"Office and Plot Establishment Protocols"

These correspond to chapters 1-7 in the Iowa's Multiple Species Inventory & Monitoring Technical Manual

Chapter 1
Introduction

This manual was written in response to the need for a monitoring plan to help fulfill the Iowa Wildlife Action Plan (IWAP) for the state of Iowa. In order for a state to continue to receive funding through the State and Tribal Wildlife Grants Program (SWG), it was required to submit a WAP which included plans for monitoring species of greatest conservation need (SGCN). The state of Iowa chose 296 species as those SGCN in the IWAP. Although there are many parameters by which the IWAP's success will be determined (funding attained, educational programs, recreational opportunities developed, etc.), the ultimate measure of the success of the IWAP will be the impact on the wildlife resources in Iowa. Long term monitoring of all wildlife will be necessary to demonstrate the reversal in declining trends of SGCN and to document that common species are remaining common. Long term monitoring will also be necessary to demonstrate true species declines. This can be accomplished only through the application of a rigorously designed long term monitoring program to track the status of Iowa's wildlife resources.

The current monitoring efforts within Iowa have centered primarily on either game species or been conducted by individuals and groups interested in a specific taxa of wildlife. These surveys are important and will continue but Iowa also needs efforts on other less visible species as several of these surveys are either out of date and/or limited in scope. For clarity, inventory, census, survey, and monitoring are defined as (Thompson et al. 1998):

Census – A complete count of individuals, objects, or items within a specific area and time period.

Survey – An incomplete count of individuals, objects, or items within a specified area and time period.

Inventory – Process of making an itemized list of species occurring within a given area. This may or may not be a complete list of species depending on whether the information was collected through a survey or a census, alternatively repeated surveys may be used for the inventory of a given area (MacDonald et al. 1991).

Monitoring – A repeated assessment of some quality, attribute, or task for the purpose of detecting a change in average status within a defined area over time.

Long-term monitoring programs give the best picture of the status of wildlife populations over time. Well-designed short term surveys and inventories can indicate the current status and distribution of wildlife but are often valid only in the area where they are conducted and may quickly become obsolete if habitat or other critical factors change. In Iowa, the rapidly changing habitat availability on agricultural lands as USDA farm programs change is a frequent example.

PURPOSE OF MONITORING PROGRAM:

The lack of species specific information on the abundance and distribution of SGCN was one of the concerns highlighted in the IWAP. In some cases, species were added to the list simply

because information was outdated or unavailable. The amount and distribution of potential wildlife habitat is comparatively well known, but in order to relate habitat information directly to wildlife information on a smaller (site) scale, data will also be collected on habitat. The habitat information can then be used as explanatory covariates in species occurrence analyses.

The Multiple Species Inventory and Monitoring Program (MSIM), therefore, is a standardized, statewide survey implemented in order to provide basic inventory information as to the wildlife species in Iowa. The surveys will also serve as baseline data for a long term monitoring program. The program consists of surveys instead of censuses for two reasons: (1). Most likely species will be missed in some sites (i.e. the animals are inconspicuous) and (2). The entire state of Iowa cannot be included in the program (i.e. the area is too large). However, using a randomized sampling design for the site selection, along with the surveys will allow inferences to be made from the sites examined to the habitats statewide.

This program incorporates permanent sampling areas on both public (federal, state, and county owned) as well as private (CRP, WRP, NGO, etc.) lands. As funding becomes available, the program outlined in Iowa's MSIM Technical Manual will be implemented on additional areas. The program will focus on public lands and private lands and is designed to aid in monitoring private lands enrolled in conservation programs (CRP, WRP, LIP, etc.). The Iowa Department of Natural Resources (IDNR) has the primary responsibility for coordinating the program, but the program is designed so that partners (County Conservation Boards, USFWS, NGO's, etc.) can participate fully in the process.

BACKGROUND:

As developing and maintaining different inventory and monitoring programs for 296 species is cost prohibitive, the design of the MSIM program is loosely based on the US Forest Service's "Multiple Species Inventory and Monitoring Guide" (Manley et al. 2005). The USFS MSIM program shifted from the idea of monitoring indicator species as these programs have been heavily criticized for failing to scientifically show true correlations between indicator or umbrella species and multiple other species of interest (Landres et al. 1988, Niemi et al. 1997, and Lindenmayer et al. 2002). Therefore the Iowa MSIM program is designed to sample as many species as can be found, including those that are currently considered 'common'. In having unbiased, representative, random samples, the status and trends if all species can be described to the best extent possible. There is no way to predict which common species will be rare in the future, nor which rare species may or may not be common in the future.

The Iowa MSIM program establishes permanent monitoring areas to sample as many species as possible. Each 'core' area encompasses 10.4 hectares (25.7 acres), but additional areas will be covered at each location as needed for the species protocols to be implemented. Chapters 8-18 of this manual describe the taxonomic protocols in detail. In addition to the faunal protocols, habitat data collection is described in Chapters 19 and 20. The protocols require various numbers of visits to each site per season.

OBJECTIVES:

The first stage for implementation of a monitoring program in Iowa is to inventory a random sampling of public and private lands through surveys. The inventory is conducted following the same procedures used in the monitoring program and will serve as the first, or baseline, data

collection for the long-term monitoring program. More specifically, the primary objectives for the inventory stage of the program include:

1. What proportion of sampled habitat is occupied by a given species?
    a. What are the detection probabilities for each species? Once the detection probabilities are estimated, it will be possible to estimate habitat occupancy proportions for a variety of scales and specific comparisons of interest, including:
        i. Iowa as a whole
        ii. A given region within Iowa
        iii. A given county
        iv. A habitat association at the land cover classification level
        v. Private vs. public ownership
            1. Private federal aid program land vs. active agriculture land vs. public land
2. What is the spatial distribution of occupancy based upon these sites?
    a. Are there any unexpected gaps in species occurrence from a strictly spatial perspective?
3. What are the physical and biological attributes of sampled sites?
4. Are there changes that need to be made to the individual sampling protocols?
5. Do the results illuminate the need for future or immediate research on specific species, communities, or habitats?

Other benefits anticipated to be gained during the inventory stage of the monitoring program include:

1. Estimation of inclusion and exclusion errors in the Iowa GAP models.
2. What are the relationships between spatial distribution of a species and associated habitat conditions?
    a. Predictive models of species occurrence based upon habitat variables (logs, snags, vegetation composition, etc.)
    b. This information should be useful for management decisions such as:
        i. Is more habitat needed or is it adequate?
        ii. Is the habitat high-quality or marginal?
        iii. Are there restoration opportunities or other management options?
3. Are there detectable patterns of co-occurrence between adequately detected species?
    a. This will aid in determining whether the Iowa monitoring program would be better served to switch from a multiple species approach to an indicator species approach. If so, the indicator species selection must be supported with data for both co-occurrence patterns among species and also associations between species occurrence and habitat attributes.
4. The identification of public areas susceptible to the stresses summarized in the IWAP.
    a. Assess the impact of the perceived stress.
    b. Determine if there are additional stresses not specified by the IWAP.

These additional benefits may depend upon the availability of either additional resources or interested scientists willing to assist with the analyses.

Once the initial inventory phase has been completed and sites are visited repeatedly such that at least 2-3 years of data collection has been completed at each site, the objectives move from those related to inventory into objectives more specifically related to monitoring. At this stage, the first priority becomes measuring the trends in each species. Specifically, the primary objectives for the monitoring include:

1. Is there a change in species occupancy of sampling sites over time?
    a. If so, what is the change in site occupancy rates and patterns (colonizations and extinctions)?
        i. These changes may be able to be linked to invasive species or climate change if a long time series data set is collected, Jonzen et al. (2005) suggests 15 years of data is needed in this situation.
    b. Is the change linked to a certain scale or spatial distribution pattern (i.e. is it localized to one region of the state?)
2. Is there a change in community composition?
3. Is there a change in habitat?
    a. If so, did the habitat type increase or decrease?
    b. Did the habitat quality improve or degrade?
4. Is there a relationship between changes in species and the habitat conditions?

In addition to the primary objectives for the monitoring phase of the program, we expect to have additional benefits, including information towards the following:

1. What are the effects of management actions or natural disturbance on wildlife populations and habitat conditions?
    a. This information is expected to serve as a starting point for additional research into a given topic.
2. Provide data complimentary to existing large scale monitoring programs (such as the BBS) and continue to strengthen species occurrence patterns predicted by other programs (such as GAP).

INTENDED RELATIONSHIP TO OTHER MONITORING PROGRAMS:
In following the basic outline of the USFS MSIM Program, Iowa will be collecting data that can be compared at a larger-nationwide scale, should the USFS program become nationwide. Currently, the USFS program is limited in scope and not being used in national forests near Iowa. Iowa has no national forest land.

The design of Iowa's MSIM program has been created in a manner to allow other interested partners to utilize all or part of the taxa protocols depending on their interests and available resources. Once the plots are delineated, some of the protocols could conceivably be carried out by dedicated volunteers, others will need to be performed by employed technicians. In any case, this will allow various partner organizations the ability to collect data on species of particular interest to them in a manner which will allow their data to be comparable to a larger dataset for Iowa. This should aid in illuminating meaningful changes or other information in a species of interest.

Chapter 2
Sampling Design & Plot Establishment

The strength of the monitoring program design is based upon the random site selection. By using a random selection of areas to include and by not choosing areas specifically because species of interest were known to occur there historically, inferences as can be made for more areas than are included. If only areas known to contain the species of interest were included, then any conclusions or correlations inferred from the monitoring program could only be linked to the areas examined. The expectation is that several of the areas that are known to have species of interest will be included in the study even though they were selected at random as opposed to being selected as a target. The power of the program rests on the idea that any site has an equal chance of being chosen within its given habitat stratification.

However, given that land owned, managed, or affiliated with the Iowa Department of Natural Resources or other non-farming, non-urban entity has a much greater chance of being included in this study than active farm or urban areas, this program may more aptly monitor wildlife associated with these areas as opposed to a true state-wide program. Similarly, the majority of land in Iowa (>80%) is classified as agricultural (including row crop and pasture lands), yet, again due to the majority of land ownership being private and the focal areas for the monitoring program being primarily state owned (although both row crop and cool season grasslands are habitat classifications which are included), the monitoring program will not be comprised of >80% agricultural lands. Therefore, the results obtained with the monitoring program will apply primarily to non-agricultural, non-urban areas, although limited data will be available for agricultural lands.

PLOT LOCATIONS:

Public Lands

Due to funding and personnel constraints, the majority of the effort expended by the Iowa DNR will be focused on public, state-owned lands. Iowa has less than 2% of the total land area in public ownership, with just under 1% being owned by the Iowa DNR. The 2% public ownership includes DNR lands, federal lands, and county conservation board lands. Ideally, federal entities and county conservation boards will be willing to partner with the IDNR to monitor lands in their ownership. It is expected that funding will be available from the State and Tribal Wildlife Grants program to aid both the DNR and other groups with funding for monitoring. It may also be possible that the IDNR would conduct the monitoring on the federal or CCB lands, depending on funding and personnel available.

Of the < 1% of Iowa land in DNR ownership, all areas 247 acres or larger (and some smaller areas within target wetland classes) were classified according to the 19 habitats outlined in the IWAP (Zohrer 2005). These habitats with their definitions include:

Forest – More than 60% canopy of tree species with crowns interlocking.
Wet forest/woodland – Temporarily or seasonally flooded forest or woodland.
Woodland – Open stands of tree species with 25-60% of canopy cover.
Shrubland – Shrubs >0.5 m tall forming >25% cover with <25% tree cover.

Wet shrubland – Temporarily, seasonally, and semi-permanently flooded wetlands or saturated deciduous shrubland.

Herbaceous wetlands – Temporarily, seasonally, or semi-permanently flooded or saturated herbaceous wetlands.

Warm season herbaceous vegetation – Less than 25% canopy cover made up of trees or shrub species. Herbs form at least 25% canopy cover.

Savanna – Temperate grassland with sparse coniferous or cold-deciduous tree layer.

Cool season grassland – Smooth brome, forage crops, and pasture.

Cropland – Worked land normally on an annual basis in corn, soybeans, sorghum, fallow fields or other crops.

River – Large flowing bodies of water, normally with permanent flow and draining over 100 square miles.

Stream – Smaller flowing bodies of water, normally permanent, that serve as tributaries to rivers and drain less than 100 square miles.

Creek – Even smaller flowing stretches, often intermittent and ephemeral, that flow into streams.

On-stream impoundment – Slowly flowing bodies of water formed from artificial damming of a river, stream, or creek, generally < 500 acres in size and having a watershed to lake ratio >200:1.

Backwater – Slow flowing bodies of water associated with large river systems. Back-channel, low-lying areas filled with water during high flow events but may be completely isolated from the river during low flow and may exhibit no flow during these periods. They are especially prevalent on the Mississippi River.

Oxbow – A sub-class of backwater, water bodies formed in old river channels that are currently cut off from the main channel and flow of a river.

Lake – Large bodies of water exhibiting little or no flow with emergent vegetation over less than 25% surface area. They may be either natural or constructed.

Shallow lake – Open, freshwater systems where maximum depth is less than 10 feet. Normally in a permanent open water state due to the altered hydrology of watersheds and unmanaged outlet structures that maintain artificially high water levels. May be fringed by a border of emergent vegetation in water depths < 6 feet. When clear, they are dominated by emergent and submergent vegetation.

Pond – Smaller standing bodies of water, often exhibiting large swings in dissolved oxygen and water temperature and generally < 10 acres in size.

For Iowa, habitats within each management district were classified and areas were randomly selected within each habitat class. This list of areas to be included in the monitoring program is listed in other documentation. The stratified random sample selection of sites follows the ensuing procedure:

1. Areas were listed in Excel and assigned numbers using the random number generator in Excel within each habitat classification (primary stratification) and also for the district (secondary stratification: northeast quarter, southeast quarter, northwest quarter, southwest quarter). The secondary stratification allowed for the selected habitats to be more equally split across the state as opposed to being clustered together within one corner.
2. Sites were then sorted by number and those chosen were rotated such that one selection per habitat was made during each round.

3. Once an area was selected for a particular habitat classification, that area was excluded from future selection in other habitat classifications.
4. In some regions, the number of sites with a particular habitat was limited, e.g. only 8 areas had savanna in the northwest. In this case, those 8 areas were given a higher priority in the limiting class when compared to classes with more possibilities for selection. This will still be considered to be a random site selection as 5 of the 8 possible sites were chosen using the random number generator, although these sites may have been excluded from consideration in the other categories.

Private Lands

As 98% of Iowa is in private ownership, it is imperative that the monitoring program have access to a portion of private lands. Lands owned by Iowa Natural Heritage Foundation, The Nature Conservancy, the Meskwaki Tribal lands, and Whiterock Conservancy are a few examples of private lands owned and protected by non-government organizations. These NGO's are regarded the same as the other public land owner organizations – the DNR hopes to include these areas in the monitoring, but it may be necessary that the organizations hire the temporary staff needed to conduct the protocols. Again, it is anticipated that funding will be available from the State Wildlife Grant program to aid NGO's with salary and equipment expenses.

These protocols have been developed in such a manner as to allow for some basic questions about land management practices to be examined. However, these should not replace a rigorous study design around a specific action. The protocols can be used to look at species occurrence on a large scale and using the habitat and GIS protocols will allow correlations to be made between land attributes and species occurrence. Therefore, these protocols should be adequate to monitor wildlife and wildlife responses to management and conservation actions, at least at the occurrence level for a wide variety of species. This will allow Landowner Incentive Program lands, Wetland Reserve Program lands, and other private landowner aid programs to find the information collected under these protocols useful. *However, it should be noted that if a particular species or management action is in question, a scientific study should be designed to focus on that species or action.* It is also expected that the monitoring protocols will elucidate specific species or management questions that will need to be examined through research studies.

Many of the private lands may be smaller than the 1 km^2 (247 ac) utilized in the selection of the state-owned lands for this program. The protocols can be adjusted to fit a smaller land area by either searching a smaller amount of habitat or by dropping inappropriate protocols, e.g. searching for fish can be omitted in areas without adequate habitat. It will be left to the discretion of the program director (NGO, DNR, LIP, etc.) as to which protocols are or are not of interest or practicality in implementation.

Likewise, it is expected that these organizations will not be able to randomly choose the areas to be monitored as the agency can. However, as long as the majority of areas utilized in this program are chosen at random, it is expected that the non-random site selection of partner organizations, coupled with the somewhat random ownership of land across Iowa, will not impact the statistical strength of the monitoring program.

MONITORING PLOT DESIGN:

The core area of each plot is contained within the shape of a hexagon. Six poles delineate the hexagon and serve as the bird point count locations (with an additional point located in the center of the hexagon). The hexagon is roughly 10.4 hectares (25.7 acres in size). *However, the protocols are not limited to the area inside the hexagon.* Aquatic species, especially, may need to be searched for within a larger area. Certain sites may require extra effort, but as a general rule, up to 10 wetlands within a reasonable distance (500 meters in any direction) to the center of the hexagon will be searched for aquatic species as allowed by the landowner(s). This distance should be sufficient to allow for adequate sampling for fish in lotic systems as well as it would equal roughly a 1 km^2 (247 acre) area spanning a distance of 1 km (0.62 miles) centered on the middle point.

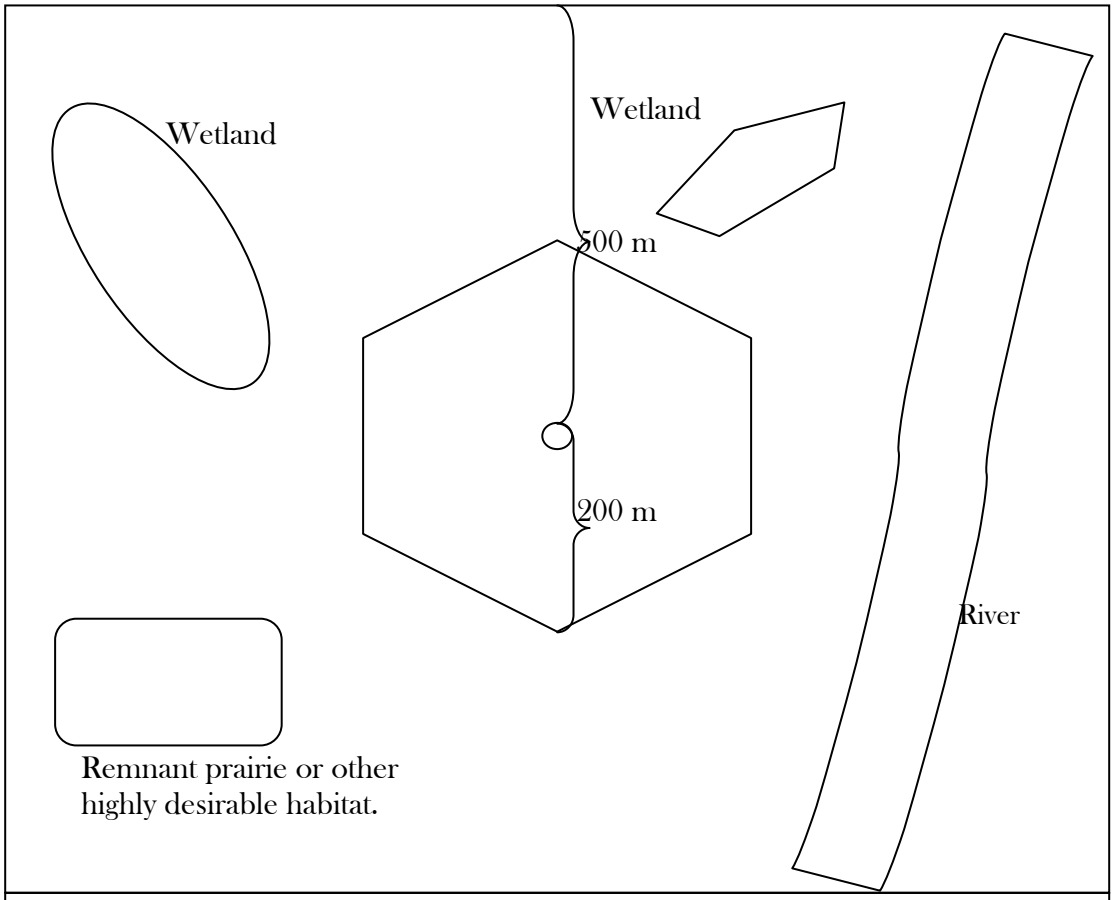


Illustration of a hexagon plot and associated sampling area. The distance from the center point to each outer point of the hexagon is 200 m, the distance from the center point to the outer edge of the additional sampling area is 500 m, or 1000 m centered on the middle point. Additional areas to be searched within this 1-km^2 area are illustrated and labeled as wetlands, remnant prairie, or other highly desirable habitat.

The protocols have been designed to be implemented in a variety of habitats. On one extreme is the bird protocol, where birds are expected to be found in all 18 habitats and therefore, the bird point counts can be conducted in all habitats. At the other extreme would be the aquatic protocols, the fish and mussel protocols in particular. Should the habitat being examined have no adequate wetlands to support fish or mussel populations, these protocols would simply be omitted at this site. Similarly, the mammal protocols would not be implemented at a site encompassed by open water.

DATA COLLECTION METHODS:

By utilizing the larger, 1 km^2 (247 ac) area, additional potential habitats should be available which should increase the number of species found per site. For example, while the small mammal traps will be placed along the lines of the hexagon, the mammal trackplates and cameras can be set anywhere within the 1 km^2 area. Bird point count locations are also tied to the hexagon, yet the nocturnal call back surveys should be done in the larger area. The search for herpetofauna will encompass the larger area as well. Looking for the aquatic species, primarily fish, but also the amphibians, butterflies and dragonflies to a lesser extent, will require searching the larger area for most plots. Individual protocols for each taxonomic group follow in the subsequent chapters.

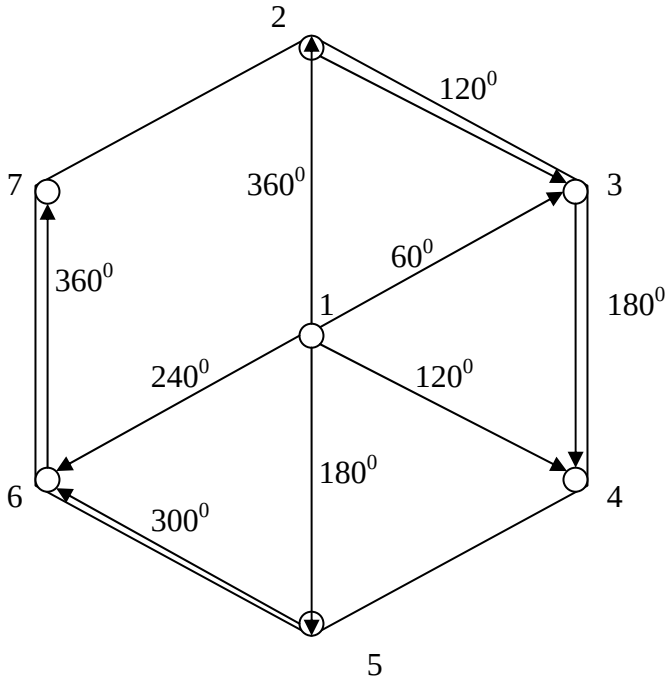
Remember that these protocols were designed so that organizations with limited resources and specific taxonomic interests can choose which protocols to implement should it be infeasible to employ all protocols.

Chapter Three
Landscape Characteristics Protocol
GPS/GIS

MONITORING:
Once the randomly chosen sites have been identified, a GIS system should be used to gather information and choose the hexagon point locations within each site. The center of the hexagon should include the habitat classification for the area. If, due to property ownership, it is not possible to center the hexagon over the habitat classification, then the hexagon should be placed such that as much as possible of the area inside is comprised of the habitat by which the site is classified.

The purpose of the hexagon is simply to place the bird point count locations and Sherman traps in the same orientation at every site. The hexagon shape is the most efficient for spacing locations although other shapes could be used. This shape requires the least amount of walking effort while maintaining a 200 meter distance between point locations.

The GIS is then used to collect information on landscape characteristics. The data should be ground-truthed by the technicians during the field season. Although the information collected under this protocol will probably not change over several years for the majority of sites, the potential for change is still present. Therefore this information should be re-collected or re-ground-truthed each additional year of the monitoring.



SURVEY METHODS:
The seven points that comprise the hexagon sampling plot will be pre-determined prior to field work through information collected under this protocol. The 7 points include the center point and 6 edge-angle points to form the hexagon shape seen below. Each point is spaced 200 m from the adjacent points.

Choose the center point for the hexagon such that it is either centered over the primary habitat classification for the site or such that the majority of the habitat within the hexagon is comprised of the habitat for which the site is classified. Record the UTM coordinates for the center point. Use the following formulas to determine the locations of the outer 6 points that form the shape of the hexagon:

	UTM E	**UTM N**
Center point (1)	Choose from GIS coverage (X)	Choose from GIS coverage (Y)
Point 2	X	Y + 200
Point 3	X + 173	Y + 100
Point 4	X + 173	Y - 100
Point 5	X	Y - 200
Point 6	X - 173	Y - 100
Point 7	X - 173	Y + 100

If, however, the property is small (or the hexagon is placed) such that the outer points are < 10 meters from adjacent land which we do not have permission to be on, please move the effected points in to allow a 10 meter buffer from other property. This will most likely be an issue on private land areas.

Note the location of wetlands in and around the hexagon. The area around the hexagon should be included up to a 101 hectare (250 acres) block. Should the site be smaller than 101 ha, then include all information, but unless we have obtained permission from the landowner to be on the adjacent property, this information will not be able to be ground-truthed. Roughly calculate the amount of each habitat type that occurs within the hexagon. Also calculate the amount of each habitat type that occurs within each 101 ha block. Include information on the number and type of roads within and around each site.

Roads and trails located within 30 m of wetlands should be listed by category and distance. There are different data sheets for lentic and lotic sites. Categories include: 4 lane highway, 2 lane highway, paved road, unpaved road, OHV (off-highway vehicle, i.e. all terrain vehicles) trail, and hiking trail. In addition, the area of compacted soil or impermeable surfaces within 10 m of the shore should be estimated. For lentic sites, also record the number of road crossings along with an estimate of the total length of the stream they impact (so, add up the widths of the roads where they cross the channel). Al information should be ground-truthed.

GROUND-TRUTHING:
Technicians will be assigned specific tasks for ground-truthing. Logically, the fisheries and amphibian technicians can be charged with ground-truthing the wetland areas. The small mammal, bird, and terrestrial habitat technicians will most likely have the responsibility of ground-truthing the habitat classifications and the rough boundaries for each habitat. Road type

and area can be checked by anyone. Once the information has been ground-truthed, it can be entered into the database.

PHOTOSTATIONS:
Each of the 6 points of the hexagon and the center point of the hexagon should be considered a photostation. Fourteen digital photos should be taken from these points at least once per year. If it is possible to take photos in each of the 4 seasons, this should be done. Leave at least 3 months between each photo session. The following table lists the angles at which the photos should be taken:

Number	Station	Angle of photo (in degrees)	Comments
1	1 (center point)	90	Due east
2	1 (center point)	270	Due west
3	2 (top of hexagon)	0	Due north
4	2 (top of hexagon)	180	Due south, toward center pt
5	3(clockwise from top)	60	Away from center
6	3 (clockwise from top)	240	Toward center point
7	4	120	Away from center
8	4	300	Toward center point
9	5 (bottom of hexagon)	0	North, toward center pt
10	5	180	South, away from center
11	6	240	Away from center
12	6	60	Toward center
13	7	300	Away from center
14	7	120	Toward center

Keep a small notebook with the camera – record the number of the photo with the site, station number, and angle at which the photo was taken. When the photos are downloaded onto the computer, be sure to label all photos with the pertinent information. It is best to use a tripod to steady the camera while taking the photos. Be sure to set the digital camera to the automatic mode and zoom out until the photo will cover the largest area.

PHOTO/MAP BOOK:
During this stage of the program, a 3-ring binder should be made for each crew. Included in the binder should be maps to each of the properties for which they are responsible and aerial photos. On the aerial photos, the wetlands should each be labeled with a number or name to facilitate in assigning the correct wetland to the data collected under the faunal protocols. Other areas of interest should be highlighted and labeled on the photos as well. This will prevent technicians assigning different names to the areas which would be confusing when the data is being entered into the database. This book should be left in the field vehicle and should include contact information for each property as well. It is also advisable to create a '911 sheet' with driving directions that could be read to a 911 operator in an emergency.

EQUIPMENT LIST:
Computer with appropriate ARCVIEW GIS software and GIS database/aerial photos
GPS unit
Compass
Surveyors tape
Data sheets
Pencils
Digital camera
Tripod

STAFF & TRAINING:
Staff will be trained in the basic use of the GIS software and GPS unit during the 2-3 weeks of training at the beginning of the field season. This training should include practice surveys to ensure that proper procedures are followed. Ideally, the technician(s) hired will be proficient in the use of GIS.

DATA QUALITY & MANAGEMENT:
Ground-truthing of the data collected through the GIS system will serve as the primary quality control for this protocol. Once information has been checked in the field, it can be entered into the database.

DATA ANALYSIS:
The data will serve to both aid in the selection of specific areas for targeted visual encounter surveys and aquatic trap placement as well as being used to correlate wildlife species presence and absence.

SAFETY CONSIDERATIONS:
Typical field considerations should be followed. Proper hygiene (i.e. hand washing, checking for ticks and other potential parasites) should be maintained. Technicians should take proper precautions around water (i.e. avoiding fast, deep flowing water).

ADDITIONAL METHODS FOR SPECIAL LOCATIONS:
None

DATA SHEETS:
Data sheets for this protocol are located in Appendix 2.

Chapter Four
Data Entry & Database Maintenance

THIS CHAPTER IS STILL UNDER CONSTRUCTION. It is expected to change during the 2007 field season.

GENERAL DATABASE INFORMATION:
All information collected during or pertaining to the field season should be entered into a computerized database. Information left on scraps of paper and hidden in a desk drawer is not useful to anyone other than the person that already knows it exists. At a minimum, the database should contain information relating to the area(s) surveyed (GIS and habitat data), the times surveyed (time of day and weather conditions) as well as the species encountered and all data collected on each individual.

The data will need to be extracted for use in various analysis programs using different formats. Therefore it is probably best to use a database that is capable of querying the data by several different manners. If a program manager wished to share data with another program manager (i.e. if an Iowa county conservation board wished to share information with the Iowa DNR) then the databases should be constructed using software that will allow them to be merged or to be imported/exported to the other software application.

IDNR MSIM DATABASE:
The information in this chapter is specific to the database created by Stephanie Shepherd and maintained within the IDNR Wildlife Diversity Program. Other database programs could be used and this is left to the discretion of the programs other than IDNR that may be using these protocols. All information collected should be entered into the database. As multiple protocols may be implemented on the same day at the same site (thereby sharing the same weather information), it may be advisable to use a relational database which allows different tables to be connected to each other as opposed to entering the same weather information repeatedly.

For data to be inserted into the IDNR MSIM database it should be either entered directly into the database or input into a computer program in such a manner to allow it to be imported into the MSIM database. Currently, the MSIM database is in Microsoft Access. Data entered in Microsoft Excel can be imported into the MSIM database if the correct fields are included. Contact the IDNR WDP for additional information.

The following information described the IDNR MSIM database:
VOCABULARY:
Property – The largest entity being surveyed.
Site – The survey locations within each property (e.g. BPC1, Pond 1, Creek, etc)
Plot – The survey locations within a particular site. Mostly used for habitat data.

UNIVERSAL FIELDS:
These are visible in a variety of forms.

ID Autonumber fields – these should be hidden for the most part.
Observers – This field should be entered using the initials provided separated by commas for multiple observers.
Species code – This field should be a drop down menu and restricted to the taxa being entered. The exception to this is the Incidental Report Form. New species can be added using the provided button on each of the forms. The new value should appear in the drop down list immediately. Please do a thorough search of the table before adding a new species to ensure it is not under a different name or spelling. This field is sorted in different ways (i.e. Latin name, species code, common name) depending on the taxa.
Time – Time should be entered as military time. The colon should be automatically inserted by the computer program. This field works easiest using the tab key.

DATABASE STRUCTURE & FIELDS:

Property Information

The main information should already be entered into the database before the beginning of the field season. This data includes information such as owner name and contact, UTM coordinates for bird point count locations and wetlands or other landforms of interest.

For survey sites on a property but NOT on a pre-programmed site, (i.e. Nocturnal Bird Counts, Herpetofauna visual encounter surveys, Camera Stations), there is a "Property-Entire" (E.g. "Jackson Property – Entire") that can be chosen as a site location. Choose this and enter UTMs (if known) for the survey site in comments.

For survey sites associated with the property transects but not on a pre-programmed site, (i.e. Butterfly Transects, Small Mammal Traps), choose "BPC-1" (a.k.a. the center point for the hexagon) as the site selection.

Habitat Data

The forms should flow (or be moved through) as follows:
1) *Wetland*: Data Entry Home – Habitat Data Entry Home – Habitat Survey Data – Wetland Switchboard – Lotic Habitat Plots Or Lentic Habitat Plots – then BACK TO Habitat Survey Data (in order to start a new record on the same property) or BACK TO Habitat Data Entry Home (in order to start a new record for a different property).
2) *Terrestrial*: Data Entry Home – Habitat Data Entry Home – Habitat Survey Data – Terrestrial Plot (this consists of a main page with several tabs of subforms) – then BACK TO Habitat Survey Data (in order to start new record on the same property) or BACK TO Habitat Data Entry Home (in order to start a new record for a different property).

Terrestrial Plot Form

1) Setup is a main form and then a series of tabs for all the subforms.
2) This form may give you some trouble with the tabs disappearing from view. Should this occur, just scroll back up to reveal the tabs.
3) Ground Cover and Tree Snag have a toggle switch as to whether the data being entered is "Within the interior plot" or not. These data are collected both within a 7.3

meter plot (within interior plot) and in a larger 17.6 meter plot (NOT within interior plot).
4) There are several fields that are setup with a default value, for these fields a value will already be entered in the field. To keep this value simply tab through the field.
5) The quadrat plant survey form has a subform within this subform. There are buttons to enter data for several quadrats ("Enter Next Quadrat") for each site within a property.
6) For Unknown or Incomplete Plant Species Record (i.e. records that need to be reviewed), there is an Unknown plant species option in the dropdown. Choose this and put all notes in the comments.

Species Survey Data

For the correct species button to appear at the bottom of the page you must click on a taxa in the taxa box. If you are trying to edit a record and need to get the button to come up it is all right to click the already highlighted taxa to get the button to appear.

Mammal Form

This form should flow as follows: Data Entry Home – Main Survey Form – Choosing "Mammals" in the Taxa box will make the mammal button appear.

Mammal Form – choose "Enter Next Site" button to enter a new record for a different site on the same property and the same day (using the same environmental data) – then BACK TO Main Survey Page ("Enter Next Survey" Button) (in order to change properties or to enter a new survey period (i.e. with different date & environmental information).

Notes on the mammal form -

1) SMT: Each visit is allocated a visit number (i.e. Mon. am = 1, Mon. pm = 2, Tues am = 3, Tues pm = 4, etc...).
2) Measurements are in mm or grams.
3) Peromyscus sp. – Choose this as the species for all mouse records which will need to be reexamined for species.
4) It is important to pay attention such that the 1)gender and 2) breeding status fields are not inconsistent with the 3)breeding condition details.

Additional information on forms will be placed here

GENERAL NOTES:

Helpful Shortcuts or Functions

a. Ctrl-F for find
b. Ctrl-‘ (Apostrophe) to copy field contents from previous record
c. If a data is in the current year, there is no need to enter year. E.g. If "6/26" is entered, Access converts this to "6/26/2006"
d. Drop down menus:
    i. Use the arrow to drop and click or
    ii. Start typing and the selection should pop up
    iii. Ctrl-‘ can still be used in these boxes

e. Instructions or descriptions for many of the fields should pop up in the bottom left corner of the screen when the cursor is in that field. This will sometimes provide instructions on the information to be entered.

WARNINGS:

1. Make sure when entering a new record that you are on a blank page. Changing a value in a drop down box does NOT create a new record. It changes an existing record.
2. Pay attention to the yellow box in the header as this tells you what property and site you for which the data being entered belongs. If it says "#Name?" then there is an error and the record will not be valid.
3. Use the buttons to navigate through the forms rather than the "X" in the right corner. Only use the "X" when adding a new species. In this case, the button will open a table to add a record and once finished, the "X" must be used to close the table and return to the form.
4. Remember the Main Form-Sub Form structure as it should help in maintaining the correct flow of the forms.
5. Read the instructions on each page carefully.
6. In you need additional codes, contact the program leader or database manager.

EDITING:

Note that all forms open on a new, blank record. There are several ways to find and edit an existing record.

<u>To Find a Record</u>

1. Use the back arrow. On most forms, the back arrow will allow you to scroll through each of the previous records.
2. If there are many records, the find tool may be faster. Place the cursor in the field to be searched and either press ctrl-F or go to Edit-Find and type in the value under scrutiny.
3. You may also filter records based on a particular field value (E.g. date or property name). Find the value you are looking for and place the cursor in that field. Press the button that looks like a funnel with a lightning bolt and then the filtered records should be able to be scrolled through. To unfilter the records, press the button with the funnel but no lightning bolt.

<u>Editing a Record on a Separate Subform</u>

For all Species Surveys and from the Main Habitat Page, first find the appropriate record on the Main Form and then go to the subform (remember it will open on a blank/new record) and use the scroll back button use the find tool here.

Chapter Five
Data Analysis

Analyses described below represent only a handful of possibilities for evaluating the data. This chapter is not meant to serve as a primer for data analysis, but should provide a starting point for further understanding. For consistency between techniques, information provided under each heading includes the parameters to be estimated, procedures used to collect the data, examples, requirements and assumptions of the analysis, advantages, disadvantages, and additional literature.

The data collected under these protocols can be analyzed with many different methods. The primary objective, at least for the first complete inventory survey, is to determine the locations of wildlife populations, the characteristics of the habitats they are found in, and the status of those habitats. The primary parameter of interest, then, is the proportion of area occupied by a given species.

PROPORTION OF AREA OCCUPIED:

Single Season Surveys:

Since the permanent sampling plots were visited >1 during the season the target species were expected to be present, Presence of Area Occupied (PAO) will be used to determine both the probability of occurrence and the detection probability of a given species in a given area following MacKenzie et al. (2002 and 2005). The permanent sampling plots can be divided into habitat classes, regional areas, or lumped together to be analyzed state-wide. Program PRESENCE was created by Darryl MacKenzie and Jim Hines (available for free download at (http://www.mbr-pwrc.usgs.gov/software.html) and was adapted and added into Program MARK (also freeware available at same web address) by Gary White. If using Program MARK to compute the calculations, be sure to choose "Occupancy Estimation" for the "data type", unless the data set contains multiple years of data.

> Parameters estimated:
> Detection probability (p) – the probability of finding an individual of a given species at a given site during a given time.
> Occupancy (Ψ) – the probability that a randomly selected site or sampling unit in an area of interest is occupied by at least one individual of a given species.

If one ignores the probability of detecting a species (and assumes that this probability is equal to 1 – meaning it is always found it if it is present), it is easy to calculate the occupancy probability, simply divide the number of sites with the species by the total number of sites surveyed. This value is commonly called the 'naïve estimate'. Most species do not have a 100% detection probability, they commonly 'hide' from the observer or avoid the trap set to capture them. The occupancy models take this into consideration and incorporate detection probability (p) into the estimate of occupancy (Ψ). For example, the likelihood function of a survey record 01010 for a given site is:

$$\psi(1-p_{i1})(p_{i2})(1-p_{i3})(p_{i4})(1-p_{i5})$$

The animal was seen during the survey, so a Ψ is included and (1-Ψ) is not included. The p_i denotes that the animal was seen during that survey, while the ($1-p_i$) indicates it was not detected during that survey. But the survey history of 00000 does not necessarily mean the species is absent and therefore must include the possibility that the species was present but not detected in addition to the possibility that the species was absent. This likelihood function is, therefore, written as:

$$(\psi)(1-p_{i1})(1-p_{i2})(1-p_{i3})(1-p_{i4})(1-p_{i5})+(1-\psi)$$

Data collection procedures:

Multiple visits are made to a given site over a single 'season'. The site is searched or trapped during this time frame for the species of interest. It is not necessary to mark the animals captured during a given visit for this analysis.

Example:

Almost any of the faunal protocols in this manual could serve as examples. Specific examples would include anuran calling surveys, visual encounter surveys, and bird point count surveys.

Requirements & Assumptions:

Requirements include multiple visits to each site during the 'season' of interest. These models assume that sites are 'closed' during the period of the survey season, meaning that a species is either present or absent on the first day of the survey and the status of the species does not change throughout the duration of the survey. Therefore, it is critical that the appropriate beginning and ending dates for each survey were chosen and followed. It may be necessary to truncate the data to ensure this assumption is met. The other 2 assumptions of the models are that species are identified correctly (& therefore, never recorded as present when in fact it is absent) and that detection between sites is independent. There may be a problem with the independence assumption if plots are located too close together and the same animal is using both areas. The permanent sampling plots should be located to avoid this situation.

Advantages:

Advantages of this technique include that it does not require that individuals be marked. Additionally, the analysis will allow the inclusion of missing observations. If a species was detected during a site-visit, then that presence is recorded as a "1" in the data set. If the species was not detected during a site-visit, then it is recorded as a "0" for that visit. Dates without survey data for a given site are denoted by a "." for missing data in program MARK and a "-" in program PRESENCE. Just because a species was not detected does not mean that it was necessarily absent, it may have been absent or it may have gone undetected for a number of reasons, including that it was hidden out of site or that it was not hidden but still missed by the observer (MacKenzie et al. 2002).

Disadvantages:

The occupancy parameter is used as a surrogate for population size or species abundance. Population size and abundance both require additional information that may or may not have been collected with a given protocol. Occupancy analyses rely on species presence and absence data only, not the number seen or captured.

Additional literature:

Burnham, KP, and D Anderson. 2003. Model Selection and Multi-Model Inference. Springer-Verlag, Inc. New York, New York.

Cooch, E, and G White. (http://www.phidot.org/software/mark/docs/book/). Introductory User's Guide to MARK. Last accessed: 9/14/05. This is a user friendly manual for Program MARK.

MacKenzie, DI, JD Nichols, GB Lachman, S Droege, JA Royle, and CA Langtimm. 2002. *Estimating Site Occupancy Rates when Detection Probabilities are Less than One*. Ecology. 83: 2248-2255.

MacKenzie, DI, JD Nichols, JA Royle, KH Pollock, LL Bailey, and JE Hines. 2006. Occupancy Estimation and Modeling. Academic Press. Burlington, MA.

The instruction manual for Program PRESENCE (available at http://www.mbr-pwrc.usgs.gov/software.html) should be read in order to fully understand this analysis.

Single season surveys with covariates:

There are 2 types of covariates which can be incorporated into the models. Site-specific covariates are those that do not change between sampling occasions. These variables would be things which would typically be measured only once during a survey season. Examples may include the number of trees in a given area, the amount of woody debris, litter depth, the amount of area of a certain habitat cover, etc. Now, realize that any of the above examples may, in fact, change (e.g. maybe a site is logged during the field season and the number of trees decreases, or a site catches fire and both amount of woody debris and litter depth changes). Should this occur, the covariates may need to be re-measured and considered as sampling covariates instead of site covariates. However, it is at the discretion of the researcher to make this decision.

A sampling covariate is a variable which changes between site-visits. Examples include amount of rainfall, temperature, amount of search effort, etc. These variables need to be measured every time the technician is in the field recording data. If someone forgets to take a measurement, the other measurements for that same day could be averaged for a given site to use for the missing values, depending on the information in question.

Multiple Season Surveys:

If the same sites are visited multiple times over several years, we can compute estimates of colonization (γ) and extinction (ε) probabilities in addition to the proportion of area occupied (Ψ) (MacKenzie et al. 2003 and 2005). This is especially useful for tracking species range expansions or contractions and can be considered as a measure of the status (or trend) of populations of a species. Also, this information could be used to help prioritize areas for conservation. If an area has been shown to have good population persistence for a certain species it might be ranked higher on a land acquisition list than an area with a larger extinction probability, perhaps.

The design for these models is basically the robust design commonly used in mark-recapture studies. The robust design includes several primary periods (usually years) during which the surveys are conducted. Within each primary period the sites are considered 'closed' as they are in the single season surveys. A site is either occupied or unoccupied during the survey, it cannot be occupied and then become unoccupied (or vice-versa) during the survey season. Within each primary period there should be 2 or more secondary period, for our purposes these are the actual dates of the surveys. Since there are several surveys within each primary period and there are also several primary periods (i.e. years of data), we can compute the extinction and colonization probabilities. This is possible because the status (occupied or unoccupied) of any site is allowed to change between primary sampling periods.

Parameters estimated:

Detection probability (p) – the probability of finding an individual of a given species at a given site during a given time.

Occupancy (Ψ) – the probability that a randomly selected site or sampling unit in an area of interest is occupied by at least one individual of a given species.

Colonization (γ) – the probability of a site being unoccupied at time *t* and occupied at time *t*+1.

Extinction (ε) – the probability of a site being occupied at time *t* and un-occupied at time *t*+1.

Change (l) – the rate of change in occupancy (not estimated from the software program):

$$\lambda_t = \frac{\Psi_{t+1}}{\Psi_t}$$

As with the single-season surveys, presence is denoted by a '1', absence by a '0', and missing data by a '.'. Again, one could use either Program MARK or PRESENCE to compute the parameter estimates. Should a model that allows year to vary for ε and γ be the best fit, it may be necessary to calculate a Ψ for each year by hand using the following equation:

$$\Psi_{(t+1)} = \Psi_t(1-\varepsilon_t)+(1-\Psi_t)\gamma_t$$

Data collection procedures:

Multiple visits are made to a given site over a single 'season' and multiple 'seasons' (or years) are covered before this can be utilized. The site is searched or trapped during the time frame for the species of interest. It is not necessary to mark the animals captured during a given visit for this analysis.

Example:

Almost any of the faunal protocols in this manual could serve as examples. Specific examples would include anuran calling surveys, visual encounter surveys, and bird point count surveys.

Requirements & Assumptions:

More than one year of data collection with several visits to a given site within a given year (or season) are required. The assumptions are the same 3 as for the single season surveys

(closure within season, correct identification, and independence between sites) but the closure assumption is relaxed between years. This means, that although the site must be either occupied or unoccupied within a season (or year), the occupancy status is allowed to change between seasons (or years).

Advantages:
The advantages are the same as for single season surveys.

Disadvantages:
The disadvantages are the same as for single season surveys.

Additional literature:
The suggested literature is the same as that for the single season surveys.

Multiple season surveys with covariates:
The same covariates as collected for single season surveys can be used in multiple season surveys. Remember that the larger the data file is, the longer the computer program will take to run. Again, refer to the MARK help files and the Cooch and White manual for information on using covariates in Program MARK. There are several ways to incorporate covariates into the models.

Site specific covariates are allowed to change between years or seasons and can be applied to occupancy (Ψ), colonization (γ), extinction (ε), and detection probability (p). Sampling occasion covariates are allowed to change with every visit and are applicable to detection probability (p) only.

DISTANCE SAMPLING WITH VARIABLE CIRCULAR PLOTS (point counts):
Using circular plots (e.g. point counts) is a method primarily used with birds and was developed as an alternate to line transects. The point count method is especially useful in rough terrain and in areas of complex vegetation. It is often preferred to line transects as point counts result in less disturbance due to the observer being stationary as opposed to moving through the habitat.

Parameters:
Density ($\hat{D}$) – number of individuals per given area.

Data collection procedures:
Determine the distance between the observer at the center of the point and the animal detected. The points where the observer stands should be either randomly or systemically placed. Typically an observer stays in the center of the point for a specified amount of time (e.g. 2 minutes) before beginning the data collection and remains standing at that location throughout the timed count (e.g. 10-12 minutes).

Example:
An example would be the data collected following the bird point count protocol.

Requirements & Assumptions:

The observer must have the ability to pinpoint the location of the animal and judge the distance to that animal. The specific assumptions for this method include that the observer always detect an animal at the point (i.e. if an animal occurs where the observer is standing it is always seen). Animals are detected at their initial location before they move in response to the observer. A third assumption is that distances are measured accurately or accurately within the distance-group interval. Other assumptions are that the animals are not counted more than once (i.e. the same individual is counted only once), that animals are correctly identified to species, and that point locations are randomly placed in the area of interest. Locations of the animals do not have to be randomly distributed through the area (i.e. can be clumped or flocked together).

Advantages:

Since the locations are known prior to the start of data collection, distances at each locations can be flagged, if necessary to aid in correct distance measuring. Other advantages (compared to line transect sampling) include that radial distances are easier to measure and that point counts are easier to employee in patchy, complex habitats.

Disadvantages:

Disadvantages include the initial disturbance caused by the approach of the observer. This can often be eased by having the observer stand still for a specified amount of time prior to beginning the timed data collection. Individuals collected between timed data collections are not usable in this analysis. This analysis may not be efficient for species with low densities.

Additional literature:

Buckland, ST, DR Anderson, KP Burnham, and JL Laake. 1993. Distance Sampling: Estimation of Biological Populations. Chapman and Hall, New York.

Williams, BK, JD Nichols, and MJ Conroy. 2001. 13.3 *Point Sampling*. In: Analysis and Management of Animal Populations: Modeling, Estimation, and Decision Making. Academic Press. San Diego, California.

MARK RECAPTURE OR MARK RESIGHT:

While this data would be collected under potentially more time consuming and costly protocols, the information gained is probably the most informative. The parameters that can be estimated will depend on the amount of effort expended. For example, survival rates for small mammals could only be computed if additional effort (compared to that required under the small mammal protocol in this manual) were employed such that sites were trapped for multiple nights on more than 1 occasion per year. Survival estimates for anurans, however, could be calculated on the number of visits needed per site, per year, IF the animals were marked, which may or may not be done under the amphibian protocol.

Parameters: These depend on the design of the field study but may include:

Density ($\hat{D}$) – number of individuals per given area

Population size ($\hat{N}$) – estimate of the number of animals in the population.

Survival (Φ or S) - typically the proportion of the population that survives from time *t* to time *t*+1.

Data collection procedures:

This involves the capture, marking, and release of animals on multiple occasions within and/or between years. The occasions should be separated by a period of time where the area is not trapped or searched for that taxonomic group. Marked and unmarked individuals should be able to be captured for multiple time intervals.

Example:

Any protocol where animals were marked and recaptured with sufficient numbers should be able to be analyzed with some of these techniques.

Requirements & Assumptions:

For these analyses to work, large numbers of animals must be able to be captured and marked on multiple occasions. There must also be the opportunity for re-finding significant portions of the animals. General assumptions include that the captured sample is representative of the large population. Age and sex are correctly determined. There is no loss of marks. Survival and recapture are not affected by marks. Time of resight, recapture, or recovery is recorded correctly. Additional assumptions may apply depending on analysis (i.e. assumptions may vary if emigration is the parameter of interest instead of population size). Typically, although the area must be closed (no emigration, birth, immigration, death) within a season (or year), the emigration, births, deaths, and immigration are allowed between seasons (or years).

Advantages:

Mark recapture studies typically yield the most information about a given species within a given area when compared to presence/absence and distance studies.

Disadvantages:

Mark recapture studies are often time consuming. They can be expensive depending on the number of visits needed per site per species and the type of method used to mark an animal.

Additional literature:

For population estimates:

White, GC, DR Anderson, KP Burnham, and DL Otis. 1982. Capture-Recapture Removal Methods for Sampling Closed Populations. Los Alamos National Laboratory Publication. LA-8787-NERP. Los Alamos, NM.

Williams, BK, JD Nichols, and MJ Conroy. 2001. Chapter 14: *Estimating Abundance for Closed Populations with Mark-Recapture Methods*. In: Analysis and Management of Animal Populations: Modeling, Estimation, and Decision Making. Academic Press. San Diego, California.

With multi-year data collection:
For survival:

Williams, BK, JD Nichols, and MJ Conroy. 2001. Chapter 17: *Estimating Survival, Movement, and Other State Transitions with Mark-Recapture Methods.* In: Analysis and Management of Animal Populations: Modeling, Estimation, and Decision Making. Academic Press. San Diego, California.

COMMUNITY PARAMETERS:

One of the more fascinating potential analyses to which the MSIM data may be applied would be community compositions. Are there species that always occur together? Species that never occur together even in appropriate habitat? Advanced analyses are still emerging (i.e. MacKenzie et al. 2004), but typical analyses include estimates of species richness and species evenness. Species richness can be estimated from any of the protocols in this manual, but species evenness is dependent upon abundance estimates and can only be computed for taxa where abundance can first be estimated from the data.

Parameters:

Species richness – number of species in a community.
Species evenness – incorporates the relative abundance of different species.

Data collection procedures:

For species richness any of the protocols in this manual can be used to determine presence/absence for many species. Rarely are all species in a given area found.

Example:

Any of the protocols listed in this manual should be able to be used in estimates of species richness. The bird point count and butterfly protocols are 2 examples that could be used in the estimation of species evenness.

Requirements & Assumptions:

Often, estimates of community parameters require the assumption of equal detection probability between species. This assumption is impossible to meet. Unequal detection probability often results in the underestimation of the true number of species in a given area. Estimates do exist which relax this assumption (e.g. the Burnham-Overton jackknife (Williams et al. 2001) which requires only that individuals of the same species have the same detection probabilities). To meet this assumption, it may be necessary to search areas of equal size, with observers of equal skill, for equal amounts of time. To estimate species evenness, the assumption that no individual is counted more than once must be met. It may be easiest to meet this assumption by marking each animal encountered.

Advantages:

If the parameter of interest is species richness, it will not be necessary to mark individuals (since it is usually easier to determine differences between species) reducing both the amount of time and money needed in the field. Estimates can be made from a) spatial plot replicates (searching several plots within the same area) and b) temporal replicates (searching the same plot on multiple occasions). If temporal replicates are used, one must assume that the

time between first and last visit is short enough to prevent the colonization/immigration or extinction/emigration of species.

Disadvantages:

It can be difficult to determine what exactly, the parameters mean. If one site has more species than another and the other site with fewer species has endangered or rare species, how do you decide which site is really more important?

Additional literature:

Krebs, CJ. 1999. Ecological Methodology, Second Edition. Benjamin Cummings. Menlo Park, California.

MacKenzie, DI, LL Bailey, and JD Nichols. 2004. *Investigating Species Co-occurrence when Species are Detected Imperfectly.* Journal of Animal Ecology. 73: 546-555.

Williams, BK, JD Nichols, and MJ Conroy. 2001. Chapter 20: *Estimation of Community Parameters.* In: Analysis and Management of Animal Populations: Modeling, Estimation, and Decision Making. Academic Press. San Diego, California.

Chapter Six
Reporting

The primary audience for the MSIM program is wildlife and public land managers, whether city, county, state, federal agency, NGO, or other organizations that are responsible for the areas used in the study. This information will be important for making and defending management decisions. However, land managers are not the only people that need to have information from this program. The scientific community, general public, and political organizations will also be interested in the information. For this program to be successful, the data must be analyzed and presented in appropriate intervals in such a way as to be most beneficial to each of the audiences. To do this, the information gained from the analyses of the data will need to be presented in differing formats. Using different formats will allow for the content and detail to vary between audiences.

The National Park Service has provided skeletal guidelines for creating reports for different audiences, including a table outlining 8 types of reports which is both summarized and expanded upon below. This 4 page document can be accessed at http://science.nature.nps.gov/im/monitor/docs/VS_Monitoring_Reporting.pdf
For the purpose of the Iowa MSIM program, 2 of these 8 reports have been combined into 1, and the final report listed by the NPS (State of the Parks Report) has been dropped as this information would be covered in Iowa's annual report. Additional information can be found in Oakley et al. (2003).

ANNUAL ADMINISTRATIVE REPORT AND WORK PLAN:
The purpose of this report is to account for the use of funding and employee time on a yearly basis. It should include information on the yearly objectives, tasks, accomplishments, and products of the effort expended in a given year. It should also include plans and budgets for the next, up-coming year.

The primary audience for this report is departmental supervisors, agency program managers, and administrators. This report should be written annually and probably due in early January to allow for inclusion of all expenditures through the end of the field season for a given year. Alternatively, it may be better to stick with the agency's fiscal year (June 30th) meaning that the report would include partial information from 2 years for the report, and the current and next year for the plan, covering 3 years total.

This report should be written by the program scientist with help from appropriate budget managers. It should be reviewed and approved by the departmental supervisor and may be used for Congressional or Federal SWG oversight reporting.

ANNUAL REPORT:
This report would combine information from 3 of the categories listed in the NPS guidelines (Annual reports for specific protocols or projects, Inventory projects reports, and State of the parks report). The purpose of this report is to record annual data and report on yearly accomplishments, describe the current condition of the species, detail any changes to the

protocols used for data collection, identify situations of concern, and highlight potential future research. The report would include information from all sites visited in the given year, but this information could be broken down into specific areas at the request of a land manager. Species lists, occupancy probabilities, detection probabilities and any additional parameters that can be computed on a yearly basis should be included for habitat class, region, county, and state-wide when the data allows.

The primary audience for this report would be agency staff, scientists, and monitoring partners. The information should include graphics that could easily be pulled from the report (stand alone, in other words) for dissemination to the general public. The report would include information from the given year only for analysis, but may include summary statistics from previous years to help illustrate details. This report should be due before the beginning of the next field season (usually April 1).

The report should be written by the program scientist with help from the appropriate staff and monitoring partners. It should be reviewed and approved by the partners, including those chosen by the IWAP plan implementer to serve on the review board for the IWAP.

PERIODIC ANALYSIS AND SYNTHESIS REPORT – TREND ANALYSIS:
The purpose of this report is to examine trends in the species occurrences (site colonization and extinction rates). In addition, the report should outline correlations to environmental conditions for each species, and should analyze the amount of change that can be detected with the current level of sampling. Any recommended changes should be suggested here, as to management actions and/or sampling effort changes.

The primary audience would be resource managers, staff, scientists, and monitoring partners, but as with the yearly report, stand alone graphics should be included which could be easily disseminated to the general public and legislative entities. This report should be written every 3 to 5 years and include all data acquired with the program in addition to comparisons to historical reports. It should also be written by the program scientist with help from the appropriate staff and monitoring partners. It should be reviewed and approved by the partners.

PROGRAM AND PROTOCOL REVIEW REPORT:
The purpose of this report is to provide a formal review of the program and protocols. It should review both the protocols used for each taxonomic group and habitat data collection as well as the products of the program to determine if changes are needed. This will help ensure quality assurance through the peer-review process. It should include any suggested changes to the program, including the number of habitats, sites, locations of plots, in addition to the protocols and outcomes.

The primary audience for this report is supervisors, administrators, the IWAP review board, and monitoring partners. The report should be written and the program reviewed every 5 years. Again, responsibility for the report belongs to the program scientist with help from appropriate staff and monitoring partners.

The remaining 2 'reports' will depend on the quantity and quality of the data collected by the MSIM program to determine the frequency of production.

SCIENTIFIC JOURNAL ARTICLES AND BOOK CHAPTERS:
The purpose here would be to express knowledge gained as part of the program or to advance the program itself. The target audience would primarily be scientists and managers. The product would be peer reviewed by journal or book editors and would serve as part of the quality assurance aspect of the program.

SYMPOSIA, WORKSHOPS, AND CONFERENCES:
The purpose of participating would be to review and summarize the information collected on a specific species. It is expected that this would help identify current and future issues as well as sparking debate for new ideas. The audience and frequency would vary depending on the setting and volume of information collected.

In summary, the Annual Administrative Report and Work Plan as well as the Annual Report should both be compiled annually. The Periodic Analysis and Synthesis Report – Trend Analysis should be compiled every 3 – 5 years, and the Program and Protocol Review Report every 5 years. Journal articles and presentations should be done as often as possible given data and time constraints.

Chapter Seven
Periodic Review and Evaluation

The final element for a monitoring program as suggested by the USGS is that of Periodic Review and Evaluation. In addition to internal review by the program scientist and the staff conducting the monitoring, external reviews should be made as well. This chapter outlines the potential protocol for conducting the external reviews. The information draws heavily for the National Park Service's "Peer Review Guidelines for the Inventory and Monitoring Program" which can be accessed at
http://science.nature.nps.gov/im/monitor/docs/DraftPeerReviewGuidelines.doc
last accessed on October 11, 2006 as well as the Oakley et al. (2003) publication.

DEFINITIONS:
Peer review - Report is reviewed by scientific reviewers and technical experts.
Internal peer review - Review is conducted by DNR staff, chosen staff should have no direct involvement with the program (i.e. do not collect or analyze the data).
External peer review - Review is conducted by independent experts from outside the DNR.

Reviews should be conducted periodically and should include review of individual protocols, sampling location selection procedures, and findings of the program. It may (or may not) be necessary to appoint a coordinator for the review process to either ensure objectivity or ensure that the most qualified experts are chosen as the reviewers.

This is a formal process and requires the maintenance of written files and approval forms signed by the reviewers or, should they choose to remain anonymous, by their representative coordinator. This will serve as the administrative record of review and is to include the original document, instructions to reviewers, reviewer comments, documentation as to how the authors responded to the comments, the final copy of the document, and the coordinator-signed approval form.

Peer reviewers should be chosen based upon expertise in the area and should be able to independently and objectively comment on the document and merit of the work. Therefore, they should not be involved or have a vested interest in the project under review. The panel should include people that are not employees or supervisors of program personnel or product authors. It will be critical to include external reviewers in this process.

TYPES OF REVIEWS:
Annual Report – should be reviewed by at least 1 internal and 2 external peer reviewers before being submitted. One of the reviewers should have a statistical background. It may be best to request reviews by taxonomic sections which would increase the number of reviews but also increase the number of reviewers with expertise in a given area. Comments received from others (i.e. monitoring partners, including the review board for the IWAP) after it is submitted should be considered and incorporated into the next annual report. It may be advisable to request friendly reviews from a select few of the partners before the report is submitted.

Periodic Analysis and Synthesis Report / Trend Analysis – should be reviewed by at least 2 external peer reviewers per taxonomic group as well as a statistician for the whole report. Monitoring partners should also be given the opportunity to comment on the report before it is considered final.

Program and Protocol Review Report – should be reviewed by at least 2 external peer reviewers per taxonomic group as well as a statistician for the whole report. The IWAP review board should also be given the opportunity to comment on the report before it is considered final.

Guidelines to the scientific peer reviewers should include (but not be limited to):

1) Are the objectives clearly defined and reachable?
2) Is the sampling and experimental design appropriate? Did or will it meet the program objectives? Is it statistically valid?
3) Are field techniques clearly described and sufficient to meet program objectives?
4) Are analytical and statistical procedures clearly described and appropriate?
5) Were analytical and statistical procedures used appropriately?
6) Are the results and conclusions logical?
7) In addition, for future plans:
    a. Does timeline and budget ensure that objectives will be met?
    b. Are reports and other products identified and adequate?
    c. Is the combination of scientific disciplines proposed sufficient to adequately meet the objectives?

Guidelines to the non-scientific reviewers should include (but not be limited to):

1) Is the report understandable and easy to read?
2) Does the report adequately describe the objectives, sites, how the data was collected and analyzed?
3) Are the conclusions logical?

The files maintained as part of the review process should be in the possession of the program scientist (or a copy of these files), with another copy (or the originals) being maintained by the review coordinator. For Iowa, it would be appropriate for the IWAP implementer to fill the role of MSIM review coordinator, if the implementer was willing. Additional possibilities for the review coordinator include the Wildlife Bureau Research Supervisor or someone appointed by this supervisor. Examples of report review forms, including the coordinator's form, the scientific peer review form, and the non-scientific peer review form, are located in Appendix 2 at the end of the data sheets.

LOCATION:_____ Tech lab initials:_____DATE:_____
Number of acres in property:_____ Field tech initial:_____DATE:_____

Roads and trails within hexagon:

Category	Width of road	Length of road	Area of road (lxw)

Categories: 4 lane highway, 2 lane highway, paved road, unpaved road, OHV (off-highway vehicle, i.e. all terrain vehicles) trail, and hiking trail.

Habitat types within hexagon:

Habitat	Percent of hexagon area in habitat
1^{o} habitat:_____	

Roads and trails within 101 ha block:

Category	Width of road	Length of road	Area of road (lxw)

Categories: 4 lane highway, 2 lane highway, paved road, unpaved road, OHV (off-highway vehicle, i.e. all terrain vehicles) trail, and hiking trail.

Habitat types within 101 ha block (approximate 101 ha):

Habitat	Percent of hexagon area in habitat
1^{o} habitat:_____	

Other notes (i.e. – block smaller than 101 ha due to property boundary, etc, etc)

Ground truthing of data obtained from GIS for LOTIC (running water) HABITATS:
This should be filled out in the lab, prior to habitat characterization field work. Field work should include recording information concerning discrepancies between the database and what is actually there. For field work, the technician should have a map of the site.
LOCATION:_____
UTM coordinates from lab: E_____ N_____
GIS OBS:_____ DATABASE USED:_____
Date of lab work:_____Date of field work:_____Field OBS:_____
Estimated spacing needed for 11 transects (at 3X width of stream):_____

Roads and trails within 30 m of each side of channel:

Category	Distance from shore	Area of road (l*w)	Width where crosses channel

Categories: 4 lane highway, 2 lane highway, paved road, unpaved road, OHV (off-highway vehicle, i.e. all terrain vehicles) trail, and hiking trail.

Additional compacted soil areas within 10 m of channel:

Description	Distance from shore	Area of compaction

Roads and trails within 30 to 100 m of each side of channel:

Category	Distance from shore	Area of road (l*w)	Width where crosses channel

Categories: 4 lane highway, 2 lane highway, paved road, unpaved road, OHV (off-highway vehicle, i.e. all terrain vehicles) trail, and hiking trail.

Remember to print a map with the wetlands numbered within each hexagon for ease of field identification, and to include these numbers, if possible to tell from previous GIS coverage, on the POOLS data table.
Additional information, things that may need checking in the field or things that may be needed in the field:

- Is this intermittent/ephemeral or does it have water?_____
- Does this need to be electroshocked and/or checked for mussels?_____

Ground truthing of data obtained from GIS for LENTIC (standing water) HABITATS:
This should be filled out in the lab, prior to habitat characterization field work. Field work should include recording information concerning discrepancies between the database and what is actually there. For field work, the technician should have a map of the site.
LOCATION:_____ POOL ID:_____
GIS OBS:_____ DATABASE USED:_____
Date of lab work:_____Date of field work:_____Field OBS:_____
UTM coordinates (from lab): E_____ N_____
Estimated perimeter/circumference: _____
Estimated spacing needed for 30 plots around perimeter:_____

Roads and trails within 30 m of shoreline:

Category	Distance from shore	Area of road (l*w)

Categories: 4 lane highway, 2 lane highway, paved road, unpaved road, OHV (off-highway vehicle, i.e. all terrain vehicles) trail, and hiking trail.

Additional compacted soil areas within 10 m of shoreline:

Description	Distance from shore	Area of compaction

Roads and trails between 30-100 m of shoreline:

Category	Distance from shore	Area of road (l*w)

Categories: 4 lane highway, 2 lane highway, paved road, unpaved road, OHV (off-highway vehicle, i.e. all terrain vehicles) trail, and hiking trail.

Additional information, things that may need checking in the field or things that may be needed in the field:

Report Review Form
Review Coordinator's Form

Iowa Multiple Species Inventory and Monitoring Program

Title of Report to be reviewed:_____
Date of review request:_____

Scientific Reviewer Name:_____ Date of review return:_____

Scientific Reviewer Name:_____ Date of review return:_____

Scientific Reviewer Name:_____ Date of review return:_____

Scientific Reviewer Name:_____ Date of review return:_____

Scientific Reviewer Name:_____ Date of review return:_____

Non-scientific Reviewer Name:_____ Date of review return:_____

Non-scientific Reviewer Name:_____ Date of review return:_____

Non-scientific Reviewer Name:_____ Date of review return:_____

Peer review of the above named document has been completed. Reviewers comments have been sent to the program scientist(s). Program scientist(s)' responses to the comments have been documented. The final document has been received. Assurance is given that the document and review have met the Periodic Review and Evaluation guidelines outlined in the MSIM manual. A record of the review comments and revision strategy is on file.

Name & Title of Peer Review Coordinator: _____

_____

_____ _____

Signature of Peer Review Coordinator Date

Instructions to Scientific Peer Reviewers
Reviewer Comments Form

To make the review process as easy as possible, the following questions are the primary ones to consider. Should the answer to a question be "no", please provide narrative comments in either the space provided or on additional paper. Address additional issues at the end of this form or on additional paper.

1. Are the objectives clearly defined and reachable?

2. Is the sampling and experimental design appropriate?

    a. Will it meet the program objectives?

    b. Is it statistically valid?

3. Are the field techniques clearly described and sufficient to meet program objectives?

4. Are analytical and statistical procedures clearly described and appropriate?

5. Does the timeline and budget ensure that objectives will be met?

6. Are reports and other products identified and adequate?

7. Is the combination of scientific disciplines proposed sufficient to adequately meet the objectives?

8. Additional issues:

*Reviewer Name & Title:_____

_____ _____

Signature or Reviewer Date

*If you wish to remain anonymous to the program staff, please make sure that the review coordinator understands this and do not sign this paper.

Instructions to Non-scientific Peer Reviewers
Reviewer Comments Form

To make the review process as easy as possible, the following questions are the primary ones to consider. Should the answer to a question be "no", please provide narrative comments in either the space provided or on additional paper. Address additional issues at the end of this form or on additional paper.

4) Is the report understandable and easy to read?

5) Does the report adequately describe the objectives, sites, how the data was collected and analyzed?

6) Are the conclusions logical?

7) Additional issues:

*Reviewer Name & Title:_____

_____ _____

Signature or Reviewer Date

*If you wish to remain anonymous to the program staff, please make sure that the review coordinator understands this and do not sign this paper.