Multiple Species Inventory and Monitoring Program

Final Report – 2010

Grant number T-6-R-2

The Iowa Multiple Species Inventory & Monitoring (MSIM) program began in 2007 on public lands with one crew responsible for 16 properties in central Iowa. In 2008, the program expanded to 2 crews, covering 29 new properties divided between southeastern Iowa and south-central Iowa. The program continues to grow toward our goal of having 5 crews cover approximately 75 properties each year. In 2010, there were 4 crews that covered 59 properties, 7 permanent locations surveyed in previous years as well as new properties: 12 in eastern Iowa (hereafter Iowamake Area), 14 in mid-western Iowa (hereafter Bays Branch Area), 13 in central Iowa (hereafter Boone-Webster Area), and 13 in northwest Iowa (hereafter Ruthven Area; see Figure 1).
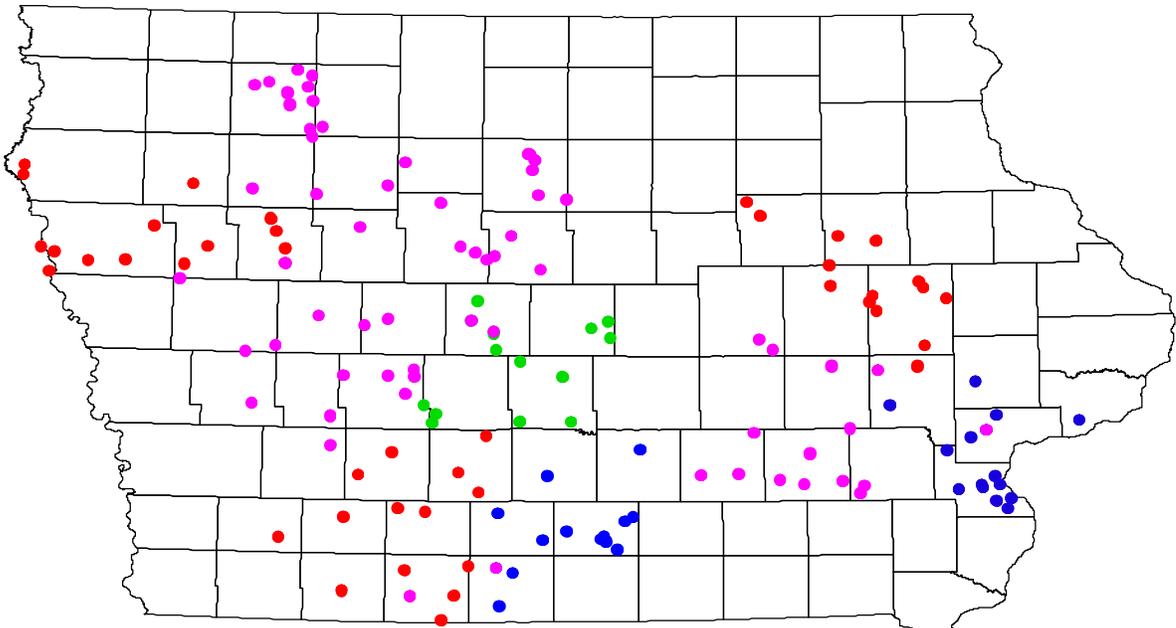

Figure 1. Properties surveyed under Iowa's Multiple Species Inventory and Monitoring Program. Green = 2007; Blue = 2008; Red = 2009; and Pink = 2010.

The specific goals for T-1-R-2 include:

1. Inventory SGCN on approximately 105 properties in 29 counties between 2009 and 2010.
2. Annual monitoring of SGCN on 4 properties in 2009 and 7 properties in 2010.
3. Determine the proportion of sampled habitat occupied by a given species of GCN.

4. Determine detection probabilities of each SGCN documented.
5. Identify changes and update current or projected statewide distribution maps of each SGCN using data collected from this project.
6. Identify physical and biological attributes of sites surveyed under objective 1.
7. Evaluate field protocols for efficiency and effectiveness.

Progress on each objective is described below.

Objectives 1 & 2: Inventory SGCN on approximately 105 properties in 29 counties between 2009 and 2010. Annual monitoring of SGCN on 4 properties in 2009 and 7 in 2010.

All properties for the MSIM Program were randomly chosen with a random number generator after being classified into potential habitat classes as defined in the Iowa Wildlife Action Plan (IWAP) by property managers. This selection process occurred in 2005. In 2009, 44 new properties were surveyed, for a total of 48 properties including 4 annual sampling locations. These properties are listed in Appendix 1. In 2010, 52 new properties were surveyed, for a total of 59 properties including 7 annual sampling locations. Properties in 42 counties were surveyed between 2009 and 2010. The table below lists each property surveyed in 2010, which of the 19 habitat types it represents, the county in which it is located, and the property owner. The 7 permanent sampling locations are listed at the end of the table and include: McCoy Wildlife Management Area (WMA) and Harrier Marsh, both of which have been surveyed annually since 2007, Cedar Bottoms WMA and DeKalb WMA which have been surveyed since 2008, and Hawkeye WMA, Black Hawk Marsh, and Mt. Ayr WMA which have been surveyed annually since 2009.

Table of properties surveyed in 2010:

	Property Name	County Name	Owner	Habitat
1	Little Storm Lake	Buena Vista	State	Stream
2	Pickerel Lake	Buena Vista	State	Impoundment
3	Barringer Slough	Clay	State	Warm Grasses
4	Dan Green Slough WPA	Clay	Federal	Warm Grasses
5	Dry Mud Lake	Clay	State	Warm Grasses
6	Elk Lake Wetland Complex	Clay	State	Wet Shrubland
7	Hawk Valley	Clay	State	Backwater
8	Little Sioux WMA	Clay	State	Woodland
9	Ocheyedan WMA	Clay	State	Backwater
10	Reiter WMA	Clay	State	Wet Forest/Woodland
11	Rush Lake _ Palo Alto County	Palo Alto	State	Stream
12	Lizard Lake	Pocahontas	State	Wet Shrubland
13	Sunken Grove _ Leo Shimon Marsh	Pocahontas	State	Creek
14	Big Bend Conservation Area	Iowa	County	Creek
15	Belva Deere Rec Area	Keokuk	County	Ag Land: Crop

Table (continued) of properties surveyed in 2010:

	Property Name	County Name	Owner	Habitat
16	Hayesville Bend WMA	Keokuk	State	Wet Forest/Woodland
17	Skunk River WMA	Keokuk	State	Oxbow
18	South Skunk Access	Keokuk	State	Oxbow
19	Hawthorne WMA	Mahaska	State	Woodland
20	Hull WMA	Mahaska	State	Herbaceous Wetland
21	Lake Keomah SP	Mahaska	State	Impoundment
22	Otter Creek WMA	Tama	State	Impoundment
23	Brinton Timber	Washington	County	Woodland
24	English River WA	Washington	County	Stream
25	Lake Darling SP	Washington	State	Creek
26	South Twin Lake	Calhoun	State	Wet Forest/Woodland
27	Whitetail Flats WMA	Franklin	State	Herbaceous Wetland
28	Briggs Woods	Hamilton	County	Lake
29	East Boone Forks	Hamilton	State	Wet Forest/Woodland
30	Little Wall Lake WMA	Hamilton	State	Ag Land: Cool Season Grass
31	Bradgate WMA	Humboldt	State	River
32	Boone Forks WMA	Webster	State	Shrubland
33	Brushy Creek Rec Area	Webster	State	River
34	Dolliver Memorial Park	Webster	State	Creek
35	Kennedy Memorial Park	Webster	County	Lake
36	Big Wall Lake	Wright	State	Lake
37	Elm Lake WMA	Wright	State	Ag Land: Cool Season Grass
38	Lower Morse Lake MSIM Crop	Wright	State	Ag Land: Crop
39	Littlefield Recreation Area	Audubon	County	Lake
40	Four Corners Rec Area	Carroll	County	Pond
41	Swan Lake	Carroll	County	Lake
42	Lake Anita SP	Cass	State	Lake
43	Yellow Smoke Park	Crawford	County	Woodland
44	Dunbar Slough	Greene	State	Creek
45	McMahon Access	Greene	State	River
46	Bays Branch WMA	Guthrie	State	Shrubland
47	Elk Grove WMA	Guthrie	State	Savanna
48	Lakin Slough WMA	Guthrie	State	Wet Shrubland
49	Lenon Mills WMA	Guthrie	State	Ag Land: Crop
50	Springbrook WMA	Guthrie	State	Wet Shrubland
51	Prairie Rose SP	Shelby	State	Creek
52	V & W Petersen WMA	Shelby	State	Creek

Table (continued) of properties surveyed in 2010:

	Property Name	County Name	Owner	Habitat
*53	Harrier Marsh	Boone	State	Warm Grasses
*54	McCoy WA	Boone	State	Pond
*55	Cedar Bottoms WMA	Muscatine	State	Herbaceous Wetland
*56	Dekalb WMA	Decatur	State	Creek
*57	Hawkeye Wildlife Area	Johnson	State	Oxbow
*58	Mt. Ayr WMA	Ringgold	State	Shallow Lake
*59	Black Hawk WMA	Sac	State	Shrubland

*Indicates a permanent sampling property, surveyed annually.

In 2010, these properties were surveyed for birds, mammals, amphibians, reptiles, odonates, and butterflies. The tables in the appendix at the end of this report list the species seen at each property during 2010. Additional tables in the appendix are duplicated from last year's annual report and include the species documented on properties in 2009. The number of bird species seen in 2010 ranged from 41 at Harrier Marsh to132 at South Twin Lake. Brushy Creek Recreation Area had the highest number of bird SGCN with 23 species, while Springbrook WMA had the fewest SGCN with 7 species. Some of the SGCN see at Brushy Creek Recreation Area include: Broad Winged Hawk, Black-billed Cuckoo, Yellow-billed Cuckoo, Red-headed Woodpecker, Willow Flycatcher, and Least Flycatcher. Appendices 2 – 6 contain the tables of bird species found on properties surveyed in 2010. Appendices 27-29 contain tables of bird species found on properties surveyed in 2009.

The number of mammal species ranged from 16 at Kennedy Memorial Park to 1 at South Skunk River Access. South Skunk Access was flooded for much of 2010, as was Hayesville Bend. These two properties will be re-surveyed in 2011 (weather permitting). All together 5 SGCN mammal species were documented: Least Shrew at 1 property, Southern Flying Squirrel at 1 property, Prairie Vole at 4 properties, River Otter at 8 properties, and Bobcat at 3 properties. Appendices 7 – 11 contain the tables of mammal species found on properties surveyed in 2010. Appendices 30-32 contain tables of mammal species documented on properties surveyed in 2009.

Cedar Bottoms WMA had the most documented amphibian and reptile species with 22. Cedar Bottoms WMA and English River WMA both had the most herpetofaunal SGCN with 3 species each. Harrier Marsh had the fewest herpetofauna documented with 5 species, but 8 properties had no amphibian and reptile SGCN found. Appendices 12 – 16 contain the tables of herpetofauna species found on properties surveyed in 2010. Appendices 33-35 contain tables of amphibian and reptiles species documented on properties surveyed in 2009.

Two properties (South Twin Lakes and Springbrook WMA)had the most odonates with 33 species, the Rinehart Tract of the Iowa River Corridor had the fewest with 6 species. This was the third property that was flooded for much of 2010 and will be re-surveyed in 2011. McMahon Access had only 13 species of odonates documented, making it the property completely surveyed yet with the fewest species. Although there were 8 odonate SGCN found, no property had more than 1 SGCN species. Twelve properties had 1 odonate SGCN, and 47 properties had no odonate SGCN. Appendices 17 – 21 contain tables of odonate species documented on properties surveyed in 2010. Appendices 36-38 contain tables of odonate species found on properties surveyed in 2009.

Hawthorne WMA had the most documented butterfly species with 34, while Skunk River WMA and Harrier Marsh had the fewest with 9 species on each site. Butterfly SGCN included only the Regal Fritillary which was found at 9 sites. A rare butterfly migrant for Iowa (the Funereal Duskywing) was found on 2 properties in the Bays Branch Area (McMahon Access and Springbrook WMA). Appendices 17 – 21 have tables of butterfly species found on properties surveyed in 2010. Appendices 39-41 contain tables of butterfly species documented on properties surveyed in 2009.

Objectives 3 & 4: Determine the proportion of sampled habitat occupied by a given SGCN.   Determine detection probabilities for each SGCN.

We are just getting started on these analyses and plan on full, in-depth analyses in 2014 after all counties in Iowa have a representative property included. The tables below offer a sample of information yet to come. Surveying a greater number of properties will result in more precise estimates for these parameters, and to this end, we have included all bird data collected since 2007 under the PI's direction (i.e. using our MSIM protocols) regardless of project funding or objective (e.g. Bird Response to WRP properties, internally funded impacts-of-management studies). We have also included the data collected on private lands under our MSIM surveys on Landowner Incentive Program properties. The information presented below should still be considered a first cut of the data as no covariates have been utilized in the analyses as of yet. In addition to SGCN, we have also included a 2 more common species (Red-Winged Blackbird and Canada Goose) as a reference for the parameters. Ψ represents the probability a site is occupied, γ represents the probability a site will be colonized, and p represents the probability a species will be detected if it is present on an area. For 2 species (Dickcissel and Northern Bobwhite Quail) models which include a parameter for extinction (ϵ) were chosen as those with the best fit for the data. All parameters were allowed to vary by year (one estimate for each of the 4 years), season across years (spring, summer, and fall in most cases although this varies by species), and no variability (one estimate for all seasons and years, denoted as '.').

Table of top models for selected species:

Species	Model	Number of Parameters
Black-billed Cuckoo	Ψ (by year) γ (.) p(by season)	8
Bobolink	Ψ (by season) γ (by season) p(by season)	9
Canada Goose	Ψ (by year) γ (by year) p(by 2 seasons)	10
*Dickcissel	Ψ (.) ϵ(.) γ (.) p(by season)	6
Grasshopper sparrow	Ψ (by year) γ (.) p(by season)	8
Least Flycatcher	Ψ (by season) γ (.) p(by season)	7
**Northern Bobwhite Quail	Ψ (by year) ϵ (.) p(by season)	8
Red-winged Blackbird	Ψ (.)E (year) γ (.) p(by 2 seasons)	8
Veery	Ψ (.) γ (.) p(by season)	5
Yellow-billed Cuckoo	Ψ (by year) γ (.) p(by season)	8

*Dickcissel model includes one parameter for extinction probability and one for colonization.
**Northern Bobwhite Quail model incorporates extinction probability instead of colonization probability.

Table of occupancy estimates for representative species. Ψ_{2007}, Ψ_{2008}, Ψ_{2009}, Ψ_{2010} represent the annual proportion of area occupied estimates, and Ψ_{spring}, Ψ_{summer}, Ψ_{fall} represent the seasonal proportion of area occupied estimates.

Species	Ψ_{2007} Ψ_{spring}	Ψ_{2008} Ψ_{summer}	Ψ_{2009} Ψ_{fall}	Ψ_{2010}
Black-billed Cuckoo (year)	9.2 (9.2-9.2)	26.0 (13.3-44.7)	14.3 (6.8-27.6)	28.5 (28.5-28.5)
Bobolink (season)	30.0 (27.6-32.6)	26.5 (24.5-28.6)	74.9 (44.0-92.0)	
Canada Goose (year)	67.9 (61.7-73.6)	68.5 (63.5-73.2)	77.5 (72.5-81.7)	74.3 (68.0-79.7)
Dickcissel (.)	37.7 (33.2-42.4)			
Grasshopper sparrow (year)	11.3 (8.8-14.6)	20.6 (18.4-23.1)	22.8 (20.4-25.3)	12.8 (10.1-16.1)
Least Flycatcher (season)	51.6 (32.9-69.9)	13.5 (8.1-21.6)	20.0 (4.5-57.2)	
Northern Bobwhite Quail (year)	11.5 (8.4-15.5)	3.2 (2.1-4.9)	8.3 (6.5-10.6)	2.3 (1.1-4.7)
Red-winged Blackbird (.)	88.0 (85.2-90.4)			
Veery (.)	1.4 (1.0-2.1)			
Yellow-billed Cuckoo (year)	48.9 (42.2-55.6)	37.4 (32.4-42.6)	43.3 (38.3-48.5)	43.7 (36.7-51.0)

Table of colonization probabilities. γ_{2007}, γ_{2008}, γ_{2009}, and γ_{2010} represent annual colonization estimates, γ_{spring}, γ_{summer}, and γ_{fall} represent seasonal colonization estimates, and $\gamma(.)$ represents 1 estimate across years and seasons.

Species	γ_{2007} γ_{spring}	γ_{2008} γ_{summer}	γ_{2009} γ_{fall}	γ_{2010}
Black-billed Cuckoo (.)	10.1 (10.1-10.1)*			
Bobolink (season)	NC*	29.7 (19.1-43.0)	NC*	
Canada Goose (year)	44.2 (23.8066.8)	43.0 (27.4-60.2)	56.1 (39.5-71.5)	0 (0-100)*
Dickcissel ($\varepsilon(.)$ & $\gamma(.)$)	ε = 11.5 (9.2–14.3)	γ = 4.4 (3.3–5.7)		
Grasshopper sparrow (.)	4.8 (4.0-5.8)			
Least Flycatcher (.)	0.5 (0-99.3)*			
Northern Bobwhite Quail (Extinction by .)	37.4 (16.2-64.9)			
Red-winged Blackbird (ε by year & γ (.))	γ = 22.6 (18.3-27.7) ε2007 = 9.7 (6.3-14.7)	ε2008 = 6.6 (4.4-9.6)	ε2009 = 4.6 (2.7-7.9)	ε2010 = 7.7 (4.5-12.9)
Veery (.)	0.7 (0.4-1.2)			
Yellow-billed Cuckoo (.)	1.2 (0.2-7.5)			

*Not reliably calculated (e.g. estimate = 99.9 (0-100)).

Table of detection probabilities. Detection probabilities (p) by year, season, or constant across year and season (.).

Species	p_{2007} p_{spring}	p_{2008} p_{summer}	p_{2009} p_{fall}
Black-billed Cuckoo (season)	0.9 (0.4-1.7)	2.5 (1.5-4.1)	0.2 (0-0.7)
Bobolink (season)	17.5 (15.6-19.7)	38.6 (36.3-40.9)	3.1 (2.2-4.3)
Canada Goose (2 seasons: Summer & fall)	22.3 (21.2-23.5)	12.5 (11.6-13.5)	
Dickcissel (season)	2.4 (1.8-3.2)	54.9 (53.0-56.8)	2.7 (2.1-3.4)
Grasshopper sparrow (season)	15.6 (13.4-18.2)	41.4 (38.8-44.1)	4.4 (3.5-5.5)
Least Flycatcher (season)	6.2 (4.1-9.1)	4.7 (2.7-8.0)	1.1 (0.2-4.5)
Northern Bobwhite Quail (season)	7.0 (4.1-11.4)	29.3 (24.5-34.7)	3.4 (2.1-5.5)
Red-winged Blackbird (2 seasons: Summer & fall)	73.1 (72.4-73.9)	39.8 (38.4-41.2)	
Veery (season)	16.4 (8.9-28.0)	35.8 (21.8-52.7)	4.7 (1.6-13.1)
Yellow-billed Cuckoo (season)	1.4 (1.0-2.0)	19.7 (17.6-21.8)	2.7 (2.2-3.4)

Objective 5: Identify changes and update current or projected statewide distribution maps of each SGCN using data collected from this inventory project.

We follow a quality control protocol for this objective. Once all faunal data has been entered into the database for a given year, county lists are produced for each taxonomic group. These lists are then sent to the Iowa Wildlife Action Plan Taxonomic Subcommittee Chairs (birds – Dr. Stephen Dinsmore, herpetofauna – Mr. Jeff LeClere, mammals – Mr. Daryl Howell and Dr. Rick Lampe, fish – Dr. Clay Pierce, mussels –Ms. Kelly Poole and Dr. Kevin Roe , odonates – Mr. Steve Hummel, butterflies – Ms. Stephanie Shepherd, snails –Dr. Kevin Roe). We currently have not sent any information to the fish, mussel, or snail committee chairs for the 2010 season.

Each chair has the option of forwarding our list to the committee or reviewing it themselves. In either case, they flag the species that are unusual or represent new county records. We then go back to the original data sheets and determine whether there was a data entry error or whether the record was entered legitimately. If the records were not made in error, then we provide any additional information we have back to the chair (e.g. bird subcommittee wants time of year and observer whereas the herpetofauna subcommittee wants photographic proof). Any records deemed unacceptable by the committees are then changed to 'unknown species' in the database with a note as to what the original identification had been. As we are still working on providing the extra information to most of the subcommittees, I again stress that the information presented in this report should be considered preliminary for 2010.

As of the end of 2010, we believe we have over 200 potential new county records for herpetofauna, odonates, and possibly butterflies and hope to begin publishing this information.

Objective 6: Identify the physical and biological attributes of sites surveyed under objective 1.

We will use the GIS Landcover classification layer from 2002 to compute the amount of habitat in each class for the properties to the best of our abilities. Some of the habitat types defined by the Wildlife Action Plan are not delineated in the 2002 Landcover (i.e. wet shrubland, wet forest, herbaceous wetland, oxbow,

backwater, etc) which can make this step very challenging. We also collect habitat measurements in the field (water depth, litter depth, canopy cover, plant species, etc). Prior to the fall of 2009, we were collecting a backlog of pressed plants in need of identification. The MSIM Tech II hired in November of 2009 has been steadily working on identifying these plants and is more than half way through the backlog. He has also been able to offer fast assistance to the field crews through site visits and photos sent via email to drastically decrease the number of pressed plants within a given year.

Objective 7: Evaluate field protocols for efficiency and effectiveness.

The majority of protocols are working very well for the MSIM program. We do still have additional protocols to get off the ground, though. Here is a brief summary of each taxonomic group's protocols:

Birds: Our breeding and migratory bird protocols are working well, our nocturnal bird protocol needs additional work. The nocturnal protocol is often skipped due to time constraints.

Mammals: Our small mammal protocol is working well, as is our trail camera protocol, although this should be evaluated for cost efficiency in the future. As of 2009, we have replaced the trackplate protocol with timed Visual Encounter Surveys for mammal tracks. In March of 2010, we presented the Mammal Subcommittee with information as to how many new species are captured in small mammal traps on each night of trap effort. The Committee agreed that if we dropped the 4th night of trapping, we should still be capturing the majority of species on a given property. We will begin implementing a 3 night small mammal trapping protocol in 2011. This should decrease the amount of time a crew spends on small mammal trapping, thereby allowing more time for other protocols. We will be updating our Techniques Manual to reflect this change. We have adapted the ANABAT protocol to include walking transects as opposed to leaving the ANABATs deployed overnight. This change was made simply to avoid having the ANABATS stolen or vandalized.

Amphibians & reptiles: Our herpetofauna protocol appears to be working well except for photograph management. As our herpetofauna subcommittee chair will not accept new county records without photographs, our Natural Resource Aides have been collecting these photographs, but do not always follow the protocol for photo labeling and storage. This is a personnel and time-management issue on which we will continue to work.

Fish: As of 2009, we have implemented our fish-in-wadeable-streams protocol with backpack shockers and seines. We still struggle with fish identification and the fish subcommittee requested that we voucher representative specimen. In 2010, we hired a Natural Resource Aide with experience in fish identification. He identified all of our fish stored in formalin and backpack shocked several areas surveyed in 2010. We have not yet acquired a shocking boat to expand these protocols to nonwadeable rivers and lakes. At this time, we have no plans to expand into non-wadeable rivers and lakes due to lack of permanent staff necessary to assist with these potentially dangerous protocols.

Insects: Our butterfly protocols work well as do our odonate protocols. However, our Butterfly Taxonomic Subcommittee believes that some of the very rare species are restricted to tiny patches of native prairie which are not surveyed as part of the MSIM program. This is a need which will need to be addressed through other means.

Mussels: We still struggle with the unpredictable Iowa flooding and mussel ID.

Snails: We have made no progress on creating field guides to identify Iowa snails.

Vegetation & habitat: The vegetation and habitat protocols appear to work well.

Even with the above listed problems, we feel that the MSIM Program is strong and working well. We are slowly making progress on the unimplemented protocols. For example, in 2009 we implemented the fish in wadeable streams protocol and began a limited run of the ANABAT protocols. Time management tasks for the Natural Resource Aides, including data entry, also remains a top priority for us. To address this, we have developed a reporting feature on the database which should allow our permanent staff to keep a closer eye on the amount of data entry being accomplished by the Natural Resource Aides.

Conclusion:

In 2009, we surveyed 44 new properties and 4 annual properties, in 2010 we surveyed 52 new properties and 7 annual properties as part of the T-6-R-2 funded program. In 2009, we documented a total of 92 SGCN on these sites. In 2010, we documented a total of 88 SGCN on the properties surveyed. In 2009, we also documented a grand total of 447 species of mammals, birds, amphibians, reptiles, butterflies, and odonates. This includes 229 bird species, 35 mammals, 40 amphibian and reptiles, 65 butterflies, and 78 odonate species as well as 63 bird SGCN, 3 mammal SGCN, 12 amphibian and reptile SGCN, 3 butterfly SGCN, and 11 odonate SGCN. In 2010, we recorded a grand total of 458 species, including 249 bird species, 36 mammals, 33 amphibians and reptiles, 59 butterflies, and 81 odonates. SGCN numbers for each taxonomic group in 2010 include 68 bird SGCN, 5 mammal, 6 amphibians and reptiles, 1 butterfly, and 8 odonate species.

Appendix 1. Table of properties surveyed in 2009:

	Property	County	Owner	Habitat
1	Black Hawk WMA	Sac	DNR	Shrubland
2	Browns Lake WMA	Woodbury	DNR	Oxbow
3	Burrows Wetland WMA	Sac	DNR	Herb wetland
4	Crawford Recreation Area	Ida	County	Impoundment
5	Deer Creek WMA	Plymouth	DNR	Cool Grass
6	Five Ridge Prairie State Preserve	Plymouth	County	Stream
7	Kiowa Marsh WMA	Sac	DNR	Shrubland
8	Mile Long Island WMA	Woodbury	DNR	Wet forest/wood
9	Moorehead Park	Ida	County	Warm grass
10	Oakridge Conservation Area	Woodbury	County	Pond
11	Owego Wetland Complex	Woodbury	County	Herb wetland
12	Redtail Ridge Habitat Area	Cherokee	County	Savanna
13	Shagbark Hills	Woodbury	County	Cool grass
14	Tomahawk Marsh WMA	Sac	DNR	Wet forest/wood
15	Winnebago Bend WMA	Woodbury	USACE	River
16	Adair WMA	Adair	DNR	Woodland
17	Badger Creek Recreation Area	Madison	DNR	Impoundment
18	Clanton Creek Recreation Area	Madison	County	Stream
19	Fogle Lake	Ringgold	DNR	Cool grass
20	Green Valley State Park	Union	DNR	Impoundment
21	Kellerton BCA	Ringgold	DNR	Warm grass
22	Lake Icaria Recreation Area	Adams	DNR	Wet forest/wood
23	Lake of 3 Fires State Park	Taylor	DNR	Forest
24	Meadow Lake WMA	Adair	DNR	Impoundment
25	Mt. Ayr WMA	Ringgold	DNR	Shallow Lake
26	Pammel State Park	Madison	DNR/County	River
27	Ringgold WMA	Ringgold	DNR	Herb wetland
28	Sand Creek WA	Decatur	DNR	Cool grass
29	Three Mile Lake	Union	DNR	Woodland
30	Viking Lake State Park	Montgomery	DNR	Savanna
31	Black Hawk Park	Black Hawk	County	Oxbow
32	Cedar River WMA	Linn	DNR	River
33	Cedar Rock State Park	Buchanan	DNR	River
34	Chain-o-Lakes WMA	Linn	DNR	Wet shrub
35	Crumbacher Wildlife Area	Buchanan	County	Woodland
36	Dudgeon Lake WMA	Benton	DNR	Shallow Lake
37	George Wyth State Park	Black Hawk	DNR	Oxbow
38	Hawkeye Wildlife Area	Johnson	DNR	Oxbow
39	Lake MacBride State Park	Johnson	DNR	Lake
40	Matsell Bridge Natural Area	Linn	County	River
41	Palisades-Kepler State Park	Linn	DNR	River
42	Pleasant Creek State Rec Area	Linn	DNR	Warm grass

Appendix 1 continued. Table of properties surveyed in 2009:

	Property	County	Owner	Habitat
43	Wakpicada Natural Area	Linn	County	Oxbow
44	Winegar Lake	Benton	County	Oxbow
45*	Harrier Marsh	Boone	State	Warm grass
46*	McCoy WMA	Boone	State	Pond
47*	Cedar Bottoms WMA	Muscatine	State	Herb wetland
48*	DeKalb WMA	Decatur	State	Creek

*Indicates a permanent sampling property, surveyed annually.