2013 Annual Report

July 2012 – June 2013

Cooperating Agencies:

U.S. Geological Survey, Ecosystems
Iowa Department of Natural Resources
Iowa State University
U.S. Fish & Wildlife Service
Wildlife Management Institute

Iowa Cooperative Fish & Wildlife Research Unit
338 Science II, Iowa State University
Ames, IA 50011-3221
Telephone: (515) 294-3056
Fax: (515) 294-5468
Email: coopunit@iastate.edu
www.cfwru.iastate.edu

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Personnel and Cooperators

Unit Coordinating Committee

Michael Tome
Units Supervisor
Cooperative Research Units
U.S. Geological Survey, Ecosystems

Sue Blodgett
Department Chair
Natural Resource Ecology & Management
Iowa State University

Dale Garner and Joe Larscheid
Wildlife and Fisheries Bureau Chiefs
Iowa Department of Natural Resources

Patrick Ruble
Midwest Representative
Wildlife Management Institute

Unit Staff

Robert W. Klaver	Unit Leader and Professor of Natural Resource Ecology & Management
Clay L. Pierce	Assistant Unit Leader, Fisheries, and Professor of Natural Resource Ecology & Management
Open Position	Assistant Unit Leader, Wildlife
Jessica Bell	Administrative Specialist, Department of Natural Resource Ecology & Management

Collaborating Professors:

Julie Blanchong, NREM
Rebecca Christoffel, NREM
William Clark, EEOB
Diane Debinski, EEOB
Stephen Dinsmore, NREM
Sue Fairbanks, NREM
Joseph Morris, NREM, NCRAC
Rolf Koford, Former Unit Leader
David Otis, Former Unit Leader
Michael Quist, Former Unit Scientist
Michael J. Weber, NREM

New Projects

Acoustic transect monitoring and White Nose Syndrome response plan for Iowa bats

Principal Investigator: Julie A. Blanchong
Rebecca Christoffel
Student Investigator:
Collaborators: Daryl Howell
Duration: July 2012 to June 2013
Funding Source(s): Iowa Department of Natural Resources (IDNR)

Goals and Objectives:
- Conduct acoustic surveys along drive transects to monitor bat activity
- Prepare a White Nose Syndrome response plan for Iowa

Introduction:
White Nose Syndrome (WNS), a devastating disease associated with the mortality of millions of bats was first documented in New York during the winter of 2005-2006, and is now confirmed in 19 US states and four Canadian provinces. The fungus that causes WNS was detected on a big brown bat hibernating in an Iowa cave in March 2012. The loss of large numbers of bats due to WNS is expected to have enormous economic impacts to agriculture. Knowledge of the abundance and distribution of bat species in Iowa is minimal, but is critically needed to understand the potential ramifications of WNS to Iowa.

In this project, we will conduct acoustic surveys along drive transects in eastern, central, and southern Iowa to document bat echolocation activity in order to gain a better assessment of bat abundance and distribution in Iowa. We will also prepare a White Nose Syndrome response plan for the state of Iowa that will include objectives, management actions and tools for bats and contaminated environments, monitoring plans, and restoration plans for responding to a WNS epidemic in Iowa bats.

Progress:
Two NREM undergraduate students were hired to work on the project. Students identified 2-3 possible drive transects in each of 7 counties (Boone, Clayton, Dubuque, Jackson, Lucas, Story, and Warren) along which to conduct acoustic surveys. White Nose Syndrome response plans from several states were reviewed, and a first draft of an Iowa-specific White Nose Syndrome response plan is being prepared. Two Anabat detectors and associated equipment for conducting drive transects have been ordered.

Future Plans:
A draft of the White Nose Syndrome response plan will be shared with the IDNR and other stakeholders for comments, and a final draft will be produced based on stakeholder feedback. Undergraduate students will spend the winter/spring learning how to use acoustic analysis software to identify bat species. Dr. Christoffel and Dr. Blanchong will attend an Anabat Techniques Workshop in the spring. Drive transects identified in the fall will be road-tested in early spring and, pending their acceptability, acoustic surveys will be conducted along each transect twice in late May through June to collect data on bat activity. A final report will be submitted to the IDNR by June 30, 2013.

Seasonal succession in floral resources and response of insect pollinator groups in three grassland types important for pollinator conservation in Iowa

Principal Investigator: Diane Debinski
Student Investigator: John Delaney
Collaborators: Karin Grimlund – TNC Missouri
Duration: May 2013 to November 2013
Funding Source(s): Iowa Department of Natural Resources (IDNR)

Goals and Objectives:

- Provide information on differences in floral resources and pollinator communities among different types of grasslands important for conservation in the Upper Midwest.
- Quantify differences and patterns of changes in floral resources over the entire growing season.
- Understand how pollinator communities change in response to differences and seasonal changes in floral resource availability.
- Use information acquired on differences of floral resources and pollinator communities among grassland types to develop recommendations to improve floral resources in tallgrass prairie reconstruction efforts and management practices of exotic dominated grasslands.

Introduction:

Recently a global decline in pollinators has been observed. Nectar and pollen from flowers are important resource for many pollinators for powering flight and increasing reproductive success. Conservation of native grassland pollinator species in Iowa relies upon the preservation of high quality habitats, the reconstruction of new habitats, and the careful management of novel grasslands (fallow fields and moderately managed pastures dominated by exotic plant species). These three types of grasslands differ in their floral resource communities. Here we propose to measure the floral resources available in three types of grasslands not only from a single or a few snapshots in time but throughout the growing season (spring-fall), and observe the pollinator community over four sampling rounds. Understanding how these habitat types differ in their floral resources and seasonal availability is an essential step in determining their utility for pollinator conservation and for refining strategies for reconstruction, restoration, and management of habitat for pollinators.

Progress:

- We have completed 4 rounds of measuring nectar resources available to pollinators at two week intervals.
- We are nearing completion of our first round of butterfly transects and will complete at least two more in the next two months.
- We have ordered supplies and finalized methodology for collecting bee and flower visiting flies in pan traps and will begin sampling Late June 2013.

Future Plans:

We will complete sampling of butterfly, bee, and flowervisiety flies in August 2013. Sampling of floral resources will continue into the fall and conclude sometime in November 2013. We will begin identifying samples collected from pan traps beginning in August 2013.

Northeastern Iowa Forest Monitoring

Principal Investigator: Stephen J. Dinsmore
Student Investigator: 2 undergraduate field technicians
Collaborators: Katy Reeder, Iowa DNR
Duration: 15 April 2013 to 30 June 2015
Funding Source(s): Iowa DNR

Goals and Objectives:

- Monitor breeding birds with Multiple Species Inventory and Monitoring (MSIM) protocols to gauge responses to forest habitat management.
- Monitor butterflies with Visual Encounter Surveys (VES) to gauge responses to forest habitat management.

Iowa was awarded a multi-state federal grant through the Competitive State Wildlife Grants program to improve habitat for open woodland and savanna-associated wildlife on forested Wildlife Management Areas in Northeast Iowa. As part of this work, the Iowa Department of Natural Resources (IDNR) committed to monitoring birds and butterflies in the project area as part of a state match for the grant. Specifically, Iowa committed to restoring 650 acres of bluff prairie, savanna, and open woodland habitat on land owned and managed by IDNR.

STUDY AREA

The study area consists of 16 wildlife management areas (WMAs) located in five counties (Allamakee, Clayton, Howard, Jones, and Winneshiek) in northeastern Iowa (Figure 1). In addition, areas within a 3-mile buffer of those WMAs may be surveyed, although this is not required.

BIRD MONITORING

Bird monitoring will follow protocols established as part of the Multiple Species Inventory and Monitoring (MSIM) program of IDNR. We will place a hexagon consisting of seven points spaced 200 m apart (or fewer points if the stand is too small) at each property. Breeding birds are the focus of monitoring, so we will conduct a minimum of 3 visits to each point (more if time permits). At each point the technician will conduct a 10 minute point count and record all birds seen or heard and place them into one of five distance bins (0-25 m, 25-50 m, 50-75 m, 75-100 m, and >100 m from the point). Counts will be conducted during acceptable weather conditions (no fog or rain, wind <20 km/hr [12 mph]) from sunrise to 4.5 hours after sunrise.

BUTTERFLY MONITORING

Butterfly monitoring will consist of visual encounter surveys (VES) and the collection of habitat information associated with surveyed areas. A VES can be conducted anywhere on the property that appears to be the best habitat for the target butterflies (Table 1). If any of the target species is found, we will record a point location using a hand-held GPS and provide a brief description of the habitat (Table 2). We will use the habitat classifications identified by the Iowa Wildlife Action Plan (Zohrer 2006) and estimate the proportion of the area surveyed into relevant habitat types (Table 2). We will also record a GPS location for the approximate midpoint of each VES as well as any stand information that is available. For other butterfly species we will record only the property name and number of individuals seen. Butterfly surveys will be conducted under standardized weather conditions that are conducive to encountering the target species. All surveys will be conducted no earlier than 10 a.m. and end by 6:30 p.m. on any given day. The temperature at the time of the survey will be between 21° and 35° C (70-95°F) with winds less than 15 mph. Surveys will be conducted on mostly sunny days.

Progress:
Two field technicians were hired in May 2013 and have begun the first season of fieldwork.

Future Plans:
Monitoring will continue through sometime in August of 2013, and a second field season will occur during the same timeframe in 2014.

Developing a Model to Predict Canada Goose Breeding Pair Densities in the Midwest Using National Wetlands Inventory Data

Principal Investigator: Robert Klaver
Student Investigator: Brenna Towery (M.S.)
Collaborators:
Duration: January 2013 to August 2015
Funding Source(s): Iowa Department of Natural Resources (IDNR); U.S. Geological Survey

Introduction:
Mississippi Flyway Council states and provinces have been developing and refining methods to estimate the giant Canada goose populations in the Flyway since 1993. Sound science-based management of giant Canada geese requires more precise estimates of the breeding populations of these birds in the states and provinces with resident populations. The survey methodology has evolved as computing tools and GIS information has improved. The surveys conducted in Iowa and surrounding states indicate that the key to precisely estimating the Canada goose breeding population in a region is the accuracy of the stratification of the universe of survey plots. Because we now have a revised and refined wetlands inventory for Iowa (circa 2002), as well as 5 years of Canada Goose observation data (from aerial surveys of 160 2 mi^2 plots/year) that ties all the observations of geese (singles, pairs, and groups) to specific wetlands or streams/rivers on individual survey plots, we can develop a model that will predict the Canada goose population for each section in the state based on number, size, and types of wetlands in each section.

Goals and Objectives:
In order to develop a model to predict giant Canada goose breeding pair densities in Iowa, we will first reclassify the NWI data by creating a system that is simplified and relevant to use of wetlands by Canada geese. We will also digitize 5 years of Canada goose aerial survey data using a GIS, identify all sections in the state with potential Canada goose nesting habitat, and assign sections to strata based on their predicted numbers of breeding pairs. In order to determine the precision of this survey methodology, we will also ground-truth aerial counts of Canada geese on plots with high densities of breeding pairs and calculate visibility correction factors if appropriate. In addition, we will determine giant Canada goose nest success at Rice Lake Wildlife Management Area, and other areas where nest densities have historically been very high.

Progress:
The process of modifying the NWI classification system is under way, as is the digitizing of the aerial survey data. Giant Canada goose nests were located and monitored at Rice Lake and Elk Creek Wildlife Management Areas (WMA), as well as Big Wall Lake during the 2013 spring nesting season. One hundred Canada goose nests were found at Rice Lake WMA, with 21 nests hatched. The daily survival rate (DSR) of nests at Rice Lake WMA was 94% and, with a 28 day nesting period, the Mayfield estimate of nest success is 18%. Twenty-nine Canada goose nests were found at Big Wall Lake, with 18 nests hatched. The DSR of nests found at Big Wall Lake was 97%, and the Mayfield estimate of nest success is 43%.

Future Plans:
Once the aerial survey data has been digitized and the wetland classifications finalized, model development will commence. Additional lakes will be searched for Canada goose nests in the 2014 nesting season. Details are still being discussed concerning which lakes will be added.

Conservation, Habitat Use, and Genetic Diversity of a Translocated Population of Greater Prairie-chickens in Iowa

Principal Investigator: Jennifer Vogel
Co-Principal Investigator: Diane Debinski
Collaborators: Stephanie Shepherd, Iowa DNR
Duration: 2013-2016
Funding Source(s): State Wildlife Grant (IDNR, USFWS)

Goals and Objectives:

- Evaluate the genetic diversity of the existing small population of greater prairie- chickens in Iowa and examine the effects on genetic diversity of supplementing the current population with translocated birds.
- Develop a habitat suitability model and examine habitat use for greater prairie-chickens in Iowa. We will use current satellite landcover data along with local scale habitat data to develop a habitat suitability model for greater prairie-chickens in Iowa.

Progress:

Genetics: We collected 74 blood samples from translocated birds in 2013. We also took possession of 48 blood samples that were collected from translocated birds in 2012.

Lek Surveys: Prairie chicken lek surveys were conducted weekly from March 21, 2013 to April 27, 2013. We surveyed 4 previously established lek survey routes in Iowa and we established 2 additional lek survey routes in Missouri (surrounding Dunn Ranch).

Habitat Surveys: For the 3 active lek sites, we established a 3 kilometer radius around each lek. Within each 3km buffer, we obtained shapefiles containing common land unit (CLU) polygons as our unit of measurement for local level habitat surveys. We are evaluating each CLU polygon within the 3km buffers. For grasslands, we are conducting vegetation surveys that include measuring visual obstruction and determining vegetation composition.

Telemetry: We attached 10 ARGOS satellite/GPS transmitters to female prairie-chickens in Nebraska prior to transport. All of the birds with our transmitters were released in Iowa between April 3, 2013 and April 7, 2013. We have been tracking location data with weekly downloads from the ARGOS satellite system. As of June 4, 2013, the marked birds have been located in 20 Counties in Iowa and 18 Counties in Missouri.

Future Plans:

We will continue habitat surveys of the areas around the 3 active leks for the remainder of the 2013 field season, we will continue to monitor the locations of the birds with transmitters, and we will start to analyze the data from the 2013 field season through the fall and winter of 2013.

Distribution and Population Dynamics of Asian Carp in Iowa Rivers

Principal Investigator: Michael J. Weber
Clay L. Pierce
Student Investigator: M.S. Graduate Student
Collaborators: Kim Bogenschutz, Iowa DNR
Jason Euchner, Iowa DNR
Duration: July 2013 to June 2016
Funding Source(s): Iowa Department of Natural Resources (IDNR)

Goals and Objectives:

- Evaluate adult population characteristics (abundance, distribution, size structure) and dynamics (recruitment, growth, mortality) of Asian carp among select Iowa rivers, including the Mississippi, Des Moines, Skunk, Iowa, and Cedar rivers
- Evaluate Asian carp reproduction (fecundity, larval and juvenile densities) and recruitment in select Iowa rivers, including the Mississippi, Des Moines, Skunk, Iowa, and Cedar rivers.

Introduction:

Bighead (Hypophthalmichthys nobilis) and silver (H. molitrix) carps (collectively, Asian carp) are non-native fishes that have invaded the Mississippi and Missouri river basins. Asian carp can reduce zooplankton assemblages which may result in negative interactions with native fishes. Extensive research has been devoted towards understanding Asian carp populations in the Illinois and lower portions of the Mississippi and Missouri rivers. However, little is known about Asian carp populations in tributaries of these systems, including those throughout southeastern Iowa. Asian carp are known to inhabit lower portions of the Des Moines, Iowa, Cedar, Skunk, and Chariton rivers in Iowa. However, it is not known whether these are resident or migrant populations, the best time of year to sample these populations, if Asian carp are successfully reproducing and recruiting in Iowa rivers, or factors regulating dynamic rate functions of these populations.

Resource managers and stakeholders are concerned that Asian carp will further contribute to the impaired ecological conditions of Iowa's aquatic resources. Success of Asian carp populations in Iowa depends on the ability of adults to find suitable conditions for reproduction (sustained, high flow velocity during spring). A more detailed evaluation of factors affecting reproduction and recruitment in Iowa tributaries of the Mississippi River is needed to better understand Asian carp population dynamics in these systems and potentially develop management strategies for these invasive fishes. A basic understanding of fish population dynamics is essential for management of any population. Additionally, fecundity, age at sexual maturity, and spawning periodicity provide insight into reproductive potential. Finally, information on the spatial and temporal distribution of Asian carp larvae will help to identify adult spawning areas, determine reproductive cues, and characterize relationships between environmental variables and survival of larvae and juveniles.

Progress:

A graduate student has been selected and has tentatively accepted the position, pending receipt of signed funding award.

Future Plans:

The graduate student will begin work in August 2013. Reconnaissance, site selection, and equipment testing will be done August-October 2013.

Evaluation of an electric barrier to reduce walleye escapement

Principal Investigator: Michael J Weber
Student Investigator: None
Collaborators: Mark Flammang, George Scholten, IDNR
Duration: **April 1, 2013 – July 31, 2013**
Funding Source(s): Iowa Department of Natural Resources

Goals and Objectives:

- Evaluate the potential effectiveness of an electric barrier at reducing walleye escapement from reservoirs. Laboratory experiments were used to compare walleye behavior, escapement, and mortality using four pulse (0, 0.3, 0.5, and 0.8 ms) and three voltage (0, 60, and 80 V) settings.

Introduction

Fish entrainment through dams, hydroelectric projects, or into cooling water intakes has been shown to have negative impacts on fish populations. In Iowa, walleye escapement from Rathbun Lake can approach 30% annually with an associated large economic cost. Section 316(b) of the Clean Water Act has required that "best technology available" be used to minimize adverse environmental impacts resulting from operation of cooling water intake structures. Thus, evaluations of barriers to reduce walleye escapement are needed. Several different types of nonphysical barriers have been employed, such as constant light, strobe lights, underwater sound, bubble curtains, electrical current, or a combination of the above. A recent barrier evaluation found that a sound-air-light barrier was minimally effective at reducing walleye escapement. The use of electric barriers has been successful at reducing movement of fishes for over 60 years. However, few formal evaluations currently exist that assess their ability to successfully deter fish movements.

Progress

All trials have been completed at Rathbun Fish Hatchery and data is currently being analyzed. Preliminary results suggest that the electric barrier was successful at reducing approaches and increasing deflections of walleyes when it was activated, suggesting fish avoided the barrier. Altered behavior resulted in nearly an 80% reduction in escapement. However, pulse width and voltage did not influence escapement rates. Walleye mortality ranged from 0.5-5.7% and was highest at the highest barrier setting (0.8 ms, 80 V).

Future Plans:

Complete data analysis and write final report for Iowa DNR.

Continuing Projects

Functional Assessment of Missouri River Mitigation Wetlands in Iowa

Principal Investigator: Rolf R. Koford
David L. Otis
Student Investigator: Tyler Grant (Ph.D.)
Collaborators: Karen Kinkead, Angi Bruce, Iowa Department of Natural Resources
NE, KS, MO State agencies and universities
Duration: June 2009 to May 2014
Funding Source(s): U.S. Army Corps of Engineers

Goals and Objectives:

- Evaluate herpetofauna habitat function of restored wetlands in the Missouri River floodplain
- Relate species response to management practices and physical attributes of wetlands
- Integrate results from comparable studies in collaborating states to produce models to inform adaptive management of existing and future mitigation programs

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Progress:

In 2012, field work was conducted from late March to mid-August. The flood of 2011 modified the landscape, so a complete assessment of the wetlands was conducted in March. New wetlands were mapped and added to the survey rotation and wetlands filled with sediment were removed from the rotation. The resulting 82 sites represented all the wetlands in the study area. The Missouri River maintained normal levels in 2012 and field work was completed as planned. Seven call surveys, five tadpole surveys, and five metamorph surveys were conducted at each site. Habitat surveys were conducted at each site twice over the summer. Drift fences installed before the flood were a complete loss. New, less permanent drift fences were installed at two new scour holes. Several species were captured but no breeding occurred in these two wetlands. Turtle trapping was conducted from July 23 to August 10 in 8 large wetlands/scour holes. Though 139 captures were made, recaptures were rare and it seems likely that a mark-recapture analysis will not be possible.

Future Plans:

In the final 2013 field season, field work will be conducted as in 2012. In addition, depth measurements of a selection of the wetlands will be taken to determine hydrology in relation to the river.

Comparison of Amphibian Habitat Suitability In USDA CREP and Reference Wetlands in the Des Moines Lobe of Iowa

Principal Investigator: Clay L. Pierce
Student Investigator: Rebecca Reeves (M.S.)
Collaborators: Erin Muths, USGS Fort Collins Science Center
Mark Vandever, USGS Fort Collins Science Center
Duration: September 2011 to December 2014
Funding Source(s): U.S. Geological Survey, Fort Collins Science Center, SSP

Goals and Objectives:

- This project compares amphibian populations in restored CREP and in reference wetlands in the Des Moines Lobe landform of Central Iowa. Population size is being estimated for chorus frogs and leopard frogs (*Pseudacris maculata* and *Lithobates pipiens*, respectively) and a measure of stress derived from measurements of fluctuating asymmetry is being determined in leopard frogs. We are also comparing water quality and anuran species richness and characterizing the presence of parasites, predacious fish, and emergent diseases in target wetlands.
- Our assessment of diseases in wetlands will focus primarily on identifying the prevalence of the amphibian chytrid fungus in wetlands. Fluctuating asymmetry, which is any difference in bilateral symmetry between paired body parts, may indicate exposure to emergent diseases or other environmental stressors (e.g. poor water quality, parasites, predation etc.) and has been found to be a good indicator of overall developmental stress in amphibians. We are also investigating the presence of predacious fish in wetlands as it affects the species richness and potential breeding success of several anuran species.
- Specifically, our hypotheses were that there would be: 1) lower *anuran species richness, 2) s*maller *anuran population sizes* and 3) increased levels of *fluctuating asymmetry* at sites with decreased water quality, predacious fish, disease, and parasites. Due to the presence of tile drainage outflow in CREP wetlands, we also predicted that water quality would be lower in CREP than in reference wetlands.

Introduction:

Habitat loss, emergent disease and chemical contaminants are all factors contributing to recent amphibian population declines. The effects of anthropogenic activities such as urban development and agriculture may have exacerbated the role of these factors. The Conservation Reserve Enhancement Program (CREP) strategically restores wetlands in landscape locations where they primarily receive subsurface tile drainage, and aims to reduce nutrient (especially nitrogen) concentrations in surface waters. However, the benefits of this increased wetland area as amphibian habitat may be negated if the quality of the wetlands is insufficient to sustain viable amphibian populations. Other restored wetlands are prevalent across the Des Moines Lobe and generally receive surface water and to a lesser extent subsurface flow. Similar to CREP wetlands, these "reference" wetlands were restored from agricultural use at one time but are not typically positioned to accept substantial amounts of tile drainage.

Progress:

This project is examining these two wetland types (CREP and reference) in Central Iowa, and investigating their ability to support amphibian biodiversity. We are measuring contaminant occurrence in water, sediment and frog liver tissue; pathogen (*Batrachochytrium dendrobatidis* (Bd)) occurrence, and aquatic predator occurrence to assess the relative quality of the habitat for native amphibians. Water, sediment and liver tissue samples are being analyzed for 100 compounds, including 36 fungicides, 27 insecticides, 23 herbicides and 14 degradation products. We will relate these metrics to anuran species richness, the population sizes of chorus and leopard frogs (*Pseudacris maculata* and *Lithobates pipiens*, respectively) and the levels or fluctuating asymmetry, or variations from expected bilateral symmetry, in leopard frogs.

Genetic Analysis of White-tailed Deer Population Structure in Iowa: Identifying Potential Patterns and Rates of Disease Spread

Principal Investigator: Julie Blanchong
Student Investigator: Lynne Gardner (Ph.D.)
Collaborators:
Duration: July 2011 to June 2015
Funding Source(s): Iowa Department of Natural Resources

Goals and Objectives:

- Conduct a statewide assessment of deer population genetic structure in Iowa to determine the scale of spatial autocorrelation and dispersal rates among sampled areas across the state.
- Determine the degree of genetic connectivity between free-ranging deer populations in Iowa and free-ranging deer populations in states bordering Iowa where CWD has been detected in free-ranging and/or captive deer.

Progress:

White-tailed deer (*Odocoileus virginianus*) are a valued resource for hunters, for viewing, and for state revenue. Knowledge of deer population structure can provide insight into aspects of deer ecology (e.g., dispersal) that are important for managing populations and understanding potential for disease introduction and spread. The goal of this project is to use genetic techniques to characterize deer population genetic structure in Iowa and other Midwest states with particular attention on those where chronic wasting disease (CWD) has been detected in close proximity to Iowa's borders (e.g., Illinois, Minnesota, Missouri, Nebraska, South Dakota, and Wisconsin).

Lynne Gardner, a PhD student, began work on this project in August 2011. Work thus far has focused on securing samples from harvested deer across Iowa and the Midwest and establishing protocols for the project, including optimization of microsatellite markers for the study. To that end, we received several thousand deer tissue samples collected for the Iowa Department of Natural Resource's 2009-2010 CWD surveillance efforts and will receive additional samples from the 2011-2012 CWD surveillance program.

In addition, we obtained ~300 deer tissue samples from two captive cervid facilities in Iowa, and will obtain additional samples from CWD-positive facilities in the state. We received 100 deer samples from deer harvests in two urban communities, and another 100 deer samples will be solicited from two more urban communities. Thus far, 1,675 deer tissue samples have been received from eight states in the Midwest, including Illinois, Indiana, Kansas, Minnesota, Nebraska, Ohio, North Dakota, South Dakota, and Wisconsin, and we expect to receive samples from Missouri's 2012-2013 hunting season.

Future Plans:

In winter-spring 2013, we will select samples of deer harvested in areas of low, medium, and high density in Iowa, and begin genotyping these samples at 10 microsatellite loci. In summer 2013, we will continue to genotype samples from deer harvested in Iowa, and optimize mitochondrial DNA (mtDNA) sequencing protocols and sequence these samples. We will coordinate collection of 100 deer from each of two additional urban areas during the 2013-2014 hunting season. We will use the genetic data collected from winter-summer 2013 to characterize population genetic structure in Iowa deer, and compare the scale of genetic structure among areas of low, medium, and high deer density. In the future, we will quantify and compare genetic diversity and population structure between captive and free-ranging deer and between urban and rural deer in Iowa. We will also characterize genetic connectivity between deer in Iowa and several surrounding Midwest states.

Lead in Species of Greatest Conservation Need: Free-flying Bald Eagles as Indicators

Principal Investigator: Julie Blanchong
Stephen Dinsmore
Student Investigator: William Reiter-Marolf (M.S.)
Collaborators:
Duration: January 2012 to December 2014
Funding Source(s): Iowa Department of Natural Resources, State Wildlife Grant

Goals and Objectives:
- Characterize lead levels in nesting and wintering Bald Eagles in Iowa State University
- Compare lead exposure in free-flying eagles with eagles admitted to rehabilitation centers

Progress:
The high proportion of Bald Eagles (*Haliaeetus leucocephalus*) with lead poisoning reported by wildlife rehabilitation centers and wildlife health monitoring programs has raised concern about the magnitude and consequences of lead exposure in this species and other bird Species of Greatest Conservation Need (SGCN). This study is examining the degree to which avian SGCN are being exposed to lead in their diets by examining lead levels in raptors and other birds brought to wildlife rehabilitation centers and in nesting and wintering Bald Eagles in Iowa.

In 2012, M.S. student William Reiter-Marolf and his technician non-invasively collected fecal samples from wintering Bald Eagle roosts and from 110 randomly Bald Eagle nest sites in winter (during egg incubation) and again in spring (when eaglets were 3-9 weeks of age). Fifty nests were in close proximity to the Mississippi River and 50 were distributed throughout the rest of Iowa. Blood and fecal samples were also collected from Bald Eagles admitted to 3 rehabilitation centers in Iowa. All samples were sent to the Iowa State Hygienic Lab for lead testing. The majority of testing for 2012 is complete and we have begun to summarize and analyze these data.

Future Plans:
In spring 2013, we will continue to analyze the data collected in 2012. We will conduct the 2013 field season in a similar manner to that of 2012. Specifically, fecal samples will be non-invasively collected at nest sites in winter during egg incubation and in spring when eaglets are 3-9 weeks of age. Fecal samples will also be collected at wintering eagle roosts. Fecal and blood samples will be collected from eagles and other species of SGCN that are admitted to 3 wildlife rehabilitation centers in Iowa. All samples will be sent to the Iowa State Hygienic Lab for lead testing. More formal statistical analyses will be conducted following the 2013 field season.

The Use of Fire and Grazing to Improve Grassland Habitats for Species of Greatest Conservation Need

Principal Investigators:	Diane M. Debinski	James R. Miller (University of Illinois)
	Lois Wright-Morton	David M. Engle (Oklahoma State University)
	Ryan N. Harr	
Student Investigators:	John Delaney (Ph.D.),	Tim Lyons (Ph.D., UI)
	Courtney Duchardt (Ph.D., UI)	Derek Scasta (Ph.D., OSU)
Duration:	August 2010 to July 2013	
Funding Source(s):	Iowa Department of Natural Resources, State Wildlife Grant Comp.	

Goals and Objectives:

- We will develop specific guidelines for natural resource managers regarding the use of fire and grazing to enhance habitat conditions for Species of Greatest Conservation Need (SGCN) and other grassland-dependent wildlife in the Grand River Grasslands on approximately 2500 acres.
- We will extend what is learned on experimental pastures to nearby private lands by increasing landowner knowledge and skills in the application of restoration practices to enhance habitat conditions for SGCN and other grassland-dependent wildlife while maintaining grazing and recreational uses on 1800-3000 acres.

Progress:

This project builds on an experiment that began in 2006 that was designed to compare plant, insect, and bird responses to three types of grassland management in Grand River Grasslands of southern Iowa: 1) patch-burn graze, 2) graze-and-burn, and 3) burn-only. We are examining bird, butterfly, and vegetation responses to each of the three treatments during the second three-year burn cycle and this project incorporates a social science component focused on working with local farmers to extend what is learned on experimental pastures. All treatment variables remain the same as in the first three-year burn cycle with the exception of stocking rate, which was reduced in 2010 compared to previous years, and it has been maintained at this reduced rate since 2010. Twelve pastures, four of each treatment type, serve as study sites in our efforts to assess the effectiveness of patch-burn grazing in improving habitat for grassland Species of Greatest Conservation Need (SGCN). Pastures range in size from 38 to 84 acres and are located at the IA DNR's Ringgold and Kellerton Wildlife Management Areas, on properties owned by The Nature Conservancy, on private properties in Ringgold County, Iowa, and at the Missouri Department of Conservation's Pawnee Prairie Preserve in Harrison County, Missouri. The three treatments are defined as follows: 1) *patch-burn graze:* burning of spatially distinct patches within the pasture and free access by cattle, 2) *graze-and-burn:* free access by cattle and burning of the entire pasture, and 3) *burn-only:* burning of the entire pasture but no grazing (typical management for protected lands in the region). Each of the three treatments is burned on a three year fire-return-interval. Patch-burn graze and graze-and-burn pastures are stocked annually from May 1 until October 1 at an average rate of 0.7 animal-unit months per acre (this stocking rate began in 2010). Burn-only pastures are not fenced. No fertilizers or herbicides have been applied in the pastures during the study, and no chemicals will be applied during the course of the current study. We hold annual field days for landowners and we organize workshops to explain the use of fire and grazing for grassland management. We also conduct in-person interviews to document landowner knowledge, attitudes, and willingness to learn about and implement conservation and restoration management practices such as prescribed fire and grazing on their lands.

Future Plans:

Our research will continue for one more field season, with data collection and analysis of plant, butterfly, and bird responses to the prescribed fire and grazing treatments. Social science approaches will also continue, with the goal of building a strong landowner group that will grow and develop a management program of their own. We will work with landowners to use assessment techniques to collect baseline datasets on their own properties that will enable them to track changes in their grasslands as they begin to implement restoration practices over the coming years.

Iowa Multiple Species Inventory and Monitoring (MSIM) Program

Principal Investigator: Stephen J. Dinsmore
Student Investigator: N/A
Collaborators: Karen E. Kinkead Iowa Department of Natural Resources (DNR)
Tyler M. Harms, Research Associate, Iowa State University
Duration: January 2012 to December 2014
Funding Source(s): Iowa Department of Natural Resources, State Wildlife Grant

Goals and Objectives:

- Conduct MSIM surveys on a minimum of 113 new properties and up to 26 previously surveyed properties.
- Ensure collected data are entered into the MSIM on line database.
- Submit county occurrence records to the appropriate Iowa WAP taxonomic subcommittee.
- Provide additionally requested information to the IWAP subcommittees and change database records as advised.
- Thoroughly review the MSIM Program in 2014, based on the information collected between 2007 and 2013.

Progress:

In 2012 we hired a Research Associate II (Tyler M. Harms) at Iowa State University to help with many aspects of this project, especially data analyses and preparing publications for the peer-reviewed literature. In addition we hired a total of 29 seasonal field technicians to staff five field crews throughout Iowa and implemented MSIM protocols at more than 60 sites from 2 April to 31 October 2012. During the 2012 survey season, we entered 3,078 surveys into the MSIM database. At surveyed properties across Iowa, we found 234 species of birds, 34 species of mammals, 44 species of reptiles and amphibians, 58 species of fish, 13 species of freshwater mussels, 87 species of Odonates, and 79 species of butterflies. We also found two Odonates that were new records for Iowa. Those species were the Stream Cruiser (*Didymops transversa*) and Springtime Darner (*Basiaeschna janata*). Lastly, we published a short note in *Argia* documenting several significant records of Odonates that resulted from MSIM surveys.

Future Plans:

Our initial focus will be to complete data entry for 2012 and submit records of rare occurrences to the appropriate IWAP taxonomic subcommittees for review. We are also continuing to work on publications arising from MSIM data, including one looking at landscape effects on Odonate distribution and another looking at grassland birds. In 2013 we will complete the final year of full fieldwork by hiring crews at five locations throughout Iowa to implement MSIM protocols at 61 sites. Interviews will occur in February 2013 and fieldwork will begin in early April.

Impact of Wind Farms on Birds and Bats in Iowa

Principal Investigator: Stephen J. Dinsmore
Student Investigator: Molly K. Gillespie (M.S.)
Collaborators: Karen E. Kinkead, Iowa Department of Natural Resources (DNR)
Duration: October 2010 to August 2013
Funding Source(s): Iowa Department of Natural Resources, State Wildlife Grant

Goals and Objectives:

- *Document bird use at wind farm sites in Iowa*. I will employ point counts and distance sampling techniques to provide an assessment of bird community responses at wind farms and paired control sites. This will produce a measure of community response (species richness) and species-specific density estimates as a means for comparisons. [field work from May to July in 2011 and 2012]
- *Monitor nesting success of birds in response to proximity to wind turbines*. I will locate and monitor nests of one or more common species (probably Dickcissel or Red-winged Blackbird) to determine if nest success is related to proximity to wind farms. The probability of successfully completing a nesting attempt is an important demographic parameter and will be the means for comparing results. [field work from May to July in 2011 and 2012]
- *Monitor bat proximity to wind turbines using Anabat technology*. I will place Anabat receivers at wind farm and control sites to monitor species composition and encounter frequency at each site. Anabats do not allow individuals to be identified, so I will rely on call encounter rates by species as a measure for comparisons. [field work from May to July in 2011 and 2012]

Progress:

Objective 1) Document bird use at wind farm sites in Iowa

The 2012 survey season went from 1 June to 15 July. During this season we were able to conduct 924 point counts across the 3 sites. At these points we detected birds from over 47 species. The five species most commonly detected included Killdeer (625 detections), Vesper Sparrow (627 detections), Dickcissel (1014 detections), Red-winged Blackbird (1870 detections), and Common Grackle (734 detections).

Objective 2) Monitor nesting success of birds in response to proximity to wind turbines

We monitored a total of 217 Red-winged Blackbird nests during the incubation stage and 191 during the nestling stage. Nests were found 250 m from the turbine base out to 10 km from a turbine.

Objective 3) Monitor bat proximity to wind turbines using Anabat technology

Bat activity was monitored from 5 June through 5 October 2012 at eight turbine and eight control sites in Story County, Iowa. This resulted in 510 detector nights across 48 different points in Story County. We then used an activity index to determine the number of 1-min intervals which contained bat activity (Miller 2001), and this was then converted to a fraction of minutes with activity to account for changes in search effort over the course of the season as sunset and sunrise changed.

Future Plans:

In 2013 we will continue data analyses and prepare the results for publication in at least three peer-reviewed manuscripts. Molly Gillespie will graduate in spring 2013. By the end of the year a final project report and M.S. thesis will be finalized and submitted.

Reproductive Ecology of White-tailed Jackrabbits in Central Iowa

Principal Investigator: W. Sue Fairbanks
Collaborators: Peter Wolter, ISU; Iowa DNR: Todd Bogenschutz, Mark McInroy
Duration: June 2010 to May 2013
Funding Source(s): Iowa Department of Natural Resources, Wildlife Diversity Small Grants Program

Goals and Objectives:

- To identify number and timing of births of litters in white-tailed jackrabbits in central Iowa
- To determine number of offspring born per litter
- To assess habitat use by females and young offspring
- To estimate survival of young jackrabbits

Progress:

Although we captured, opportunistically, three young jackrabbits the year before this study began, all from different nests, we were unable to find any young in 2010, despite radio-tracking collared females and conducting intense searches in fields of their home ranges. We have continued to track radio-collared male and female jackrabbits to supplement the sample size from a previous study, for estimating survival rates. In an attempt to provide useable information as an outcome of this grant, we are gathering information on the occurrence of jackrabbits across the state of Iowa to characterize, using GIS, the types of landscapes in which remnant populations still exist.

Future Plans:

We met with DNR and other biologists to pool data on jackrabbit locations in the state. These locations come from the annual deer spotlighting data, August roadside surveys, road-killed jackrabbits obtained for a previous population genetic study, and biologist and citizen reports of remnant jackrabbit populations and sightings. We are attempting to convert the data into GIS locations (points or areas, depending on the precision of the location data), and evaluate the likelihood that the locations represent incidental or dispersing individuals vs. potential remnant populations. We expect the result to be a map of Iowa indicating likely locations of remnant populations, which may be used to characterize associated landscape features. We expect the resulting information to assist in focusing efforts to locate and monitor remaining populations of this declining species in the state.

Urban Fisheries Development Plans in Central Iowa

Principal Investigator: Joseph E. Morris
Student Investigator: Steven J. Konrady (M.S.)
Collaborators: Ben Dodd, Iowa Department of Natural Resources (DNR); Barb Gigar, Iowa DNR
Duration: February 2012 to April 2014
Funding Source(s): Iowa Department of Natural Resources

Goals and Objectives:

- Develop list of lakes and ponds in public ownership near incorporated cities in nine counties of Central Iowa
- Examine social, physical, chemical, and biological characteristics of the sites and their respective watersheds
- Determine potential for sustainable fishery development at selected sites
- Create list of priority sites based on potentials in all categories by working with DNR staff
- Determine management needs for priority lakes and develop restoration strategies
- Assist local area stakeholders with funding guidance

Progress:

A list of lakes was developed through the use of aerial imagery, mapping, and publicly available information on city boundaries using GIS software and other tools. Additional information was gathered through contacts with city, county, and other local organizations. An ongoing Institutional Review Board (IRB) approved interview process with managing organizations is being conducted to capture data on managerial support for public fishing and fisheries development at these potential sites. Additionally, these interviews attempt to capture the managers' opinions on the local support for restoration and improvement of the water bodies.

In total, 153 lakes were identified through this first pass. Steps are being taken to narrow this list to a workable number, and this process will continue through the following years. Collaboration with Iowa DNR, NRCS, Polk County Soil and Water Conservation District, and others has been established for this process. Several meetings with these collaborators have been conducted to both update them on findings and inform the "first pass" prioritization process.

Working with GIS tools, pond acreage, watershed boundaries, watershed land use, and other pertinent information was and is being gathered for many of the sites not eliminated by the established matrix for site selection. Organization into a GIS database is ongoing and will be used to further the end goals of the project – management plans for approximately 15 sites.

Additional work was applied to waterbodies targeted by the stakeholders (Iowa DNR, others) for immediate restoration activities including: water quality assessment, watershed assessment, drafting of management plans, and informing management organizations of options and best management practices. These projects include several lakes with active projects and future projects funded by both the Iowa DNR and other sources through various grants.

Future Plans:

Application of the site selection matrix developed in phase one of this project will be continued as more data is collected in year two. The summer of 2013 will see an in depth field investigation of 15+ sites chosen to go to this second stage. A ranking of these sites will be drafted, using the evaluation matrix, and submitted to aforementioned stakeholders and collaborators for further review. After consulting with these parties a more concrete plan of work will be established to finalize the narrowed list to a top 15 site list.

Further analysis of the top 15 priority sites in Central Iowa will be conducted to assess needed management and restoration strategies with the goal of establishing or maintaining sustainable fisheries at these sites. These strategies will be formulated into appropriate management plans for the sites and used by the local governments and the Iowa DNR to apply for grant funding for implementation. This work is in conjunction with the Iowa DNR's mission to provide quality, sustainable fisheries for Iowa's urban areas.

Completed Projects

Population Dynamics and Dispersal of Bobcats in Iowa

Principal Investigator: William R. Clark
Student Investigator: Dawn Reding (Ph.D.)
Collaborators: Todd Gosselink, Iowa Department of Natural Resources
Anne Bronikowski, Iowa State University
Duration: July 2006 to December 31, 2012
Funding Source(s): Iowa Department of Natural Resources

Goals and Objectives:

- Determine local habitat selection by bobcats, including home range characteristics and dispersal patterns in relation to forest, grassland, and agricultural land and the configuration of these habitats
- Evaluate population monitoring techniques that can be reliably and efficiently used to survey bobcats both at the local scale and also across Iowa
- Determine demographic rates of bobcats in Iowa, including recruitment and survival
- Evaluate genetic similarity of the Iowa population in relation to potential dispersal linkages with populations in other states.

Progress:
During the last year of the project and our focus was on final publication of results. We continued to refine estimates of survival, dispersal, and population trends.

Conclusions and Recommendations:
Analyses at both the scale of the home range (Tucker et al. 2008, Journal of Wildlife Management) and at the landscape scale (Reding et al. 2013 Landscape Ecology) consistently support the conclusion that forest cover is highly selected by bobcats but also that the interspersion of forests with perennial grasslands is important to both resident and dispersing bobcats. Despite observing the influence of habitat heterogeneity on movement behavior through Iowa's landscape, we did not detect an effect of landscape configuration on fine-scale genetic structure (Reding et al. 2013). But at the regional scale of the Midwest, the expanse of the row crop agriculture is a significant limitation to residence and dispersal of bobcats (Objective 1)

The bowhunter observation survey (BOS) has proven to be a reliable and efficient way to survey bobcats and other carnivores across the state (Linde et al. 2012, Journal of Wildlife Management). Models of relative BOS abundance at the county-level and HUC 12 watershed scale led to the same conclusion that bobcats are present and abundant where perennial grassland habitat is interspersed with patches of forests. Hard edge between forest and cropland was negatively related to abundance and brushy edge associated with cottontail abundance was positively related. (Objective 2)

Based on nearly 1200 carcasses of bobcats litter size averaged 3.2 kittens and pregnancy rate peaked at 83% of 3-year-old females. Age structure based on tooth sectioning indicates that only about 10% of the population is greater than 4 years old. Estimates of survival derived from radio telemetry are somewhat greater and surprisingly suggest that annual survival of 1 and 2 aged bobcats (77%) exceeds that of 3-5 aged animals (60%). We estimated that the bobcat population in Iowa is growing 1.09 per year (CI 0.99 - 1.19). (Objective 3)

Analyses indicate that the recent regional expansion of bobcats into Iowa has come from the states immediately to the south and west. But analysis of both nuclear and mitochrondrial DNA collected across the nation revealed a major phylogeographic break between bobcats in the eastern versus western United States with a transition zone occurring along the Great Plains. These two basic lineages apparently were separated during the time of Pleistocene glaciation. The greater number of subpopulations on the landscape that was delineated by the nuclear markers within some regions of the continent is the result of variation that has arisen more recently. This landscape genetic variation is largely the result of anthropogenic changes in habitat and population levels in the last 200 years, e.g. conversion of the Corn Belt, and has been superimposed on the longer term evolutionary patterns (Reding et al. 2012, Molecular Ecology). (Objective 4)

Collectively the data suggest that not only have bobcat populations successfully re-colonized Iowa but that populations are sufficient to maintain a limited harvest season.

Iowa Breeding Bird Atlas project completion

Principal Investigator: Stephen J. Dinsmore
Student Investigator: N/A
Collaborators: Karen E. Kinkead, Iowa Department of Natural Resources (DNR)
Duration: April 2012 to December 2012
Funding Source(s): Iowa Department of Natural Resources

Goals and Objectives:

- Complete breeding bird atlas work on grid-based blocks during the 2012 field season.
- Complete data entry for all blocks visited during the 2012 field season.

Progress:

In summer 2012 we hired seven field technicians (four for the entire season and three to complete a small number of remaining blocks in August) to assist with the completion of the second Iowa Breeding Bird Atlas project.

Results:

During the 2012 breeding season for birds, the team of atlasers helped complete all grid-based BBA blocks in Iowa (this was accomplished in late July). After meeting the original objective of this project, the BBA steering committee came up with revised block completion guidelines (using ratios of confirmed to total species, overall percent confirmed/probable status, etc.). These new guidelines created additional work for the BBA technicians, which they were also able to complete by the end of the project. Collectively, these technicians completed more than1450 hours of atlas work and entered data for more than 13,000 records, all of which was critical for project completion (Table 1). The Iowa BBA steering committee is now working towards a 2013 book publication summarizing the atlas' results.

Table 1. Effort and productivity data for seven ISU technicians hired to assist with the second Iowa Breeding Bird Atlas project, 2012. CO = Confirmed breeding records and PR = Probable breeding records.

Tech	Start Date	Block Visits	Total Hours	CO/PR Species Records
Tom Schilke	5/29/2012	156	429.63	1869
Walt Zuurdeeg	5/29/2012	133	397.07	689
Claudette Sandoval-Green	5/29/2012	53	139.86	130
Tucker Lutter	5/29/2012	95	280.40	1508
Corey Lange	8/1/2012	37	106.91	676
Jamie Balk	8/1/2012	15	49.80	109
Rachel Simmons	8/10/2012	15	55.15	417
Totals		504	1,458.82	5,398

Best Management Practices for Hybrid Striped Bass Culture

Principal Investigator: Joseph E. Morris
Student Investigator: James Wamboldt (M.S.)
Collaborators: Alan Johnson, Iowa Department of Natural Resources (DNR)
Jay Rudacille, Iowa DNR
Duration: June 2010 to November 2012
Funding Source(s): Iowa DNR

Goals and Objectives:
- Perform literature search on extensively-reared hybrid striped bass (HSB) and review past hatchery records to determine relationships between rearing techniques, survival, and water quality.
- Identify best management practices for movement of hybrid striped bass fry to Iowa's hatcheries.
- Identify best management practices for culturing hybrid striped in plastic-lined and earthen ponds in Iowa.
- Compile, analyze, and publish in federal aid documents and appropriate journals the best management practices for rearing hybrid striped bass in earthen and plastic-lined ponds

Progress:
In addition to the field portion of this study, we also conducted a Hybrid Striped Bass Survey in 2011. The survey was sent to hatcheries throughout the US with questions pertaining to physical, chemical, biological, and logistical components of HSB production. The goal of this survey was to 1) identify existing production practices, 2) examine the success of each technique, and 3) determine the best management practices for culturing phase-I and II HSB in Iowa hatcheries. Survey results were compiled and compared to values published in literature. This information, as well as previous production experience at Mt. Ayr, was used to guide our HSB culture operations starting in 2011 and 2012..

The 2012 culture season focused on three experimental studies. In the first study, we tested the difference in production of two different crosses of hybrid striped bass (palmetto and sunshine bass) in plastic-lined ponds at the Rathbun Research Facility. Similar to 2011, the second study focused on the need of organic fertilizers in earthen ponds at the Mt. Ayr Hatchery. However, the 2012 study at Mt. Ayr had a greater stocking densities and a different hybrid striped bass taxa than in 2011. The third study was conducted at the ISU horticulture station and focused on determining an appropriate stocking density for hybrid striped bass in earthen ponds. Palmetto bass were flown in from Kansas on May 15 while sunshine bass were shipped in from Keo-Fish Farms, AR two days later. Fry were stocked at 160,000/acre , 4-6 days after pond flooding at both the Mt. Ayr and Rathbun facilities. Stocking densities at the ISU horticulture station were 80,000/acre and 160,000/acre. Due to high ammonia levels within ISU source water, we began filling ponds 8 days prior to stocking in an attempt to dissipate access ammonia.
Although there is still a question concerning whether or not there are production differences between palmetto and sunshine bass, results from the 2012 culture season indicate that sunshine bass may grow longer and heavier during phase I. However, increased growth rates during phase I is likely attributed to higher mortality rates of the sunshine bass. Because both crosses of hybrid striped bass performed similarly during phase I culture, other considerations, such as fry or brood stock availability or post-stocking survival and growth of juveniles and adults, may dictate which cross the IDNR chooses to culture for sport fishery enhancement.

Funding to complete this study was removed prior to data analysis of the Mt. Ayr Hatchery experiment; excessive ammonia within ISU source water resulted in all fish being lost during the stocking density study. We hypothesize that high ammonia within our well water is directly likened to local drought conditions. Without the ability to remove ammonia from the water along with similar drought conditions forecasted, future research is on hold within ISU ponds.

Conclusions and Recommendations:
Final analyses of the 2012 culture season will be completed in 2013 with related publications published.

Effects of Introduced Common Carp and Invading Zebra Mussels on Water Quality and the Native Biological Community of Clear Lake, Iowa

Principal Investigator: Clay L. Pierce
Timothy W. Stewart
Student Investigator: Michael E. Colvin (Ph.D)
Collaborators: Joe Larscheid, Iowa Department of Natural Resources (DNR)
Jim Wahl, Iowa DNR
Duration: May 2007 – June 2012
Funding Source(s): Iowa Department of Natural Resources

Goals and Objectives:

- Develop a lake ecosystem model, an associated carp population dynamics model, monitor biological populations and water quality, and evaluate management strategies for Clear Lake, Iowa

Progress:

All data have been acquired, processed and entered into a database. A technology transfer workshop was held to demonstrate the carp biomass dynamics model (CarpBioDyn) and the Clear Lake Ecosystem Simulation Model (CLESM) to Iowa DNR employees. A final report was submitted. Two articles titled "Strategies to control a common carp (*Cyprinus carpio)* population by pulsed commercial harvest", and "Semi-discrete biomass dynamic modeling: an improved approach for assessing fish stock responses to pulsed harvest events" have been published in the North American Journal of Fisheries Management and the Canadian Journal of Fisheries and Aquatic Sciences, respectively. Two additional manuscripts titled "Common carp, zebra mussels, and the food web of Clear Lake, Iowa: consequences of non-native species for lake restoration and the recreational fishery", and "A simulation approach to evaluate potential non-native species impacts on water quality and fishery yield in a shallow eutrophic lake undergoing restoration", are in preparation for submission to Ecological Modeling. Two additional manuscripts, as yet untitled, describing the biological communities over the course of the study are also in preparation.

Conclusions and Recommendations:

We found that accounting for discrete fish harvest using a semi-discrete biomass dynamics model reduced parameter bias and recommend this approach for future applications when discrete fish harvest is occurring, such as when employing commercial fishers to remove non-native species like common carp. Using this approach, we found that the carp population in Clear Lake was increasing and that current levels of commercial harvest were insufficient to suppress biomass. A framework to assess the minimum amount of harvest needed to maintain control of common carp biomass was presented.

Food web analysis revealed a potential impediment to water quality improvement. Zooplankton predation by abundant age 0 yellow bass may hinder top down regulation of phytoplankton biomass. Based on mass-balance estimates, age 0 yellow bass were estimated to consume up to 50% of zooplankton production. The recent invasion of zebra mussel was shown to reduce phytoplankton populations, likely compensating for reduced zooplankton abundance. Common carp food web impacts were lower than expected, due to abundant benthic food resources.

In the full Clear Lake Ecosystem Simulation Model (CLESM), simulated changes in common carp biomass had dramatic effects on water quality and recreational fishery yield. This effect was due to increased suspended sediment reducing water transparency, which in turn limited phytoplankton production. This also limited any effect of zebra mussels on water quality by limiting food resources (i.e., edible phytoplankton).

Results suggest that in-lake processes are a significant determinant of water quality and recreational fishery yield. Controlling common carp biomass will be critical to achieve water quality goals and minimize adverse effects on recreational fishery yield. The recent invasion of zebra mussels will likely positively affect water clarity; however this will be limited by common carp. With common carp biomass controlled, zebra mussels can be expected to clear the water column; however this will reduce pelagic primary production, and require consumers to shift to feeding on benthic food resources.

Fish Species of Greatest Conservation Need in Iowa's Nonwadeable Rivers: Distribution, Relative Abundance, and Influences from Potential Movement Barriers

Principal Investigators: Michael Quist
Clay Pierce
Student Investigator: Timothy Parks (M.S.)
Collaborators: Gregory Gelwicks, Greg Simmons, and Thomas Wilton; Iowa Department of Natural Resources (DNR)
Duration: January 2010 to September 2012
Funding Source(s): Iowa Department of Natural Resources

Goals and Objectives:

- Describe the distributions of fish species of greatest conservation need in Iowa's nonwadeable rivers.
- Evaluate the influence of potential movement barriers and anthropogenic stressors on fish distributions in Iowa's nonwadeable rivers.
- Determine effects of dams and instream habitat characteristics on fish assemblage structure in Iowa's nonwadeable rivers

Progress:

In addressing the first objective, we assessed the historic changes in fish distributions and fish assemblage structure. Changes in fish distribution were determined by comparing species occurrences between a historic and contemporary assessment periods in mainstem portions of five focal river systems. Changes in the distribution of 126 species were judged using iterative resampling methods and shifts in species composition were determined using multivariate approaches. As expected, our results indicated obvious temporal changes in fish assemblage structure. The magnitude of these changes varied both within and among river systems. Fish assemblages in the Des Moines, Iowa, and Cedar rivers exhibited significant temporal change in species composition; whereas the fishes showed little change (i.e., potential persistence) Wapsipinicon River and inconclusive changes in the Maquoketa River. With the exception of the Maquoketa River, the highest values of species turnover were emphasized in lower river reaches showing connectivity to the Mississippi River. Compared to other rivers, the fish assemblages in the Des Moines River showed the most decline (~50% of its species). Species that have declined were primarily characterized as backwater-phytophilic species and fluvial specialists across river systems; whereas, species exhibiting an expanded occurrence were primarily macrohabitat generalists. Insights from this research can aid in re-evaluating the conservation status of Iowa's riverine fish species as well as reprioritizing monitoring and rehabilitation efforts needed in specific riverine habitats.

Conclusions and Recommendations:

The last two objectives were addressed when evaluating environmental influences on fish assemblage structure in the Cedar and Iowa rivers. Specifically, we evaluated the relative importance of environmental characteristics measured at multiple spatial scales [e.g. reach-scale, intermediate-scale (dams), and landscape-scale]. Comprehensive fish assemblage and environmental data were collected from 33 sample reaches in the Cedar and Iowa rivers and analyzed. Associations were identified between fish assemblage structure (taxonomic and functional descriptors) and environmental variables using canonical correspondence analysis (CCA) for each gear type and assemblage descriptor. Partial CCAs indicated that fish assemblage structure was explained by reach-scale habitat characteristics in 11 models and dam-related and landscape scale characteristics in 9 models. Despite the influence from dams and the landscape, reach-scale habitat characteristics explained the most fish assemblage variance in the majority of the models. Mean annual discharge and percentage of shoreline rip-rap were among reach-scale variables that explained highest proportions of fish assemblage variation. In particular, spatiotemporal dynamics of discharge explained life history variation described in river reaches. Despite the importance of reach-scale habitat, dams and the landscape accounted for considerable amounts of variation in fish assemblage structure. Specific taxonomic and functional patterns were explained consistently by mainstem fragment length and distance to downstream impoundment. Additionally, several species displayed patterns truncated occurrence (eight in the Cedar River and 11 species in the Iowa River) below dams indicating that dams operate as barriers to dispersal. Findings from this study further describe how fish assemblages respond to both natural and anthropogenic factors, which offer new considerations for measurements of biological integrity and for discerning important habitats needed to conserve functional fish assemblages.

Occurrence and Abundance of Topeka Shiners in West-Central Iowa

Principal Investigators: Clay L. Pierce, Michael C. Quist
Student Investigator: Bryan Bakevich (M.S.)
Collaborators: Daryl Howell
Greg Gelwicks, Iowa DNR
Duration: August 2009 to September 2012
Funding Source(s): Iowa Department of Natural Resources, Endangered Species
U.S. Geological Survey, Science Support Partnership (SSP)

Goals and Objectives:

- Describe the distribution and occurrence (i.e., presence-absence) of Topeka shiners in west-central Iowa
- Estimate the density of Topeka shiners in west-central Iowa
- Describe and define abiotic factors (i.e., physical and chemical habitat) and biotic interactions (i.e., predators, competitors) associated with the occurrence and abundance of Topeka shiners in Iowa waters.

Progress:
All project objectives were completed, a final report was submitted, and three manuscripts are being submitted for publication.

Conclusions and Recommendations:
Fish assemblages and habitat characteristics were sampled in 67 stream and 27 off-channel sites during 2010 – 2011. Topeka shiners were found in 52% of off-channel sites, but only 9% of stream sites, supporting the hypothesis that off-channel habitats are an important component of their life history. When compared to prior distributions, our results indicated a recent reduction in the distribution of Topeka shiners in Iowa. Fish assemblages in stream sites differed significantly from off-channel sites and had higher species richness. Fish assemblages containing Topeka shiner were different from those that did not contain Topeka shiner in off-channel sites, but not in stream sites. Results from logistic models suggested that Topeka shiner presence was associated with increased submerged vegetation and abundance of fathead minnow *Pimephales promelas*. Contrary to the findings of other studies, the abundance of large piscivorous fishes was not associated with the occurrence of Topeka shiner. Our results provide new information about the biology and life history of Topeka shiners in west-central Iowa that will guide restoration and other recovery efforts.

Testing the Use of Patch-Burn Grazing to Provide Habitat for Species of Greatest Conservation Need

Principal Investigators: Diane M. Debinski
David M. Engle (Oklahoma State University)
Ryan N. Harr

Postdoctoral Associate: Raymond Moranz, Iowa State University
Duration: October 2010 to September 2012
Funding Source(s): Iowa Department of Natural Resources (DNR), State Wildlife Grant

Goals and Objectives:

- Conduct controlled experiments to test the effects of patch-burn grazing on species distribution patterns of butterfly taxa in the Grand River Grasslands.
- Quantify the response of grassland-obligate and Species of Greatest Conservation Need (SGCN) butterflies to changes in vegetation structure and composition.

Progress:

This project built on an experiment that began in 2006 that was designed to compare plant, insect, and bird responses to three types of grassland management in Grand River Grasslands of southern Iowa: 1) patch-burn graze, 2) graze-and-burn, and 3) burn-only. It focused on examining butterfly responses to each of the three treatments during the second three-year burn cycle. All treatment variables remained the same as in the first three-year burn cycle with the exception of stocking rate, which was reduced in 2010 compared to previous years. Twelve pastures, four of each treatment type, served as study sites in our efforts to assess the effectiveness of patch-burn grazing in improving habitat for grassland Species of Greatest Conservation Need (SGCN). Pastures ranged in size from 38 to 84 acres and were located at the IA DNR's Ringgold and Kellerton Wildlife Management Areas, on properties owned by The Nature Conservancy, on private properties in Ringgold County, Iowa, and at the Missouri Department of Conservation's Pawnee Prairie Preserve in Harrison County, Missouri. The three treatments were defined as follows: 1) *patch-burn graze:* burning of spatially distinct patches within the pasture and free access by cattle, 2) *graze-and-burn:* free access by cattle and burning of the entire pasture, and 3) *burn-only:* burning of the entire pasture but no grazing (typical management for protected lands in the region). Each of the three treatments was burned on a three year fire-return-interval. Patch-burn graze pastures and graze-and-burn pastures were stocked annually from May 1 until October 1 at an average rate of 0.7 animal-unit months per acre beginning in 2010. Burn-only pastures were not fenced. No fertilizers or herbicides were applied in the pastures during the study.

Conclusions and Recommendations:

Since 2007, the degraded grassland remnants have become more similar to the high quality remnants, both with respect to the vegetation and the butterfly communities. Numerous years of intense grazing prior to our treatments were probably more responsible than fire history for the low numbers of SGCN butterflies in these sites. Thus, the reduction of stocking rate is probably the largest factor contributing to the recovery of these pastures. The trend in SGCN butterflies observed within our study pastures has shown improvement over time. Only one SGCN butterfly species (regal fritillary) was seen in our experimental pastures from 2007 to 2009, whereas four SGCN butterfly species were observed during 2010 to 2012 (regal fritillary, two-spotted skipper, zebra swallowtail, and Edwards' hairstreak). In addition, three other SGCN butterflies were observed in the vicinity of our experimental pastures during 2010-2012 (wild indigo duskywing, zabulon skipper, and byssus skipper). Two of the most abundant prairie-specialist butterfly species (common wood nymph and regal fritillary) appear to be resilient to negative effects of dormant-season fire in this system and with the appropriate landscape context (i.e., substantial amounts of unburned habitat remaining within 300 m of patch boundaries). We hypothesize that landscape context (i.e., the amount of grassland surrounding a particular site) should be considered when developing burn plans because a prairie specialist (Edwards' hairstreak) might have been extirpated from a graze-and-burn site in 2012 due to a large, complete burn. Although this may be considered weak evidence of causality, taking a precautionary perspective with fire and SGCN butterflies is advisable.

Before conducting this study, we hypothesized that we would find greater patch contrast within patch burn-graze tracts attributable to lower stature in the most-recently burned patch and grazer avoidance of the unburned patches. Secondly, we hypothesized that greater patch contrast would lead to greater abundance of prairie sensitive butterflies in patch-burn graze pastures. However, during 2010-2012 we found little difference in patch contrast among the three treatment groups. This may account for the less-than-positive response we observed with respect to butterfly abundance within the patch-burn graze treatment. In essence, we were not able to test the patch-contrast hypothesis. Pre-treatment (2006) values of vegetation characters remained important predictors of butterfly abundance in 2010-2012, evidence of the importance of land-use legacies. Common wood nymph abundance was positively associated with proportion of native plant cover. Regal fritillary abundance was positively associated with grass cover within 300 m of the perimeter and *negatively* associated with pre-treatment time since fire. Post-treatment vegetation variables associated with abundance of common wood nymphs included vegetation height (positive effect) and tall fescue canopy cover (negative effect). For regal fritillary abundance these variables included vegetation height and warm-season grass cover (both with positive effects) and tall fescue cover (negative effect). From the vegetation perspective, the greatest difference between remnant and degraded sites was in the cover of tall fescue, which was much more abundant on degraded sites. Our recent analyses have also specifically highlighted the significance of butterfly milkweed (*Asclepias tuberosa*) as a preferred nectar source for several SGCN butterflies. This nectar source has occurred in relatively low density, but appears to be increasing over time in pastures where grazing intensity has been reduced. It will be an important species to monitor in the future and in the context of each of the management treatments. We recommend *Asclepias tuberosa* as a key indicator plant species to monitor in assessing grassland recovery. The monitoring is easy and straightforward given the showy nature of its inflorescence.

Developing Benchmarks of Biological Integrity for Iowa Lake and Reservoir Restoration Success

Principal Investigator: Michael Quist
John Downing
Student Investigator: Jesse Fischer (Ph.D.)
Collaborators: Michael McGhee, George Antoniou, Joseph Larscheid, George Schoelten, Randall Schultz

Duration: January 2008 to December 2012
Funding Source(s): Iowa Department of Natural Resources

Goals and Objectives:

- To provide ecological benchmarks of lake and reservoir restoration through an integrated, interdisciplinary approach combining measures of macroinvertebrate and fish assemblages, and water quality.

Progress:

Six water bodies representing a wide range of trophic conditions in Iowa were sampled seasonally in 2008 with multiple gears (i.e., seines, benthic trawls, fyke nets, gill nets, electrofishing) to determine standard sampling protocols for future sampling. A total of 43 fish species and 61,293 individuals were sampled in 2008 across all seasons and gears. Probabilities of species detection indicated strong selectivities and seasonal trends. The evaluation of total species richness and the total number of individuals sampled using multiple gear combinations demonstrated that appreciable benefits over relatively few gears (e.g., three to four) used in optimal seasons were not present. Our results indicated that the characterization of lentic fish assemblages was highly influenced by the selection of sampling gears and seasons, but did not appear to be influenced by waterbody type (i.e., natural lake, impoundment). Methods established from fish sampling in 2008 were used to sample 39 additional lakes in 2009, 2010, and 2011. Sampling methods included trawling during the summer (i.e., late June – mid July) and fyke netting and nighttime electrofishing during the fall (i.e., mid-September – late October). The lakes and impoundments sampled were selected from "high water quality" water bodies (e.g., West Okoboji) or "restoration priority" water bodies (e.g., Clear Lake, Storm Lake) designated by Iowa DNR. Sampling from 2008 to 2010 yielded a total 50 species and 149,108 fish across all 45 lakes.

Conclusions and Recommendations:

Our results indicated that increased species diversity in reservoirs was most strongly related to morphometric characteristics (i.e., larger surface area, increased depth); whereas, fewer species were observed in natural lakes with low water clarity and high suspended solids. Fish assemblage structure between natural lakes and reservoirs was also consistently dissimilar for taxonomic and trophic data. Overall, distinct differences in fish assemblage structure were observed between natural and artificial lentic ecosystems. Our results emphasize the need to consider waterbody origin (i.e., natural or artificial) on fish assemblage characterization and subsequent inferences made from environmental correlations.