Iowa Darter	<i>Etheostoma exile</i>	
Johnny Darter	<i>Etheostoma nigrum</i>	
Banded Darter	<i>Etheostoma zonale</i>	
Yellow Perch	<i>Perca flavescens</i>	
Blackside Darter	<i>Percina maculata</i>	