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CHANGES IN THE DISTRIBUTION OF MICHIGAN'S FLYING SQUIRRELS

By

Robert Russell Skillen

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ABSTRACT

CHANGES IN THE DISTRIBUTION OF MICHIGAN'S FLYING SQUIRRELS

By

Robert Russell Skillen

In light of growing concern for boreal mammalian species at the southern edge of their range, the current and historical ranges of flying squirrels (*Glaucomys*) in Michigan were examined. The available data clearly indicate a dramatic northward advance of the southern flying squirrel (*G. volans*) in the Lower Peninsula and an eastward advance in the Upper Peninsula. While northern flying squirrels (*G. sabrinus*) persist in the eastern Upper Peninsula, recent intensive trapping efforts indicate that populations may be declining in other parts of the historical range, particularly the northern Lower Peninsula. January isotherms coinciding with the northern range limit of the southern flying squirrel proposed by Muul (1968) and Stapp *et al.* (1991) appear not be valid in Michigan. However, changes in other climatic measures more indicative of winter severity and in the distribution of conifer forests may be influencing the recent changes in the distribution of flying squirrels in Michigan.

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INTRODUCTION

Recent syntheses of numerous studies of wild plants and animals attribute shifts in phenology (timing of events such as egg laying, flowering, or migration) and range (toward the poles or higher elevations) to climate change (Parmesan and Yohe 2003; Root *et al.* 2003). These studies examined over 1,500 species; of those species showing statistically significant changes in either phenology or range, over 80% are shifting either their phenology or range in a direction predicted by global warming.

In Michigan, Myers *et al.* (in press) have documented a northward shift in the range of the white-footed mouse (*Peromyscus leucopus*), and a coincident decline in captures of its northern congener, the woodland deer mouse (*Peromyscus maniculatus gracilis*). Myers *et al.* (in press) suggest that climatic warming may be responsible for the distributional changes in these species.

Based on recent and historical capture records, Myers and colleagues (personal communication) have also speculated that another pair of closely related species with overlapping ranges in Michigan, the southern flying squirrel (*Glaucomys volans*) and the northern flying squirrel (*Glaucomys sabrinus*), are experiencing changes in their distribution similar to the pattern documented for *Peromyscus*. The historical range maps drawn for *Glaucomys* in Michigan by Burt (1969), Baker (1983), and Kurta (1995) illustrate some of these changes. All three authors depict *G. volans* as ubiquitous throughout the Lower Peninsula (LP). However, in the Upper Peninsula (UP), *G. volans* has advanced eastward through time. Specifically, in Burt's (1969) map, they occur only in the southernmost UP County, Menominee; in Baker's (1983) map, their range extends through Menominee, Marquette and Houghton Counties; and in Kurta's (1995) map, *G.*

volans occurs through most of the mid-section of the UP, with the eastern boundary at approximately the western border of Seney National Wildlife Refuge and the western boundary at the western borders of Houghton and Iron Counties. These changes in the distribution of *G. volans* in Michigan were summarized by Wells-Gosling (1982), who noted that the records available at the time "may indicate a northward range extension for this species [*G. volans*] in the Upper Peninsula". However, Wells-Gosling (1982) believed this difficult to substantiate at the time due to the limited representation of *Glaucomys* in museum mammal collections.

Burt (1969), Baker (1983), and Kurta (1995) illustrate the range of *G. sabrinus* to consistently include all of the UP and the northern two-thirds of the LP (excluding the "thumb" region). However, the low number of *G. sabrinus* captures from the LP and the western half of the UP in the 1980s and 1990s led Myers and colleagues (personal communication) to believe that a more detailed examination of the current and historical ranges of *Glaucomys* in Michigan was warranted.

Although I know of no studies that examine changes in the distribution of *Glaucomys* in Michigan beyond those mentioned here, changes in the distribution of *Glaucomys* have been documented in neighboring regions, including Pennsylvania (Mahan *et al.* 1999), Quebec (Oxley and Gall 1977; Youngman and Gill 1968), and Ontario (J. Bowman, Ontario Ministry of Natural Resources, personal communication). Mahan *et al.* (1999) have documented a decline in *G. sabrinus* and Oxley and Gall (1977), Youngman and Gill (1968), and J. Bowman (Ontario Ministry of Natural Resources, personal communication) have noted northward range expansions of *G. volans*. Four factors that may influence changes in the distribution of *Glaucomys* have

been proposed by these and other authors: habitat fragmentation or destruction (Mahan *et al.* 1999), parasite transmission (Wetzel and Weigl 1994), competition between *G. sabrinus* and *G. volans* (Weigl 1978), and climate change (Muul 1968; Stapp *et al.* 1991).

Mahan *et al.* (1999) focused on habitat change as a possible cause for the decline in *G. sabrinus* captures in Pennsylvania. Studies have shown *G. sabrinus* to prefer mature conifer forests and occasionally mature mixed and pure stands of deciduous forest, all within fairly close proximity to water (Carey *et al.* 1999; Cotton and Parker 2000; Harestad 1990; Payne *et al.* 1989; Ransome and Sullivan 1997; Weigl 1978; Wells-Gosling and Heaney 1984). Mahan *et al.* (1999) have documented fragmentation and loss of old growth forests associated with the decline in *G. sabrinus* captures.

Wetzel and Weigl (1994) suggest that *G. sabrinus* populations may be negatively affected by the transmission of the cold intolerant parasite *Strongyloides robustus* from the more resistant *G. volans* in areas of range overlap where the two species may come into close contact. The recent discovery that both species of *Glaucomys* occasionally share the same dens during the winter months (Lavers 2004) may be an important factor when considering parasite transmission, although den sharing by both species of *Glaucomys* has not been documented in Michigan.

A study by Weigl (1978) indicates that *G. volans* may out-compete *G. sabrinus*. Specifically, *G. volans* was found to be more aggressive in defending its home area and typically controlled nests when paired in laboratory behavioral trials with *G. sabrinus*. Weigl (1978) speculated that by breeding earlier in the year, *G. volans* may occupy a limited supply of nest cavities in the wild first. However, it is not clear that a limited supply of nest cavities negatively impacts *G. volans* (Brady *et al.* 2000) or *G. sabrinus*

(Carey 2002) population densities. Both Brady *et al.* (2000) and Carey (2002) found that supplementary nest boxes did not result in a significant increase in population densities of either *Glaucomys* species as compared to control populations.

Additionally, Muul (1968), and more recently Stapp *et al.* (1991), have proposed the existence of thermal barriers that may impose physiological limitations on the ability of *G. volans* to occupy northern regions of the United States and southern Canada. Specifically, Muul (1968) proposed that the northern range limit of *G. volans* "agrees fairly well with the 20°F (-6.7°C) isotherm of average January temperature" and Stapp *et al.* (1991) that "the northern boundary nearly coincided with the -15°C isotherm of January minimum daily temperature". Stapp *et al.* (1991) argue that at -15°C, *G. volans* nesting either in aggregations (multiple squirrels nesting together) or singly in cavity nests require 18.82 kcal, or 2.5 x Basal Metabolic Rate (BMR), daily. They speculate that at this extreme maximum of daily energy expenditure, *G. volans* may not be able to store enough food to survive the winter. This relationship of the northern range boundary coinciding with 2.5 x BMR also holds true for several bird species (Root 1988). Stapp *et al.* (1991) admit that it is not clear why this relationship exists and that it could be "purely coincidental". However, given the paucity of information on the physiological limitations of *G. volans,* this provides a useful starting point for examining the relationship between climatic variables and the geographical range limits of this squirrel. If such thermal barriers exist and the range of *G. volans* has shifted northward in Michigan, there should be evidence that these thermal barriers have shifted northward in Michigan as well.

The objectives of this study were to 1) describe distributional changes in *G. sabrinus* and *G. volans* in Michigan, U.S.A. over the last ca.100 years, 2) determine whether changes in biologically important climatic variables coincide with changes in *Glaucomys* distributions, 3) describe the habitats associated with *Glaucomys* capture locations and 4) determine whether changes in critical habitat coincide with changes in *Glaucomys* distributions.

METHODS

Glaucomys Distribution

To evaluate the distributional changes of *Glaucomys* in Michigan, collecting data (i.e., species, date, and locality; Appendix I) were solicited from North American natural history museum mammal collections (Appendix II). These data were supplemented by live-trapping records from Dr. Philip Myers (University of Michigan) and his students, mist netting records from Dr. Allen Kurta (Eastern Michigan University), and specimens collected by animal damage control workers and subsequently donated to the Michigan State University Museum (Appendix I). Although a variety of biases inevitably exist in the methods of and reasons for collection of individual specimens, these records are the only sources of information available. Therefore, it is assumed that, in the aggregate, these records are a reasonable representation of the past and present distribution of *Glaucomys* in Michigan.

Trapping (AUF # 03/02-044-00, MDNR Scientific Collectors Permit # SC1169) was conducted specifically for this study during May-August 2002 in the northern LP (defined to be north of 44° north latitude, excluding the "thumb" region) and central UP (in and around Seney National Wildlife Refuge). These regions were believed to include the zone of range overlap between *G. volans* and *G. sabrinus*. Individual trapping sites within these regions were chosen based on the availability of appropriate habitat (mature conifer, deciduous, or mixed forests) on public lands (Appendix III). Trap lines consisted of 40 traps, alternating LFA (3 x 3.5 x 9") with XLF-15 (4 x 4.5 x 15") Sherman™ live traps; traps were set approximately 8 meters apart. All trap lines were set for at least two consecutive nights (up to five consecutive nights in some areas) at all locations and total

trapping effort was 72 trap lines and 8440 total trap nights (Appendix III). However, 1772 traps were found shut without captures for an effective total of 6668 trap nights. Traps were placed in lines instead of a grid pattern to maximize the number of flying squirrel territories that could be sampled per unit effort. All traps were baited with oats and sunflower seeds. In addition to trapping, nest boxes erected mainly for wood ducks by the U.S. Forest Service in Alcona County were surveyed (under the same permits as trapping) from December 2002 to February 2003 for over-wintering flying squirrels (Appendix IV).

The localities of all *Glaucomys* captures from trapping and nest box surveys were determined using a Garmin eTrex™ handheld Global Positioning System (GPS) unit set to North American Datum 1927 (NAD27). Trapping data from other studies and locality data from all specimens were georeferenced using protocols defined by the Mammal Network Information System (MaNIS; http://dlp.cs.berkeley.edu/manis/) using NAD27. Records were imported into ArcView GIS 3.2 (Environmental Systems Research Institute 1992-1995) and transformed to the Michigan Georef coordinate system for analysis.

Rather than reporting absolute numbers of squirrels captured, the relative abundance of *G. sabrinus* and *G. volans* was documented as the ratio (#*G. sabrinus*)/(#*G. sabrinus*+*G. volans*) in five year intervals from 1878 to 2003. Absolute numbers were not used because the trapping effort (number of trap-nights) of surveys was often unknown and inconsistent from survey to survey. It should be noted that changes in relative abundance over time will be misleading if methods used in earlier surveys (e.g., type of trap, bait, habitats trapped) differed from those used recently and those methods

were biased towards one of the species. However, there is no evidence to suggest that this is the case.

Climate and Range

Daily temperature data (datasets 3200, 3206, and 3210) covering the period from January 1, 1900 to December 31, 2003, and Cooperative Weather Station localities were downloaded from the National Oceanographic and Atmospheric Administration (NOAA) National Climate Data Center websites (ftp://ftp.ncdc.noaa.gov/pub/data/inventories/ COOP.TXT, http://www4.ncdc.noaa.gov/ cgi-win/wwcgi.dll?wwDI~GetCity~USA) for the entire state of Michigan. These data were used to calculate three temperature measures per year per Cooperative Weather Station: the January average of daily minimum temperature, the January average of average daily temperature, and the number of days per year at or below the daily minimum of -15°C.

NOAA was unable to provide accurate information as to the datum used to georeference each of their Cooperative Weather Stations. However, they indicated that the majority (88.6%) of their station locations nationwide are NAD83 (J. Arnfield, NOAA, personal communication). Therefore, NAD83 was assumed for all Michigan weather station locations. The data were transformed to the Michigan Georef coordinate system and, as each station was listed by county, each location was checked to determine if it was actually located within the county listed. As all stations were accurate to at least the county level, the potential error due to inaccuracies in location data were considered negligible as trends in climate were analyzed at the statewide level for this study.

In addition to datum inaccuracies, multiple locations were occasionally identified with the same Cooperative Weather Station number. Cooperative Weather Stations were assigned the same number only if they were within 2 horizontal miles or 100 vertical feet of one another (http://lwf.ncdc.noaa.gov/oa/climate/stationlocator.html). Since the most recent location data were accurate to seconds (older location data were accurate to minutes), only the most recent location data for any particular NOAA Cooperative Weather Station were used for these analyses. Januarys with fewer than thirty-one days of data and years with an incomplete record of the number of days minimum temperature was $\leq$ -15°C were excluded from these analyses. Known errors, as cited in NOAA metadata (http://www4.ncdc.noaa.gov/ol/documentlibrary/datasets.html#TD9767B) and errors discovered during data processing (mainly duplicate records) were corrected before analysis.

The January average daily temperature isotherm of –6.7°C and the January minimum daily temperature isotherm of -15°C were evaluated for change over time using logistic regressions for each weather station. The independent variable in each regression was time (year), and the dependent variable was either the number of Januarys where the January average daily temperature was $\leq$ –6.7°C or the number of Januarys where the January minimum daily temperature was $\leq$ –15°C. The slopes of these regressions were assessed to determine if temperature was significantly increasing over time (negative slope), decreasing over time (positive slope), or not significantly different from zero ($p \leq 0.05$) for each weather station. Simple linear regressions were run with time (year) as the independent variable and the number of days per year that were $\leq$ –15°C as the dependent variable. These regression slopes were assessed using the same methods as

those described for January temperatures. The number of Januarys/years of data per station varied; stations with fewer than six Januarys/years of data were dropped from the regression analyses. Program "R" (Ihaka and Gentleman 1996) was used for all regressions.

Habitat Associations

Classified land cover data for the entire state of Michigan from the 2001 IFMAP/GAP Landsat Thematic Mapper imagery (Michigan Department of Natural Resources 2003) were obtained from the Michigan Department of Natural Resources (MDNR) and the 1992 National Land Cover Landsat Thematic Mapper data (Vogelmann *et al.* 2001) were downloaded from the USGS National Land Cover Characterization web site (http://landcover.usgs.gov/natllandcover.asp/). The 1992 data were re-projected from Albers equal area conic (NAD83) to the Michigan Georeference coordinate system. All of the land cover data used are raster files with 30x30 meter pixels. The time periods of data collection varied; the 1992 land cover data were collected between 1989 and 1995, and the 2001 land cover between 1997 and 2001.

To determine habitat associated with *Glaucomys* capture locations, a literature review was conducted to estimate a typical home range size for both *G. sabrinus* and *G. volans* (Table 1). A buffer with a radius of 160 meters (or a circle with an area of 8.002 ha) was chosen as a reasonable home range size for both species as this value falls within range of most of the home ranges calculated by the studies listed in Table 1. Each 160 meter buffer was centered on each georeferenced specimen location. Only specimen

Table 1. List of literature sources and home range sizes for *Glaucomys sabrinus* and *Glaucomys volans*.

Species	Range (ha)	Mean (ha)	Location	Source
G. sabrinus	4.9-12.6	8.7	Pennsylvania	Weigl & Osgood 1974
G. sabrinus	4.9-7.1	5.9	North Carolina	Weigl & Osgood 1974
G. sabrinus	6-31	-	Alaska	Mowrey & Zasada 1982
G. sabrinus	3.4-4.9	-	Oregon	Witt 1992
G. sabrinus	5.1-6.7	-	Oregon	Martin & Anthony 1999
G. volans	1.6-2.0	-	Missouri	Schwartz &Schwartz 1959
G. volans	0.53	-	New York	Madden 1974
G. volans	1.89-3.49	-	Maryland	Gilmore & Gates 1985
G. volans	2.45	2.45 (±0.88 *SE*)	Maryland	Bendel & Gates 1987
G. volans	11.3-24.8	16 (±6.0 *SD*)	New Hampshire	Fridell & Litvaitis 1991
G. volans	4.0-16.0	9.0 (±2.5 *SE*)	Arkansas	Stone *et al.* 1997
G. volans	2.76-44	-	Arkansas	Taulman and Seaman 2000

localities that were recorded with a maximum error $\leq$ 26.0 meters were analyzed (calculated by MaNIS protocols; see Appendix Ia). Additionally, only *Glaucomys* capture locations that were recorded within two years of a particular land cover year were used, i.e. *Glaucomys* captures from 1990-1994 were associated with the 1992 land cover, and captures from 1999-2003 with the 2001 land cover. Although land cover data are available statewide for 1978, none of the *Glaucomys* capture location data from 1976-1980 met the maximum error criteria set above as none were recorded using GPS.

The raster land cover data were converted to vector and the buffered capture locations were used to clip habitat data from the associated land cover. Clipped habitat data were used to calculate the percentages of each habitat type associated with each species of *Glaucomys*.

Michigan Land Cover Change

The 2001 land cover and the 1978 Michigan Resource Information System (Michigan Department of Natural Resources 1999; collected between 1978 and 1979) land cover were used to determine change in conifer land cover statewide from 1978 to 2001. Original land cover classes were reclassified to conifer, deciduous, mixed forest, or other (see Table 2 for 1978 and Table 3 for 2001). To assess land cover change over time, the map calculator function of ArcView GIS 3.2 was used to add the 1978 land cover reclassification to the 2001 land cover reclassification. For example, when a pixel reclassified as conifer from the 1978 land cover was added to the reclassified 2001 land cover, four outcomes were possible: unchanged (conifer to conifer), conifer to deciduous, conifer to mixed, or conifer to other.

Table 2. Reclassification of 1978 MIRIS land cover classes.

Grid code	ha	Label	Reclassification
0	2059		Other
1100	6	Residential	Other
1110	496	Multi-Family-Medium to High Rise	Other
1120	12029	Multi-Family-Low Rise	Other
1131	486328	Single Family Duplex	Other
1132	97254	Single Family Duplex Low Density	Other
1150	8886	Mobile Home Park	Other
1200	6113	Commercial Services Institutional	Other
1210	6477	Central Business District	Other
1220	3325	Shopping Center Mall	Other
1230	121	Strip Commercial	Other
1240	31567	Neighborhood Business	Other
1260	41421	Institutional	Other
1300	45843	Industrial	Other
1380	8181	Industrial Park	Other
1400	949	Transportation Communication Utilities	Other
1410	16242	Air Transportation	Other
1420	1891	Rail Transportation	Other
1430	528	Water Transportation	Other
1440	35084	Road Transportation	Other
1450	787	Communication Facilities	Other
1460	18062	Utilities Waste Disposal	Other
1700	479	Extractive	Other
1711	5155	Metallic Mineral Quarry	Other
1712	245	Nonmetallic Mineral Quarry	Other
1713	40059	Open Pit	Other
1714	8	Other Open Pit	Other
1715	3273	Sand and Gravel	Other
1721	378	Metallic	Other
1722	5829	Underground Extractive	Other
1731	8	Extractive Wells Salt	Other
1732	6	Oil Wells	Other
1733	6	Waste Disposal	Other
1734	2197	Wells	Other
1900	3312	Open Land and Other	Other
1930	52515	Outdoor Recreation	Other
1940	8305	Cemeteries	Other
2100	4141331	Cropland	Other
2200	103306	Orchards Vineyards	Other
2300	5465	Confined Feeding	Other
2400	144342	Permanent Pasture	Other
2900	9173	Other Agriculture	Other
3100	669164	Herbaceous Openland	Other

Table 2 (cont'd).

3200	539911	Shrubland	Other
3300	487	Pine or Oak Opening (Savanna)	Other
4000	59	Forested Land	Mixed
4100	27491	Broadleaved Forest (Generally Deciduous)	Deciduous
4111	2	Basswood	Deciduous
4112	126	Beech	Deciduous
4113	89	Cherry	Deciduous
4114	55	Elm	Deciduous
4115	1904234	Northern Hardwood	Deciduous
4116	2158	Red Maple	Deciduous
4117	21782	Sugar Maple	Deciduous
4118	209003	Undifferentiated Northern Hardwood	Deciduous
4119	1	White Ash	Deciduous
4121	165	Black Oak	Deciduous
4122	790176	Central Hardwood	Deciduous
4123	106068	Red Oak	Deciduous
4124	56452	Undifferentiated Oak/Hickory	Deciduous
4125	58	White Oak	Deciduous
4131	1156900	Aspe Birch	Deciduous
4132	3245	Bigtooth Aspen	Deciduous
4133	214	Trembling Aspen	Deciduous
4134	270658	Undifferentiated Aspen/White Birch	Deciduous
4135	1277	White Birch	Deciduous
4141	32	Ash	Deciduous
4142	67223	Aspen	Deciduous
4143	23	Balm-of-Gilead	Deciduous
4144	3	Cottonwood	Deciduous
4145	42	Elm	Deciduous
4146	897545	Lowland Hardwood	Deciduous
4147	13781	Soft Maple	Deciduous
4148	27561	Undifferentiated Lowland Hardwood	Deciduous
4149	138	White Birch	Deciduous
4200	36	Coniferous Forest	Conifer
4211	134100	Jack Pine	Conifer
4212	637323	Pine	Conifer
4213	69287	Red Pine	Conifer
4214	4458	Scotch Pine	Conifer
4215	3353	Undifferentiated Pine	Conifer
4216	8646	White Pine	Conifer
4221	137	Balsam Fir	Conifer
4222	16	Black Spruce	Conifer
4223	19	Hemlock	Conifer
4224	165582	Other Upland Conifer	Conifer
4225	3058	Undifferentiated Upland Conifer	Conifer
4226	1279	White Spruce	Conifer

Table 2 (cont'd).

4231	454	Balsam Fir	Conifer
4232	290	Balsam Fir/White Spruce	Conifer
4233	1209	Black Spruce	Conifer
4234	21654	Cedar	Conifer
4235	7	Jack Pine	Conifer
4236	627716	Lowland Conifer	Conifer
4237	1022	Tamarack	Conifer
4238	84441	Undifferentiated Lowland Conifer	Conifer
4291	15	Blue Spruce	Conifer
4292	27430	Christmas Tree Plantation	Other
4293	156	Scotch Pine	Conifer
4294	437	Undifferentiated Christmas Tree Plantation	Other
4295	5	White Pine	Conifer
5100	20292	River	Other
5200	292016	Lake Pond	Other
5300	29568	Reservoir	Other
5400	267	Great Lakes	Other
6000	1770	Wetlands	Other
6110	104512	Wooded Wetland	Mixed
6120	479102	Shrub/Scrub Wetland	Other
6200	9	Nonforested Wetlands	Other
6210	24519	Aquatic Bed Wetland	Other
6220	168115	Emergent Wetland	Other
6230	1891	Flats	Other
6240	7	Deep Marshes	Other
7000	269	Barren	Other
7200	4547	Beach Riverbank	Other
7300	7601	Sand Dune	Other
7400	8023	Bare Exposed Rocks	Other

Table 3. Reclassification of 2001 IFMAP/GAP land cover classes.

Code	ha	Class (Label)	Reclassification
1	219353	Low Intensity Urban	Other
2	140935	High Intensity Urban	Other
3	3707	Airports	Other
4	425223	Road/Parking Lot	Other
5	23824	Non-Vegetated Farmland	Other
6	1612563	Row Crops	Other
7	2132315	Forage Crops/Non-Tilled Herb. Ag.	Other
9	73543	Orchards/Vineyards/Nursery	Other
10	1106399	Herbaceous Openland	Other
12	393140	Upland Shrub/Low Density Trees	Other
13	31510	Parks/Golf Courses	Other
14	1737133	Northern Hardwood Assoc.	Deciduous
15	627457	Oak Association	Deciduous
16	1031460	Aspen Association	Deciduous
17	16450	Other Upland Deciduous	Deciduous
18	431669	Mixed Upland Deciduous	Deciduous
19	837983	Pines	Conifer
20	150033	Other Upland Conifers	Conifer
21	82056	Mixed Upland Conifers	Conifer
22	785004	Upland Mixed Forest	Mixed
23	591817	Water	Other
24	733021	Lowland Deciduous Forest	Deciduous
25	934763	Lowland Coniferous Forest	Conifer
26	52492	Lowland Mixed Forest	Mixed
27	45613	Floating Aquatic	Other
28	628714	Lowland Shrub	Other
29	110584	Emergent Wetland	Other
30	313352	Mixed Non-Forest Wetland	Other
31	54385	Sand, Soil	Other
32	2627	Exposed Rock	Other
33	14	Mud Flats	Other
35	20718	Other Bare/Sparsely Vegetated	Other

RESULTS

Glaucomys Distribution

The combination of efforts to acquire current and historical *Glaucomys* capture records for Michigan resulted in 198 records for *G. sabrinus* and 316 records for *G. volans*. These distributional data are presented by decade for *G. volans* (Figure 1) and *G. sabrinus* (Figure 2). It is clear that the range of *G. volans* has advanced northward in the LP and eastward in the UP (Figures 1 and 3). The relative abundance of *G. sabrinus* in the northern LP and the UP decreased from a range of 84-100% for the time intervals before 1984 to <44% after 1984 (Figure 4).

Climate and Range

The regressions of Michigan January temperatures against time (N = 7 significant, N = 164 not significant for January average daily temperature, Figure 5a; and N = 2 significant and N = 174 not significant for January minimum daily temperature, Figure 5b) indicate that the trend for the majority of stations is not different from zero. This suggests that neither the January average daily temperature isotherm of $-6.7^{o}C$ nor the January minimum daily temperature isotherm of $-15^{o}C$ have changed in Michigan in the last ca. 100 years. Regressions of number of days per year per weather station that were $\leq -15^{o}C$ against time (N = 178, Figure 5c) indicate that winters are becoming less severe in some areas of the LP and UP where *G. volans* has recently expanded its range (Figure 1).

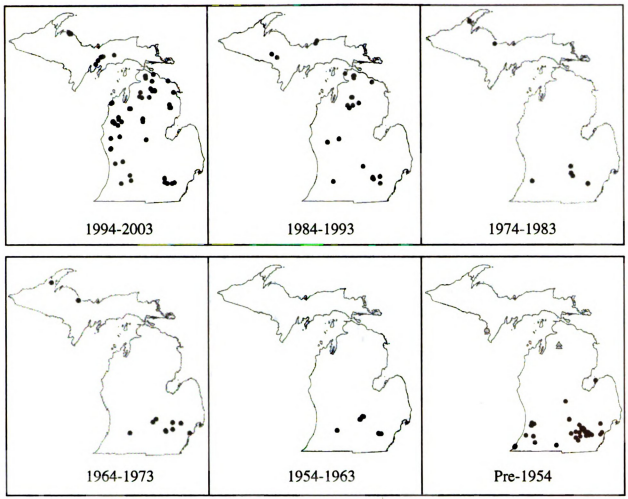

Figure 1. Decadal distribution of *Glaucomys volans* capture locations in Michigan (N = 316). Pre-1954 triangular points represent three 1923 outliers; open circle point represents two records from 1939.

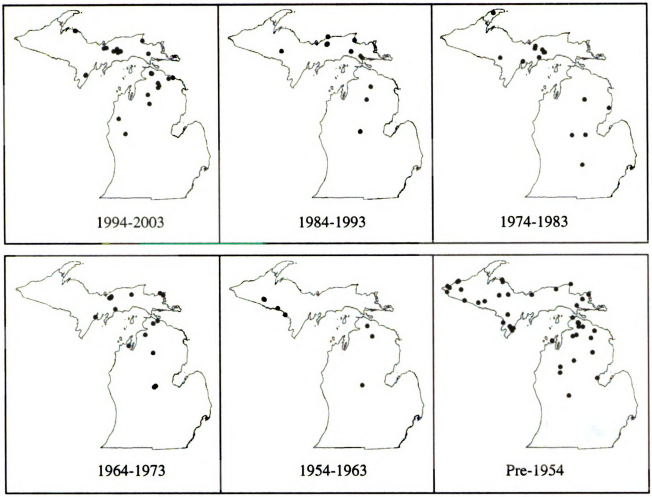

Figure 2. Decadal distribution of *Glaucomys sabrinus* capture locations in Michigan (N = 198).

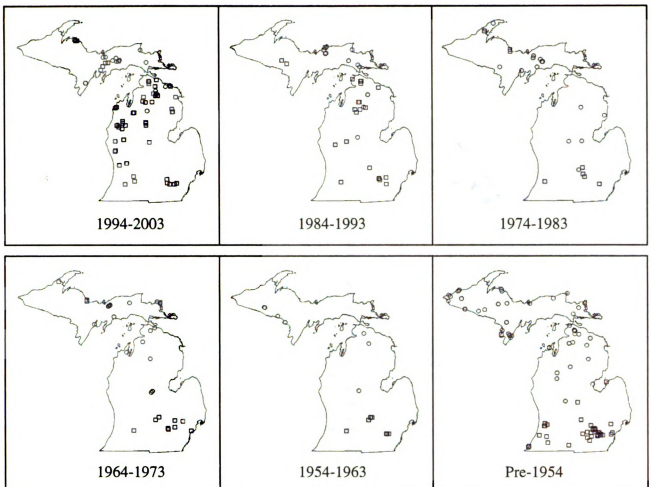

Figure 3. Decadal distribution of both *Glaucomys sabrinus* (O , N = 198) and *Glaucomys volans* (□ , N =316) capture locations in Michigan.

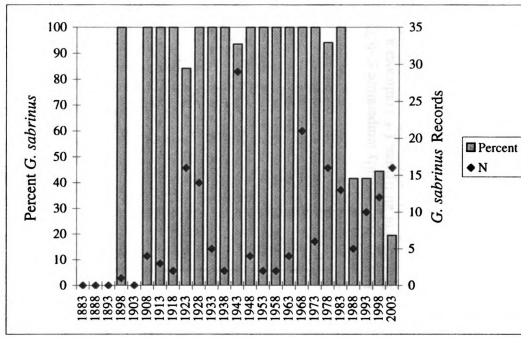

Figure 4. Relative abundance index of *G. sabrinus* as a percent of total *Glaucomys* captures north of 44° north latitude in five year intervals from 1878 to 2003.

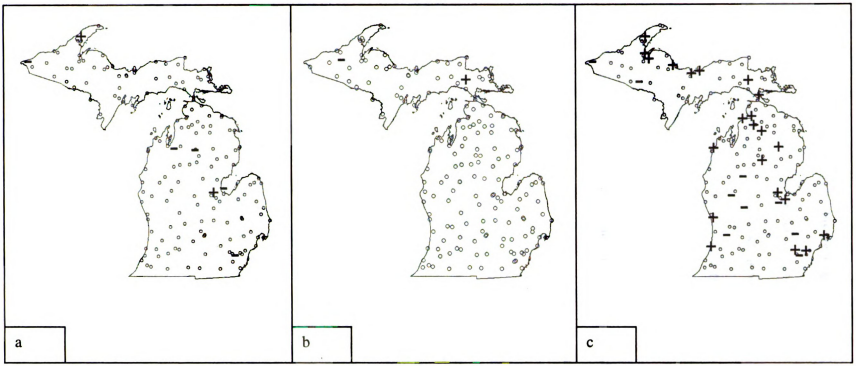

Figure 5. Trends of number of Januarys per NOAA Cooperative Weather Station with January average daily temperature $\leq$ -6.7°C (a), January minimum daily temperature $\leq$ -15°C (b), and the number of days per year $\leq$ -15°C (c). For all figures, (+) indicates a significant increase in temperature over time, (-) a significant decrease, and (O) is not significantly different from zero ($p \leq 0.05$). Although the number of years of data available for each individual weather station vary, data overall range from January 1, 1900 to December 31, 2003.

Habitat Associations

The 2001 land cover classes associated with the buffered capture location records for *G. volans* from 1999-2003 (N = 39) are presented in Table 4. The five deciduous classes (northern hardwood, aspen, and oak associations; lowland and mixed upland deciduous forests) cover 56.2% of the 39 combined buffers for *G. volans*. The four coniferous classes (pines, lowland conifer, mixed upland conifer, and other upland conifer) cover 18.1%, and the two mixed forest classes (upland and lowland) cover 8.7%. The 1992 land cover classes associated with the buffered capture location records for *G. volans* from 1990-1994 (N = 6) resulted in 85.8% deciduous forest, 8.1% mixed forest, and 3.2% conifer forest cover (Table 5).

The 2001 land cover classes associated with the buffered capture location records for *G. sabrinus* from 1999-2003 (N = 13) are presented in Table 4. If the conifer, deciduous, and mixed forest classes are grouped as for *G. volans* (described above), deciduous forest classes cover 38.4%, conifer forest 22.8%, and mixed forest 10.0% of the thirteen combined buffers for *G. sabrinus*. The 1992 land cover classes associated with the buffered capture location records for *G. sabrinus* from 1990-1994 (N = 3) resulted in woody wetlands covering 37.2%, mixed forest 29.7%, conifer forest 22.0%, and deciduous forest 9.7% (Table 5).

Table 4. 2001 IFMAP/GAP land cover associated with buffers of Michigan *Glaucomys* records from 1999-2003 with a maximum error ≤ 26 meters.

Glaucomys sabrinus			*Glaucomys volans*		
Habitat description	ha	% of total ha	Habitat description	ha	% of total ha
Aspen Association	18.3	19.0	Northern Hardwood Assoc.	75.8	24.3
Northern Hardwood Assoc.	13.5	14.1	Oak Association	40.2	12.9
Pines	12.3	12.8	Aspen Association	39.7	12.7
Lowland Coniferous Forest	9.4	9.8	Pines	34.2	11.0
Upland Mixed Forest	9.1	9.5	Upland Mixed Forest	26.4	8.5
Upland Shrub/Low Density Trees	6.7	7.0	Lowland Coniferous Forest	14.5	4.7
Lowland Shrub	4.6	4.8	Herbaceous Openland	12.5	4.0
Lowland Deciduous Forest	4.3	4.5	Mixed Non-Forest Wetland	11.3	3.6
Mixed Non-Forest Wetland	4.1	4.3	Upland Shrub/Low Density Trees	10.0	3.2
Water	3.7	3.8	Lowland Deciduous Forest	9.9	3.2
Herbaceous Openland	3.1	3.3	Mixed Upland Deciduous	9.7	3.1
Road/Parking Lot	3.0	3.1	Lowland Shrub	9.2	2.9
Other Upland Conifers	0.9	0.9	Water	5.9	1.9
Floating Aquatic	0.7	0.7	Mixed Upland Conifers	4.1	1.3
Oak Association	0.6	0.6	Other Upland Conifers	3.6	1.2
Lowland Mixed Forest	0.5	0.5	Road/Parking Lot	2.8	0.9
Low Intensity Urban	0.4	0.4	Lowland Mixed Forest	0.9	0.3
Emergent Wetland	0.4	0.4	Forage Crops/Non-Tilled Herb. Ag.	0.7	0.2
Mixed Upland Deciduous	0.2	0.3	Emergent Wetland	0.5	0.2
Mixed Upland Conifers	0.2	0.2	Row Crops	0.1	0.0
-	-	-	Low Intensity Urban	0.1	0.0
Total Conifer Forest	21.9	22.8	Total Conifer Forest	56.4	18.1
Total Deciduous Forest	36.9	38.4	Total Deciduous Forest	175.3	56.2
Total Mixed Forest	9.6	10.0	Total Mixed Forest	27.3	8.7
Total Other	27.6	28.8	Total Other	53.1	17.1

Table 5. 1992 Landsat Thematic Mapper National Land Cover associated with buffers of Michigan *Glaucomys* records from 1992-1994 with a maximum error ≤ 26 meters.

Glaucomys sabrinus			*Glaucomys volans*		
Habitat description	ha	% of Total ha	Habitat Description	ha	% of Total ha
Woody Wetlands	8.93	37.2	Deciduous Forest	41.2	85.8
Mixed Forest	7.14	29.7	Mixed Forest	3.9	8.1
Conifer Forest	5.28	22.0	Conifer Forest	1.5	3.2
Deciduous Forest	2.33	9.7	Grasslands/Herbaceous	1.1	2.2
Pasture/Hay	0.27	1.1	Pasture/Hay	0.1	0.1
Emergent Herbaceous Wetlands	0.07	0.3	Emergent Herbaceous Wetlands	0.0	0.1
-	-	-	Woody Wetlands	0.0	0.0
-	-	-	Quarries/Strip Mines/Gravel Pits	0.2	0.5

Michigan Land Cover Change

Conifer land cover changes in Michigan were evaluated using the reclassifications of the 1978 and 2001 land covers (in Tables 2 and 3 respectively). These reclassifications were added creating sixteen unique categories that describe land cover change (Table 6). Conifer forests increased from 11.7% of the total land cover in 1978 to 13.1% of the total land cover in 2001 (Table 7). Approximately 51% of the conifer land cover that existed in 1978 remained in the same locations throughout Michigan in 2001 (Table 6 and Figure 6). Deciduous forest land cover decreased from 36.9% of the total land cover in 1978 to 29.8% of the total land cover in 2001 (Table 7). However, approximately 69.3 % of the deciduous land cover that existed in 1978 remained in the same locations in 2001 (Table 6).

Table 6. Sixteen categories of land cover change from 1978 to 2001 (based on reclassifications from Tables 2 & 3).

Unchanged from 1978 to 2001	Changed from (1978)	Changed to (2001)	ha	% Unchanged from 1978 to 2001
Conifer	-	-	1005418	51.0
-	Other	Conifer	333012	-
-	Deciduous	Conifer	633953	-
-	Mixed	Conifer	4	-
Total Conifer	-	-	1972387	-
Deciduous	-	-	1956593	69.3
-	Other	Deciduous	715129	-
-	Conifer	Deciduous	153571	-
-	Mixed	Deciduous	20	-
Total Deciduous	-	-	2825313	-
Mixed	-	-	2	0.0
-	Other	Mixed	158291	-
-	Conifer	Mixed	174434	-
-	Deciduous	Mixed	496210	-
Total Mixed	-	-	828937	-
Other	-	-	6508096	69.5
-	Conifer	Other	412664	-
-	Deciduous	Other	2439179	-
-	Mixed	Other	33	-
Total Other	-	-	9359972	-

Table 7. Reclassification of 1978 MIRIS and 2001 IFMAP/GAP land cover classes.

Reclassification	% of Total	
	1978	2001
Conifer	11.7	13.1
Deciduous	36.9	29.8
Mixed	0.7	5.5
Other	50.7	51.7

Figure 6. Change in conifer land cover from 1978 to 2001 in Michigan. From left to right, conifer land cover gain, loss, and unchanged.

DISCUSSION

Glaucomys Distribution

Changes in the distribution of *Glaucomys* have been documented in Pennsylvania (Mahan *et al.* 1999), Quebec (Oxley and Gall 1977; Youngman and Gill 1968), and Ontario (J. Bowman, Ontario Ministry of Natural Resources, personal communication). In Michigan, there is convincing evidence that *G. volans* has advanced northward in the LP and eastward in the UP over the last ca. 100 years (Figure 1). Of special note are three *G. volans* that were captured in the northern LP near the city of Elmira (Otsego County) in 1923 (#469-471; Appendix I and marked by triangles in Figure 1). Although the identification of these three specimens has been verified by the respective museum staff, these records represent significant outliers as *G. volans* was not captured again in the northern LP until 1986 (see record #337, Appendix I). Nineteen *G. sabrinus* were captured between 1923 and 1986 in various localities throughout the same region. From these data it seems unlikely that *G. volans* populations were well established in the northern LP much before 1986.

The available *Glaucomys* distribution data suggest that in regions where *G. volans* is advancing, *G. sabrinus* is retreating. Intensive trapping has recently been conducted in areas where *G. sabrinus* were previously known to occur. However, these efforts have predominantly resulted in *G. volans* captures. As an example, only three *G. sabrinus* captures have been recorded for the northern LP within the last five years. For the same time period and region, forty-one *G. volans* were captured. Similarly, trapping conducted during the summer of 2003 by P. Myers and B. Lundrigan at the Huron Mountain Club

(Marquette County), an area where all previous captures recorded were *G. sabrinus*, resulted in nineteen *G. volans* captures and only one *G. sabrinus*. Although trapping efforts for my study were focused on habitats believed to be appropriate for *G. sabrinus*, it is unknown whether other trapping efforts had habitat biases. The lack of *G. sabrinus* captures is never a sure indicator that the species is not present. However, it is reasonable to assume that capture of both *Glaucomys* species is equally likely using the trapping methods typically employed by researchers in the field (e.g., Sherman™ live traps). Therefore, the available data indicate that *G. sabrinus* populations are declining in Michigan.

Due to the geographic isolation of Michigan in all directions except the south in the LP and the west in UP, the isolated pockets of *G. sabrinus* that remain in the state should be considered "island" populations, as no northern refugia are available. The geographic isolation of Michigan's *G. sabrinus* populations curtails gene flow between these populations and the larger metapopulation, which depending on population densities, could in time lead to inbreeding depression. Significant genetic differences have been found between the populations of *G. sabrinus* in the LP and UP (Arbogast 1999), and the loss of these populations could mean a significant loss of genetic diversity for the species as a whole.

Climate and Range

It has been speculated that winter temperature extremes prevent *G. volans* from occupying habitats north of its present distribution (Muul 1968; Stapp *et al.* 1991). No correspondence was found between changes in the distribution of *G. volans* in Michigan

(Figure 1) and changes in the January isotherms described by Muul (1968) or Stapp *et al.* (1991) (Figures 5a and 5b respectively). It should be noted that both Muul (1968) and Stapp *et al.* (1991) used different and more limited sources of climate data than did this study. Muul (1968) used 1941 Michigan weather maps to describe isotherms (U.S. Dept. of Agriculture Yearbook 1941), and Stapp *et al.* (1991) used national weather maps from 1970 for the U.S. and 1974 for Canada (Canada Dept. of Energy Mines and Resources 1974; United States Geological Survey 1970). The climate data for this study ranged from January 1, 1900 to December 31, 2003.

January temperatures alone may not be a good indicator of winter severity, and may therefore be less biologically meaningful to *G. volans* than temperature variables that incorporate more information. For this reason, the number of days $\leq$ -15°C per year per weather station were also evaluated for significant trends. This analysis revealed a correspondence between the number of days $\leq$ -15°C per year per weather station (Figure 5c) and changes in the distribution of *G. volans* over time (Figure 1). Overall, there are more weather stations with significant warming trends than cooling trends and stations with these significant warming trends are located in those areas of the northern LP and UP where *G. volans* has recently expanded its range.

Habitat Associations

Although the 1992 land cover data are classified into fewer land cover types (and are therefore coarser) than the 2001 land cover data, both are 30x30 meter resolution. By aggregating the classes of both land covers into the broad categories of

conifer, deciduous, and mixed forest, general comparisons between the two datasets are possible.

Glaucomys volans is thought to be associated with mature deciduous and mixed forests, while avoiding pure stands of conifer (Dolan and Carter 1977; Gilmore and Gates 1985; Ivan and Swihart 2000; Sonenshine and Levy 1981; Taulman and Seaman 2000; Weigl 1978). Habitat associated with *G. volans* capture locations (Tables 4 and 5) fits well with the associations described in the literature. *Glaucomys volans* was highly associated with deciduous forests (56.2% for the 2001 land cover and 85.8% for the 1992 land cover). Mixed forests were expected to represent a larger proportion of the habitat association than conifer, which held true for the 1992 land cover (8.1% vs. 3.2% respectively), but not for the 2001 land cover (8.7% vs. 18.1% respectively).

G. sabrinus is thought to be associated primarily with mature conifer forests and occasionally with mature mixed and pure stands of deciduous forest, all within fairly close proximity to water (Carey *et al.* 1999; Cotton and Parker 2000; Harestad 1990; Payne *et al.* 1989; Ransome and Sullivan 1997; Weigl 1978; Wells-Gosling and Heaney 1984). In somewhat of a departure from the literature, the *G. sabrinus* records associated with the 2001 land cover (Table 4) revealed that the total conifer forest (22.8%) represented a lower percentage than the total deciduous forest (38.4%), while the total mixed forest at 10% is comparable to the 8.7% calculated for *G. volans*. The *G. sabrinus* records associated with the 1992 land cover (Table 5) supported the association of *G. sabrinus* with wet habitats, i.e. a relatively high percentage (37.2%) of the records were associated with woody wetlands, as compared to the less than one tenth of one percent for *G. volans*. However, this result was somewhat surprising as the metadata for the 1992

land cover describes the woody wetlands class as "Areas where forest or shrubland vegetation accounts for 25-100 percent of the cover and the soil or substrate is periodically saturated with or covered with water" (http://landcover.usgs.gov/natllandcover.asp/). It is highly unlikely that *G. sabrinus* would be associated with shrublands as forests are quintessential to their gliding lifestyle (Wells-Gosling and Heaney 1984). Additionally, mixed forests (29.7%) were a stronger component than conifer forests (22.0%) for the *G. sabrinus* records associated with the 1992 land cover. However, these results may be skewed by the low sample size (N = 3).

Based on the habitat requirements described for *G. sabrinus* in the literature, conifer forests were expected to represent a higher percentage of the combined buffers for each capture location. One possible explanation for this disparity is that placing perfectly circular buffers around *Glaucomys* capture locations does not accurately represent the actual home range and habitat used by an individual squirrel. Another possibility is that habitat preferences differ geographically. Genetic data indicate significant genetic differences between eastern and western subspecies of *G. sabrinus* (Arbogast 1999). Additionally, much of the research on the habitat associations of *G. sabrinus* has been conducted in the Pacific Northwest and may not adequately describe habitat associations for the species as a whole.

Michigan Land Cover Change

Mature conifer forests have been described as important habitat for *G. sabrinus* in the literature; changes in land cover between 1978 and 2001 were thus examined to determine if land cover has changed in Michigan in ways that are either beneficial or

detrimental to the species. Although statewide 1992 land cover data were available, these data were not used to assess changes in land cover. The 19-year time span between the data collection periods for the 1978 and 2001 land covers was believed to provide a better assessment of long term habitat change. Only 2 years elapsed between the data collection periods for the 1992 land cover (1989-1995) and the 2001 land cover (1997-2001). Although 10 years elapsed between the 1978 land cover (1978-1979) and the 1992 land cover (1989-1995), this was not considered sufficient for a robust assessment of land cover change.

A key factor to consider when analyzing land cover change between 1978 and 2001 is that for the 1978 land cover, forested lands are defined as those which "...are at least 10% stocked by forest trees of any size" (MDNR, 1981; http://www.crs.msu.edu/pdf/lclu/CUI.pdf) and for the 2001 land cover, forested lands are defined as those which have at least 25% canopy cover (http://www.dnr.state.mi.us/spatialdatalibrary/sdl2/land_use_cover/2001/IFMAP_lp_landcover.htm) which equates to 16.7% stocked by forest trees of any size (MDNR, 2001; http://www.rsgis.msu.edu/pdf/lclu/Michigan_LC_LU_ Classification_System_2000.pdf). By these definitions it clear that any gains in forest land cover from 1978 to 2001 are likely to be true gains, while losses may be partly a function of the more conservative 2001 definition of forested lands.

Conifer forests increased from 11.7% of the total land cover in 1978 to 13.1% in 2001 (Table 7). While this may benefit *G. sabrinus*, it is important to note that as little as 51% of the conifer land cover that existed in Michigan in 1978 remained in the same locations through 2001 (Table 6 and Figure 5). The gain in conifer land cover from 1978 to 2001 may benefit *G. sabrinus* if it represents an increase in the percentage of mature

conifer forests. However, if this gain is the result of a high rate of turnover of conifer forests, this may be detrimental to the species.

The status of Michigan's conifer forests as appropriate habitat for *G. sabrinus* requires further investigation. Habitat variables important to *G. sabrinus* such as stand age, the amount of down woody debris, and the distribution of fungi (a food source) cannot be determined from satellite imagery.

Recommendations

More formal studies of the habitat requirements of *G. sabrinus* in Michigan may reveal departures from those described in the literature. In order to more accurately determine habitat use by both species of *Glaucomys* in Michigan, radio telemetry studies such as those conducted by Stone *et al.* (1997) and Taulman and Seaman (2000) should be considered. However, the primary emphasis of future research should be placed on locating and monitoring *G. sabrinus* populations within the state. Such monitoring should include genetic analysis of the remaining *G. sabrinus* populations, which may reveal much about their current viability. Second, the region of the UP from the western border of Seney National Wildlife Refuge eastward should be monitored for the possibility of a continued advance of *G. volans* into that region.

To better understand the relationship between climate and the northern range limit of *G. volans*, populations at the extreme northern edge of their range should be monitored, particularly those within close proximity to weather stations. If, as Stapp *et al.* (1991) propose, $-15^{o}C$ is physiologically meaningful to *G. volans* in terms of limiting the northern range boundary, it may be instructive to compare the number of *consecutive*

days $\leq -15^{o}C$ per year per weather station to the range expansion of *G. volans* in Michigan over time.

Future efforts to capture flying squirrels should focus on either the use of nest boxes specifically designed for flying squirrels (Althoff and Althoff 2001; Mahan *et al.* 1999) or traps placed in trees (Taylor and Lowman 1996), which although more labor intensive, have been found to be more effective than ground trapping.

To the best of my knowledge, no current management strategy exists for *G. sabrinus* or *G. volans* in the state of Michigan. Additionally, as these species are currently not considered endangered, threatened, or game species, I could not find any legislation regulating the take of flying squirrels in Michigan. Based on the findings of this research, it would be advisable to implement a state sponsored monitoring plan for *G. sabrinus* populations before federal intervention is required. A first step in such a plan may include the requirement that all incidental take of flying squirrels, including their capture locations, be reported to the MDNR and, where possible, specimens donated to the nearest natural history museum. Currently, the only requirement for the incidental take by commercial trappers is to report that a "squirrel" was caught with no indication of species or location.

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APPENDIX Ia

Georeferenced location data for *Glaucomys* captured in Michigan (North American Datum 1927).

No.	Source*	Museum no.	Year	Species	County	Latitude	Longitude	Error (km)	Georef Source†
1	Myers		2003	*G. sabrinus*	Menominee	45.513200	-87.393000	0.013	Skillen/Topozone
2	Myers		2003	*G. sabrinus*	Schoolcraft	46.303700	-86.098500	0.013	Skillen/Topozone
3	Myers		2003	*G. sabrinus*	Marquette	46.843900	-87.854900	0.013	Skillen/Topozone
4	Myers		2002	*G. sabrinus*	Menominee	45.500400	-87.413500	0.013	Skillen/Topozone
5	Skillen		2002	*G. sabrinus*	Schoolcraft	46.236222	-86.240430	0.013	Garmin eTrex
6	Myers		2002	*G. sabrinus*	Schoolcraft	46.241833	-85.949000	0.013	GPS
7	Myers		2002	*G. sabrinus*	Schoolcraft	46.241900	-85.948900	0.013	Skillen/Topozone
8	Myers		2002	*G. sabrinus*	Schoolcraft	46.241900	-85.948900	0.013	Skillen/Topozone
9	Skillen		2002	*G. sabrinus*	Alger	46.330346	-86.658424	0.013	Garmin eTrex
10	Skillen		2002	*G. sabrinus*	Alger	46.343595	-86.548870	0.013	Garmin eTrex
11	Myers		2001	*G. sabrinus*	Schoolcraft	46.199500	-86.074900	0.013	Skillen/Topozone
12	Myers		2001	*G. sabrinus*	Cheboygan	45.547833	-84.665333	0.311	GPS
13	Myers		2000	*G. sabrinus*	Otsego	45.169900	-84.376800	1.164	MaNIS
14	Kurta		1999	*G. sabrinus*	Newaygo	43.714000	-85.780100	0.013	GPS
15	MSB	92421	1999	*G. sabrinus*	Crawford	44.625800	-84.784400	0.311	Skillen/Topozone
16	Myers		1999	*G. sabrinus*	Alger	44.903800	-84.848100	2.588	GPS
17	Myers		1999	*G. sabrinus*	Otsego	45.111500	-84.414900	0.013	MaNIS
18	Kurta		1998	*G. sabrinus*	Manistee	44.180200	-86.047200	0.013	GPS
19	UWSP	8000	1997	*G. sabrinus*	Chippewa	46.557600	-85.033800	0.978	Skillen/Topozone
20	Friedrich		1997	*G. sabrinus*	Presque Isle	45.256930	-84.415150	1.164	Skillen/Topozone
21	UMMZ	172140	1997	*G. sabrinus*	Presque Isle	45.386750	-83.976550	0.187	MaNIS
22	Friedrich		1997	*G. sabrinus*	Presque Isle	45.410700	-83.802000	0.335	Skillen/Topozone
23	Friedrich		1997	*G. sabrinus*	Presque Isle	45.410700	-83.802000	0.174	Skillen/Topozone
24	Friedrich		1997	*G. sabrinus*	Presque Isle	45.410700	-83.802000	1.164	Skillen/Topozone
25	Friedrich		1997	*G. sabrinus*	Cheboygan	45.545630	-84.681490	1.164	Skillen/Topozone
26	UMMZ	172138	1997	*G. sabrinus*	Cheboygan	45.565000	-84.679500	1.164	MaNIS

27	Friedrich		1997	*G. sabrinus*	Cheboygan	45.565600	-84.699900	0.335	Skillen/Topozone
28	Myers		1996	*G. sabrinus*	Mackinac	46.161700	-84.785400	0.597	Skillen/Topozone
29	Myers		1994	*G. sabrinus*	Cheboygan	45.547833	-84.665333	0.013	GPS
30	UMMZ	168426	1993	*G. sabrinus*	Mackinac	46.211600	-85.201400	0.978	MaNIS
31	UMMZ	168427	1993	*G. sabrinus*	Mackinac	46.211600	-85.201400	0.311	MaNIS
32	Myers		1993	*G. sabrinus*	Alger	46.435600	-86.222700	0.304	Skillen/Topozone
33	Myers		1993	*G. sabrinus*	Alger	46.435600	-86.222700	0.304	Skillen/Topozone
34	UMMZ	172068	1993	*G. sabrinus*	Alger	46.456000	-86.185100	0.311	MaNIS
35	UWSP	8000	1993	*G. sabrinus*	Chippewa	46.557590	-85.036130	0.311	Skillen/Topozone
36	Myers		1992	*G. sabrinus*	Mackinac	46.077700	-84.802400	0.311	Skillen/Topozone
37	MHP	29827	1992	*G. sabrinus*	Crawford	44.732500	-84.592400	0.013	GPS
38	UMMZ	166909	1990	*G. sabrinus*	Alger	46.662900	-86.162900	0.026	MaNIS
39	UMMZ	166910	1990	*G. sabrinus*	Alger	46.662900	-86.162900	0.026	MaNIS
40	CMUM	M-1662	1989	*G. sabrinus*	Isabella	43.774100	-84.874400	0.597	Skillen/Topozone
41	MSU	MR.34195	1987	*G. sabrinus*	Iron	46.210900	-88.127200	1.164	MaNIS
42	UMMZ	162439	1984	*G. sabrinus*	Mackinac	46.014700	-84.723500	16.303	MaNIS
43	Myers		1984	*G. sabrinus*	Otsego	45.128800	-84.410500	0.311	MaNIS
44	Myers		1984	*G. sabrinus*	Otsego	45.128800	-84.410500	0.311	MaNIS
45	UMMZ	162440	1984	*G. sabrinus*	Otsego	45.128800	-84.410500	0.311	MaNIS
46	MSU	MR.33356	1982	*G. sabrinus*	Delta	45.900000	-86.916700	N/A	Skillen/Topozone
47	MSU	MR.33357	1982	*G. sabrinus*	Delta	45.900000	-86.916700	N/A	Skillen/Topozone
48	MSU	MR.33358	1982	*G. sabrinus*	Keweenaw	47.366700	-88.200000	N/A	Skillen/Topozone
49	UIMNH	UIMNH 59722	1981	*G. sabrinus*	Ingham	42.732500	-84.555600	8.381	MaNIS
50	USNM	551840	1980	*G. sabrinus*	Schoolcraft	46.180200	-86.042700	1.164	Skillen/Topozone
51	USNM	552249	1980	*G. sabrinus*	Schoolcraft	46.296400	-86.417400	1.164	Skillen/Topozone
52	USNM	551843	1980	*G. sabrinus*	Schoolcraft	46.296400	-86.417400	1.164	Skillen/Topozone
53	USNM	551842	1980	*G. sabrinus*	Schoolcraft	46.296400	-86.417400	1.164	Skillen/Topozone
54	USNM	551841	1980	*G. sabrinus*	Schoolcraft	46.296400	-86.417400	1.164	Skillen/Topozone
55	USNM	530555	1979	*G. sabrinus*	Schoolcraft	46.180000	-86.000600	1.164	Skillen/Topozone
56	USNM	530554	1979	*G. sabrinus*	Schoolcraft	46.180000	-86.000600	1.164	Skillen/Topozone
57	USNM	530556	1979	*G. sabrinus*	Schoolcraft	46.180200	-86.042700	1.164	Skillen/Topozone
58	USNM	530557	1979	*G. sabrinus*	Schoolcraft	46.180200	-86.042700	1.164	Skillen/Topozone

59	USNM	530553	1979	*G. sabrinus*	Schoolcraft	46.296400	-86.417400	1.164	Skillen/Topozone
60	USNM	527620	1978	*G. sabrinus*	Schoolcraft	46.257900	-86.104700	35.431	MaNIS
61	USNM	527619	1978	*G. sabrinus*	Schoolcraft	46.296400	-86.417400	1.164	Skillen/Topozone
62	USNM	524544	1977	*G. sabrinus*	Schoolcraft	46.180000	-86.000600	1.164	Skillen/Topozone
63	USNM	524543	1977	*G. sabrinus*	Schoolcraft	46.180200	-86.042700	1.164	Skillen/Topozone
64	CMUM	M-1487, MS-778	1977	*G. sabrinus*	Isabella	43.643700	-84.933400	1.164	Skillen/Topozone
65	UMMZ	131983	1977	*G. sabrinus*	Crawford	44.718500	-84.401400	1.164	MaNIS
66	UMMZ	131984	1977	*G. sabrinus*	Crawford	44.718500	-84.401400	0.597	MaNIS
67	UWSP	3089	1976	*G. sabrinus*	Schoolcraft	46.019300	-86.245900	6.896	Skillen/Topozone
68	UWSP	3090	1976	*G. sabrinus*	Schoolcraft	46.019300	-86.245900	6.896	Skillen/Topozone
69	USNM	514256	1976	*G. sabrinus*	Schoolcraft	46.296400	-86.417400	1.164	Skillen/Topozone
70	USNM	514257	1976	*G. sabrinus*	Schoolcraft	46.296400	-86.417400	1.164	Skillen/Topozone
71	USNM	514258	1976	*G. sabrinus*	Schoolcraft	46.296400	-86.417400	1.164	Skillen/Topozone
72	USNM	514259	1976	*G. sabrinus*	Schoolcraft	46.296400	-86.417400	1.164	Skillen/Topozone
73	CMUM	MS-1165	1975	*G. sabrinus*	Midland	43.650000	-84.400000	N/A	Skillen/Topozone
74	CMUM	M-1464	1974	*G. sabrinus*	Dickinson	46.000600	-87.866700	3.232	Skillen/Topozone
75	CMUM	M-1399	1974	*G. sabrinus*	Alger	46.367400	-86.395400	1.164	Skiilen/Topozone
76	CMUM	M-1422, MS-728	1974	*G. sabrinus*	Alger	46.367400	-86.395400	1.164	Skiilen/Topozone
77	MSU	MR.23984	1974	*G. sabrinus*	Iosoco	44.448010	-83.424140	N/A	MaNIS
78	MSU	MR.21166	1972	*G. sabrinus*	Delta	45.768000	-87.068500	6.896	MaNIS
79	UWSP	3089	1972	*G. sabrinus*	Schoolcraft	46.018500	-86.228800	6.896	Skillen/Topozone
80	UWSP	3090	1972	*G. sabrinus*	Schoolcraft	46.018500	-86.228800	0.187	Skillen/Topozone
81	USNM	397041	1972	*G. sabrinus*	Alger	46.347600	-86.474000	3.244	MaNIS
82	CMUM	M-1154	1972	*G. sabrinus*	Charlevoix	45.216700	-85.000600	N/A	Skillen/Topozone
83	CMUM	M-1155	1972	*G. sabrinus*	Charlevoix	45.216700	-85.000600	N/A	Skillen/Topozone
84	USNM	397068	1968	*G. sabrinus*	Alger	46.347600	-86.474000	0.187	MaNIS
85	USNM	397017	1968	*G. sabrinus*	Chippewa	46.433600	-84.216500	14.619	MaNIS
86	USNM	397020	1968	*G. sabrinus*	Chippewa	46.433600	-84.216500	14.619	MaNIS
87	USNM	397022	1968	*G. sabrinus*	Chippewa	46.433600	-84.216500	14.619	MaNIS
88	USNM	397023	1968	*G. sabrinus*	Chippewa	46.433600	-84.216500	14.619	MaNIS
89	USNM	397065	1968	*G. sabrinus*	Chippewa	46.433600	-84.216500	14.619	MaNIS
90	USNM	397067	1968	*G. sabrinus*	Chippewa	46.433600	-84.216500	14.619	MaNIS

91	UNSM	ZM-13039	1968	*G. sabrinus*	Cheboygan	45.563400	-84.663700	1.313	MaNIS
92	KU	138573	1968	*G. sabrinus*	Cheboygan	45.563400	-84.663700	1.313	MaNIS
93	CMUM	M-681	1966	*G. sabrinus*	Luce	46.466700	-85.550000	N/A	Skillen/Topozone
94	CMUM	M-559	1965	*G. sabrinus*	Alger	46.354000	-86.458700	3.244	MaNIS
95	CMUM	M-560	1965	*G. sabrinus*	Alger	46.355300	-86.479000	1.164	MaNIS
96	CMUM	M-561	1965	*G. sabrinus*	Alger	46.355300	-86.479000	1.164	MaNIS
97	MSU	MR.10639	1965	*G. sabrinus*	Alger	46.368400	-86.417600	1.164	MaNIS
98	MSU	MR.10640	1965	*G. sabrinus*	Alger	46.368400	-86.417600	1.164	MaNIS
99	CMUM	M-613	1965	*G. sabrinus*	Isabella	43.597800	-84.673900	1.164	Skillen/Topozone
100	CMUM	M-615	1965	*G. sabrinus*	Isabella	43.633000	-84.618300	6.854	Skillen/Topozone
101	CMUM	M-503, MS-202	1965	*G. sabrinus*	Leelanau	44.886300	-85.688600	1.164	Skillen/Topozone
102	UMMZ	114813	1965	*G. sabrinus*	Cheboygan	45.646900	-84.474400	1.164	MaNIS
103	MSU	MR.10620	1964	*G. sabrinus*	Alger	46.387900	-86.408600	4.963	MaNIS
104	MSU	MR.10621	1964	*G. sabrinus*	Alger	46.401000	-86.390000	4.859	MaNIS
105	UMMZ	113398	1964	*G. sabrinus*	Chippewa	46.495400	-84.345000	6.014	MaNIS
106	CMUM	M-414	1964	*G. sabrinus*	Crawford	44.664500	-84.689900	1.164	Skillen/Topozone
107	USNM	397040	1963	*G. sabrinus*	Cheboygan	45.483900	-84.595300	0.818	Skillen/Topozone
108	MSU	MR.7858	1962	*G. sabrinus*	Dickinson	45.818300	-88.005300	5.488	MaNIS
109	MSU	MR.7859	1962	*G. sabrinus*	Otsego	45.155600	-84.397400	2.842	MaNIS
110	MSU	MR.5898	1960	*G. sabrinus*	Iron	46.014400	-88.336700	6.692	MaNIS
111	CMUM	M-29	1960	*G. sabrinus*	Isabella	43.650000	-84.850000	N/A	Skillen/Topozone
112	UMMZ	105622	1957	*G. sabrinus*	Iron	46.273000	-88.903600	1.164	MaNIS
113	UMMZ	105623	1957	*G. sabrinus*	Iron	46.282500	-88.937900	0.595	MaNIS
114	UMMZ	99852	1952	*G. sabrinus*	Chippewa	46.433600	-84.216500	14.619	MaNIS
115	UMMZ	96178	1949	*G. sabrinus*	Iron	46.167000	-88.834100	1.164	MaNIS
116	MSU	MR.2453	1948	*G. sabrinus*	Alger	46.441200	-86.603300	6.077	MaNIS
117	UMMZ	92699	1948	*G. sabrinus*	Missaukee	44.411920	-84.891730	3.888	MaNIS
118	KU	149502	1948	*G. sabrinus*	Cheboygan	45.569500	-84.660300	0.991	MaNIS
119	KU	59245	1944	*G. sabrinus*	Mackinac	46.101800	-84.723600	12.231	MaNIS
120	UMMZ	88408	1942	*G. sabrinus*	Oscoda	44.653100	-84.130100	11.291	MaNIS
121	UMMZ	88409	1942	*G. sabrinus*	Oscoda	44.653100	-84.130100	0.830	MaNIS
122	UMMZ	88072	1942	*G. sabrinus*	Emmet	45.734200	-84.902800	0.830	MaNIS

123	UMMZ	86376	1941	*G. sabrinus*	Ontonagon	46.815100	-89.701000	1.635	MaNIS
124	UMMZ	86377	1941	*G. sabrinus*	Marquette	46.887600	-87.864800	1.635	MaNIS
125	UMMZ	86378	1941	*G. sabrinus*	Marquette	46.887600	-87.864800	1.635	MaNIS
126	UMMZ	86379	1941	*G. sabrinus*	Marquette	46.887600	-87.864800	2.623	MaNIS
127	UMMZ	84439	1940	*G. sabrinus*	Menominee	45.343100	-87.408600	0.515	MaNIS
128	UMMZ	84440	1940	*G. sabrinus*	Menominee	45.406700	-87.359700	7.051	MaNIS
129	UMMZ	84433	1940	*G. sabrinus*	Menominee	45.412400	-87.461000	7.051	MaNIS
130	UMMZ	84434	1940	*G. sabrinus*	Menominee	45.412400	-87.461000	1.313	MaNIS
131	UMMZ	84435	1940	*G. sabrinus*	Menominee	45.412400	-87.461000	4.485	MaNIS
132	UMMZ	84436	1940	*G. sabrinus*	Menominee	45.412400	-87.461000	9.732	MaNIS
133	UMMZ	84437	1940	*G. sabrinus*	Menominee	45.412400	-87.461000	9.732	MaNIS
134	UMMZ	84438	1940	*G. sabrinus*	Menominee	45.412400	-87.461000	9.732	MaNIS
135	UMMZ	84441	1940	*G. sabrinus*	Menominee	45.464000	-87.502500	9.732	MaNIS
136	UMMZ	84442	1940	*G. sabrinus*	Menominee	45.464000	-87.502500	9.732	MaNIS
137	UMMZ	84432	1940	*G. sabrinus*	Menominee	45.577300	-87.785000	9.732	MaNIS
138	UMMZ	84443	1940	*G. sabrinus*	Menominee	45.827100	-87.601000	10.763	MaNIS
139	UMMZ	84444	1940	*G. sabrinus*	Menominee	45.827100	-87.601000	10.763	MaNIS
140	UMMZ	84445	1940	*G. sabrinus*	Menominee	45.827100	-87.601000	10.763	MaNIS
141	UMMZ	84446	1940	*G. sabrinus*	Menominee	45.827100	-87.601000	10.763	MaNIS
142	UMMZ	85208	1940	*G. sabrinus*	Wexford	44.221180	-85.443840	5.650	Skillen/Topozone
143	UMMZ	82635	1939	*G. sabrinus*	Luce	46.615600	-85.580600	1.313	MaNIS
144	UMMZ	82636	1939	*G. sabrinus*	Presque Isle	45.320400	-84.016800	1.313	MaNIS
145	UMMZ	82637	1939	*G. sabrinus*	Presque Isle	45.320400	-84.016800	23.767	MaNIS
146	UMMZ	82638	1939	*G. sabrinus*	Presque Isle	45.320400	-84.016800	0.830	MaNIS
147	UMMZ	82633	1939	*G. sabrinus*	Cheboygan	45.563400	-84.663700	0.830	MaNIS
148	UMMZ	82634	1939	*G. sabrinus*	Cheboygan	45.563400	-84.663700	0.830	MaNIS
149	UMMZ	74588	1935	*G. sabrinus*	Bay	43.853600	-83.965000	1.463	MaNIS
150	AMNH	97604	1935	*G. sabrinus*	Leelanau	45.023100	-85.759700	1.622	MaNIS
151	AMNH	97605	1935	*G. sabrinus*	Leelanau	45.023100	-85.759700	1.622	MaNIS
152	UMMZ	67075	1932	*G. sabrinus*	Gogebic	46.455500	-90.171000	18.919	MaNIS
153	UMMZ	67076	1932	*G. sabrinus*	Gogebic	46.592500	-90.080600	8.072	MaNIS
154	UMMZ	67074	1932	*G. sabrinus*	Gogebic	46.635200	-90.164800	4.049	MaNIS

155	UMMZ	168270	1929	*G. sabrinus*	Cheboygan	45.450000	-84.500600	N/A	Skillen/Topozone
156	UMMZ	168269	1929	*G. sabrinus*	Cheboygan	45.450000	-84.500600	N/A	Skillen/Topozone
157	MMNH	673	1928	*G. sabrinus*	Iron	46.216700	-88.566700	N/A	Skillen/Topozone
158	UMMZ	58308	1927	*G. sabrinus*	Marquette	46.823800	-87.833400	1.635	MaNIS
159	UMMZ	168267	1926	*G. sabrinus*	Cheboygan	45.549300	-84.670000	1.233	MaNIS
160	UMMZ	168268	1926	*G. sabrinus*	Cheboygan	45.563400	-84.663700	3.084	MaNIS
161	UMMZ	58951	1926	*G. sabrinus*	Cheboygan	45.579200	-84.695900	3.084	MaNIS
162	MVZ	53891	1924	*G. sabrinus*	Montmorency	45.092000	-84.178700	8.072	MaNIS
163	UMMZ	57735	1924	*G. sabrinus*	Cheboygan	45.463000	-84.667400	3.084	MaNIS
164	CUVC	CU668	1924	*G. sabrinus*	Cheboygan	45.563400	-84.663700	3.084	MaNIS
165	KU	4614	1924	*G. sabrinus*	Cheboygan	45.563400	-84.663700	3.084	MaNIS
166	OSUCOV	56	1924	*G. sabrinus*	Cheboygan	45.579200	-84.695900	3.084	MaNIS
167	OSUCOV	59	1924	*G. sabrinus*	Cheboygan	45.579200	-84.695900	3.084	MaNIS
168	OSUCOV	62	1924	*G. sabrinus*	Cheboygan	45.579200	-84.695900	0.830	MaNIS
169	OSUCOV	66	1924	*G. sabrinus*	Cheboygan	45.579200	-84.695900	3.084	MaNIS
170	UMMZ	56561	1924	*G. sabrinus*	Cheboygan	45.579200	-84.695900	3.084	MaNIS
171	KU	4084	1923	*G. sabrinus*	Charlevoix	45.168100	-84.916100	2.773	MaNIS
172	UMMZ	55206	1923	*G. sabrinus*	Charlevoix	45.168100	-84.916100	1.139	MaNIS
173	UMMZ	55208	1923	*G. sabrinus*	Charlevoix	45.168100	-84.916100	1.139	MaNIS
174	UMMZ	55209	1923	*G. sabrinus*	Charlevoix	45.168100	-84.916100	1.139	MaNIS
175	UMMZ	55210	1923	*G. sabrinus*	Charlevoix	45.168100	-84.916100	1.139	MaNIS
176	UMMZ	55207	1923	*G. sabrinus*	Charlevoix	45.199340	-84.762800	1.139	MaNIS
177	UMMZ	54030	1921	*G. sabrinus*	Leelanau	45.037580	-85.759700	3.875	MaNIS
178	UMMZ	53614	1920	*G. sabrinus*	Gogebic	46.216200	-89.413800	0.509	MaNIS
179	UMMZ	53615	1920	*G. sabrinus*	Gogebic	46.217000	-89.418600	0.830	MaNIS
180	UMMZ	53616	1920	*G. sabrinus*	Gogebic	46.217000	-89.418600	0.830	MaNIS
181	UMMZ	53617	1920	*G. sabrinus*	Ontonagon	46.548700	-89.587500	5.337	MaNIS
182	UMMZ	53618	1920	*G. sabrinus*	Ontonagon	46.548700	-89.587500	5.337	MaNIS
183	UMMZ	53619	1920	*G. sabrinus*	Ontonagon	46.548700	-89.587500	5.337	MaNIS
184	UMMZ	52528	1919	*G. sabrinus*	Marquette	46.407900	-87.977700	0.830	MaNIS
185	UMMZ	52529	1919	*G. sabrinus*	Marquette	46.407900	-87.977700	0.830	MaNIS
186	UMMZ	52530	1919	*G. sabrinus*	Marquette	46.407900	-87.977700	0.830	MaNIS

187	UMMZ	47721	1915	*G. sabrinus*	Cheboygan	45.579200	-84.695900	3.084	MaNIS
188	UMMZ	46189	1914	*G. sabrinus*	Chippewa	46.766000	-84.964800	0.296	MaNIS
189	UMMZ	44331	1913	*G. sabrinus*	Chippewa	46.300000	-84.483300	N/A	Skillen/Topozone
190	UMMZ	44332	1913	*G. sabrinus*	Chippewa	46.300000	-84.483300	N/A	Skillen/Topozone
191	UMMZ	42167	1911	*G. sabrinus*	Osceola	44.038100	-85.453900	1.141	MaNIS
192	AMNH	201402	1905	*G. sabrinus*	Leelanau	45.023100	-85.759700	1.622	MaNIS
193	UMMZ	32207	1904	*G. sabrinus*	Ontonagon	46.784500	-89.748400	4.854	MaNIS
194	UMMZ	32208	1904	*G. sabrinus*	Ontonagon	46.784500	-89.748400	4.854	MaNIS
195	UMMZ	32209	1904	*G. sabrinus*	Ontonagon	46.784500	-89.748400	4.854	MaNIS
196	USNM	71035	1894	*G. sabrinus*	Marquette	46.440800	-87.593100	2.710	Skillen/Topozone
197	UMMZ	30079	1883	*G. sabrinus*	Montcalm	43.333300	-85.116700	N/A	Skillen/Topozone
198	GVSU	484	2003	*G. volans*	Ottawa	42.8997	-85.961	6.854	MaNIS
199	GVSU	467	2003	*G. volans*	Kent	42.957471	-85.655402	0.013	GPS
200	MSU	NHM128	2003	*G. volans*	Kalamazoo	42.29288	-85.73796	0.013	Garmin eTrex
201	MSU	NHM129	2003	*G. volans*	Kalamazoo	42.29288	-85.73796	0.013	Garmin eTrex
202	MSU	NHM130	2003	*G. volans*	Kalamazoo	42.29288	-85.73796	0.013	Garmin eTrex
203	MSU	NHM131	2003	*G. volans*	Kalamazoo	42.3824	-85.3456	0.311	Skillen/Topozone
204	MSU	NHM132	2003	*G. volans*	Kalamazoo	42.3824	-85.3456	0.311	Skillen/Topozone
205	MSU	NHM133	2003	*G. volans*	Kalamazoo	42.3824	-85.3456	0.311	Skillen/Topozone
206	Myers		2003	*G. volans*	Antrim	45.0615	-84.9173	0.013	Skillen/Topozone
207	Myers		2003	*G. volans*	Montmorency	45.0957	-84.3205	0.013	Skillen/Topozone
208	Myers		2003	*G. volans*	Montmorency	45.1045	-84.3247	0.013	Skillen/Topozone
209	Myers		2003	*G. volans*	Otsego	45.1095	-84.4125	0.013	Skillen/Topozone
210	Myers		2003	*G. volans*	Montmorency	45.1122	-84.326	0.013	Skillen/Topozone
211	Myers		2003	*G. volans*	Otsego	45.1708	-84.4888	0.013	Skillen/Topozone
212	Myers		2003	*G. volans*	Otsego	45.1708	-84.4888	0.013	Skillen/Topozone
213	Myers		2003	*G. volans*	Cheboygan	45.4007	-84.4236	0.013	Skillen/Topozone
214	Myers		2003	*G. volans*	Delta	45.9307	-86.7529	0.013	Skillen/Topozone
215	Myers		2003	*G. volans*	Delta	45.9307	-86.7529	0.013	Skillen/Topozone
216	Myers		2003	*G. volans*	Schoolcraft	46.2082	-85.9825	0.013	Skillen/Topozone
217	Myers		2003	*G. volans*	Marquette	46.8397	-87.8657	0.013	Skillen/Topozone
218	Myers		2003	*G. volans*	Marquette	46.8426	-87.8632	0.013	Skillen/Topozone

219	Myers	2003	*G. volans*	Marquette	46.8426	-87.8632	0.013	Skillen/Topozone
220	Myers	2003	*G. volans*	Marquette	46.8439	-87.8549	0.013	Skillen/Topozone
221	Myers	2003	*G. volans*	Marquette	46.8439	-87.8549	0.013	Skillen/Topozone
222	Myers	2003	*G. volans*	Marquette	46.8439	-87.8549	0.013	Skillen/Topozone
223	Myers	2003	*G. volans*	Marquette	46.8439	-87.8549	0.013	Skillen/Topozone
224	Myers	2003	*G. volans*	Marquette	46.8439	-87.8549	0.013	Skillen/Topozone
225	Myers	2003	*G. volans*	Marquette	46.8439	-87.8549	0.013	Skillen/Topozone
226	Myers	2003	*G. volans*	Marquette	46.8439	-87.8549	0.013	Skillen/Topozone
227	Myers	2003	*G. volans*	Marquette	46.8439	-87.8549	0.013	Skillen/Topozone
228	Myers	2003	*G. volans*	Marquette	46.8452	-87.8057	0.013	Skillen/Topozone
229	Myers	2003	*G. volans*	Marquette	46.8684	-87.897	0.013	Skillen/Topozone
230	Myers	2003	*G. volans*	Marquette	46.8684	-87.897	0.013	Skillen/Topozone
231	Myers	2003	*G. volans*	Marquette	46.8684	-87.897	0.013	Skillen/Topozone
232	Myers	2003	*G. volans*	Marquette	46.8819	-87.9049	0.013	Skillen/Topozone
233	Myers	2003	*G. volans*	Marquette	46.8819	-87.9049	0.013	Skillen/Topozone
234	Myers	2003	*G. volans*	Marquette	46.8819	-87.9049	0.013	Skillen/Topozone
235	Myers	2003	*G. volans*	Marquette	46.8819	-87.9049	0.013	Skillen/Topozone
236	Skillen	2003	*G. volans*	Alcona	44.576306	-83.731221	0.013	Garmin eTrex
237	Skillen	2003	*G. volans*	Alcona	44.57929	-83.693365	0.013	Garmin eTrex
238	Skillen	2003	*G. volans*	Alcona	44.582888	-83.693627	0.013	Garmin eTrex
239	Skillen	2003	*G. volans*	Alcona	44.582888	-83.693627	0.013	Garmin eTrex
240	Skillen	2003	*G. volans*	Alcona	44.582888	-83.693627	0.013	Garmin eTrex
241	Skillen	2003	*G. volans*	Alcona	44.668744	-83.736748	0.013	Garmin eTrex
242	Skillen	2003	*G. volans*	Alcona	44.668744	-83.736748	0.013	Garmin eTrex
243	Skillen	2003	*G. volans*	Alcona	44.668744	-83.736748	0.013	Garmin eTrex
244	Myers	2002	*G. volans*	Cheboygan	45.560833	-84.701333	0.013	GPS
245	Skillen	2002	*G. volans*	Roscommon	44.167053	-84.840324	0.013	Garmin eTrex
246	Skillen	2002	*G. volans*	Grand Traverse	44.568104	-85.375396	0.013	Garmin eTrex
247	Skillen	2002	*G. volans*	Grand Traverse	44.568316	-85.375998	0.013	Garmin eTrex
248	Skillen	2002	*G. volans*	Grand Traverse	44.571888	-85.333561	0.013	Garmin eTrex
249	Skillen	2002	*G. volans*	Grand Traverse	44.572244	-85.334987	0.013	Garmin eTrex
250	Skillen	2002	*G. volans*	Grand Traverse	44.572244	-85.334987	0.013	Garmin eTrex

251	Skillen		2002	*G. volans*	Alpena	45.041019	-83.558201	0.013	Garmin eTrex
252	Skillen		2002	*G. volans*	Alpena	45.042152	-83.558334	0.013	Garmin eTrex
253	Skillen		2002	*G. volans*	Delta	46.151324	-86.547548	0.013	Garmin eTrex
254	Skillen		2002	*G. volans*	Schoolcraft	46.162715	-86.445338	0.013	Garmin eTrex
255	GVSU	355	2001	*G. volans*	Kent	42.9633	-85.6681	10.218	MaNIS
256	Myers		2001	*G. volans*	Otsego	44.909	-84.5643	0.311	Skillen/Topozone
257	Myers		2001	*G. volans*	Cheboygan	45.4905	-84.68533	0.013	GPS
258	Myers		2001	*G. volans*	Cheboygan	45.6067	-84.3608	0.013	Skillen/Topozone
259	Myers		2001	*G. volans*	Cheboygan	45.6067	-84.3608	0.013	Skillen/Topozone
260	GVSU	236	2000	*G. volans*	Barry	42.5416	-85.3889	0.460	Skillen/Topozone
261	GVSU	245	2000	*G. volans*	Barry	42.5416	-85.3889	0.460	Skillen/Topozone
262	Myers		1999	*G. volans*	Antrim	44.9052	-84.8523	0.595	MaNIS
263	Kurta		1999	*G. volans*	Muskegon	43.3421	-86.1467	0.013	GPS
264	Kurta		1999	*G. volans*	Muskegon	43.3694	-86.127	0.013	GPS
265	Kurta		1999	*G. volans*	Oceana	43.6631	-86.1346	0.013	GPS
266	Kurta		1999	*G. volans*	Oceana	43.6631	-86.1346	0.013	GPS
267	Kurta		1999	*G. volans*	Newaygo	43.714	-85.7801	0.013	GPS
268	Kurta		1999	*G. volans*	Lake	44.0595	-85.8491	0.013	GPS
269	Myers		1999	*G. volans*	Roscommon	44.236833	-84.848866	0.013	GPS
270	Myers		1999	*G. volans*	Roscommon	44.253833	-84.837567	0.013	GPS
271	Myers		1999	*G. volans*	Roscommon	44.256283	-84.839017	0.013	GPS
272	Myers		1999	*G. volans*	Antrim	44.9326	-84.9622	0.311	MaNIS
273	Myers		1999	*G. volans*	Otsego	45.0993	-84.417	0.311	MaNIS
274	Myers		1999	*G. volans*	Cheboygan	45.4905	-84.68533	0.013	GPS
275	Myers		1999	*G. volans*	Cheboygan	45.560833	-84.701333	0.013	GPS
276	UMMZ	173716	1999	*G. volans*	Livingston	42.4342	-84.0222	0.819	MaNIS
277	UMMZ	173740	1999	*G. volans*	Lake	44.1191	-85.9828	6.854	MaNIS
278	UMMZ	172472	1999	*G. volans*	Roscommon	44.1738	-84.8403	0.311	MaNIS
279	UMMZ	172473	1999	*G. volans*	Roscommon	44.1738	-84.8403	0.311	MaNIS
280	UMMZ	172538	1999	*G. volans*	Delta	46.0448	-86.6589	0.597	Skillen/Topozone
281	Kurta		1998	*G. volans*	Mason	44.1643	-86.0718	0.013	GPS
282	Kurta		1998	*G. volans*	Wexford	44.173	-85.7045	0.013	GPS

283	Kurta		1998	*G. volans*	Manistee	44.18	-86.0495	0.013	GPS
284	Kurta		1998	*G. volans*	Wexford	44.2403	-85.817	0.013	GPS
285	Kurta		1998	*G. volans*	Manistee	44.3055	-85.8244	0.013	GPS
286	Myers		1998	*G. volans*	Cheboygan	45.4905	-84.68533	0.013	GPS
287	UMMZ	172070	1998	*G. volans*	Cheboygan	45.4905	-84.685666	0.013	GPS
288	CMUM	M-1869	1997	*G. volans*	Isabella	43.6187	-84.7176	1.164	Skillen/Topozone
289	Myers		1997	*G. volans*	Cheboygan	45.4905	-84.68533	0.013	GPS
290	Myers		1997	*G. volans*	Cheboygan	45.560833	-84.701333	0.013	GPS
291	UMMZ	172573	1997	*G. volans*	Washtenaw	42.2727	-83.9169	2.280	MaNIS
292	UMMZ	172680	1997	*G. volans*	Washtenaw	42.2727	-83.9169	2.280	MaNIS
293	UMMZ	172139	1997	*G. volans*	Presque Isle	45.3913	-83.7648	0.830	MaNIS
294	UMMZ	172069	1997	*G. volans*	Cheboygan	45.4905	-84.685666	0.013	GPS
295	UMMZ	172136	1997	*G. volans*	Cheboygan	45.560833	-84.701333	0.013	GPS
296	UMMZ	172137	1997	*G. volans*	Cheboygan	45.565	-84.6795	1.164	MaNIS
297	UMMZ	172131	1996	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
298	UMMZ	172132	1996	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
299	UMMZ	172133	1996	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
300	UMMZ	172572	1996	*G. volans*	Washtenaw	42.3031	-83.6376	0.349	MaNIS
301	UMMZ	172681	1996	*G. volans*	Washtenaw	42.3181	-84.0206	0.832	MaNIS
302	MSB	73231	1994	*G. volans*	Benzie	44.725	-86.125	0.140	Skillen/Topozone
303	MSB	73230	1994	*G. volans*	Benzie	44.75	-86.075	0.140	Skillen/Topozone
304	CMUM	M-1785	1992	*G. volans*	Mecosta	43.65	-85.3333	N/A	Skillen/Topozone
305	MHP	29831	1992	*G. volans*	Kalkaska	44.5771	-84.8996	0.013	GPS
306	MHP	29829	1992	*G. volans*	Crawford	44.6595	-84.7487	0.013	GPS
307	MHP	29830	1992	*G. volans*	Kalkaska	44.6627	-84.9628	0.013	GPS
308	MHP	29828	1992	*G. volans*	Crawford	44.7222	-84.5015	0.013	GPS
309	UMMZ	168067	1992	*G. volans*	Livingston	42.4835	-83.7282	1.073	MaNIS
310	UMMZ	168381	1992	*G. volans*	Cheboygan	45.5634	-84.6637	1.313	MaNIS
311	UMMZ	168356	1992	*G. volans*	Cheboygan	45.5634	-84.6637	1.313	MaNIS
312	CMUM	M-1832	1991	*G. volans*	Presque Isle	45.35	-83.9333	N/A	Skillen/Topozone
313	Myers		1991	*G. volans*	Cheboygan	45.4905	-84.685666	0.013	GPS
314	Myers		1991	*G. volans*	Cheboygan	45.560833	-84.701333	0.013	GPS

315	Myers		1990	*G. volans*	Cheboygan	45.4905	-84.685666	0.013	GPS
316	UMMZ	167975	1990	*G. volans*	Emmet	45.6332	-85.0485	0.348	MaNIS
317	UMMZ	167069	1990	*G. volans*	Alger	46.562	-86.2742	0.311	MaNIS
318	UMMZ	166911	1990	*G. volans*	Alger	46.636	-86.222	0.187	MaNIS
319	UMMZ	166912	1990	*G. volans*	Alger	46.636	-86.222	0.187	MaNIS
320	UMMZ	168068	1989	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
321	CMUM	M-1158	1988	*G. volans*	Newaygo	43.55	-85.8	N/A	Skillen/Topozone
322	CMUM	M-1159	1988	*G. volans*	Newaygo	43.55	-85.8	N/A	Skillen/Topozone
323	CMUM	M-1160	1988	*G. volans*	Newaygo	43.55	-85.8	N/A	Skillen/Topozone
324	CMUM	M-1161	1988	*G. volans*	Newaygo	43.55	-85.8	N/A	Skillen/Topozone
325	CMUM	M-1966	1988	*G. volans*	Newaygo	43.55	-85.8	N/A	Skillen/Topozone
326	CMUM	M-1967	1988	*G. volans*	Newaygo	43.55	-85.8	N/A	Skillen/Topozone
327	CMUM	M-2003	1988	*G. volans*	Newaygo	43.55	-85.8	N/A	Skillen/Topozone
328	CMUM	M-2029	1988	*G. volans*	Newaygo	43.55	-85.8	N/A	Skillen/Topozone
329	MSU	MR.34458	1988	*G. volans*	Dickinson	46.1092	-87.8969	1.164	MaNIS
330	MSU	MR.34459	1988	*G. volans*	Dickinson	46.1092	-87.8969	1.164	MaNIS
331	MSU	MR.34194	1987	*G. volans*	Dickinson	46.1092	-87.8969	1.164	MaNIS
332	MSU	MR.34193	1987	*G. volans*	Iron	46.2109	-88.1272	1.164	MaNIS
333	Myers		1987	*G. volans*	Otsego	44.9002	-84.7597	0.311	MaNIS
334	UMMZ	165022	1987	*G. volans*	Livingston	42.4621	-84.0166	0.591	MaNIS
335	UMMZ	165014	1987	*G. volans*	Otsego	44.9037	-84.8057	0.311	MaNIS
336	UMMZ	165013	1986	*G. volans*	Cheboygan	45.5634	-84.6637	1.313	MaNIS
337	UWBM	35225	1986	*G. volans*	Kalamazoo	42.3543	-85.5799	1.165	MaNIS
338	MSU	MR.33795	1985	*G. volans*	Clinton	42.8053	-84.3925	3.233	MaNIS
339	UMMZ	165021	1985	*G. volans*	Washtenaw	42.4092	-83.9831	0.597	MaNIS
340	UMMZ	163703	1985	*G. volans*	Livingston	42.4461	-84.0252	0.068	MaNIS
341	OMNH	17702	1984	*G. volans*	Allegan	42.5303	-85.553	1.164	Skillen/Topozone
342	UMMZ	164953	1981	*G. volans*	Van Buren	42.3755	-85.9376	6.856	MaNIS
343	MSU	MR.31108	1980	*G. volans*	Clinton	42.8053	-84.3925	3.233	MaNIS
344	OMNH	17703	1980	*G. volans*	Kalamazoo	42.2506	-85.55	N/A	Skillen/Topozone
345	MSU	MR.33604	1979	*G. volans*	Clinton	42.8072	-84.3936	1.164	MaNIS
346	MSU	MR.28287	1978	*G. volans*	Ingham	42.6	-84.3833	N/A	Skillen/Topozone

347	MSU	MR.28288	1978	*G. volans*	Ingham	42.6	-84.3833	N/A	Skillen/Topozone
348	UMMZ	126604	1978	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
349	CRCM	79-398	1977	*G. volans*	Houghton	47.1204	-88.5693	2.601	MaNIS
350	Haveman/NMZ	243	1975	*G. volans*	Marquette	46.558	-87.418	1.164	Skillen/Topozone
351	MSU	MR.24337	1975	*G. volans*	Ingham	42.5134	-84.3196	N/A	Skillen/Topozone
352	Stormer		1975	*G. volans*	Houghton	47.1204	-88.5693	1.164	Skillen/Topozone
353	Stormer		1975	*G. volans*	Houghton	47.1207	-88.6484	1.164	Skillen/Topozone
354	UMMZ	124003	1975	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
355	Haveman		1974	*G. volans*	Marquette	46.515	-87.419	1.164	Skillen/Topozone
356	Haveman		1974	*G. volans*	Marquette	46.515	-87.419	1.164	Skillen/Topozone
357	Haveman		1974	*G. volans*	Marquette	46.515	-87.419	1.164	Skillen/Topozone
358	UMMZ	124002	1974	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
359	Haveman		1973	*G. volans*	Marquette	46.519	-87.396	1.164	Skillen/Topozone
360	Haveman/NMZ	157	1973	*G. volans*	Marquette	46.519	-87.396	1.164	Skillen/Topozone
361	UMMZ	124171	1973	*G. volans*	Livingston	42.4563	-84.0128	1.798	MaNIS
362	MSU	MR.21179	1972	*G. volans*	Ingham	42.72996	-84.50659	4.334	MaNIS
363	UMMZ	122809	1972	*G. volans*	Livingston	42.4267	-83.9922	0.900	MaNIS
364	Haveman/NMZ	97	1969	*G. volans*	Marquette	46.556	-87.391	1.164	Skillen/Topozone
365	USNM	397030	1968	*G. volans*	Wayne	42.3561	-83.0686	3.233	Skillen/Topozone
366	USNM	397038	1968	*G. volans*	Kalamazoo	42.3997	-85.4114	4.199	MaNIS
367	USNM	397018	1968	*G. volans*	Livingston	42.4563	-84.0128	1.798	MaNIS
368	USNM	397058	1968	*G. volans*	Livingston	42.4563	-84.0128	1.798	MaNIS
369	USNM	397057	1968	*G. volans*	Livingston	42.4864	-83.7308	4.966	Skillen/Topozone
370	USNM	397019	1968	*G. volans*	Livingston	42.4864	-83.7308	4.966	Skillen/Topozone
371	USNM	397025	1968	*G. volans*	Livingston	42.4864	-83.7308	4.966	Skillen/Topozone
372	USNM	397032	1968	*G. volans*	Livingston	42.4864	-83.7308	4.966	Skillen/Topozone
373	USNM	397033	1968	*G. volans*	Livingston	42.4864	-83.7308	4.966	Skillen/Topozone
374	CMUM	M-799	1967	*G. volans*	Oakland	42.6667	-83.4	N/A	Skillen/Topozone
375	UWBM	43896	1967	*G. volans*	Ingham	42.8144	-84.374	3.244	MaNIS
376	MSU	MR.14279	1966	*G. volans*	Livingston	42.6962	-83.7195	0.311	MaNIS
377	Stormer		1965	*G. volans*	Houghton	47.1204	-88.5693	1.164	Skillen/Topozone
378	UMMZ	112363	1962	*G. volans*	Washtenaw	42.2737	-83.6506	13.942	MaNIS

379	MSU	MR.7899	1961	*G. volans*	Ingham	42.7369	-84.4839	3.875	MaNIS
380	MSU	MR.8769	1961	*G. volans*	Ingham	42.7369	-84.4839	3.875	MaNIS
381	MSU	MR.5407	1960	*G. volans*	Ingham	42.7278	-84.4661	766.920	MaNIS
382	MSU	MR.7660	1960	*G. volans*	Ingham	42.7369	-84.4839	3.875	MaNIS
383	MSU	MR.4399	1959	*G. volans*	Kalamazoo	42.3957	-85.3864	0.563	MaNIS
384	MSU	MR.7593	1958	*G. volans*	Ingham	42.81885	-84.37272	8.130	MaNIS
385	UAM	4770	1958	*G. volans*	Ingham	42.81885	-84.37272	8.130	MaNIS
386	MSU	MR.1753	1957	*G. volans*	Ingham	42.73249	-84.45734	13.597	MaNIS
387	MSU	MR.8529	1957	*G. volans*	Clinton	42.8053	-84.3925	3.233	MaNIS
388	UMMZ	103656	1957	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
389	UMMZ	105650	1957	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
390	UMMZ	105651	1957	*G. volans*	Washtenaw	42.2907	-83.7583	11.603	MaNIS
391	MSU	MR.2173	1956	*G. volans*	Kalamazoo	42.3957	-85.3864	0.563	MaNIS
392	MSU	MR.2174	1956	*G. volans*	Kalamazoo	42.3957	-85.3864	0.563	MaNIS
393	MSU	MR.2175	1956	*G. volans*	Kalamazoo	42.3957	-85.3864	0.563	MaNIS
394	MSU	MR.2176	1956	*G. volans*	Kalamazoo	42.3957	-85.3864	0.563	MaNIS
395	MSU	MR.1831	1956	*G. volans*	Ingham	42.72965	-84.4839	4.949	MaNIS
396	MSU	MR.2312	1956	*G. volans*	Clinton	42.8053	-84.3925	3.233	MaNIS
397	MSU	MR.2233	1956	*G. volans*	Clinton	42.8053	-84.3925	3.233	MaNIS
398	MSU	MR.2234	1956	*G. volans*	Clinton	42.8053	-84.3925	3.233	MaNIS
399	MSU	MR.2235	1956	*G. volans*	Clinton	42.8053	-84.3925	3.233	MaNIS
400	MSU	MR.835	1956	*G. volans*	Clinton	42.8053	-84.3925	3.233	MaNIS
401	MSU	MR.1830	1956	*G. volans*	Shiawassee	42.8109	-84.3239	1.164	MaNIS
402	UMMZ	102436	1955	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
403	UMMZ	102437	1955	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
404	UMMZ	102438	1955	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
405	MVZ	136803	1953	*G. volans*	Washtenaw	42.326	-83.7966	0.597	MaNIS
406	MVZ	136804	1953	*G. volans*	Washtenaw	42.326	-83.7966	0.597	MaNIS
407	UMMZ	99302	1950	*G. volans*	Livingston	42.4563	-84.0128	1.798	MaNIS
408	UMMZ	162681	1950	*G. volans*	Livingston	42.4563	-84.0128	1.798	MaNIS
409	KU	149548	1949	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
410	MSU	MR.834	1949	*G. volans*	Ingham	42.7438	-84.4786	686.450	MaNIS

411	MSU	MR.2454	1948	*G. volans*	Ingham	42.7369	-84.4839	3.875	MaNIS
412	MSU	MR.2455	1948	*G. volans*	Ingham	42.7369	-84.4839	3.875	MaNIS
413	KU	154095	1947	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
414	TCWC	3813	1945	*G. volans*	Ingham	42.72965	-84.4839	4.949	MaNIS
415	TCWC	3814	1945	*G. volans*	Ingham	42.72965	-84.4839	4.949	MaNIS
416	TCWC	3815	1945	*G. volans*	Ingham	42.72965	-84.4839	4.949	MaNIS
417	TCWC	3816	1945	*G. volans*	Ingham	42.72965	-84.4839	4.949	MaNIS
418	KU	59250	1944	*G. volans*	Jackson	42.0739	-84.1575	1.624	MaNIS
419	MSB	11590	1944	*G. volans*	Jackson	42.0739	-84.1575	1.624	MaNIS
420	MSB	703	1944	*G. volans*	Jackson	42.0739	-84.1575	1.624	MaNIS
421	MVZ	183711	1944	*G. volans*	Jackson	42.0739	-84.1575	1.624	MaNIS
422	UIMNH	UIMNH 24020	1944	*G. volans*	Kalkaska	42.2123	-83.837	6.856	Skillen/Topozone
423	UIMNH	UIMNH 1559	1942	*G. volans*	Berrien	41.9153	-86.5933	6.576	Skillen/Topozone
424	HCMZ	1435	1940	*G. volans*	Allegan	42.5498	-85.9563	6.854	MaNIS
425	UMMZ	86145	1940	*G. volans*	Washtenaw	42.2051	-84.0723	6.856	MaNIS
426	HCMZ	1356	1939	*G. volans*	Allegan	42.6	-85.8667	N/A	Skillen/Topozone
427	UMMZ	82628	1939	*G. volans*	Van Buren	42.2528	-86.1847	1.061	MaNIS
428	UMMZ	82629	1939	*G. volans*	Van Buren	42.2528	-86.1847	1.061	MaNIS
429	UMMZ	82630	1939	*G. volans*	Van Buren	42.2528	-86.1847	1.061	MaNIS
430	UMMZ	81725	1939	*G. volans*	Allegan	42.6372	-85.9573	6.854	MaNIS
431	UMMZ	82631	1939	*G. volans*	Menominee	45.4386	-87.8133	5.662	MaNIS
432	UMMZ	82632	1939	*G. volans*	Menominee	45.4386	-87.8133	5.662	MaNIS
433	AMNH	122698	1938	*G. volans*	Branch	41.9403	-85.0006	2.750	Skillen/Topozone
434	MVZ	97094	1938	*G. volans*	Washtenaw	42.2535	-83.8372	24.168	MaNIS
435	UMMZ	80429	1938	*G. volans*	Jackson	42.3383	-84.2347	1.463	MaNIS
436	HCMZ	645	1937	*G. volans*	Allegan	42.557	-85.9867	1.164	Skillen/Topozone
437	UMMZ	79468	1937	*G. volans*	Livingston	42.4563	-84.0128	1.798	MaNIS
438	UMMZ	79469	1937	*G. volans*	Livingston	42.4563	-84.0128	1.798	MaNIS
439	UMMZ	79470	1937	*G. volans*	Livingston	42.4563	-84.0128	1.798	MaNIS
440	LSUMZ	463	1936	*G. volans*	Livingston	42.4563	-84.0128	1.798	MaNIS
441	LSUMZ	464	1936	*G. volans*	Livingston	42.4563	-84.0128	1.798	MaNIS
442	LSUMZ	465	1936	*G. volans*	Livingston	42.4563	-84.0128	1.798	MaNIS

443	LSUMZ	466	1936	*G. volans*	Livingston	42.4563	-84.0128	1.798	MaNIS
444	LSUMZ	467	1936	*G. volans*	Livingston	42.4563	-84.0128	1.798	MaNIS
445	LSUMZ	468	1936	*G. volans*	Livingston	42.4563	-84.0128	1.798	MaNIS
446	UMMZ	80445	1936	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
447	UMMZ	76420	1935	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
448	UMMZ	76421	1935	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
449	UMMZ	125062	1935	*G. volans*	Jackson	42.291	-84.4232	6.856	MaNIS
450	UMMZ	76425	1935	*G. volans*	Livingston	42.4563	-84.0128	1.798	MaNIS
451	UMMZ	77543	1935	*G. volans*	Livingston	42.4563	-84.0128	1.798	MaNIS
452	UMMZ	80264	1935	*G. volans*	Livingston	42.4563	-84.0128	1.798	MaNIS
453	CIS	731	1934	*G. volans*	Oakland	42.5756	-83.2725	6.856	Skillen/Topozone
454	CIS	732	1934	*G. volans*	Oakland	42.5756	-83.2725	6.856	Skillen/Topozone
455	UMMZ	88420	1934	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
456	UMMZ	68116	1933	*G. volans*	Washtenaw	42.3256	-83.8153	0.349	MaNIS
457	UMMZ	68121	1933	*G. volans*	Livingston	42.4281	-83.9115	1.785	MaNIS
458	UMMZ	65460	1932	*G. volans*	Livingston	42.4567	-83.9464	1.463	MaNIS
459	UMMZ	65457	1931	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
460	UMMZ	64155	1931	*G. volans*	Livingston	42.4563	-84.0128	1.798	MaNIS
461	UMMZ	98887	1930	*G. volans*	Washtenaw	42.2288	-83.7243	13.158	MaNIS
462	UMMZ	98888	1930	*G. volans*	Washtenaw	42.2728	-83.6883	12.445	MaNIS
463	UMMZ	80523	1929	*G. volans*	Washtenaw	42.2281	-83.8058	12.297	MaNIS
464	UMMZ	58839	1928	*G. volans*	Washtenaw	42.3256	-83.8153	0.349	MaNIS
465	UMMZ	58835	1927	*G. volans*	Cass	42.0258	-85.83503	3.570	MaNIS
466	UMMZ	58836	1927	*G. volans*	Cass	42.0258	-85.83503	3.570	MaNIS
467	UMMZ	58928	1927	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
468	UMMZ	57190	1925	*G. volans*	Washtenaw	42.3199	-83.7593	0.832	MaNIS
469	KU	4083	1923	*G. volans*	Otsego	45.0032	-84.8545	2.440	MaNIS
470	UMMZ	55204	1923	*G. volans*	Otsego	45.0636	-84.8556	0.830	MaNIS
471	UMMZ	55205	1923	*G. volans*	Otsego	45.0636	-84.8556	0.830	MaNIS
472	UMMZ	54979	1922	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
473	UMMZ	53156	1918	*G. volans*	Washtenaw	42.4058	-84.0011	0.188	MaNIS
474	UMMZ	53157	1918	*G. volans*	Washtenaw	42.4058	-84.0011	0.188	MaNIS

475	UMMZ	52340	1917	*G. volans*	Berrien	41.8814	-86.6286	0.658	MaNIS
476	UMMZ	48351	1916	*G. volans*	Van Buren	42.2178	-85.8911	1.946	MaNIS
477	UMMZ	48352	1916	*G. volans*	Van Buren	42.2178	-85.8911	1.946	MaNIS
478	UMMZ	48353	1916	*G. volans*	Van Buren	42.2178	-85.8911	1.946	MaNIS
479	UMMZ	48354	1916	*G. volans*	Van Buren	42.2178	-85.8911	1.946	MaNIS
480	UMMZ	48355	1916	*G. volans*	Van Buren	42.2178	-85.8911	1.946	MaNIS
481	UMMZ	48356	1916	*G. volans*	Van Buren	42.2178	-85.8911	1.946	MaNIS
482	UMMZ	48357	1916	*G. volans*	Van Buren	42.2178	-85.8911	1.946	MaNIS
483	UMMZ	48358	1916	*G. volans*	Van Buren	42.2178	-85.8911	1.946	MaNIS
484	UMMZ	48359	1916	*G. volans*	Van Buren	42.2178	-85.8911	1.946	MaNIS
485	UMMZ	53926	1916	*G. volans*	Van Buren	42.2178	-85.8911	1.946	MaNIS
486	MCZ	41789	1911	*G. volans*	Huron	43.9119	-83.3972	0.819	MaNIS
487	UMMZ	41785	1911	*G. volans*	Huron	43.9119	-83.3972	0.819	MaNIS
488	UMMZ	41786	1911	*G. volans*	Huron	43.9119	-83.3972	0.819	MaNIS
489	UMMZ	41787	1911	*G. volans*	Huron	43.9119	-83.3972	0.819	MaNIS
490	UMMZ	41788	1911	*G. volans*	Huron	43.9119	-83.3972	0.819	MaNIS
491	UMMZ	41790	1911	*G. volans*	Huron	43.9119	-83.3972	0.819	MaNIS
492	UMMZ	41791	1911	*G. volans*	Huron	43.9119	-83.3972	0.819	MaNIS
493	UMMZ	41792	1911	*G. volans*	Huron	43.9119	-83.3972	0.819	MaNIS
494	UMMZ	41793	1911	*G. volans*	Huron	43.9119	-83.3972	0.819	MaNIS
495	UMMZ	41794	1911	*G. volans*	Huron	43.9119	-83.3972	0.819	MaNIS
496	UMMZ	38672	1909	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
497	UMMZ	35759	1907	*G. volans*	Washtenaw	42.2116	-83.8366	6.856	MaNIS
498	UMMZ	35760	1907	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
499	UMMZ	34372	1907	*G. volans*	Washtenaw	42.3383	-83.8886	0.993	MaNIS
500	UMMZ	34486	1907	*G. volans*	Washtenaw	42.4196	-83.9175	0.832	MaNIS
501	UMMZ	34498	1907	*G. volans*	Livingston	42.5535	-84.0884	6.856	MaNIS
502	UMMZ	33690	1906	*G. volans*	Washtenaw	42.4196	-83.9175	0.832	MaNIS
503	UMMZ	31594	1904	*G. volans*	Washtenaw	42.2411	-83.6131	4.855	MaNIS
504	UMMZ	31785	1904	*G. volans*	Washtenaw	42.318	-84.1001	0.671	MaNIS
505	UMMZ	31786	1904	*G. volans*	Washtenaw	42.318	-84.1001	0.671	MaNIS
506	UMMZ	31787	1904	*G. volans*	Washtenaw	42.318	-84.1001	0.671	MaNIS

507	UMMZ	31307	1904	*G. volans*	Gratiot	43.2917	-84.6075	1.624	MaNIS
508	UMMZ	31308	1904	*G. volans*	Gratiot	43.2917	-84.6075	1.624	MaNIS
509	UMMZ	30560	1903	*G. volans*	Jackson	42.1606	-84.2461	2.429	MaNIS
510	CIS	399	1898	*G. volans*	Wayne	42.3053	-83.2247	6.856	Skillen/Topozone
511	UMMZ	31356	1897	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS
512	CAS	18956	1890	*G. volans*	Wayne	42.2506	-83.2833	N/A	Skillen/Topozone
513	UMMZ	30021	1879	*G. volans*	Washtenaw	42.2708	-83.7264	9.683	MaNIS

*Sources of data include museums listed by codes in Appendix II and trapping records from Dr. Phil Myers, Robert R. Skillen, Dr. Allen Kurta, Teresa Friedich, Stormer and Sloan (1976), and Haveman and Robinson (1976).
†Georeference sources include the Mammal Network Information System (MaNIS), data directly from Geographic Positioning System (GPS) handheld receivers, and TopoZone.com.

APPENDIX Ib

Original location information associated with each record from Appendix Ia.

No.	Location
1	T36N, R25W, sec 21, NE1/4 of SE1/4, 45deg 30.79', 87deg 23.59'
2	Seney NWR, T45N, R14W, sec 7, SE1/4 of SE1/4, 46deg 18.22', 86deg 5.92'
3	Huron Mtn Club, Stone House, 46deg 50.63', 87deg 51.30'
4	T36N, R25W, sec 20,SE1/4 of NE1/4, 45o30.02', 87o24.82'
5	GPS
6	SNWR, T45N, R13W, sec 4, NW1/4 of NW1/4 46o14.51', 85o56.94'
7	SNWR, T45N, R13W, sec 4, NW1/4 of NW1/4 46o14.51', 85o56.94'
8	SNWR, T45N, R13W, sec 4, NW1/4 of NW1/4 46o14.51', 85o56.94'
9	GPS
10	GPS
11	Seney National Wildlife Refuge, T45N, R14W, sec 20, NE1/4 of NE1/4
12	UMBS, Reese's swamp, 45o 32.87'; 84o 39.92
13	T32N, R1W, sec 12 and 13
14	GPS
15	Camp Grayling
16	T29N, R5W, sec 13, SE1/4, 44o54.228'; 84o50.886
17	T31N, R1W, sec 3, NW1/4 of NE1/4
18	GPS
19	River Mouth Campground, Tahquamenon Falls State Park
20	SHEM = southern hemlocks off of Osmun Road between Cross Bridge Rd and Webb Rd (PRCSF)
21	West side of Silver Creek Rd., north of Little Ocqueoc River
22	SCE = east of Silver Creek Trail, Presque Isle Co. T35N R5E sec 23 (MSF) Manistee?
23	SCE = east of Silver Creek Trail, Presque Isle Co. T35N R5E sec 23 (MSF) Manistee?
24	SCW = west of Silver Creek Trail, Presque Isle Co. T35N R5E sec 23 (MSF)
25	CC = along Carp Creek just south of Hogsback Rd (UMBS)
26	University of Michigan Biological Station, T37N, R3W, SEC 28

27 Q = parallel to P, across the road from the burn plot (UMBS)
28 T44N, R4W, sec34, SE1/4
29 UMBS, Reese's swamp, 45o 32.87'; 84o 39.92
30 T44N,R7W,SEC 17, SW1/4 OF NE 1/4
31 T44N,R7W,SEC 17, SW1/4 OF NE 1/4
32 T47N, R15W, sec 30, SE1/4 of SE1/4
33 T47N, R15W, sec 30, SE1/4 of SE1/4
34 T47N, R15W, SEC 20, SE1/4 OF SE1/4
35 River Mouth Campground, Tahquamenon Falls State Park
36 T43N, R4W, sec 33, NE1/4 of SE1/4
37 CAMP GRAYLING M. R. LCTA O95, UTM:690635, 4956055
38 Pictured Rocks National Lakeshore, Hurricane River at H58
39 Pictured Rocks National Lakeshore, Hurricane River at H58
40 T16N, R5W, SE 1/4 of Sec 14
41 Michigamme Experimental Site
42 12MI N ST. IGNACE
43 T32N, R1W, sec 27, SE1/4 of SE1/4
44 T32N, R1W, sec 27, SE1/4 of SE1/4
45 T32N, R1W, SEC 27, SE1/4 OF SE1/4
46 Delta county
47 Delta county
48 Keweenaw county
49 vicinity Lansing
50 Seney National Wildlife Refuge, T44N, R14W, sec 27
51 Seney National Wildlife Refuge, T45N, R15W, sec 3
52 Seney National Wildlife Refuge, T45N, R15W, sec 3, line 2-9
53 Seney National Wildlife Refuge, T45N, R15W, sec 3, line 3, station 18
54 Seney National Wildlife Refuge, T45N, R15W, sec 3, line 5, station 18
55 Seney National Wildlife Refuge, T44N, R14W, sec 25, line 10, station 11
56 Seney National Wildlife Refuge, T44N, R14W, sec 25, line 10, station 2
57 Seney National Wildlife Refuge, T44N, R14W, sec 27, line 16, station 6
58 Seney National Wildlife Refuge, T44N, R14W, sec 27, line 17, station 17

59	Seney National Wildlife Refuge, T45N, R15W, sec 3
60	Seney National Wildlife Refuge
61	Seney National Wildlife Refuge, T45N, R15W, sec 3
62	Seney National Wildlife Refuge, T44N, R14W, sec 25
63	Seney National Wildlife Refuge, T44N, R14W, sec 27
64	T15N, R6W, SE 1/4 of Sec 32
65	T27N,R1W,SEC 23
66	T27N,R1W,SEC 23
67	4 miles N. of Manistique
68	4 miles N. of Manistique
69	Seney National Wildlife Refuge, T45N, R15W, sec 3
70	Seney National Wildlife Refuge, T45N, R15W, sec 3
71	Seney National Wildlife Refuge, T45N, R15W, sec 3
72	Seney National Wildlife Refuge, T45N, R15W, sec 3
73	Midland county
74	Dickenson county
75	T46N, R17W, Sec 23
76	T46N, R17W, Sec 23
77	5 mi. WNW of Oscoda
78	1 mi. N of Escanaba
79	4 miles N. of Manistique
80	4 miles N. of Manistique
81	Shingleton, Cuisno Wildlife Research Station
82	Charlevoix county
83	Charlevoix county
84	Shingleton, Cuisno Wildlife Research Station
85	Sugar Island
86	Sugar Island
87	Sugar Island
88	Sugar Island
89	Sugar Island
90	Sugar Island

91 University of Michigan Biological Station
92 University of Michigan Biological Station
93 Luce county
94 T46N, R17W, Sec 29
95 T46N, R17W, Sec 30
96 T46N, R17W, Sec 30
97 T46N, R17W, Sec 22
98 T46N, R17W, Sec 22
99 T14N, R3W
100 T14N, R3W, Sec 1
101 T29N, R11W, Sec 30
102 Cheboygan City
103 3 mi. NE of Shingleton
104 4 mi. NE of Shingleton
105 SAULT STE.MARIE
106 T26N, R3W, Sec 8
107 Topinabee, Mullet Lake
108 2 mi. E of Iron Mountain
109 13 mi. E of Vanderbilt
110 5 mi. S Crystal Falls
111 Isabella county
112 T45 N,R37 W,SEC.26,NW Q.
113 T45 N,R37 W,SEC.21
114 SUGAR IS.
115 T44 N,R36 W,SEC.32
116 3 mi. NE Munising
117 8MI NW THE HEIGHTS
118 Douglas Lake, East side of Fishtail Bay
119 Rudyard, 9 miles south of
120 Mio
121 Mio
122 Wilderness park

123 Porcupine Mts., 4 miles west of Union River
124 Huron Mt. Club
125 Huron Mt. Club
126 Huron Mt. Club
127 5MI SW CEDAR RIVER,HAYWARD BAY
128 0.5MI SW CEDAR RIVER
129 7MI E STEPHENSON
130 7MI E STEPHENSON
131 7MI E STEPHENSON
132 7MI E STEPHENSON
133 7MI E STEPHENSON
134 7MI E STEPHENSON
135 5MI E DAGGETT
136 5MI E DAGGETT
137 6MI NW BANAT
138 8MI N HERMANSVILLE
139 8MI N HERMANSVILLE
140 8MI N HERMANSVILLE
141 8MI N HERMANSVILLE
142 3MI SW CADILLAC
143 TWO-HEARTED RIVER,18MI N NEWBERRY
144 BARNHART LAKE
145 BARNHART LAKE
146 BARNHART LAKE
147 U.MICH.BIOL.STA.
148 U.MICH.BIOL.STA.
149 PINCONNING
150 Leland
151 Leland
152 IRONWOOD
153 BLACK RIVER
154 13MI N IRONWOOD

155 GORGE
156 PINE POINT
157 Iron county
158 HURON MTNS.
159 BETWEEN DOUGLAS AND BURT LAKES
160 DOUGLAS LAKE AND HOOK POINT
161 DOUGLAS LAKE
162 Valentine Lake
163 BURT LAKE
164 Douglas Lake (Hook Point)
165 DOUGLAS LAKE; CARP CREEK
166 Douglas Lake
167 Douglas Lake
168 Douglas Lake
169 Douglas Lake
170 DOUGLAS LAKE
171 BOYNE FALLS
172 BOYNE FALLS
173 BOYNE FALLS
174 BOYNE FALLS
175 BOYNE FALLS
176 0.5MI N THUMB LAKE
177 1MI N LEELAND
178 FISH-HAWK LAKE
179 LINDSLEY LAKE
180 LINDSLEY LAKE
181 GOGEBIC LAKE
182 GOGEBIC LAKE
183 GOGEBIC LAKE
184 REPUBLIC
185 REPUBLIC
186 REPUBLIC

187 DOUGLAS LAKE
188 WHITEFISH POINT
189 Chippewa county
190 Chippewa county
191 LE ROY
192 Leland
193 PORCUPINE MTS.
194 PORCUPINE MTS.
195 PORCUPINE MTS.
196 Palmer
197 Montcalm county
198 Blendon Township
199 312 Paris, SE GR
200 T2S, R12W, NE1/4 of NW1/4 of Sec. 17, 9577 Amber Circle, Kalamazoo
201 T2S, R12W, NE1/4 of NW1/4 of Sec. 17, 9577 Amber Circle, Kalamazoo
202 T2S, R12W, NE1/4 of NW1/4 of Sec. 17, 9577 Amber Circle, Kalamazoo
203 T1S, R9W, NW1/4 of SE1/4 of Sec. 15, Trillium Dr., Richland
204 T1S, R9W, NW1/4 of SE1/4 of Sec. 15, Trillium Dr., Richland
205 T1S, R9W, NW1/4 of SE1/4 of Sec. 15, Trillium Dr., Richland
206 T31N, R5W, sec 21, SE1/4 of SE1/4, 45deg 3.69', 84deg 55.04'
207 T31N, R1E, sec 9, NE 1/4 of NW 1/4, 45deg 5.74', 84deg 19.23'
208 T31N, R1E, sec 4, NW1/4 of SW1/4, 45deg 6.27', 84deg 19.48'
209 T31N, R1W, sec 3, NW1/4 of NE1/4, 45deg 6.57', 84deg 24.75'
210 T31N, R1E, sec 4, NW 1/4 of NW 1/4, 45deg 6.73', 84deg 19.56'
211 T32N, R1W, sec 18, NW1/4 of NW1/4, 45deg 10.25', 84deg 29.33'
212 T32N, R1W, sec 18, NW1/4 of NW1/4, 45deg 10.25', 84deg 29.33'
213 T35N, R1W, sec 27, NE1/4 of NW1/4, 45deg 24.04', 84deg 25.42'
214 Hiawatha NF, T41N, R20W, sec 24, SW1/4 of SW1/4, 45deg 55.84', 86deg 45.18'
215 Hiawatha NF, T41N, R20W, sec 24, SW1/4 of SW1/4, 45deg 55.84', 86deg 45.18'
216 Seney NWR, T44N, R13W, sec 18, SW1/4, 46deg 12.49', 85deg 58.96'
217 Huron Mtn Club, Cedars, T51N, R28W, sec 4, SE1/4 of SW1/4, 46deg 50.38', 87deg 51.95'

218 Huron Mtn Club, Elm Creek, T51N, R28W, sec 4, NE1/4 of SW1/4, 46deg 50.55', 87deg 51.80'
219 Huron Mtn Club, Elm Creek, T51N, R28W, sec 4, NE1/4 of SW1/4, 46deg 50.55', 87deg 51.80'
220 Huron Mtn Club, Stone House, 46deg 50.63', 87deg 51.30'
221 Huron Mtn Club, Stone House, 46deg 50.63', 87deg 51.30'
222 Huron Mtn Club, Stone House, 46deg 50.63', 87deg 51.30'
223 Huron Mtn Club, Stone House, 46deg 50.63', 87deg 51.30'
224 Huron Mtn Club, Stone House, 46deg 50.63', 87deg 51.30'
225 Huron Mtn Club, Stone House, 46deg 50.63', 87deg 51.30'
226 Huron Mtn Club, Stone House, 46deg 50.63', 87deg 51.30'
227 Huron Mtn Club, Stone House, 46deg 50.63', 87deg 51.30'
228 Huron Mtn Club, 5 Forks, T51N, R28W, sec 1, NW1/4 of SW1/4, 46deg 50.71', 87deg 48.35'
229 Huron Mtn Club, Mountain Lake, T52N, R28W, sec 30, SE1/4 of SE1/4, 46deg 52.10', 87deg 53.83'
230 Huron Mtn Club, Mountain Lake, T52N, R28W, sec 30, SE1/4 of SE1/4, 46deg 52.10', 87deg 53.83'
231 Huron Mtn Club, Mountain Lake, T52N, R28W, sec 30, SE1/4 of SE1/4, 46deg 52.10', 87deg 53.83'
232 Huron Mtn Club, Rush Lake, T52N, R28W, sec 30, NE1/4 of NW1/4, 46deg 52.91', 87deg 54.30'
233 Huron Mtn Club, Rush Lake, T52N, R28W, sec 30, NE1/4 of NW1/4, 46deg 52.91', 87deg 54.30'
234 Huron Mtn Club, Rush Lake, T52N, R28W, sec 30, NE1/4 of NW1/4, 46deg 52.91', 87deg 54.30'
235 Huron Mtn Club, Rush Lake, T52N, R28W, sec 30, NE1/4 of NW1/4, 46deg 52.91', 87deg 54.30'
236 N/A
237 N/A
238 N/A
239 N/A
240 N/A
241 N/A
242 N/A
243 N/A
244 UMBS, Burn Plot, 45o 33.65'; 84o 42.08'
245 N/A
246 N/A
247 N/A
248 N/A

249 N/A
250 N/A
251 N/A
252 N/A
253 N/A
254 N/A
255 Grand Rapids
256 T29N, R2W, sec 16, SW1/4 of NW1/4
257 UMBS, Colonial Point hardwoods, 45o 29.43'; 84o 41.12'
258 45o36'24"N, 84o21'39"W
259 45o36'24"N, 84o21'39"W
260 Cloverdale - PCCI
261 Cloverdale - PCCI
262 T29N, R5W, sec 13, SE1/4
263 N/A
264 N/A
265 N/A
266 N/A
267 N/A
268 N/A
269 T21N, R4W, sec 6, SW1/4 of SW1/4, 44o14.21'; 84o50.932'
270 T22N, R4W, sec 31, SW1/4 of NE1/4, 44o15.230';84o50.254'
271 T21N, R4W, sec 6, SW1/4 of SW1/4, 44o15.377';84o50.341
272 T29N, R5W, sec 6, SE1/4 of SW1/4, 44o55.842'; 84o57.793'
273 T31N, R1W, sec 3, SW1/4 of SE1/4
274 UMBS, Colonial Point hardwoods, 45o 29.43'; 84o 41.12'
275 UMBS, Burn Plot, 45o 33.65'; 84o 42.08'
276 Patterson Lake
277 Elk Twsp.
278 T21N, R4W, SECT. 31, SW1/4 OF NE1/4
279 T21N, R4W, SECT. 31, SW1/4 OF NE1/4
280 HIAWATHA NATIONAL FOREST, T42N, R19W, SECT 10, SE CORNER OFF OF H13, NEAR FR2753

281 Mason county
282 N/A
283 N/A
284 N/A
285 N/A
286 UMBS, Colonial Point hardwoods, 45o 29.43'; 84o 41.12'
287 UNIVERSITY OF MICHIGAN BIOLOGICAL STATION, COLONIAL POINT
288 T14N, R3W, SEC 7
289 UMBS, Colonial Point hardwoods, 45o 29.43'; 84o 41.12'
290 UMBS, Burn Plot, 45o 33.65'; 84o 42.08'
291 DEXTER 1815 STEINBACK RD.
292 DEXTER 1815 STEINBACK RD.
293 T36N, R5E, SEC 25, OFF OF US 23
294 UNIVERSITY OF MICHIGAN BIOLOGICAL STATION, COLONIAL POINT
295 UNIVERSITY OF MICHIGAN BIOLOGICAL STATION, BURN PLOT
296 UNIVERSITY OF MICHIGAN BIOLOGICAL STATION, T37N, R3W, SEC 28
297 ANN ARBOR
298 ANN ARBOR
299 ANN ARBOR
300 SUPERIOR TWP., CHERRY HILL RD. 1 MILE E OF GALE RD.
301 CHELSEA 5095 QUEEN OAKS DR.
302 TIESMA RD, 1.5 MI NW EDGEWATER OFF LAKE MICHIGAN R, 44D43'30"N 86D07'30"W, 180M
303 ESCH RD AT ARAL, LINE 7, 44D45'N 86D04'30"W, 185M
304 Mecosta county
305 CAMP GRAYLING M. R. LCTA 171, UTM:666755, 4938115
306 CAMP GRAYLING M. R. LCTA 123, UTM:678485, 4947595
307 CAMP GRAYLING M. R. LCTA 014, UTM:661500, 4947500
308 CAMP GRAYLING M. R. LCTA 113, UTM:697865, 4955125
309 MCCABE RD.
310 UM BIOLOGICAL STATION
311 UM BIOLOGICAL STATION CABIN WS-1
312 Presque Isle county

313 UMBS, Colonial Point hardwoods, 45o 29.43'; 84o 41.12'
314 UMBS, Burn Plot, 45o 33.65'; 84o 42.08'
315 UMBS, Colonial Point hardwoods, 45o 29.43'; 84o 41.12'
316 CROSS VILLAGE
317 PICTURED ROCKS NATIONAL LAKESHORE, T48N, R16W, SEC 14, NE 1/4 OF NW 1/4
318 PICTURED ROCKS NATIONAL LAKESHORE, TWELVEMILE BEACH CAMPGROUND
319 PICTURED ROCKS NATIONAL LAKESHORE, TWELVEMILE BEACH CAMPGROUND
320 ANN ARBOR, 240 OAKWAY
321 Newaygo county
322 Newaygo county
323 Newaygo county
324 Newaygo county
325 Newaygo county
326 Newaygo county
327 Newaygo county
328 Newaygo county
329 Michigan State University-TVG Pirlot Road Test Plot, T43N, R29W, Sec. 23
330 Michigan State University-TVG Pirlot Road Test Plot, T43N, R29W, Sec. 23
331 Pirlot Road Test Site
332 Michigamme Experimental Site
333 T29N, R4W, sec 23, NE1/4 of NW1/4
334 E.S. GEORGE RESERVE, NORTH WOODS
335 T29N, R4W, SEC. 16, SW .25 OF SW .25
336 UNIVERSITY OF MICHIGAN BIOLOGICAL STATION
337 Cooper Township
338 Rose Lake Wildlife Research Area, Bath Township
339 R4E, T1S, SEC. 5, SW 1/4 PICKEREL LAKE
340 E.S. GEORGE RESERVE, CAMBURU LAB
341 N/A
342 BLOOMINGDALE TOWNSHIP
343 Rose Lake Wildlife Research Area, Bath Township
344 N/A

345 Sec. 23, R1W, T5N
346 Old School House
347 Old School House
348 ANN ARBOR
349 Houghton
350 T48N, R25W, Sec. 15, at the edge of the city of Marquette
351 Dansville State Game Area
352 T55N, R34W, Sec. 36 near MTU campus
353 T55N, R34W, Sec. 32, approximately 5.6 km west of the city of Houghton
354 ANN ARBOR
355 T47N, R25W, Sec. 3
356 T47N, R25W, Sec. 3
357 T47N, R25W, Sec. 3
358 ANN ARBOR
359 T48N, R25W, Sec. 35
360 T48N, R25W, Sec. 35
361 E.S.GEORGE RESERVE
362 1.25 mi WSW of East Lansing
363 HIGHLAND LAKE
364 T48N, R25W, Sec. 14 in the city of Marquette
365 Detroit, Wayne State University
366 Gull Lake
367 E.S. George Reserve, Pinckney
368 E.S. George Reserve, Pinckney
369 Island Lake Recreation Area
370 Island Lake State Recreation Area, Brighton
371 Island Lake State Recreation Area, Brighton
372 Island Lake State Recreation Area, Brighton
373 Island Lake State Recreation Area, Brighton
374 Oakland county
375 Haslett; near Rose Lake, Peacock Rd.
376 SW 1/4, SW 1/4, Sec. 35, Tyrone Township

377 T55N, R34W, Sec. 36 near MTU campus
378 4MI E ANN ARBOR
379 East Lansing
380 East Lansing
381 Sanford Woodlot, Michigan State University campus, East Lansing
382 East Lansing
383 Kellogg Bird Sanctuary
384 8 mi. NE of East Lansing
385 8 mi NE East Lansing
386 5 mi. E Lansing
387 Rose Lake
388 ANN ARBOR
389 ANN ARBOR
390 2MI NW ANN ARBOR
391 Kellogg Bird Sanctuary
392 Kellogg Bird Sanctuary
393 Kellogg Bird Sanctuary
394 Kellogg Bird Sanctuary
395 0.5 mi. S East Lansing
396 Rose Lake Experiment Station
397 Rose Lake
398 Rose Lake Conservation Station
399 Rose Lake Conservation Station
400 Rose Lake Conservation Station
401 T5N, R1E, Sec. 22
402 ANN ARBOR
403 ANN ARBOR
404 ANN ARBOR
405 NW1/4 S12 Scio Township
406 NW1/4 S12 Scio Township
407 E.S. GEORGE RESERVE
408 E.S. GEORGE RESERVE

409 ANN ARBOR
410 East Lansing High School
411 East Lansing
412 East Lansing
413 ANN ARBOR
414 0.5 mi S East Lansing
415 0.5 mi S East Lansing
416 0.5 mi S East Lansing
417 0.5 mi S East Lansing
418 WAMPLERS LAKE
419 NORVILLE TOWNSHIP, WAMPLER'S LAKE
420 WAMPLER'S LAKE, NORVILLE TWSP.
421 Wampler's Lake
422 Lodi Township
423 Warren Dunes
424 Valley Township
425 SHARON TWP.
426 Allegan county
427 VAN AUKEN LAKE
428 VAN AUKEN LAKE
429 VAN AUKEN LAKE
430 HEATH TWP.
431 8MI SW BANAT
432 8MI SW BANAT
433 Coldwater
434 no specific locality recorded
435 PORTAGE LAKE
436 T2N, R14W, sec 17
437 E.S.GEORGE RESERVE
438 E.S.GEORGE RESERVE
439 E.S.GEORGE RESERVE
440 George Reserve

441 George Reserve
442 George Reserve
443 George Reserve
444 George Reserve
445 George Reserve
446 ANN ARBOR
447 ANN ARBOR
448 ANN ARBOR
449 BLACKMAN TWP
450 E.S.GEORGE RESERVE
451 E.S.GEORGE RESERVE
452 E.S.GEORGE RESERVE
453 Bloomfield Township
454 Bloomfield Township
455 ANN ARBOR
456 DELHI
457 PORTAGE LAKE
458 PINCKNEY
459 ANN ARBOR
460 E.S.GEORGE RESERVE
461 3MI S ANN ARBOR
462 2MI E ANN ARBOR
463 5MI SW ANN ARBOR
464 DELHI
465 1MI W MARCELLUS
466 1MI W MARCELLUS
467 ANN ARBOR
468 ANN ARBOR,BARTON HILLS
469 ELMIRA, 5 MI S OF
470 ELMIRA
471 ELMIRA
472 ANN ARBOR

473 DEAD LAKE
474 DEAD LAKE
475 BIRCHWOOD BEACH
476 PAW PAW
477 PAW PAW
478 PAW PAW
479 PAW PAW
480 PAW PAW
481 PAW PAW
482 PAW PAW
483 PAW PAW
484 PAW PAW
485 PAW PAW
486 SAND POINT
487 SAND POINT
488 SAND POINT
489 SAND POINT
490 SAND POINT
491 SAND POINT
492 SAND POINT
493 SAND POINT
494 SAND POINT
495 SAND POINT
496 ANN ARBOR
497 LODI TWP.
498 ANN ARBOR
499 DEXTER
500 PORTAGE LAKE
501 IOSCO
502 PORTAGE LAKE
503 YPSILANTI
504 CAVANNAUGH LAKE

505 CAVANNAUGH LAKE
506 CAVANNAUGH LAKE
507 ITHACA
508 ITHACA
509 NAPOLEON
510 Greenfield Township
511 ANN ARBOR
512 Wayne county
513 ANN ARBOR

APPENDIX Ic

Notes corresponding to each record from Appendix Ia.

No.	Notes
1	Trapping record
2	Trapping record
3	Trapping record
4	Trapping record
5	Trapping record
6	Trapping record
7	Trapping record
8	Trapping record
9	Trapping record
10	Trapping record
11	Trapping record
12	Trapping record
13	Trapping record
14	mist netting record
15	N/A
16	Trapping record
17	Trapping record
18	Mist netting record
19	N/A
20	Trapping record
21	midpoint of portion of road running through section
22	Trapping record
23	Trapping record
24	Trapping record
25	Trapping record
26	MaNIS error terms corrected for section

27 Trapping record, estimated from MaNIS location of UMBS burn plot
28 center of a 1/4 section
29 Trapping record
30 N/A
31 N/A
32 Trapping record
33 Trapping record
34 N/A
35 N/A
36 Trapping record
37 N/A
38 N/A
39 N/A
40 center of a 1/4 section, Gilmore Township
41 N/A
42 N/A
43 Trapping record
44 Trapping record
45 N/A
46 center of county
47 center of county
48 center of county
49 Lansing area
50 Fluid carcass
51 Right front foot dissected
52 N/A
53 Skeleton not found, spc 2001.
54 N/A
55 N/A
56 N/A
57 N/A
58 No skull, body in fluid

59 N/A
60 Skeleton not found, spc 2001.
61 N/A
62 Skeleton not found, spc 2001.
63 N/A
64 center of a 1/4 section, Nottawa Township
65 N/A
66 N/A
67 assumed by air
68 assumed by air
69 N/A
70 N/A
71 N/A
72 N/A
73 center of county
74 center of county
75 N/A
76 N/A
77 Assumed by air
78 N/A
79 N/A
80 N/A
81 N/A
82 center of county
83 center of county
84 N/A
85 N/A
86 N/A
87 N/A
88 N/A
89 N/A
90 N/A

91 From center of biological station
92 N/A
93 center of county
94 N/A
95 N/A
96 N/A
97 N/A
98 N/A
99 Chippewa Township
100 Chippewa Township
101 N/A
102 center of city
103 county listed as Schoolcraft in orgional record
104 county listed as Schoolcraft in orgional record
105 N/A
106 N/A
107 Center of Topinabee
108 N/A
109 N/A
110 N/A
111 center of county
112 N/A
113 N/A
114 N/A
115 N/A
116 N/A
117 Calculated by air from "The Heights" coordinates; county listed as Roscommon on origional record
118 center of bay, eastern side
119 N/A
120 center of city
121 center of city
122 N/A

123 N/A
124 N/A
125 N/A
126 N/A
127 N/A
128 N/A
129 N/A
130 N/A
131 N/A
132 N/A
133 N/A
134 N/A
135 N/A
136 N/A
137 N/A
138 N/A
139 N/A
140 N/A
141 N/A
142 N/A
143 18 mi. by air N of Newberry to determine latitude; longitude is closest point on Little Two Hearted River
144 center of upper and lower Barnhart Lakes
145 center of upper and lower Barnhart Lakes
146 center of upper and lower Barnhart Lakes
147 From center of biological station
148 From center of biological station
149 extent based on TopoZone's bounding box
150 N/A
151 N/A
152 N/A
153 N/A
154 N/A

155 center of county
156 center of county
157 center of county
158 N/A
159 between northernmost point of Burt Lake, and South Fishtail Bay on Douglas Lake
160 center of lake
161 center of lake
162 center of lake
163 center of lake
164 center of lake
165 center of lake
166 center of lake
167 center of lake
168 center of lake
169 center of lake
170 center of lake
171 N/A
172 N/A
173 N/A
174 N/A
175 N/A
176 Assumed by air
177 N/A
178 currently considered part of Lindsley Lake.
179 N/A
180 N/A
181 N/A
182 N/A
183 N/A
184 N/A
185 N/A
186 N/A

187 center of lake
188 N/A
189 center of county
190 center of county
191 N/A
192 N/A
193 N/A
194 N/A
195 N/A
196 center of city
197 center of county
198 coordinates for intersection of sections 15, 16, 21, and 22
199 Assumed SE GR is southeast Grand Rapids
200 Wildlife Wranglers Inc.
201 Wildlife Wranglers Inc.
202 N/A
203 Wildlife Wranglers Inc., Ross Township
204 Wildlife Wranglers Inc., Ross Township
205 Wildlife Wranglers Inc., Ross Township
206 Trapping record
207 Trapping record
208 Trapping record
209 Trapping record
210 Trapping record
211 Trapping record
212 Trapping record
213 Trapping record
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246 Trapping record
247 Trapping record
248 Trapping record
249 Trapping record
250 Trapping record

251 Trapping record
252 Trapping record
253 Trapping record
254 Trapping record
255 N/A
256 Trapping record
257 Trapping record
258 Trapping record
259 Trapping record
260 N/A
261 N/A
262 coordinates based on TRS information only
263 Mist netting record
264 Mist netting record
265 Mist netting record
266 Mist netting record
267 Mist netting record
268 Mist netting record
269 Trapping record
270 Trapping record
271 Trapping record
272 coordinates based on TRS information only
273 Trapping record
274 Trapping record
275 Trapping record
276 N/A
277 intersection of Sections 15,16,21, and 22 T20N R14W
278 N/A
279 N/A
280 center of a 1/4 section
281 Mist netting record
282 Mist netting record

283 Mist netting record
284 Mist netting record
285 Mist netting record
286 Trapping record
287 From other Myers records
288 Chippewa Township
289 Trapping record
290 Trapping record
291 midpoint of rd; could not find address
292 midpoint of rd; could not find address
293 assumed to be T36N, R4E, Sec. 25, off of midpoint of US 23 that runs through section
294 From other Myers records
295 From other Myers records
296 MaNIS error terms corrected for section
297 From center of locality
298 From center of locality
299 From center of locality
300 From center of intersection
301 center of Chelsea; could not find road
302 assumed NAD27
303 assumed NAD27
304 center of county
305 N/A
306 N/A
307 N/A
308 N/A
309 coordinates are approximate midpoint of road located in T1N R6E S16
310 From center of biological station
311 From center of biological station
312 center of county
313 Trapping record
314 Trapping record

315 Trapping record
316 N/A
317 N/A
318 N/A
319 N/A
320 From center of locality
321 center of county
322 center of county
323 center of county
324 center of county
325 center of county
326 center of county
327 center of county
328 center of county
329 N/A
330 N/A
331 N/A
332 N/A
333 Trapping record
334 N/A
335 N/A
336 From center of biological station
337 N/A
338 county center of wildlife area
339 center of 1/4 of section
340 N/A
341 N/A
342 coordinates are for the intersection of sections 15, 16, 21, and 22, T1S R14W= Bloomingdale Twp.
343 county center of wildlife area
344 N/A
345 county center of wildlife area
346 center of county

347 center of county
348 from center of locality
349 N/A
350 N/A
351 N/A
352 N/A
353 N/A
354 From center of locality
355 N/A
356 N/A
357 N/A
358 From center of locality
359 N/A
360 N/A
361 N/A
362 Assumed by air
363 N/A
364 N/A
365 Born aug 1968
366 coordinates for center of lake; extent includes town of same name
367 N/A
368 N/A
369 N/A
370 N/A
371 N/A
372 N/A
373 N/A
374 center of county
375 Coordinates are for midpoint of length of Peacock Road
376 N/A
377 N/A
378 From center of locality

379 N/A
380 N/A
381 N/A
382 N/A
383 N/A
384 Assumed by air
385 Assumed by air
386 Assumed by air
387 county center of wildlife area
388 From center of locality
389 From center of locality
390 From center of locality
391 N/A
392 N/A
393 N/A
394 N/A
395 Assumed by air
396 county center of wildlife area
397 county center of wildlife area
398 county center of wildlife area
399 county center of wildlife area
400 county center of wildlife area
401 county center of wildlife area
402 From center of locality
403 From center of locality
404 From center of locality
405 center of 1/4 of section
406 center of 1/4 of section
407 N/A
408 N/A
409 From center of locality
410 N/A

411 N/A
412 N/A
413 From center of locality
414 Assumed by air
415 Assumed by air
416 Assumed by air
417 Assumed by air
418 N/A
419 N/A
420 N/A
421 N/A
422 center of township
423 Macomb? County on origional record, center of Warren Dunes State Park
424 N/A
425 center of township
426 N/A
427 N/A
428 N/A
429 N/A
430 N/A
431 N/A
432 N/A
433 assumed Branch county, center of city
434 center of county
435 center of lake
436 center of section
437 N/A
438 N/A
439 N/A
440 N/A
441 N/A
442 N/A

443 N/A
444 N/A
445 N/A
446 From center of locality
447 From center of locality
448 From center of locality
449 N/A
450 N/A
451 N/A
452 N/A
453 center of township
454 center of township
455 From center of locality
456 center of locality
457 N/A
458 N/A
459 From center of locality
460 N/A
461 From center of locality
462 From center of locality
463 From center of locality
464 center of locality
465 considered by air
466 considered by air
467 From center of locality
468 center of locality
469 N/A
470 N/A
471 N/A
472 From center of locality
473 center of lake
474 center of lake

475 assumed Lake Michigan beach near town of Birchwood intended
476 N/A
477 N/A
478 N/A
479 N/A
480 N/A
481 N/A
482 N/A
483 N/A
484 N/A
485 N/A
486 N/A
487 N/A
488 N/A
489 N/A
490 N/A
491 N/A
492 N/A
493 N/A
494 N/A
495 N/A
496 From center of locality
497 center of twp.
498 From center of locality
499 center of locality
500 center of portion of lake in city.
501 assumed Iosco Township intended; coordinates represent intersection of sections 15, 16, 21, 22
502 center of portion of lake in city.
503 center of locality
504 center of lake
505 center of lake
506 center of lake

507 assumed city of Ithaca intended
508 assumed city of Ithaca intended
509 N/A
510 assumed to be Greenfield Village but error term for size of a township used
511 From center of locality
512 center of county
513 From center of locality

APPENDIX II

List of U.S and Canadian natural history museums contacted and data received.

Museum/Institution	Code	State/ Province	Date contacted	*G.s.*	*G.v.*	MaNIS	Notes
Academy of Natural Sciences of Philadelphia	ANSP	PA	1/22/2004	0	0	N	-
American Museum of Natural History	AMNH	NY	9/8/2003	3	1	N	-
Angelo State Natural History Collection	ASNHC	TX	9/22/2003	0	0	N	-
Arkansas State University, Collection of Recent Mammals	ASUMZ	AZ	9/8/2003	-	-	N	no response
Bemidji State University, Vertebrate Collections	BSCVC	MN	9/24/2003	1	7	Y	-
Bishop Museum	BPBM	HI	2/16/2004	0	0	Y	-
California Academy of Sciences	CAS	CA	2/16/2004	0	1	Y	-
California State University, Long Beach	CSULB	CA	9/8/2003	-	-	Y	no response
Canadian Museum of Nature	CMN	Ontario	9/8/2003	-	-	N	no response
Carleton University, Museum of Zoology	CUMZ	Ontario	9/23/2003	-	-	N	no response
Carnegie Museum of Natural History	CM	PA	10/4/2003	0	0	N	-
Chicago Academy of Sciences	CHAS	IL	9/23/2003	-	-	Y	no response
Cleveland Museum of Natural History	CMNH	OH	1/15/2004	-	-	N	no response
Cornell University, Vertebrate Collections	CUVC	NY	10/4/2003	1	0	N	-
Cranbrook Institute of Science	CIS	MI	1/23/2004	0	3	N	-
Denver Museum of Natural History	DMNH	CO	9/8/2003	-	-	N	no response
Earlham College, Joseph Moore Museum	JMM	IN	9/8/2003	0	0	N	-
Eastern Illinois University	EIU	IL	9/8/2003	-	-	N	no response
Eastern New Mexico University, Natural History Museum	ENMUNHM	NM	1/15/2004	-	-	N	no response
Emporia State University, Schmidt Museum of Natural History	SMNH	KS	9/8/2003	-	-	N	no response
Field Museum	FMNH	IL	9/23/2003	0	0	N	-
Fort Hays State University, Sernberg Museum of Natural History	MHP	KS	10/4/2003	1	4	N	-

Harvard University, Museum of Comparative Zoology	MCZ	MA	9/8/2003	-	-	Y	no response
Hope College	HCMZ	MI	10/10/2003	0	6	N	3 N.U.
Illinois Natural History Survey	INHS	IL	-	-	-	N	see UIMNH
Illinois State Museum	ISM	IL	9/23/2003	-	-	N	no response
Illinois State University	ISU	IL	9/8/2003	-	-	N	no response
James R. Slater Museum	PSM	WA	2/16/2004	0	0	N	-
Kansas State University	KSU	KS	9/8/2003	0	0	N	-
Lake Superior State College	LSSC	MI	9/23/2003	-	-	Y	no response
Los Angeles County Museum of Natural Science	LACM	CA	2/16/2004	0	0	Y	-
Louisiana State University, Museum of Natural Science	LSUMZ	LA	1/15/2003	0	6	N	-
Luther College, Sherman A. Hoslett Museum of Natural History	SHMC	IA	9/8/2003	0	0	N	-
Michigan State University Museum	MSU	MI		14	40	Y	-
Michigan Technological University	MTU	MI	1/13/2004	4	5	Y	-
Museum of Texas Tech University	TTU	TX	2/16/2004	0	0	Y	-
Museum of Vertebrate Zoology	MVZ	CA	2/16/2004	1	4	Y	-
Nevada State Museum and Historical Society	NSMHA	NV	1/16/2004	0	0	N	-
New York State Museum	NYSM	NY	1/15/2004	0	0	N	-
North Carolina State Museum of Natural Sciences	NCSM	NC	1/15/2004	-	-	N	no response
North Carolina State University	NCS	NC	9/8/2003	-	-	N	no response
Northeastern University Vertebrate Collection	NUVC	MA	9/8/2003	-	-	N	no response
Northern Michigan University Museum	NMZ	MI	N/A	-	3	N	See Haveman and Robinson (1976)
Oklahoma State University, Collection of Vertebrates	OSUCOV	OK	2/12/2004	4	0	N	-
Provincial Museum of Alberta	PMA	Alberta	9/23/2003	0	0	N	-
Royal British Columbia Museum	RBCM	B.C.	1/7/2004	0	0	Y	online database
Royal Ontario Museum	ROM	Ontario	2/19/2004	0	0	N	-
Sam Houston State University, Vertebrate Natural History Collection	SHSU	TX	9/22/2003	0	0	N	-
San Diego Natural History Museum	SDNHM	CA	9/23/2003	0	0	Y	-

Smithsonian Institution, National Museum of Natural History	USNM	MD	1/21/2003	29	21	N	1*G.s.* & 12*G.v.* N.U.
Southern Illinois University	SIUCM	IL	9/23/2003	0	0	N	-
St. John's University, Biological Collections	SJUBC	MN	9/23/2003	1	0	N	-
Texas A&M University, Texas Cooperative Wildlife Collection	TCWC	TX	9/22/2003	0	4	N	-
The Field Museum	FMNH	IL	3/18/2003	3	1	Y	-
The Science Museum of Minnesota	SMM	MN	9/23/2003	0	0	N	-
Tulane University, Museum of Natural History	TU	LA	9/8/2003	-	-	Y	no response
University of Alaska Museum	UAM	AK	2/16/2004	0	1	Y	-
University of Alberta, Museum of Zoology	UAMZ	Alberta	9/23/2003	-	-	Y	no response
University of Arizona, Collection of Mammals	UA	AZ	9/23/2003	0	0	N	-
University of British Columbia, Cowan Vertebrate Museum	UBC	B.C.	10/4/2003	0	0	N	-
University of California, Santa Barbara Vertebrate Museum	UCSB	CA	9/23/2003	0	0	N	-
University of Colorado Museum	UCM	CO	9/8/2003	-	-	N	no response
University of Connecticut	UCONN	CT	9/8/2003	-	-	N	no response
University of Florida, Florida Museum of Natural History	UF	FL	9/8/2003	-	-	N	no response
University of Georgia, Museum of Natural History	UGAMNH	GA	9/8/2003	-	-	N	no response
University of Illinois, Museum of Natural History	UIMNH	IL	9/23/2003	1	3	N	-
University of Kansas Museum of Natural History	KU	KS	2/16/2004	5	4	Y	-
University of Michigan Museum of Zoology	UMMZ	MI	12/19/2003	82	118	N	-
University of Minnesota, James Ford Bell Museum of Natural History	MMNH	MN	9/8/2003	1	0	N	-
University of Montana, Zoological Museum	UMZM	MT	1/22/2004	0	0	Y	-
University of Nebraska State Museum	UNSM	NE	1/15/2014	1	0	N	-
University of Nevada, Museum of Biology	UNEVR	NV	1/7/2004	0	0	N	-
University of New Mexico Museum of Southwestern Biology	MSB	NM	2/16/2004	1	4	Y	-
University of North Carolina at Wilmington	UNCW	NC	9/8/2003	-	-	N	no response
University of Oklahoma, Oklahoma Museum of Natural History	OMNH	OK	1/22/2004	0	2	N	-
University of Texas at Austin, Laboratory of Physical Anthropology	UTLPA	TX	9/22/2003	0	0	N	-

University of Texas at El Paso, Centennial Museum	UTEP	TX	9/22/2003	0	0	N	-
University of Vermont, Zadock Thompson Natural History Collections	VSC-L	VT	9/22/2003	0	0	N	-
University of Washington Burke Museum	UWBM	WA	2/16/2004	0	2	Y	-
University of Wisconsin, Stevens Point, Museum of Natural History	UWSP	WI	2/5/2003	3	0	Y	-
University of Wisconsin, Zoological Museum	UWZM	WI	9/23/2003	0	0	N	-
Utah Museum of Natural History	UMNH	UT	2/16/2004	0	0	Y	-
Virginia Museum of Natural History	VMNH	VA	9/22/2003	0	0	N	-
Western Illinois University, Museum of Natural History	WIU	IL	9/8/2003	-	-	N	no response
Yale University, Peabody Museum of Natural History	YPM	CT	9/23/2003	0	0	N	-

G.s.: *Glaucomys sabrinus*, *G.v.*: *Glaucomys volans*, MaNIS: member of the Mammal Network Information System, and N.U.: not used due to lack of associated date, location, or both.

Appendix III

Sites trapped during summer 2002 field season. All localities are NAD27.

Date	Trap line	Start		Finish	
		Latitude	Longitude	Latitude	Longitude
5/7-5/10/02	1	45.114578	-84.426192	45.118581	-84.389490
5/7-5/10/02	2	45.125600	-84.397852	45.123250	-84.397658
5/7-5/10/02	3	45.125485	-84.398179	45.123315	-84.397707
5/7-5/10/02	4	45.128251	-84.404935	45.127215	-84.407306
5/7-5/10/02	5	45.127228	-84.407227	No Data	No Data
5/21-5/24/02	1	44.169317	-84.833245	44.168491	-84.832963
5/21-5/24/02	2	44.169432	-84.832431	44.168230	-84.832588
5/21-5/24/02	3	44.169304	-84.834388	44.168244	-84.834006
5/21-5/24/02	4	44.169244	-84.832016	44.168184	-84.831848
5/21-5/24/02	5	44.167586	-84.839368	44.165759	-84.838768
5/21-5/24/02	6	44.167599	-84.839451	44.166558	-84.842497
5/21-5/24/02	7	44.167635	-84.839465	44.167968	-84.841014
5/28-5/31/02	1	45.263083	-84.430839	45.259486	-84.432740
5/28-5/31/02	2	45.261871	-84.430816	45.259079	-84.431336
5/28-5/31/02	3	45.299302	-84.425989	45.299789	-84.422056
5/28-5/31/02	4	45.299686	-84.426095	45.300065	-84.421883
5/28-5/31/02	5	45.296222	-84.428992	No Data	No Data
5/28-5/31/02	6	45.281397	-84.422405	45.281636	-84.427537
5/28-5/31/02	7	45.281813	-84.421003	45.280099	-84.417223
6/10-6/14/02	1	44.617968	-83.763305	44.614716	-83.762792
6/10-6/14/02	2	44.617712	-83.763791	44.614623	-83.765766
6/10-6/14/02	3	44.666560	-83.838452	44.665356	-83.842618
6/10-6/14/02	4	44.617777	-83.706396	44.618395	-83.701593
6/10-6/14/02	5	44.617385	-83.706588	44.617908	-83.701855
6/10-6/14/02	6	44.573372	-83.784222	44.572627	-83.785832
6/18-6/21/02	1	44.572297	-85.335715	44.571492	-85.333485
6/18-6/21/02	2	44.568669	-85.368610	44.571910	-85.369837
6/18-6/21/02	3	44.568018	-85.370212	44.564656	-85.369331
6/18-6/21/02	4	44.567960	-85.378572	44.568123	-85.375287
6/18-6/21/02	5	44.568528	-85.378613	44.569668	-85.375933
6/18-6/21/02	6	44.542110	-85.409041	44.542777	-85.404246
6/18-6/21/02	7	44.542392	-85.409572	44.542304	-85.414001
6/22-6/24/02	1	45.040163	-83.559207	45.042152	-83.558334
6/22-6/24/02	2	45.039401	-83.558647	45.041405	-83.557741
6/22-6/24/02	3	45.009329	-83.511692	45.007477	-83.511712
6/22-6/24/02	4	45.009227	-83.512077	45.007479	-83.511976
7/11-7/12/02	1	46.330577	-86.658022	46.327895	-86.660159
7/11-7/12/02	2	46.330275	-86.656891	46.327118	-86.657598
7/11-7/12/02	3	46.342255	-86.548035	46.339618	-86.544600
7/11-7/12/02	4	46.342393	-86.547707	46.344340	-86.549702

7/11-7/12/02	5	46.350661	-86.632689	46.352102	-86.636759
7/11-7/12/02	6	46.349982	-86.632123	46.348457	-86.628510
7/13-7/14/02	1	46.154932	-86.546543	46.150847	-86.547407
7/13-7/14/02	2	46.155096	-86.545137	46.151978	-86.545118
7/13-7/14/02	3	46.138080	-86.589208	No Data	No Data
7/13-7/14/02	4	46.137992	-86.589069	46.136778	-86.585051
7/13-7/14/02	5	46.165853	-86.648499	46.163199	-86.646576
7/13-7/14/02	6	46.167117	-86.646511	46.164020	-86.644325
7/15-7/17/02	1	45.988540	-86.685322	45.985846	-86.681402
7/15-7/17/02	2	45.989604	-86.686062	45.987241	-86.682977
7/15-7/17/02	3	46.027927	-86.697060	46.029199	-86.701823
7/15-7/17/02	4	46.027855	-86.696029	46.025670	-86.692548
7/24-7/25/02	1	46.282720	-86.078945	46.280775	-86.077613
7/24-7/25/02	2	46.282722	-86.079325	46.284885	-86.083615
7/24-7/25/02	4	46.236144	-86.241118	46.236953	-86.236694
7/27-7/29/02	1	46.465395	-86.125652	46.463634	-86.123313
7/27-7/29/02	2	46.463474	-86.123134	46.462013	-86.121266
7/27-7/30/02	3	46.210177	-86.001959	46.211487	-85.998648
7/27-7/30/02	4	46.210616	-86.001811	46.212671	-85.999420
7/31-8/1/02	1	46.287630	-85.939210	No Data	No Data
7/31-8/1/02	2	46.287600	-85.938680	No Data	No Data
7/31-8/1/02	3	46.216560	-85.968700	No Data	No Data
7/31-8/1/02	4	46.216610	-85.965290	No Data	No Data
8/14-8/15/02	1	46.324194	-86.449554	46.326188	-86.447743
8/14-8/15/02	2	46.323903	-86.448667	46.324450	-86.444577
8/14-8/15/02	3	46.292130	-86.452903	46.293418	-86.454917
8/16-8/18/02	1	46.186028	-86.497762	46.187843	-86.500144
8/16-8/18/02	2	46.185138	-86.497534	46.184889	-86.494604
8/16-8/18/02	3	46.153860	-86.403676	46.153005	-86.401380
8/19-8/21/02	1	46.074685	-86.459082	46.072548	-86.459142
8/19-8/21/02	2	46.162925	-86.448599	46.162836	-86.445412
8/19-8/21/02	3	46.168129	-86.451275	46.165852	-86.452369

APPENDIX IV

Nest boxes surveyed for over-wintering *Glaucomys* from December 2002 to February 2003. All locations are NAD27.

Date	Type	Latitude	Longitude	Notes	Appendix I #
12/16/2002	Wood duck	43.436217	-85.665993	-	-
12/16/2002	Wood duck	43.436346	-85.665956	-	-
12/16/2002	Wood duck	43.436200	-85.666342	-	-
12/16/2002	Wood duck	43.502625	-85.579619	-	-
12/16/2002	Wood duck	43.502488	-85.579281	-	-
12/16/2002	Wood duck	43.502808	-85.578384	*Peromyscus* species	-
12/16/2002	Wood duck	43.503488	-85.577525	-	-
12/16/2002	Wood duck	43.503319	-85.575879	-	-
12/16/2002	Wood duck	43.504674	-85.570732	-	-
12/16/2002	Wood duck	43.504575	-85.570676	-	-
12/16/2002	Wood duck	43.504415	-85.570477	-	-
12/16/2002	Wood duck	43.500621	-85.587459	-	-
12/16/2002	Wood duck	43.500531	-85.587320	-	-
12/16/2002	Wood duck	43.499871	-85.589210	-	-
12/16/2002	Wood duck	43.499935	-85.589286	-	-
12/16/2002	Wood duck	43.498653	-85.592360	-	-
12/16/2002	Wood duck	43.498731	-85.592504	-	-
12/17/2002	Wood duck	43.433347	-85.665637	-	-
12/17/2002	Wood duck	43.433436	-85.665715	-	-
12/17/2002	Wood duck	43.432563	-85.665278	-	-
12/17/2002	Wood duck	43.432565	-85.663151	-	-
12/17/2002	Wood duck	43.432530	-85.662983	-	-
12/17/2002	Wood duck	43.432625	-85.661456	-	-
12/17/2002	Wood duck	43.432504	-85.660901	-	-
12/17/2002	Wood duck	43.432636	-85.660157	-	-
12/17/2002	Wood duck	43.486584	-85.640145	-	-
12/17/2002	Wood duck	43.486166	-85.642277	-	-
12/17/2002	Wood duck	43.486009	-85.642382	-	-
12/17/2002	Wood duck	43.485768	-85.644485	-	-
12/17/2002	Wood duck	43.485789	-85.644613	-	-
12/17/2002	Wood duck	43.485336	-85.646598	-	-
12/17/2002	Wood duck	43.485250	-85.646628	-	-
12/17/2002	Wood duck	43.613110	-85.480661	-	-
12/17/2002	Wood duck	43.613083	-85.480746	-	-
12/18/2002	Wood duck	43.413213	-83.359881	-	-
12/18/2002	Wood duck	43.449575	-83.418696	-	-
12/18/2002	Wood duck	43.764003	-82.892274	-	-
12/18/2002	Wood duck	43.764448	-82.892109	-	-
12/18/2002	Wood duck	43.764812	-82.892354	-	-
12/18/2002	Wood duck	43.786168	-82.821684	-	-
12/18/2002	Wood duck	43.785944	-82.820820	-	-

12/18/2002	Wood duck	43.785947	-82.820439	-	-
12/18/2002	Wood duck	43.783280	-82.920223	-	-
12/18/2002	Wood duck	43.782292	-82.920052	-	-
12/21/2002	Wood duck	44.405668	-85.730920	-	-
12/21/2002	Wood duck	44.405347	-85.731116	-	-
12/21/2002	Wood duck	44.405127	-85.731084	-	-
12/21/2002	Wood duck	44.365249	-85.820878	-	-
12/21/2002	Wood duck	44.365681	-85.827101	-	-
12/21/2002	Wood duck	44.365469	-85.827197	-	-
12/21/2002	Wood duck	44.265954	-85.912351	-	-
12/21/2002	Wood duck	44.265863	-85.912491	-	-
12/21/2002	Wood duck	44.265459	-85.928609	-	-
12/21/2002	Wood duck	44.265319	-85.928696	-	-
12/21/2002	Wood duck	44.265229	-85.938362	-	-
12/21/2002	Wood duck	44.265273	-85.938391	-	-
12/21/2002	Wood duck	44.256368	-85.939519	-	-
12/21/2002	Wood duck	44.256312	-85.939202	-	-
12/21/2002	Wood duck	44.255083	-85.933526	-	-
12/21/2002	Wood duck	44.238743	-85.783090	-	-
12/21/2002	Wood duck	44.255746	-85.935360	-	-
12/21/2002	Wood duck	44.237689	-85.918903	-	-
12/21/2002	Wood duck	44.237271	-85.919633	-	-
12/22/2002	Wood duck	44.664177	-84.141219	-	-
12/22/2002	Wood duck	44.664202	-84.141420	-	-
12/22/2002	Wood duck	44.665782	-84.147000	-	-
12/22/2002	Wood duck	44.665735	-84.147307	-	-
12/22/2002	Wood duck	44.561940	-83.806400	-	-
12/22/2002	Wood duck	44.562101	-83.806397	-	-
12/22/2002	Wood duck	44.561280	-83.805362	-	-
12/22/2002	Wood duck	44.766451	-83.719687	-	-
12/22/2002	Wood duck	44.454009	-83.680378	-	-
12/22/2002	Wood duck	44.454082	-83.680710	-	-
12/22/2002	Wood duck	44.455504	-83.687320	-	-
12/22/2002	Wood duck	44.652092	-84.116670	-	-
12/22/2002	Wood duck	44.456562	-83.693286	-	-
12/22/2002	Wood duck	44.456674	-83.693264	-	-
12/22/2002	Wood duck	44.456200	-83.675223	-	-
12/22/2002	Wood duck	44.430744	-83.452868	-	-
12/22/2002	Wood duck	44.430918	-83.452647	-	-
12/22/2002	Wood duck	44.433956	-83.459760	-	-
12/22/2002	Wood duck	44.433912	-83.459706	-	-
12/22/2002	Wood duck	44.435906	-83.465672	-	-
12/22/2002	Wood duck	44.430136	-83.460574	-	-
1/3/2003	Wood duck	44.220274	-85.713083	-	-
1/3/2003	Wood duck	44.221310	-85.708601	-	-
1/3/2003	Wood duck	44.221326	-85.708277	-	-
1/3/2003	Wood duck	44.222272	-85.695740	-	-
1/16/2003	Wood duck	44.452724	-83.852249	-	-

1/16/2003	Wood duck	44.453108	-83.850468	-	-
1/16/2003	Wood duck	44.453385	-83.846507	-	-
1/16/2003	Wood duck	44.452483	-83.847414	-	-
1/16/2003	Wood duck	44.457049	-83.806144	-	-
1/16/2003	Wood duck	44.457979	-83.805503	-	-
1/17/2003	Wood duck	44.448552	-83.825281	-	-
1/17/2003	Wood duck	44.446962	-83.823665	-	-
1/17/2003	Wood duck	44.446916	-83.823063	-	-
1/17/2003	Wood duck	44.445374	-83.823674	-	-
1/17/2003	Wood duck	44.446514	-83.826846	-	-
1/17/2003	Wood duck	44.445896	-83.822551	-	-
1/17/2003	Wood duck	44.445940	-83.821251	-	-
1/17/2003	Wood duck	44.444840	-83.822262	-	-
1/17/2003	Wood duck	44.448231	-83.823217	-	-
1/17/2003	Wood duck	44.448140	-83.824401	-	-
1/17/2003	Wood duck	44.461287	-83.824629	-	-
1/17/2003	Wood duck	44.459199	-83.826485	-	-
1/17/2003	Wood duck	44.461280	-83.826352	-	-
1/17/2003	Wood duck	44.432752	-83.858476	-	-
1/17/2003	Wood duck	44.433576	-83.856909	-	-
1/17/2003	Wood duck	44.433992	-83.858142	-	-
1/17/2003	Wood duck	44.435077	-83.858382	-	-
1/17/2003	Wood duck	44.434150	-83.859507	-	-
1/17/2003	Wood duck	44.435711	-83.861130	-	-
1/17/2003	Wood duck	44.435050	-83.861667	-	-
1/17/2003	Wood duck	44.433947	-83.861676	-	-
1/18/2003	Wood duck	44.437473	-83.862809	-	-
1/18/2003	Wood duck	44.438792	-83.862845	-	-
1/18/2003	Wood duck	44.440484	-83.863075	-	-
1/18/2003	Wood duck	44.441497	-83.863096	-	-
1/18/2003	Wood duck	44.442108	-83.861752	-	-
1/18/2003	Wood duck	44.436165	-83.862935	-	-
1/18/2003	Wood duck	44.585561	-83.884600	-	-
1/18/2003	Wood duck	44.584714	-83.882406	-	-
1/18/2003	Wood duck	44.582877	-83.882544	-	-
1/18/2003	Wood duck	44.587012	-83.885563	-	-
1/18/2003	Wood duck	44.588085	-83.883879	-	-
1/18/2003	Wood duck	44.589004	-83.885377	-	-
1/18/2003	Wood duck	44.587790	-83.882394	-	-
1/18/2003	Wood duck	44.588281	-83.881562	-	-
1/18/2003	Wood duck	44.587195	-83.882888	-	-
1/23/2003	Wood duck	44.570568	-83.883195	-	-
1/23/2003	Wood duck	44.571846	-83.882499	-	-
1/23/2003	Wood duck	44.572602	-83.883557	-	-
1/23/2003	Wood duck	44.571806	-83.883780	-	-
1/23/2003	Wood duck	44.574721	-83.871778	-	-
1/23/2003	Wood duck	44.576082	-83.869797	-	-
1/23/2003	Wood duck	44.576024	-83.868309	-	-

1/23/2003	Wood duck	44.575318	-83.869686	-	-
1/23/2003	Wood duck	44.541109	-83.871781	-	-
1/23/2003	Wood duck	44.540582	-83.873917	-	-
1/23/2003	Wood duck	44.541463	-83.873493	-	-
1/24/2003	Wood duck	44.554011	-83.885461	-	-
1/24/2003	Wood duck	44.552347	-83.910286	-	-
1/24/2003	Wood duck	44.552911	-83.885458	-	-
1/24/2003	Wood duck	44.552196	-83.884602	-	-
1/24/2003	Wood duck	44.551691	-83.882926	-	-
1/24/2003	Wood duck	44.552101	-83.880090	-	-
1/24/2003	Wood duck	44.551660	-83.879548	*Peromyscus* species	-
1/24/2003	Wood duck	44.553748	-83.876418	-	-
1/24/2003	Wood duck	44.554180	-83.873546	-	-
1/24/2003	Wood duck	44.552734	-83.873321	-	-
1/24/2003	Wood duck	44.554664	-83.875353	-	-
1/24/2003	Wood duck	44.555227	-83.876411	-	-
1/24/2003	Wood duck	44.554769	-83.877110	-	-
1/24/2003	Wood duck	44.554138	-83.878192	-	-
1/24/2003	Wood duck	44.555096	-83.879507	-	-
1/25/2003	Wood duck	44.574008	-83.774975	-	-
1/25/2003	Wood duck	44.571992	-83.773361	-	-
1/25/2003	Wood duck	44.571759	-83.771639	-	-
1/25/2003	Wood duck	44.572130	-83.771094	-	-
1/25/2003	Wood duck	44.577014	-83.759796	-	-
1/25/2003	Wood duck	44.578320	-83.760523	-	-
1/25/2003	Wood duck	44.579364	-83.761900	-	-
1/25/2003	Wood duck	44.581647	-83.763106	-	-
1/25/2003	Wood duck	44.581865	-83.761353	-	-
1/25/2003	Wood duck	44.577394	-83.758364	-	-
1/25/2003	Wood duck	44.576704	-83.756815	-	-
1/25/2003	Wood duck	44.574969	-83.757347	-	-
1/25/2003	Wood duck	44.575376	-83.758835	-	-
1/25/2003	Wood duck	44.576916	-83.730829	-	-
1/25/2003	Wood duck	44.577278	-83.731979	-	-
1/25/2003	Wood duck	44.578301	-83.733887	-	-
1/25/2003	Wood duck	44.576306	-83.731221	2 *Glaucomys*, caught 1 *G. volans*	228
2/6/2003	Wood duck	44.578199	-83.693657	-	-
2/6/2003	Wood duck	44.579290	-83.693365	3 *Glaucomys*, caught 1 *G. volans*	229
2/6/2003	Wood duck	44.582886	-83.694379	-	-
2/6/2003	Wood duck	44.582155	-83.693503	-	-
2/6/2003	Wood duck	44.582172	-83.692510	-	-
2/6/2003	Wood duck	44.582644	-83.692802	-	-
2/6/2003	Wood duck	44.582888	-83.693627	Caught 3 *G. volans*	230, 231, & 232
2/6/2003	Wood duck	44.583421	-83.694211	-	-
2/6/2003	Wood duck	44.586792	-83.700386	-	-
2/6/2003	Wood duck	44.587305	-83.699249	-	-
2/6/2003	Wood duck	44.587344	-83.702545	-	-
2/6/2003	Wood duck	44.580983	-83.702984	-	-

2/6/2003	Wood duck	44.580253	-83.703046	-	-
2/6/2003	Wood duck	44.579032	-83.704523	-	-
2/7/2003	Wood duck	44.580128	-83.682757	-	-
2/7/2003	Wood duck	44.580294	-83.683633	-	-
2/7/2003	Wood duck	44.579613	-83.683965	-	-
2/7/2003	Wood duck	44.579488	-83.683203	-	-
2/7/2003	Wood duck	44.578992	-83.682961	-	-
2/7/2003	Wood duck	44.578349	-83.682560	-	-
2/7/2003	Wood duck	44.577735	-83.682946	-	-
2/7/2003	Wood duck	44.574929	-83.683251	-	-
2/7/2003	Wood duck	44.575519	-83.682448	-	-
2/7/2003	Wood duck	44.575322	-83.680651	-	-
2/7/2003	Wood duck	44.575656	-83.681225	-	-
2/7/2003	Wood duck	44.575865	-83.683498	-	-
2/7/2003	Wood duck	44.577831	-83.679190	-	-
2/7/2003	Wood duck	44.579654	-83.681854	-	-
2/7/2003	Wood duck	44.579835	-83.680551	-	-
2/7/2003	Wood duck	44.600824	-83.735181	-	-
2/7/2003	Wood duck	44.600790	-83.741132	-	-
2/7/2003	Wood duck	44.601049	-83.740270	-	-
2/8/2003	Wood duck	44.599520	-83.730739	-	-
2/8/2003	Wood duck	44.600124	-83.731154	-	-
2/8/2003	Wood duck	44.600206	-83.732642	-	-
2/8/2003	Wood duck	44.600012	-83.732397	-	-
2/8/2003	Wood duck	44.598837	-83.731380	*Sciurus carolinensis*	-
2/8/2003	Wood duck	44.600487	-83.728519	-	-
2/8/2003	Wood duck	44.596426	-83.760181	*Glaucomys* found week before	-
2/13/2003	Wood duck	44.638332	-83.741967	-	-
2/13/2003	Wood duck	44.636957	-83.741236	-	-
2/13/2003	Wood duck	44.637255	-83.739803	-	-
2/13/2003	Wood duck	44.638156	-83.737707	-	-
2/13/2003	Wood duck	44.635881	-83.736040	-	-
2/13/2003	Wood duck	44.639683	-83.736305	-	-
2/13/2003	Wood duck	44.640869	-83.733316	-	-
2/13/2003	Wood duck	44.640528	-83.735448	-	-
2/13/2003	Wood duck	44.641892	-83.738332	-	-
2/13/2003	Wood duck	44.641859	-83.738707	*Sciurus niger*	-
2/13/2003	Wood duck	44.638644	-83.739201	-	-
2/13/2003	Wood duck	44.594137	-83.782614	-	-
2/13/2003	Wood duck	44.594454	-83.782736	-	-
2/13/2003	Wood duck	44.594993	-83.784500	-	-
2/13/2003	Wood duck	44.595735	-83.783398	-	-
2/13/2003	Wood duck	44.595202	-83.782174	-	-
2/14/2003	Wood duck	44.674916	-83.744910	*Sciurus carolinensis*	-
2/14/2003	Wood duck	44.670523	-83.745709	-	-
2/14/2003	Wood duck	44.668690	-83.745271	*Sciurus carolinensis*	-
2/14/2003	Owl	44.674692	-83.741539	-	-
2/14/2003	Wood duck	44.674734	-83.733365	-	-

2/14/2003	Wood duck	44.673844	-83.730842	-	-
2/14/2003	Owl	44.671029	-83.729110	-	-
2/14/2003	Wood duck	44.668744	-83.736748	10 *Glaucomys*, caught 3 *G. volans*	233, 234, & 235
2/14/2003	Owl	44.668254	-83.733401	-	-
2/14/2003	Wood duck	44.670534	-83.737612	-	-