Alabama Cooperative Fish and Wildlife Research Unit

Report of Activities
October 2009 – September 2010

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U.S. Geological Survey
Alabama Department of Conservation and Natural Resources
Wildlife and Freshwater Fisheries Division
Auburn University
Wildlife Management Institute
U.S. Fish and Wildlife Service

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Program Direction Statement

The Cooperative Fish and Wildlife Research Unit program facilitates cooperation among the U.S. Geological Survey, Biological Resources Division; universities; state fish and wildlife agencies; and private organizations in programs of research and education related to fish and wildlife resource management. The objectives of the program are: 1) to conduct research on fish and wildlife ecology and to investigate the production, utilization, management, protection, and restoration of populations of fish and wildlife; 2) to provide technical and professional education and continuing education primarily on the graduate and professional level in the fields of fish and wildlife management, teaching, research, demonstration and administration; and 3) to make facts, methods, and new findings discovered through research available to scientists, landowners, sportsmen, outdoor recreationists, conservationists, extension workers, teachers, and local, state and federal agencies. The Unit shall also continue to work closely with the U.S. Fish and Wildlife Service to be informed of, and where requested, assist with the development of that agency's initiatives. The operations of the Alabama Unit are governed by a Coordinating Committee operating under a formal cooperative agreement signed by the U.S. Geological Survey, Biological Resources Division; Auburn University; the Alabama Department of Conservation and Natural Resources, Division of Wildlife and Freshwater Fisheries; U.S. Fish and Wildlife Service, and the Wildlife Management Institute.

The Alabama Unit has identified four areas in which to concentrate its research efforts: 1) determining the effects of forest management techniques on wildlife populations; 2) investigating the ecology and management of riverine systems; 3) investigating the status, life history, habitat requirements, and population dynamics of species of conservation concern; and 4) investigating the ecology and management of fish and wildlife on landscape scales. The Unit will not be restricted to these areas of investigation; however, it will work towards the development of comprehensive research programs in each.

Effects of Forest Management on Wildlife Populations

Approximately 70% of non-urban land in Alabama is forested, much of it managed intensively for the production of forest products. Wildlife populations can be valuable components of forestlands. However, in some forests wildlife may be quite scarce. The abundance of wildlife in woodlands depends upon available food and cover resources that are in turn determined by forest management practices. Timber management can have major impacts on wildlife populations, and information is required to enable adequate evaluation of these impacts and to permit provision for support of wildlife species in the timber program. Many questions need to be answered relative to the relationships between wildlife species or groups and timber management practices. The response of wildlife to such factors as rotation schedule, species composition of forests, burning and thinning schedules, snag retention or removal, and size of clear cuts, needs to be determined. Area sensitive species need to be identified and their area requirements determined. Response of wildlife species to reforestation efforts requires evaluation. Wildlife is of high economic and aesthetic value and represents an important component of our forest ecosystem. It is important that we obtain the necessary information to ensure the retention of wildlife populations as forest management intensifies.

Ecology and Management of Riverine Systems

A typical southeastern river system is a wetland complex composed of flowing-water aquatic habitats, adjacent riparian habitats, and periodically flooded bottomland habitats. Also, any particular stream corridor is just a segment of a drainage system with a sequence of corridor zones associated with streams from headwaters to large rivers. Stream corridors are important sources of renewable resources such as commercial and recreational fisheries, aquatic-oriented wildlife, and terrestrial wildlife utilizing productive bottomland areas. In addition, stream corridors are highly valued recreation and aesthetic areas due to high biological productivity and landscape diversity.

River corridors have always been, and continue to be, the focus of many forms of economic and land developments that exert some effect on these systems. Impacts to stream and river systems basically stem from two general factors, altered hydrologic conditions (i.e., water quality and quantity) and physical alterations of streams and associated lands (e.g., agricultural plots, backwater draining, navigation improvements). Both land and water changes tend to influence the integrity of instream, riparian, and bottomland communities since all these habitats are dependent on water/land relationships. The natural flowing-water processes of erosion and deposition impose a dynamic character to instream, riparian, and bottomland habitats and their associated fish and wildlife communities. Human modifications to stream corridors tend to intensify this dynamic character and frequently require continual human intervention to maintain artificial stream corridor conditions.

The most pressing areas of research involving stream corridors concern the interactions between fish and wildlife communities and the physical and chemical processes of flowing waters. The Unit intends to develop research that integrates fish and wildlife resource characteristics and functions with the hydrologic processes that influence stream corridor habitats. Specific areas for development include: renewable resource management, conservation of species, preservation of communities, impact assessment and prediction of effects, and mitigation and restoration.

Endangered Species

Numerous species and subspecies that occur in Alabama have been declared endangered or threatened by the federal government (Threatened and Endangered Species System, USFWS). Several hundred additional species appear on the state list of species of greatest conservation need. Information on the status, habitat requirements, and life history of these taxa is required to permit identification and declaration of critical habitat and to enable the formulation of management practices providing for their protection and, where possible, eventual recovery. Addressing the needs of these species now may prevent the need for listing them as threatened or endangered in the future. Research needs vary greatly by taxon; however, the Unit is capable of enlisting a diversity of expertise in addressing identified needs. Research in this area will be developed primarily in response to specific requests for assistance by cooperating agencies.

Landscape Ecology

Traditionally, research in wildlife and fisheries has focused on population or community dynamics on relatively small or undefined spatial scales, with the size of a study area

defined by protocols for collecting data or by management units such as forest stands or agricultural fields. Recent work in the field of landscape ecology strongly suggests that many ecological processes of interest to wildlife and fisheries researchers and managers occur on a variety of spatial scales, ranging from local (e.g., stand-scale) to regional (e.g., landscape-scale) dynamics. Landscape processes often are an emergent ecological property that cannot be directly extrapolated from observations collected on small scales. Inferences from small-scale or aspatial studies could be misleading in addressing the large scale ecological effects of increasing urbanization, changes in land use, and habitat fragmentation evident on modern landscapes.

Recent advances in technology are making spatially explicit data covering large areas widely available at relatively low cost. These data and the tools required to access and interpret them are rapidly becoming essential and affordable to wildlife and fisheries biologists. The Unit will develop research that quantifies and evaluates large-scale, landscape processes for wild populations and the ecological communities that sustain them. The Unit will also be involved in other landscape approaches, including the development and application of spatially explicit, individual-based behavioral models and the use of landscape characteristics to predict the distribution of wild populations.

EFFECTS OF FOREST MANAGEMENT ON WILDLIFE POPULATIONS

Mapping the distribution of longleaf ecosystems for herpetofauna conservation

Funding Source: U.S. Fish and Wildlife Service

Principal Investigator: James B. Grand

Co-principal Investigator: Mark MacKenzie (*deceased*)

Research Assistants: Kevin Kleiner, Tyler Kreps, Amy Silvano

Duration: August 2007 – December 2010

Over the last two centuries, the longleaf pine ecosystem has been dramatically altered by logging, replanting with other pine species, and fire suppression. Current estimates, suggest that longleaf occupies 5% of its pre-European settlement extent. This reduction in habitat has affected numerous birds, reptiles, and amphibians. The best known example of this is the red-cockaded woodpecker (*Picoides borealis)*, a federally endangered species that inhabits old growth longleaf pine woodlands. The gopher tortoise (*Gopherus polyphemus*) and the black pine snake (*Pituophis melanoleucus lodingi*) are also longleaf ecosystem inhabitants of increasing concern. Successful management of these animals requires knowledge of the current distribution of the longleaf pine ecosystem.

Currently, the course scale spatial distribution of longleaf pine can be obtained from the USDA Forest Service's Forest Inventory and Analysis Program (FIA, Prasad and Iverson 2003). In 2005, John Hogland, a graduate student at Auburn University, created a fine-grain probability distribution of longleaf pine ecosystems (Hogland 2005). The goals of this project are to evaluate the accuracy of the Hogland's Map and explore new approaches for large-scale mapping of longleaf pine using IKONOS and SPOT imagery as a tool for mapping longleaf pine systems on the DeSoto National Forest.

Status – The assessment of Hogland's model has been completed and a more accurate model is required for herpetofauna conservation. IKONOS and SPOT imagery were acquired for the DeSoto National Forest. Stand maps based on textural analysis were created to provide an appropriate sampling framework. Field work to collect information on stand characteristics and use by Gopher Tortoises was completed in summer 2010. A Bayesian belief network was developed based on expert opinion and literature review for a probabilistic classification of the stands sampled on the DeSoto, and classification results are under internal review.

Balancing game and non-game management objectives on the J.D. Martin Skyline Wildlife Management Area (new)

Funding Source: Cooperative Research Units and Alabama Department of Conservation and Natural Resources

Principal Investigator: James B. Grand

Co-investigators: Elise R. Irwin, Frank Allen (ADCNR, Wildlife Section), Andrew Nix (ADCNR, Wildlife Section), Jim Schrenkel (ADCNR, Wildlife Section), Eric Soehren (ADCNR Heritage Section), Nick Sharp (Lands Division)

Research Associate: Amy L. Silvano

Duration: June 2009 – August 2010

J.D. Martin Skyline Wildlife Management Area (Skyline) occupies approximately 163 km^2 in Jackson County, Alabama and was the study site for a recently completed investigation of terrestrial vertebrate biodiversity. This project will use structured decision making tools to develop management recommendations for Skyline that provide an optimal balance between management for game and non-game wildlife, recreational uses, "Natural areas," and serve as a model for developing similar recommendations for other lands managed by Alabama Department of Conservation and Natural Resources. Three fundamental objectives were identified by a team of investigators based on the mandates of the land owners and managing agencies. These objectives include maintaining or restoring ecosystem function, maximizing the quality and quantity of habitat for hunted species, and maximizing outdoor recreation opportunities. Sub-objectives identified within the fundamental objectives include maximizing use by priority species identified in the Alabama's comprehensive state wildlife conservation strategy, maximizing early successional habitat, conserving and restoring natural areas, and conserving and restoring aquatic systems, maximizing hunting and non-hunting recreational opportunities. Management alternatives that include uneven-aged forest management, creation and maintenance of early successional habitats, and trail establishment are under consideration.

Status – We held two successive workshops, where investigators were engaged in a structured decision making process to elucidate objectives and management actions that could be implemented on Skyline. Three subsequent workshops were also held to develop early successional habitat and forest management models, as well as habitat models for priority and game species. Resultant information from these workshops was assimilated into a decision support tool by means of Bayesian Decision Network (BDN) analysis to evaluate species responses to identified management actions. The completed BDN was presented to ADCNR stakeholders for review and comment. A report of this effort is in preparation and is anticipated to be complete in 2011.

Ecological assessment of habitats occupied by breeding birds at Redstone Arsenal, Alabama

Funding Source: Department of Defense

Principal Investigator: Troy L. Best (Auburn University)

Graduate Students: Lisa A. McWilliams, Charles A. Kilgore, Brian L. Ortman

Undergraduate Students: Rebecca Roper, Francisco Cartaya

Duration: April 2007 – December 2010

The state of Alabama has one of the richest faunal biodiversities in the United States (Mirarchi 2004). There are 420 species of birds comprising the official American Ornithological Society state list (Mirarchi 2004). This is almost half the total species recognized for the continental United States by the American Birding Association.

Redstone Arsenal encompasses a variety of habitats within its 38,248 secured acres. It contains extensive wetland areas associated with the Tennessee River, several local springs, woodlands, and fields. The varied habitats attract a large percentage (~290 species) of Alabama's avifauna either as residents, migrants, or rare visitors (Porter 2001). The area's variable water levels of ponds, sinks, and cypress swamps, much of which is maintained by the Wheeler National Wildlife Refuge, attract many winter waterfowl, herons, egrets, and shorebirds (Porter 2001). The Redstone Arsenal area also attracts many raptors and passerines of both woodland and field species.

Twenty-eight species of birds are of special concern in Alabama. Many species of these birds of special concern may occur in the Redstone Arsenal area of the Tennessee Valley region. Alabama provides critical breeding, wintering, or migratory habitats necessary for the overall success of these species.

Considering the need for information on avian diversity and ecological associations in the region, an assessment of species present, distribution, breeding activity, habitats occupied, etc., is highly desirable. These data would be useful in developing management plans for the Redstone Arsenal, and would provide baseline data for comparisons and future research. This study will be a significant contribution to overall assessment of presence, distribution, breeding activities, and habitat associations of avian species of special concern in Alabama.

Status – Preliminary data on occurrence of birds at Redstone Arsenal were gathered during 2006 and 2007. These data formed the basis for a preliminary report submitted to Redstone Arsenal in September 2007. During January-August 2008, January-July 2009, and January-July 2010, field work was conducted at Redstone Arsenal to assess presence of species, distribution on the facility, breeding activity, and habitats occupied. Field work was completed and a final report was submitted by 13 September 2010.

ECOLOGY AND MANAGEMENT OF RIVERINE SYSTEMS

Relations between occupancy rates, fish health and water quality parameters for fishes inhabiting Wheeler NWR (completed)

Funding Source: U.S. Geological Survey, U.S. Fish and Wildlife Service

Principal Investigator: Elise Irwin

Research Associate: Kathryn Kennedy

Duration: August 2007 – October 2010

Wheeler National Wildlife Refuge (WNWR) located in North Alabama adjacent to Wheeler Reservoir on the Tennessee River encompasses 35,000 acres, and includes several satellite Refuges. During recent Biological Review of WNWR, recommendations were made to complete an assessment of occupancy rates and overall fish health in relation to water quality for nongame fishes on refuge lands. In addition to Wheeler Reservoir, streams that drain to the reservoir are located on refuge lands and current information is lacking regarding fish populations in these systems. Refuge personnel are also concerned about overall health of the aquatic systems on the Refuge and are interested in the incidence of disease or other abnormalities expressed by fishes inhabiting aquatic systems on the Refuge. It is hypothesized that water quality is compromised in several water bodies on the Refuge, therefore warranting a quantitative assessment of how water quality parameters may be affecting both fish occupancy rates and overall fish health.

The objective of this project is to estimate occupancy rates and health for fish species inhabiting Wheeler Reservoir and streams located on refuge lands. Specifically, we will 1) provide Refuge staff with probability of occurrence for each species in water bodies on the Refuge, 2) conduct a fish health assessment for fishes encountered during the survey, 3) measure water quality parameters and other covariates that may affect occupancy and fish health at each site, and 4) investigate relations between physical and chemical characters of the streams and reservoir and fish population characters.

Status - We conducted fish sampling on Wheeler NWR in July 2008. Seven watersheds were surveyed based on recommendations by Refuge Personnel. Specific sites within each watershed were selected in a systematic random fashion and visited within a three week period in July 2008. The most common species, bluegill (*Lepomis macrochirus*), was selected for the health analysis. Thirty individuals (TL > 60mm) were collected from each of the seven watersheds either with backpack electrofishing or by hook-and-line. A gross health assessment, which considered gross abnormalities, parasites, and condition of internal organs, was conducted on individual bluegill. In addition, tissue samples were collected for histological analysis and otoliths were extracted for growth estimation. Fish identification, otolith processing for growth analysis, and histological analysis is presently underway. Species occupancy rates, as well as lesion and disease rates, will be related to landscape characters to make initial predictions on relation of land use/land cover to fish assemblage structure and overall health. A final report will be prepared December 2010.

Adaptive management and monitoring for restoration and faunal recolonization of shoal habitats

Funding source: Alabama Division of Wildlife and Freshwater Fisheries, Alabama Power Company

Principal Investigator: Elise Irwin

Research Associate (s): Kathryn Mickett Kennedy

Student (s): Taconya Piper (Ph.D.), Ben Martin (M.S.), Molly Martin (M.S.)

Duration: October 2006 – September 2011

High imperilment rates of fishes and mussels in the state of Alabama are related to impoundment and regulation of riverine flows. Specifically, the inundation and disruption of natural flow regimes of shoal habitats in medium sized rivers was hypothesized to be the primary cause for imperilment of 53% of fishes in Southeastern Rivers. In Alabama, loss of functional shoal has likely affected 64% of fish species of greatest conservation need (GCN). Restoration and protection of functional shoal habitat in the remaining unimpounded (i.e., free flowing) fragments of rivers of the State is a critical element of conservation of aquatic species. However, effects of specific flow regimes on shoal habitats and ultimately on biotic processes are not well known. We evaluated effects of experimental flow regimes on shoal dependent aquatic fauna in the Piedmont region of Tallapoosa River. Specific objectives were to: 1) Compare fish and invertebrate assemblages and population structure between flow-managed and naturally flowing river reaches (for all GNC species and using an IBI); 2) Assess habitat stability (i.e., shoals) and persistence for GCN species and other species of concern; and 3) Determine applicability of flow management and habitat restoration for other river systems.

Status – In general, IBI values were lower at regulated sites, varied widely among sites, within and among river reaches, between seasons, and among years. Ten of the fourteen species examined for species occupancy dynamics had parameter estimates that were a function of river regulation. Two GCN darters were apparently unaffected by the impact of Harris Dam; occupancy was estimated to increase across the basin for both species. Occupancy of the remaining GCN darter species and minnow species were estimated to be dam-dependent, but relatively high or stable. Stippled studfish was absent altogether from the regulated reach, and Tallapoosa sculpin was estimated to have sharp declines in occupancy basin-wide. For all crayfish species, occupancy was high but population structure varied among sites and species. Hatch dates of age-0 centrarchids were not correlated to prolonged stable flow periods in 2005, but were correlated in 2007 and 2008, when the majority of hatches occurred during or up to three days after periods of stable, low flows. In general, our results indicated that the Tallapoosa River fish and crayfish assemblage varies considerably, not only between the regulated and unregulated river, but also within the unregulated reaches, both between seasons and among years. Flow regimes affected shallow-fast habitat differentially in the pre- and post-management periods. Specifically, the amount of time that shallow-fast habitat was available to the fauna increased in the post-management period. Positive responses of the fauna to changes in the flow regime are supported with our data; however, habitat models in relation to flow management are needed. The adaptive approach allowed us to reduce uncertainty regarding components of the flow regime related to fish population parameters.

ENDANGERED/DECLINING POPULATIONS

Integrated analysis of spring pygmy sunfish habitat in Limestone and Madison Counties, Alabama

Funding Source: U.S. Geological Survey

Principal Investigator: Elise Irwin

Research Associate: Kathryn Mickett Kennedy

Student: Taconya Piper (Ph.D.)

Duration: August 2008 – September 2011

Alabama is experiencing rapid growth in many parts of the state; one of the fastest growing is the Huntsville/Madison County region. Human population growth and associated changes in land use in the region will increase and impose potential stress on natural resources such as water quality and quantity and biodiversity. The region has multiple species of conservation need and FWS is in the process of considering the listing of at least one additional species, spring pygmy sunfish (*Elassoma alabamae*) identified as imperiled.

Evaluation of effects of landscape change on natural ecosystems is needed. Often water resources (quality and quantity) equate to common currency in systems where multiple competing uses for water have been identified. In the case of the Huntsville, Alabama area, consumption of groundwater and surface water for human uses is needed; however, several issues related to imperiled aquatic species (fish and snails) have also been identified by State and Federal agencies. Understanding water sources and effects of increased use on water quality and quantity for multiple competing objectives will require development of models to 1) define linkages among abiotic and biotic components of ecosystems; 2) identify key uncertainties regarding ecosystem function; and 3) quantify effects of management on state variables. The goal of this project is to integrate the expertise in USGS Water and Biology to assist FWS with evaluating the effects of ground water and surface water on the persistence of spring pygmy sunfish habitat. Ultimately, the project will provide FWS with a product that could be incorporated into or become a recovery plan or Habitat Conservation Plan for the species of concern.

Status – Identification of key ecosystem components, uncertainties, links, and stakeholder values is underway. Meetings with experts in the fields of ecology, water resource management, and groundwater geochemistry have been scheduled. These meetings will provide the necessary expert opinion and sources for empirical data to inform a structured decision model for management of spring pygmy sunfish.

Reproductive biology of the federally threatened Price's Potato Bean (new)

Funding Source: U.S. Department of Defense (Redstone Arsenal, AL)

Principal Investigator: Robert Boyd (Auburn University)

Graduate Student: Kyle Paris (M.S.)

Duration: August 2009 – May 2012

Price's Potato-Bean (*Apios priceana*) is described in the Recovery Plan (USFWS 1993) as a vine that grows up to 15 feet in length from a large underground stem (tuber). It is often found in open woods and along the edges of streams in areas underlain by limestone rock. Flowers of this species appear in large clusters and individual flowers are relatively large and showy (about 2 cm long). The species was first collected in 1896 and is known from only a few populations. NatureServe Explorer reports only 25 populations, often with fewer than 50 individuals, and some of these are known or believed to be extirpated. The restricted range, small population sizes, and reports of declining population sizes caused this species to be listed as Federally Threatened by the US Fish and Wildlife Service on February 5, 1990.

Little is known of the natural history of this species of *Apios*. The Recovery Plan for *Apios priceana* (USFWS 1993) contains a long list of natural history information needs for this species. Natural history studies can provide information regarding the general life history situation for a species, and form the basis of a general scientific understanding of a species' ecological relationships. This type of information can be helpful for managers seeking to understand the basic biology of a threatened species, and we propose to generate this type of information for Price's Potato-Bean. We will use the DOD's Redstone Arsenal population as the focal population for generating this information.

Status – This project is the M.S. thesis of Kyle Paris. During May/June 2010, all plants from the three largest metapopulations were measured using calipers, recording stem diameter at or near ground level. Permanent metal tags were then fixed to stems giving each plant an identification number. During July-September, fifteen plants were selected from two metapopulations to track reproductive success. On these plants, every other inflorescence was marked with a numbered bird band and periodically measured for length. Fascicle number per inflorescence was counted, and position of large, open flowers was noted. Upon subsequent trips the banded plants were measured for fruit production where inflorescence number, fascicle position, and number of seeds per fruit were noted. Fruit and seed production was also documented for the entire population. One-tenth of the population's healthy seed production was collected for predation and germination experiments planned for the upcoming year.

Multispecies adaptive management in the Delaware Bay: Predictive Modeling and Implementation

Funding Source: U.S. Geological Survey

Principal Investigator: Conor P. McGowan

Graduate student: C. Alyssa Butler

Duration: January 2011 - December 2012

Delaware Bay supports the largest spawning population of horseshoe crabs in the world and the second largest population of migrating shorebirds in North America. Delaware Bay is designated within the Western Hemisphere Shorebird Reserve Network as having the highest reserve status. The Delaware Bay is a critical migratory stopover for Western Hemispheric populations of migratory shorebirds, including red knot (*Calidris canutus rufa*), ruddy turnstone (*Arenaria interpres*), sanderling (*Calidris alba*), and semipalmated sandpiper (*Calidris pusilla*). These migrants depend on the eggs of spawning horseshoe crabs for a major portion of their diets (50 to 90 percent) each spring before migrating from the Delaware Bay beaches to Artic nesting grounds.

Migratory shorebirds on the Delaware Bay beaches have declined in recent years. Threats include reduced food availability, human disturbance, predation, loss of sandy beaches and suitable roost sites, and risk of oil and hazardous materials spills. However, there is consensus that high harvest of horseshoe crabs leading up until the late 1990's reduced the crab population and led to declines in migratory shorebirds, principally the red knot. In response to dramatic rises in horseshoe crab harvest during the 1990's and the concern for the status of dependent species, the Atlantic States Marine Fisheries Commission (ASMFC), which coordinates the interstate horseshoe crab fishery, developed a Horseshoe Crab Fishery Management Plan in 1998 (ASMFC 1998). The Plan has multiple goals: 1) sustaining horseshoe crab population levels, 2) providing critical food resources for dependent species, migratory shorebirds in particular, 3) allowing harvest for bait, and 4) providing continued use for LAL production, which is derived from horseshoe crab hemolymph and used world-wide to test for bacterial contamination of drugs and medical devices.

Recently, shorebird and horseshoe crab technical advisory committees, which were established by the ASMFC and U.S. Fish and Wildlife Service (FWS), have initiated a major collaboration to develop and evaluate predictive models that can be incorporated into an adaptive management framework (Walters 1986, Williams et. al 2001).

Predictive modeling of horseshoe crabs and shorebirds in an adaptive management framework will provide a sound scientific basis for decisions on horseshoe crab harvest, red knot endangered species status, and strategic habitat conservation.

Status – We have recruited a Masters student, C. Alyssa Butler, to begin working on the project. She will be focusing her research effort on data analyses of horseshoe crab tagging data to improve the horseshoe crab population model. She will also be addressing urgent spatial analyses to help devise a plan to allocate allowable harvest across four mid-Atlantic States.

LANDSCAPE ECOLOGY

Inventory and conservation planning for species of greatest conservation need on Alabama DCNR lands

Funding Source: Alabama Division Wildlife and Freshwater Fisheries, Auburn University

Principal Investigator: James B. Grand

Co-principal investigators: Mike Gangloff, Craig Guyer, Elise Irwin, Carol Johnston, Mark MacKenzie, Ed Loewenstein, Todd Steury

Project Coordinator: Amy Silvano

Graduate Students: Rob Allgood, Jessie Boulerice, Emily Hartfield, Daniel Holt, Carrie Johnson, Eva Kristofik, Patricia Spears, Jimmie Stiles, Sierra Stiles, Michelle Tacconneli, Kevin White (ASU)

Duration: October 2006 – December 2011

During this five year project, the Alabama Cooperative Fish and Wildlife Research Unit will coordinate the development of multi-species Inventory and Conservation Plans (ICPs) for selected lands managed by the Alabama Department of Conservation and Natural Resources. The project will potentially include lands in six ecological regions, and could affect 303 species of greatest conservation need (GCN), of which 118 are listed as threatened or endangered. During the first year, a steering committee will be established, lands and species for inclusion in the plan will be identified, information needs assessment will begin, and an outreach plan will be developed. Subsequent years will be used to gather information and develop decision support tools, conduct outreach programs, and develop the ICPs. The overall goal is to provide a science-based plan for the conservation of GCN species and the habitats they depend on as they occur or could occur on ADCNR managed lands. Additional goals are to establish a protocol and a baseline for monitoring GCN species, to provide a basis for the development of new ICPs, to provide guidance for the improvement of populations of GCN species, to improve upon our understanding of the issues affecting the conservation of GCN species, and to foster relationships among public and private stakeholders.

Status – We completed our third and final year of field inventories, conducting surveys on three study areas in northern Alabama: Guntersville State Park, Monte Sano State Park and Lauderdale-Colbert, encompassing Lauderdale & Freedom Hills WMAs. At each study area, we used standardized protocols to sample bird, mammal, reptile, amphibian, fish, mussel, and crayfish populations and their associated habitats. We initiated workshops to assemble information for development of decision support tools to evaluate management alternatives on each study area. We engaged Co-PIs and ADCNR personnel using structured decision making approaches to outline the management problem and identify stakeholder's management objectives. Subsequent workshops will be held in 2011 to develop forest and non-forest management models and assess species responses to identified management actions.

Climate change in the Southeast U.S. and its impact on bird habitat

Funding Source: U.S. Geological Survey

Principal Investigator: James B. Grand

Research Associate: Kevin Kleiner, Tyler Kreps

Student(s): Vacant

Duration: September 2008 – September 2011

Many fish and wildlife agencies are preparing to respond to projected changes in climate at local, regional, and global scales. Numerous climate models were developed under the Intergovernmental Panel on Climate Change (IPCC) that predict changes in temperature and rainfall patterns throughout much of North America. These changes are expected to cause substantial alteration to habitat conditions and thus species distributions. Current models, run at a continental scale, have been inconsistent with regard to predicting temperature trends and trends in storm duration and intensity over the Southeastern U.S. Understanding the impact of potential changes in climate on wildlife habitat adds yet another dimension of uncertainty when agencies attempt formulate management plans based on historical trends of population abundance. Terrestrial landscapes are expected to change yielding altered forest and terrestrial ecotypes, to the extent that species distributions and migratory patterns for birds and other species may dramatically change. However, this change may be obfuscated by land use change in many areas. Still, state fish and wildlife agencies will need information on potential changes to wildlife habitat for long-range planning efforts. Unfortunately, climate change predictions from the current suite of Global Circulation Models (GCM) have not been scaled appropriately for state or local level planning. This project seeks to develop historical land use and land cover data (LULC) at decadal intervals from the late-1970's through 2006 and examine change in relation to observed climate and land use. These data will complement ongoing projects at North Carolina State University (NSCU) to examine changes in bird distribution over the same time period. Data from both projects will be used in conjunction with climate change predictions based on Regional Circulation Models (RCM) that are in development at Texas Tech University to examine the potential changes in bird distribution in the southeastern U.S.

Status – Remote-sensing data for mapping historical LULC have been acquired. The uniform land cover legend has been determined for the historic classification. Several classification techniques were tested and a mapping protocol has been established. This protocol includes stratification of imagery using ecoregions and current LULC, multiple unsupervised classifications, and subsequent image interpretation.

Mapping for all three dates is complete for the pilot study area and the area of the South Atlantic Migratory Bird Initiative (SAMBI). Currently, an accuracy assessment is being performed on these maps using fuzzy set theory. Upon completion of the accuracy assessment, matrices will be created showing transition rates between LULC classes for each time step and estimates of their accuracy. Future work will focus on other areas within Southeast if project partners want additional data.

Decision Support Models for Multi-species Bird Conservation

Funding Source: North Carolina State University

Principal Investigator: James B. Grand

Graduate Student: Allison Moody

Duration: January 2008 – March 2011

Populations of many game and non-game bird species in the eastern US are declining relatively rapidly. With limited funding for bird conservation, there is an urgent need to make informed conservation decisions because in many areas lands suitable for bird conservation are disappearing rapidly. Moreover, programs to conserve and manage those lands are competing with land uses that drive the cost effectiveness of conservation programs even higher. To further improve conservation design and make the best use of limited conservation funds for bird populations, planning efforts need to be spatially explicit, large-scale, based on physiographic not political boundaries, and they need to consider the relative conservation potential of the landscape as well as the relative need for conservation of each bird species. We are developing a framework for the biological planning and conservation design elements of strategic habitat conservation that will ensure the sustainability of bird populations in the South Atlantic Migratory Bird Initiative (SAMBI) area. The framework will be based on identified assumptions that can be evaluated and updated through monitoring and applied research. This framework will be applied based on projections of land use and land cover and emergent projections of animal distribution that incorporate both urbanization and predicted climate change developed by cooperators at the North Carolina Cooperative Fish and Wildlife Research Unit (NCCFWRU) at North Carolina State University. The products are expected to identify strategically important areas for bird conservation efforts through partnerships forged by the Atlantic Coast Joint Venture (ACJV).

Status – In conjunction with researchers at NCCFWRU and ACJV staff, during FY2008, we hosted four workshops within the SAMBI area to inform land managers and ACJV partners of this effort and to solicit their input on the review of animal distribution models, selection of focal species, and conservation design objectives through a structured decision making exercise. A book chapter in review describes how information provided by workshop participants was used to develop lists of focal species using two approaches. Projections of land cover change in the Charleston, SC and Camp Le Jeune, NC areas were used in a preliminary examination of the effects of climate change and urban growth on conservation priorities for longleaf pine birds for the ACJV technical team. Researchers at NCCFWRU have developed projections of urban growth and land cover change and sea level rise under three climate scenarios. NCCFWRU has also modeled the effects of those changes on the distribution of potential habitat for the focal bird species identified by ACJV partners. ALCFWRU is preparing to computer programs to analyze those data and identify priority areas for conservation in 13 ecosystems over the next three months.

Optimal Conservation Strategies to Cope with Climate Change (new)

Funding Source: U.S. Geological Survey, Southeast Climate Assessment

Principal Investigator: James B. Grand

Postdoctoral Fellow: Max Post van der Burg

Graduate students: Vacant (2)

Duration: September 2009 – August 2013

Natural resource managers in the southeastern United States face unprecedented pressure to develop effective and efficient conservation strategies. Climate change and other anthropogenic stressors further complicate the challenges associated with maintaining populations of trust species and the habitats they require. Additionally, opportunistic, reactive strategies frequently have not been effective for stabilizing or bolstering already declining populations of many terrestrial and aquatic species. Thus, we propose to employ a strategic, integrated approach to ensure the health and resilience of those species that allows adaptation to changing climate and other anthropogenic activities. We will use the principles of Adaptive Management (AM) and Strategic Habitat Conservation (SHC) to address the potential impacts of climate change on terrestrial and aquatic wildlife populations in the southeastern United States at regional scales. AM provides an ideal framework for the establishment and attainment of conservation objectives in the face of many sources of uncertainty, while SHC is specifically designed to address issues associated with establishing and maintaining target wildlife populations. Although it can be argued that SHC is only applicable at landscape scales, the iterative nature of both processes is essentially parallel. To be successful either approach requires explicit involvement and commitment of stakeholders in planning, design, decision making, monitoring, and research.

In Phase I of the project, we will hold a series of workshops for the fish and wildlife conservation community to: 1) Identify focal species for planning conservation actions within each ecoregion, 2) Assess the state of populations of focal species based on the best available information, 3) Determine population objectives and habitat objectives for focal species that will ensure their persistence, and 4) Identify and quantify the effects of management and policy alternatives for the conservation of focal species. In Phase II, we will 1) Select habitat relationship models for predicting population responses by focal species to climate change and conservation actions, 2) Determine optimal conservation strategies based on the identified management and policy alternatives that are most likely to sustain populations of focal species, and 3) Identify key elements for monitoring that will reduce uncertainty regarding the effect of climate change on terrestrial and aquatic populations and their habitats and measure progress towards population and habitat objectives.

Status – We have developed a modeling framework for assessing optimal landscape planning decisions. In the summer of 2010, we held a workshop planning meeting with the leadership of the South Atlantic LCC. In December 2010, we held another meeting the SALCC leadership to scope a potential decision problem to be addressed in the planned workshops. In January 2011, we expanded this problem scoping group to include representatives of federal and state agencies and non-governmental organizations and held an initial meeting with this group. We anticipate holding our first workshop in the spring of 2011.

OTHER PROJECTS

Using time-lapse cameras to estimate abundance and structure of Eastern wild turkeys (Meleagris gallopavo) in Alabama (completed)

Funding Source: ADCNR, Alabama Wild Turkey Federation

Principal Investigator: James B. Grand

Graduate Research Assistant: Phil Damm

Duration: August 2007 – December 2009

The increased harvest of Eastern Wild Turkey populations in recent years has led to questions regarding the sustainability of this harvest. We propose a statistically rigorous population survey using time-lapse cameras and bait to estimate age and sex ratios, abundance, and annual poult production to assess harvest sustainability in the state of Alabama. Hypotheses of density in relation to habitat characteristics at the landscape level have been developed *a priori* from the literature to determine the sources of variability that cause unequal distribution of wild turkeys at an ecoregional scale. The objectives of the study are to 1) estimate the abundance (through estimates of density and incorporation of models of detectability) of turkeys using repeated time lapse camera surveys in a nine county area in southwest Alabama; 2) estimate annual production (poults per hen) and age and sex structure of the population; and 3) determine sources of heterogeneity in habitat that cause bias in estimates of turkey density and detectability. An important assumption to this survey is that each trapping occasion (photograph) is independent. If turkeys become faithful to bait sites that would not normally use those sites, then density estimates could be overestimated. To explore the possible bias, we intend to conduct a short term telemetry study to determine the effects of bait on density of use of space by turkeys. Upon completion, this proposal will provide land managers with critical information required to maintain current population levels of wild turkeys through sustainable harvest.

Status – This project was completed resulting in one M.S. Thesis and one manuscript submitted for publication (in review). The procedures developed in this project are in operation use by ADCNR, Wildlife and Freshwater Fisheries Division.

PRODUCTIVITY

Publications

Craven, S.W., J.T. Peterson, M.C. Freeman, T.J. Kwak, and E. Irwin. 2010. Modeling the relations between flow regime components, species traits and spawning success of fishes in warmwater streams. Environmental Management. 46(2):181-194.

Damm, P.E., Grand, J.B. Grand, and S.W. Barnett. Variation in detection among passive infrared triggered-cameras in wildlife research. Proceedings Southeastern Association of Fish and Wildlife Agencies.

Irwin, E. R. and K. D. M. Kennedy. 2009. Engaging stakeholders for adaptive management using structured decision analysis. Proceedings of the Third Interagency Conference on Research in the Watersheds: U.S. Geological Survey Scientific Investigations Report 2009-5049, 292 p.

Jolley, D. B., S. S. Ditchkoff, B. D. Sparklin, L. B. Hanson, M. S. Mitchell, and J. B. Grand. 2010. Estimate of herpetofauna depredation by a population of wild pigs. Journal of Mammalogy 91:519-524.

Martin, B. M. and E. R. Irwin. 2010. A digital underwater video camera system for aquatic research. North American Journal of Fisheries Management 30:1365-1369.

McGowan, C. P., and M. R. Ryan. 2010. Arguments for using population models in incidental take assessments for endangered species. Journal of Fish and Wildlife Management 1:183-188.

Mitchell, M. S., L. B. Pacifici, J. B. Grand, and R. A. Powell. 2009. Contributions of vital rates to growth of a protected population of American black bears. Ursus 20:77-84.

Sakaris, P. C., and E. R. Irwin. Tuning stochastic matrix models with hydrologic data to predict the population dynamics of a riverine fish. Ecological Applications 20:483-496.

Sharp, N. W., M. S. Mitchell, and J. B. Grand. 2009. Sources, sinks, and spatial ecology of cotton mice in longleaf pine stands undergoing restoration. Journal of Mammalogy.

Publications Pending

Irwin, E. R. Coarse woody debris provides productive fish habitat in streams. *In press*. Page xx in Managing Forests on Private Lands in Alabama and the Southeast. Alabama Forestry Commission and Alabama Forestry Foundation, Montgomery, Alabama.

Jolley, J. C. and E. R. Irwin. *In press*. Catfish population characteristics in tailwater and reservoir habitats of the Coosa River, Alabama. Pages xx-xx in Conservation, Ecology, & Management of Worldwide Catfish Populations and Habitats. American Fisheries Society Special Publication XX.

McGowan, C.P., D.R. Smith, J. Sweka, J. Martin, J. D. Nichols, R. Wong, J. E. Lyons, L. J. Niles, K. Kalasz, J. Drust, M. Klopfer, and B. Spear. 2011. Multispecies modeling for adaptive management of horseshoe crabs and red knots in the Delaware Bay. Natural Resource Modeling, *in press* (available online, January 2011).

Olive, J., H. Schramm, P. Gerard and E. Irwin. *In press*. An evaluation of agreement between pectoral spines and otoliths for estimating ages of catfishes. Pages xx-xx in Conservation, Ecology, & Management of Worldwide Catfish Populations and Habitats. American Fisheries Society Special Publication XX.

Reports

Kennedy, K.D. and E.R. Irwin. Patterns of fish and disease occupancy in Wheeler National Wildlife Refuge, Alabama. ACFWRU Report 2009-3. Final Report Submitted to USFWS, October 2009.

Presentations

Damm, P. E., J.B. Grand, S.W. Barnett. Variation in detectability among passive infrared triggered-cameras in wildlife research. Annual Meeting of the Alabama Chapter of the Wildlife Society. Spanish Fort, AL 25 February 2010.

Gangloff, M.M., Hoch, R.A., Hamstead, B.A., Silvano, A.L., Grand, J.B. Freshwater mussel microhabitat use in the Sipsey River, Alabama. Annual Meeting North American Benthological Society.

Grand, J.B, Kleiner, K.J. A decision support tool for longleaf pine restoration using Southeast Regional GAP data and methodology developed by the East Gulf Coastal Plain Joint Venture. Longleaf Alliance Regional Meeting 29-30 October 2009, Sandestin, FL.

Grand, J.B. Wildlife conservation and climate change: How tomorrow's landscape should influence today's decisions. Carbon Sequestration in Longleaf Pine Ecosystems: Current State of Knowledge and Information Needs. Auburn, Alabama. January 2010.

Hoch, R.A., Gangloff, M.M., Hamstead, B.A., Silvano, A.L., Grand, J.B. Inventory of crayfish and mollusk resources on Alabama state-managed lands. Annual Meeting North American Benthological Society.

Hollmén, T.E., Grand, J.B., Frost, C.J., Nichols, J.D., Swem, T.R., and Matz, A.C. Using Structured Decision Making to Evaluate Re-introduction as a Tool to Recover.an Arctic Sea Duck, the Steller's Eider, in Alaska. Species Introductions & Re-introductions: Opportunities & Challenges, Starkville, Mississippi.

Irwin, E. R. and K. D. M. Kennedy. February 2010. Evaluation and development of tools to estimate large-river ecological integrity. Spring Meeting of the Southern Division of the American Fisheries Society, Asheville, North Carolina.

Irwin, E. R., A. M. Ferrara, K. D. M. Kennedy, P. C. Sakaris, and R. Campbell. January 2009. Alligator gar conservation in the southeast United States: development of a decision tool for evaluating effects of management on population viability. Spring Meeting of the Southern Division of the American Fisheries Society, New Orleans, Louisiana.

Irwin, E. R., K. D. M. Kennedy, V. Herr and B. Boston. May 2010. Facilitation and Decision Support Technology for Adaptive Management. 4th Environmental Conflict Resolution Conference, Tucson, Arizona. INVITED.

Johnson, C.B, and J.B. Grand. 2010. Managing wildlife openings for use by birds in the Gulf Coastal Plain of Alabama. Annual Meeting of Alabama Chapter of The Wildlife Society. Spanish Fort, Alabama.

Jolley, J. C. and E. R. Irwin. Catfish population characteristics in tailwater and reservoir habitats of the Coosa River. Catfish 2010: Conservation, Ecology, and Management of Catfish: The Second International Symposium, St. Louis, Missouri.

Olive, J.*, Schramm, H. L., Gerard, P. D., and E. R. Irwin. An evaluation of agreement between pectoral spines and otoliths for estimating ages of catfishes. Catfish 2010: Conservation, Ecology, and Management of Catfish: The Second International Symposium, St. Louis, Missouri.

Silvano, A.L., J.B. Grand. Inventory and Conservation Planning Project (ICP) of Alabama DCNR Managed Lands. Annual Meeting of the Alabama Chapter of the Wildlife Society. Spanish Fort, Alabama.

Graduate Theses and Dissertations

Damm, P.E., 2010. Using automated cameras to estimate wildlife populations. M.Sc. Thesis. Auburn University, Alabama.

Johnson, C.B. 2010. The Relationships Between Wildlife Openings and Bird Use and Abundance in the East Gulf Coastal Plain. M.Sc. Thesis. Auburn University, Alabama.

Martin Moore, M.A. 2010. Shoal occupancy estimation for three lotic species of crayfishes in the Tallapoosa River Basin, Alabama. Master's Thesis. Auburn University, Auburn, Alabama.

Outreach/Technical Assistance

Dr. Grand

Using structured decision making to evaluate management alternatives for ICP study areas. ICP Project Steering Committee Meeting Auburn, Alabama.

Member, Eider Recovery Team, U.S. Fish and Wildlife Service, Anchorage, Alaska.

Member, Technical Team, East Gulf Coastal Plain Joint Venture

Member, Science Advisory Team, Gulf Coastal Plain and Ozarks, Landscape Conservation Cooperative.

Dr. Irwin

Climate Change Effects on Southeastern Fishes Workshop-Attended workshop facilitated by J. Peterson and M. Freeman to set priorities and provide expert opinion relative to a model of effects of climate change on fishes. Athens, GA. February 2010.

Environmental Conflict Resolution Workshop.- Organized and facilitated with Group Solutions. Attended by 60 consultants, agency personnel, and academics. Tucson, AZ. May 2010.

Co-coach, Montana Wildlife Health Program, Structured Decision Making Workshop, National Conservation Training Center. September 2010.

Adaptive Management - Team-taught 5-day course at National Conservation Training Center, Shepherdstown, West Virginia.

Dr. McGowan

Member, Piping Plover Recovery Team.

Coach, Black Duck Adaptive Management Working Group. Structured Decision Making Workshop; National Conservation Training Center. September 2010.

Adaptive Management - Team-taught 5-day course at National Conservation Training Center, Shepherdstown, West Virginia.

Teaching

Dr. Grand

WILD 7250 – Analysis of Wildlife Populations. 3 credit hours.

WILD 7930 – Directed Study. Intro to GIS. 3 credit hours.

WILD 7970 – Special Topic. Occupancy Analysis. 2 credit hours.

WILD7930 – Directed Study – Use of focal species for conservation planning. 2 credit hours.

WILD 7970 – Habitat use, selection, and occupancy. 3 credit hours.

WILD 4970 – Special Topics. Wildlife Practicum.

- Intro to SDM (5 part lecture series)
- Bird identification and point count surveys.
- Analysis of bird point Bird data analysis
- Field trip to Southwest Alabama

Dr. Irwin

FAA 6870 – Special Topic. River Basin Management and Planning. 3 credit hours.

FAA 4600 – Special Topics. Lotic Ecology. 4 credit hours.

FAA 7380 – Ecology and Management of Riverine Systems 4 credit hours.