It is our great pleasure to circulate the Triennial Report of the Oklahoma Cooperative Fish and Wildlife Research Unit, which highlights graduate research and scholarship for 2014–2016.

The Oklahoma Unit of the U.S. Geological Survey’s Cooperative Research Units Program has been an integral part of graduate-level research and post-graduate training in natural resources, particularly fisheries and wildlife conservation, at Oklahoma State University since 1948.

With direction from our Coordinating Committee, research is conducted on a wide variety of natural resource conservation topics in cooperation with federal and state agencies, the University, the Oklahoma Department of Wildlife Conservation, the U.S. Fish and Wildlife Service, the Wildlife Management Institute, and various private entities. Most of our research projects are problem oriented and designed to provide cooperators with useful information on time-sensitive natural resource issues.

From its establishment in 1948 to 2006, the Unit was affiliated with OSU’s Department of Zoology (now Integrative Biology) in the College of Arts and Sciences. In 2006, the Unit’s affiliation moved to the newly created Department of Natural Resource Ecology and Management in the Division of Agricultural Sciences and Natural Resources.

Research through the Oklahoma Unit is conducted mainly by M.S. and Ph.D. candidates. Over 400 theses and dissertations have resulted from their persistence and scholarship. Students have conducted research on fisheries management in reservoirs, ponds, and rivers; stream ecology; species of special concern including the Arkansas river shiner and Ozark big-eared bat; toxicology; and management of bobwhite quail, black bears, and smallmouth bass. While many of our research projects occur in Oklahoma, other projects conducted by our scientists and students occurred in Georgia, Missouri, New Mexico, Nebraska, and Texas. As we complete our 7th decade, future projects will continue to emphasize applied research on the natural resources of Oklahoma and the nation.

The Oklahoma Unit and its Cooperators would be pleased to share additional information on any project summarized herein. You are welcome to contact any of the investigators listed by project through the Unit Office.


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Shannon K. Brewer
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Steve A. Williams
President, Wildlife Management Institute
Cooperators and Research Personnel

Cooperating faculty from the University, resource professionals from many agencies and affiliated universities, post-doctoral researchers, graduate students, research specialists and technicians, and volunteers are the lifeblood of Unit operations and opportunity.

Aquatic Resources

From mussels to smallmouth bass and with clear applications of Geographic Information System technologies, completed and ongoing Unit projects in aquatic resources explore complex resource issues focusing on conservation, recreation, recovery, and human dimensions.

Terrestrial Resources

From bobwhite to other avian assessments in prairies and forest and from conservation genetics of bears to a variety of management issues, completed and ongoing Unit projects in terrestrial resources encompass most topics in contemporary wildlife conservation.

Scholarship

The spirit of scientific contribution and scholarship of Unit participants in 2014–2016 is clear: 35 student/faculty awards, 22 theses/dissertations, 73 peer-reviewed and technical publications, and 184 presentations at professional state, regional, national, and international meetings.
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Chattahoochee River National Recreation Area: Paula Capece, Ann Couch, Deanna Greco

U.S. DEPARTMENT OF DEFENSE
Corps of Engineers, Construction Engineering Research and Development Laboratory: Kurt Gust; Kansas City District Office: Todd Gemeinhardt, Nate Gosch, Marcus Miller.

U.S. DEPARTMENT OF AGRICULTURE
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PEORIA TRIBE OF INDIANS OF OKLAHOMA
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Micah Walker
Alexis Whiles
Derek Wieland
Morgan Womack
Alexis Wood
Spencer Wood
Aquatic Resources

COMPLETED PROJECTS

Processing samples to monitor at-risk fish species in large prairie rivers of Oklahoma

The Oklahoma Ecological Services Field Office of the U.S. Fish and Wildlife Service conducts annual monitoring of species of conservation concern. The primary interest is documenting the status of the Arkansas River Shiner, a federally-threatened species, and the Prairie Speckled Chub, an endemic species of the Red River. A backlog of samples has prevented a rigorous analysis of those samples. We identified and processed samples from 2014-2016 to develop a reference collection of fishes inhabiting the rivers of the southern Great Plains.

FUNDING
Oklahoma Department of Wildlife Conservation

FACULTY INVESTIGATORS
Shannon K. Brewer

STUDENT INVESTIGATORS
Jake Holliday, Dakota McNeill, Dawson McNeill, Desiree Williams, and Joshua Mouser, Lab Technicians

COMPLETED
April 2016

Impacts of flow alterations on crayfishes in southeast Oklahoma

Narrow-range endemics are considered particularly vulnerable to extirpation because they often use specific habitats that are highly susceptible to human disturbance. We investigated several crayfish species endemic to the Ouachita Mountains of Oklahoma and Arkansas. We established spatial distributions (i.e., range) using Maximum Entropy modeling. We then investigated crayfish habitat use with quantitative sampling and a paired movement study. Finally, we evaluated the ability of crayfish to burrow under different environmental conditions in a controlled laboratory setting. Our results suggest climate change and sedimentation resulting from land-use practices, combined with increased water withdrawals have the potential to alter crayfish distributions and affect persistence of some crayfish populations.

FUNDING
Oklahoma Department of Wildlife Conservation

FACULTY INVESTIGATORS
Shannon K. Brewer and Michael Tobler

STUDENT INVESTIGATORS
Joey Dyer, M.S Candidate; Blayne Housh, Kortney Kowal, Julia Mueller, Jarrod Powers, and Justin Rolen, Field Technicians

COMPLETED
May 2014

Aquatic Resources
Flow-ecology relationships of fishes in the Arbuckle Mountains and Ozark Highlands

Stream flow and thermal regimes are often coupled and can be altered by anthropogenic activities. We examined the influence of altered flows on assemblages of the Arbuckle Mountains and Ozark Highlands, and characterized the thermal tolerances of 15 stream fish species. Our flow-ecology relationships showed that many abiotic and biotic characteristics were positively related to dynamic flow conditions including increased magnitude and number of flow reversals. Many species belonging to reproductive guilds with some taxonomic resolution (e.g., Moxostoma) showed similar patterns to both flow and temperature. We ranked species in order of their environmental tolerances and showed that species with higher tolerances were generally able to increase their tolerances under slower heating conditions. Our data suggest fine guild designations may be useful to predicting both thermal and flow responses.

FUNDING
The Nature Conservancy

FACULTY INVESTIGATOR
Shannon K. Brewer

STUDENT INVESTIGATORS
Nicole Farless, M.S. Candidate; Jake Holliday, Field Technician

COMPLETED
December 2015

Predicting the distribution of freshwater mussel assemblages in small rivers of southeastern Oklahoma

The goal of this project was to determine the environmental factors related to the distribution and abundance of mussels in the Muddy and Clear Boggy rivers in southern Oklahoma. We determined that side-scan sonar was an effective tool for preliminary assessments of mussel presence when they are located at the substrate surface and in relatively fine substrate. Models predicting freshwater mussel densities performed much better than presence models with drainage area, width-depth ratios, and percent of shale geology selected most often as explanatory variables. Unlike many species, Wabash pigtoe was tolerant of agriculture land use. Mussel species known to have a limited number of host fishes showed significant positive relationships between mussel density and fish-host density. The results of our study provide information about the environmental factors influencing specific-species densities, which can guide conservation initiatives.

FUNDING
Oklahoma Department of Wildlife Conservation

FACULTY INVESTIGATORS
Shannon K. Brewer and Timothy J. O’Connell

STUDENT INVESTIGATORS
Jarrod Powers, M.S. Candidate; Bryce Burhead, Thomas Campbell, and Mark Jensen, Field Technicians

COMPLETED
May 2016

Ecosystem stress response function of climate change in the Arkansas-Red River basin

Maintaining appropriate flows to support the biological integrity of larger riverine ecosystems is difficult. Understanding interactions among climate, streamflow, water quality, and stream ecology for watersheds in the Canadian River Basin can be achieved using existing data and technology. A physics-based hydrologic model that simulates streamflow using high-resolution radar data was used to more accurately capture spatial and temporal patterns in precipitation variability. Existing fish-community data were collected and compiled into a database and biotic responses were assessed to evaluate the influence of modeled streamflow. The relationship between water quality and the fish community only revealed an expected downstream addition of fishes. Our calculated flow metrics showed inconsistencies in metrics related to variance, while those related to central tendency match predicted flows. Examination of these abrupt changes revealed over-prediction during a storm when hail was present. There were several other cases in the lower Canadian River where the model exhibited similar behavior of isolated over-prediction. As a result, flow-ecology relationships were limited to describing patterns with average flow values. The outcome of this work suggest modeling extreme high and low flows of the Great Plains is difficult and historic gage data would be most useful to establishing patterns between relevant extreme flows and fishes.

FUNDING
U.S. Department of the Interior, South-Central Climate Science Center

FACULTY INVESTIGATOR
Shannon K. Brewer

STUDENT INVESTIGATOR
Thomas Worthington, Postdoctoral Fellow

COMPLETED
December 2016

FRESHWATER MUSSEL FROM THE MUDDY BOGGY RIVER
(PHOTO: J. POWERS)

NICOLE FARLESS WITH A LONGNOSE GAR
(PHOTO: S. BREWER)
Standardized fish-sampling methods for Oklahoma streams

Fundamental challenges of establishing stream fish-environment relationships are variable detection and the multiscale structure of stream systems. We modeled tow-barge electrofishing detection among Ozark Highland stream fishes across environmental conditions. Seven reach-scale variables and segment-scale lithology were associated with variable electrofishing detection. We also improved the applicability of electrofishing for monitoring stream-dwelling Smallmouth Bass using a multinomial N-mixture model, where water clarity, depth, and wetted channel width explained variable detection. We compared snorkeling to tow-barge electrofishing to both examine differences in species detection and evaluate the efficacy of snorkeling for estimating warmwater stream-fish abundance. Electrofishing tended to detect rarer species more often than snorkeling. Snorkeling also typically underestimated abundance, particularly for cryptic species. Lastly, we examined Ozark Highland stream fish-environment relationships at multiple spatial scales. Variable stream-fish densities were associated with reach-scale temperature variation and segment-level geology. Variable stream-fish occurrence was associated with riffle-run-pool sequence area and reach-scale substrate size, temperature variation, and residual pool depth. Our project demonstrated the complexity of stream-fish detection across environmental conditions and highlighted the importance of multiscale approaches to advance stream-fish ecology and management.

FUNDING
Oklahoma Department of Wildlife Conservation

FACULTY INVESTIGATOR
Shannon K. Brewer

STUDENT INVESTIGATOR
Robert Mollenhauer, Ph.D. Candidate

COMPLETED
December 2016

Effects of USDA conservation programs on High Plains playa wetlands

This research assessed the influence of USDA conservation practices on playa wetland ecosystems in the High Plains. We evaluated ecosystem services for playa wetlands in three land treatment groups: cropland, lands enrolled in USDA conservation programs (e.g., CRP and WRP), and grassland. Results include the development of predictive functional condition indicator models that include multiple-scale factors that contribute to differences in ecosystem service estimates. The work helped develop models for a USGS Integrated Landscape Modeling effort.

FUNDING
U.S. Department of Agriculture, Natural Resources Conservation Service

FACULTY INVESTIGATORS
Loren Smith and Scott McMurry

STUDENT INVESTIGATOR
Bart Kensinger, Ph.D. Candidate

COMPLETED
December 2015

Improving sampling and monitoring of shovelnose sturgeon in the Great Plains

Isolated populations of Shovelnose Sturgeon in the Arkansas River and Red River basins of the southern Great Plains represent the southwest extent of the species current range. The distribution of Shovelnose Sturgeon in the Arkansas River basin was primarily related to mean annual discharge, but the Red River populations were related to the extent of available habitat and discharge. As expected by big river fishes, both populations were negatively correlated with elevation. We had very limited success capturing Shovelnose Sturgeon in the Arkansas River using gears and methods reported in reviewed studies. Thus, we developed a hybrid method using trammel nets, while flows were manipulated by water-management agencies. We captured 26 Shovelnose Sturgeon in five days using our hybrid method, the most successful method used. Results from this study will be used to provide insight into future study designs, and advise future study objectives.

FUNDING
Oklahoma Department of Wildlife Conservation

FACULTY INVESTIGATOR
Shannon K. Brewer

STUDENT INVESTIGATOR
Josh Johnston, M.S. Candidate

COMPLETED
December 2016
Synthesizing models useful for ecohydrology and ecohydraulic approaches: an emphasis on integrating models to address complex research questions

Ecohydrology combines empiricism, data analytics, and the integration of models to characterize linkages between ecological and hydrological processes. A challenge for practitioners is determining which models best generalize heterogeneity in hydrological behavior, including water fluxes across spatial and temporal scales, integrating environmental and socio-economic activities to determine best watershed management practices, and data requirements. We conducted a literature review and synthesis of hydrologic, hydraulic, water quality, and ecological models designed for solving interdisciplinary questions. We reviewed 1,275 papers and identified 178 models that have the capacity to answer an array of research questions. Of these models, 43 were commonly applied. Forty-one of 43 reviewed models were linked to at least one other model: WASP (linked to 21 other models), SWAT (19), and HEC-RAS (15). However, model integration was still relatively infrequent. Simply increasing the interoperability of model platforms, transformation of models to user-friendly forms, increasing user-support, defining the reliability and risk associated with model results, and increasing awareness of model applicability may promote increased use of models across sub-disciplines.

FUNDING
U.S. Geological Survey, South-Central Climate Science Center

FACULTY INVESTIGATOR
Shannon K. Brewer

STUDENT INVESTIGATOR
Tom Worthington, Post-Doctoral Fellow

COMPLETED
December 2016

Zooplankton composition and prey-use of juvenile fishes in constructed shallow-water habitats

The Missouri River has experienced significant anthropogenic alterations over the past 100 years, particularly loss of shallow-water habitat (SWH). In response, the U.S. Army Corps of Engineers created ~1,390 ha of SWH on the lower Missouri River from Sioux City, Iowa downstream to the confluence with the Mississippi River. The hypothesized benefits of created-SWH for native juvenile fish were apparent for alpha and gamma diversity, but not beta diversity, which was affected by longitudinal position in the riverscape. For the two most commonly captured species, Hiodon spp. and Freshwater Drum, prey use was not affected by habitat type. Juvenile Macrhybopsis spp. minnows, which are declining in abundance in the lower Missouri River, consumed mostly midge pupae, but variations in prey use were evident among the species.

FUNDING
U.S. Army Corps of Engineers

FACULTY INVESTIGATORS
James M. Long and Andrew R. Dzialowski

STUDENT INVESTIGATORS
William Mausbach, Ph.D. Candidate; Trevor Starks, M.S. Candidate

COMPLETED
December 2014

Evaluating the effects of shallow water habitat implementation on age-0 Scaphirhynchus sp. prey use and body condition

The Missouri River has been heavily modified for navigation. Of particular interest is the loss of shallow-water habitat (SWH) that is hypothesized to have negatively affected certain riverine species. In response, the U.S. Army Corps of Engineers created ~1,390 ha of SWH on the lower Missouri River. In conjunction with U.S. Army Corps of Engineers, we sampled age-0 sturgeon at 5 sites that varied in amounts of SWH to determine if prey use and lipid content varied accordingly. We also worked with U.S. Geological Survey biologists to determine the effects of starvation and satiation on lipid content. From 2 years of study, we found that interannual variation was a larger influence on prey use and body condition than amount of SWH. Flow variability was likely the main driving force, with higher lipid contents found during the year with higher mean discharge.

FUNDING
U.S. Army Corps of Engineers

FACULTY INVESTIGATORS
James M. Long and Andrew R. Dzialowski

STUDENT INVESTIGATORS
Anthony Civiello, M.S. Candidate; Alin González-Barnes, Temporary Technician

COMPLETED
December 2016
Effects of water quality and drought on fish community composition in an aging Great Plains reservoir

Sedimentation at Great Salt Plains Lake (GSPL) in northwestern Oklahoma has reduced water storage capacity to the point where the lake is not supporting aquatic recreation. Additionally, long-term drought and high turbidity have negatively affected the resident ichthyofauna. We sampled multiple habitats in the reservoir to document the current composition of the fish assemblage and compare to previous assessments when the reservoir was first impounded. The current composition of fishes at GSPL is dominated by two small-bodied fishes that are tolerant of salinity: Inland Silverside and Plains Killifish. Large-bodied fishes are largely absent, with the exception of Common Carp, which is in contrast to the community immediately after impoundment when Gizzard Shad, River Carpsucker, and Channel Catfish were very common.

FUNDING
Oklahoma Cooperative Fish and Wildlife Research Unit

FACULTY INVESTIGATOR
James M. Long

STUDENT INVESTIGATORS
Evan Cartabiano, M.S. Candidate; Tanner Hart, Field Technician

COMPLETED
December 2014

Identification of Neosho smallmouth bass (Micropterus dolomieu velox) stocks for reintroduction into Grand Lake, Oklahoma

There has long been interest in stocking non-native forms of Smallmouth Bass in eastern Oklahoma that tolerate reservoir conditions and grow larger than native forms. However, potential native stocks could be cultivated to increase abundance in reservoirs while avoiding issues with non-natives. As a result, we surveyed several tributaries in the Grand Lake and Lake Tenkiller regions of Oklahoma within the native range of Neosho Smallmouth Bass to assess genetic variation and potential brood stock sources for aquaculture. Genetic surveys identified three main stocks: one in the Illinois River basin and two in the Grand Lake watersheds. The Grand Lake stocks corresponded to large and small rivers and that large rivers (e.g., Elk River) supported a greater amount of genetic diversity.

FUNDING
Peoria Tribe of Indians of Oklahoma

FACULTY INVESTIGATORS
Shannon K. Brewer, James M. Long, Michael D. Tringali, Michael R. Schwemm

STUDENT INVESTIGATORS
Andrew Taylor, Ph.D. Candidate; Joel Bjornen and Colt Holley, Field Technicians

COMPLETED
August 2016

Aquatic Resources
Assessing the potential for rainbow trout reproduction in tributaries of the lower Mountain Fork River below Broken Bow Dam, southeastern Oklahoma

The tailwater trout fishery in the Mountain Fork of the Little River below Broken Bow Dam is one of only two year-round trout streams in Oklahoma; spawning migrations from stocked trout, particularly Rainbow Trout, could be adding to the diversity of tributary streams, at least seasonally. We sampled for fishes in 10 tributary streams of the designated trout area of the lower Mountain Fork below Broken Bow Lake, Oklahoma. Trout were found in four streams, but only those found in Bee Branch and an unnamed tributary near the spillway were small enough to indicate reproduction. These results document that stocked Rainbow Trout sometimes do migrate into these small tributaries, at least seasonally, and that reproduction can occur.

FUNDING
U.S. Forest Service

FACULTY INVESTIGATOR
James M. Long

STUDENT INVESTIGATORS
Trevor A. Starks and Tyler Farling, M.S. Candidates; Anthony Thornton, Taylor Baurichter, Jeff Johnson, Garrett Johnson, and Colt Holley, Field Technicians.

COMPLETED
September 2016

Factors affecting distribution of endangered fish and crayfish species in northeastern Oklahoma

The Oklahoma Comprehensive Wildlife Conservation Strategy indicates that small rivers (Spring and Illinois Rivers), gravel bottom streams (Spavinaw Creek), and large rivers (Grand-Neosho River) in the Ozark Region represent priority conservation landscapes. These habitats support a number of fish and crayfish species of concern. We are evaluating population biology and conservation status of state-listed fish and crayfish in the northeastern portion of Oklahoma through field surveys to assess distribution and habitat requirements. We are also evaluating current and historical distributions of the listed species using ecological niche modeling to identify landscape-level environmental factors shaping species distributions.

FUNDING
Oklahoma Department of Wildlife Conservation

FACULTY INVESTIGATOR
Michael Tobler

STUDENT INVESTIGATORS
Reid Morehouse, Ph.D. Candidate; Garrett Hopper, and Drew Miller, Field Technicians

COMPLETED
May 2014
Effects of surface-groundwater interactions on stream fishes under altered base-flow conditions

Altered thermal regimes affect stream fishes both directly and indirectly, influencing their distribution, growth, reproduction, and survival. Increasing temperatures and growing demand for freshwater highlight the need to predict stream fish responses to increasing stream temperatures under altered flow regimes. First, we determined CTMax for 10 stream fishes of the Ouachita Mountain ecoregion (20°C acclimation, 2°C per h heating rate). Critical thermal maxima ranged 34.0-38.3°C among species. Benthic fishes had the lowest CTMax, and the only surface-dwelling species tested had the highest CTMax. Next, whole-body cortisol concentrations of six stream fishes of the Ouachita Mountain ecoregion exhibited no significant differences in stress responses between treatment temperatures after prolonged exposure to elevated water temperatures. Results from our CTMax trials were used to predict thermal responses by stream fishes for 15 hypothetical release scenarios using a calibrated and validated WASP model. Results indicated the current release operation was insufficient to provide a suitable downstream thermal regime for most of the fishes tested. Increasing release magnitude and/or releasing from hypolimnetic layers could improve the downstream thermal habitat for these fishes.

FUNDING
Oklahoma Department of Wildlife Conservation

FACULTY INVESTIGATORS
Shannon K. Brewer and Garey A. Fox

STUDENT INVESTIGATORS
Yan Zhou, Ph.D. Candidate; Justin Alexander, M.S. Candidate

EXPECTED COMPLETION
May 2018

A general status assessment of blue suckers in Oklahoma rivers

Like many big-river obligate fishes in North America, Blue Suckers C. elongates are a species of conservation concern. In Oklahoma, Blue Suckers are vulnerable to extirpation; however, knowledge of Blue Suckers within the state is limited. The goal of this project is to develop a working knowledge of the Blue Sucker population in Oklahoma, and inform the State’s Wildlife Action Plan. Our objectives are: 1) determine the distribution and quantify potential spawning habitats, 2) estimate age and growth of several populations, and 3) estimate abundances using mark-recapture. Preliminary data suggest Blue Suckers move throughout the Red River between Denison Dam and the Arkansas border, and > 50 km upstream into major tributaries. Like Blue Suckers in other regions, we determined Blue Suckers often live > 20 years, and occupy habitats with swift current during the spring.

FUNDING
Oklahoma Department of Wildlife Conservation

FACULTY INVESTIGATORS
Shannon K. Brewer and Daniel E. Shoup

STUDENT INVESTIGATOR
Joseph Dyer, Ph.D. Candidate

EXPECTED COMPLETION
December 2018
Evaluating the effectiveness of stream restoration projects based in natural channel design concepts using process-based investigations

Many current stream rehabilitation projects use natural channel design concepts, which are often criticized. The alternative is a complex, process-based analysis of the dynamic system and impact of stream modifications on the hydraulics, sediment transport, and biological community. We are mentoring 21 undergraduate students from across the country over three summers (2015-2017) as part of this program. Students participate in research projects quantifying the role of vegetation on streambank erosion, documenting the influence of in-stream structures on retention in the stream, evaluating the effect of excess sediment on fish, using aquatic macroinvertebrates to assess streambank modifications, and examining interactions between groundwater and stream temperatures. Participants benefited from multi-disciplinary collaboration, research training, insight to graduate programs, and experienced mentoring.

**FUNDING**
National Science Foundation

**FACULTY INVESTIGATORS**
Shannon K. Brewer and Garey A. Fox

**EXPECTED COMPLETION**
August 2018

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Using environmental DNA (eDNA) to assess the presence of cavefish and crayfish populations in caves of the Ozark Highlands

Environmental DNA (eDNA) is a new tool that may help improve monitoring efforts for many organisms, especially those that occur in aquatic environments. Cavefish and cave crayfish are ecologically important organisms that occur in groundwater ecosystems and most are of conservation concern. Because of the habitat in which they reside, it is difficult to determine presence of populations with traditional visual surveys. Inability to adequately monitor cavefish and cave crayfish populations impedes conservation efforts. Our objective is to compare the use of eDNA to traditional visual surveys for monitoring cave fish and cave crayfish populations in the Ozark Highlands. We have completed visual surveys and eDNA collection at 1-5 survey locations at 42 caves, wells, and springs. We are currently extracting and amplifying DNA from the water samples to determine presence of cavefish and cave crayfish DNA.

**FUNDING**
U.S. Fish and Wildlife Service, Refuges

**FACULTY INVESTIGATORS**
Shannon K. Brewer and Ronald Van Den Bussche

**STUDENT INVESTIGATOR**
Josh Mouser, M.S. Candidate

**EXPECTED COMPLETION**
December 2018

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Assessing the spawning movement and habitat needs of riverine Neosho smallmouth bass

The spawning and early development periods of stream fish strongly influence population dynamics. Appropriate management efforts rely on quantifying the environmental conditions and habitats needed during these periods. Unfortunately, this information is incomplete for the Neosho Smallmouth Bass (NSMB), which occupies the southwest edge of the species’ native range. We are using radio telemetry and snorkel surveys to (1) Quantify movements and microhabitat use of adult NSMB during the spawning period, (2) Determine habitat factors at multiple spatial scales that relate to suitable spawning habitat, and (3) Quantify the survival of age-0 NSMB relative to hierarchical stream-habitat conditions. We have completed two years of tracking and snorkel surveys for both young of year and nesting fish. We have one more year of tracking to complete prior to analyses.

**FUNDING**
Oklahoma Department of Wildlife Conservation

**FACULTY INVESTIGATOR**
Shannon K. Brewer

**STUDENT INVESTIGATOR**
Andy Miller, Ph.D. Candidate

**EXPECTED COMPLETION**
December 2019
Incorporating an approach to aid river and reservoir fisheries in an altered landscape

The objective of our study was to determine the relationship between flow or water-level patterns on fish recruitment and growth of two pelagic fishes. We sampled fishes from two rivers and two reservoirs and related seasonal and annual hydrology variables to the recruitment and growth of each species. Freshwater Drum and Gizzard Shad reached maximum ages of 32 and 7 years in rivers, but 31 and 8 years in reservoirs. Both species grew larger in rivers. The annual number of river reversals and prespawn discharge explained 33% of the variation in riverine drum recruitment. Reservoir retention time was negatively related to recruitment of drum in reservoirs. Recruitment of riverine shad was positively related to high flow pulses. Growth of both species in reservoirs was positively related to the annual number of days that water levels were above conservation pool, and drum growth was also negatively related to summer minimum water levels. In general, pelagic reservoir fishes relied more on annual hydrology parameters, whereas riverine fishes benefited more from seasonal patterns. Results of this study provide important information on the influence of hydrology on pelagic fish production in both rivers and reservoirs.

FUNDING
U.S. Fish and Wildlife Service, Gulf Coast Prairie Landscape Conservation Cooperative

FACULTY INVESTIGATORS
Shannon K. Brewer and Daniel E. Shoup

STUDENT INVESTIGATOR
John Dattilo, M.S. Candidate

EXPECTED COMPLETION
December 2017

Evaluating changes in fish assemblages of the Red River via flow alteration

Understanding how alterations to flow regimes have affected biota drives contemporary research in stream ecology. However, underlying mechanisms responsible for changes in local fish assemblages remain poorly understood. There is also a high degree of uncertainty in long-term predictions of the distribution and abundance of fishes over coarse spatial scales. In the Red River basin, we will (1) Determine how flow regime alterations have changed functional diversity of fish assemblages, (2) Examine how flow metrics and species traits explain local fish assemblages, and (3) Develop flow-ecology groups using functional and ecological traits to provide a basis for comparison to other river basins. We will use a hierarchical Bayesian approach to examine species-environment and trait-environment relationships, where we will model flow-ecology relationships among stream fishes at the hydrologic response unit and ecoregion scale using a tiered model-selection procedure.

FUNDING
U.S. Geological Survey

FACULTY INVESTIGATOR
Shannon K. Brewer

STUDENT INVESTIGATOR
Robert Mollenhauer, Postdoctoral Fellow

EXPECTED COMPLETION
May 2019

Genetic integrity and population status of shoal bass in the upper Chattahoochee River, Georgia

The shoal bass is an endemic species of black bass native to the Apalachicola-Chattahoochee-Flint river system of Georgia, Alabama, and Florida. It is considered vulnerable to extinction because of competition and genetic hybridization with invasive species and habitat loss. Within the upper Chattahoochee River basin, shoal bass are isolated in Big Creek below Lake Lanier and in the Chestatee and Chattahoochee rivers above Lake Lanier. Quantifying local-scale population dynamics of Shoal Bass inhabiting three isolated tributaries of the upper Chattahoochee River basin revealed that these populations grew slower, lived longer, and experienced lower annual mortality than other studied populations, which may be adaptations to variable recruitment or lower over-winter survival of age-0 fish. The Big Creek population appears at risk of extirpation because of its isolated nature, low numbers of adults, and greater variation in recruitment.

FUNDING
U.S. National Park Service

FACULTY INVESTIGATOR
James M. Long

INVESTIGATOR
Andrew Taylor, Ph.D. Candidate

EXPECTED COMPLETION
December 2017
Determine the distribution of state-endangered longnose darter through niche model transferability

Longnose Darters are known from two river systems in Oklahoma, but believed to have been extirpated from the Poteau River system. Translocation efforts from Lee Creek into Blackfork Creek were made in 1991—92 with hopes of reestablishing a Poteau River system population, but whether this population currently persists is unknown. To investigate this, we set out to create environmental niche models of Longnose Darters at two scales: 1) river segment scale throughout the known range and 2) channel-unit scale within Lee Creek and project these models onto streams of the Poteau River basin. After mapping the habitat of the Poteau River system, the niche models will allow us to target future sampling events in areas of varying habitat suitability.

FUNDING
Oklahoma Department of Wildlife Conservation

FACULTY INVESTIGATORS
James M. Long and Monica Papeş

STUDENT INVESTIGATORS
Colt Holley, M.S. Candidate; Xiao Feng and Andrew Taylor, Ph.D. Candidates; Josh Hills, Field Technician.

EXPECTED COMPLETION
December 2018

Assessing wild juvenile trout ecology in the lower Mountain Fork

Many tailwaters in the southeastern United States have been stocked with Rainbow Trout, but few have reported natural reproduction. Past research has found juvenile trout in the main stem and tributaries of the lower Mountain Fork in southeastern Oklahoma, suggesting the potential for recruitment of wild fish. We are surveying for juvenile trout at 12 sites along 19 km of the designated trout portion of the lower Mountain Fork to estimate age, spawning date, and growth rates using otolith microstructure analysis. Results to date indicate few places where reproduction is successful and variable age and growth among successful sites. At two sites, wild juvenile Rainbow Trout were hatched between February 17 and April 11, growing between 0.25 mm/day and 0.44 mm/day. Future work will focus on prey use and availability to provide insight into mechanisms affecting among-site variation in trout growth.

FUNDING
Oklahoma Department of Wildlife Conservation

FACULTY INVESTIGATORS
James M. Long and Wyatt W. Hoback

STUDENT INVESTIGATORS
Tyler Farling, M.S. Candidate; Melissa Reed and Joel Bjornen, Field Technicians.

EXPECTED COMPLETION
June 2018

Assessment of invasion extent of Asian swamp eels in ponds and backwater marshes adjacent to the Chattahoochee River

Asian Swamp Eels in Georgia are known from 3 ponds and a backwater marsh of the Chattahoochee River, but it is unknown how widespread the eels have invaded. We are conducting intensive sampling with leaf litter traps for juveniles in an occupancy modeling framework to document the presence of the species. Our methods have documented that Asian Swamp Eels have expanded their range in the marshes of the river. Detection probability ranged from 0.20 to 0.37 depending on year and was influenced by trap depth and water temperature. Occupancy of a site was depending on proportion of vegetation and silt substrate, which we portrayed on a map to illustrate where this species could likely occur. Future work is investigating methods to control this invasive species.

FUNDING
U.S. National Park Service

FACULTY INVESTIGATOR
James M. Long

STUDENT INVESTIGATORS
Jeff Johnson, M.S. Candidate; Colt Holley, Matt Pallett, Courtney Anderson, Steven Nanez, Field Technicians.

EXPECTED COMPLETION
December 2018
Assessment of prey consumption and body condition of Missouri River age-0 *Scaphirhynchus* sturgeon

Loss of shallow-water habitat (SWH) in the Missouri River has been identified as one of the likely contributing factors in the decline of Pallid Sturgeon, and to a lesser extent, Shovelnose Sturgeon. A primary hypothesized benefit of SWH is that increased prey items are present and result in improved condition of young-of-year sturgeon. We are assessing prey use and lipid content of age-0 sturgeon from the lower Missouri River basin and comparing among sites and years. To date, we have found a strong longitudinal trend in prey use, with ephemeroptera more represented at sites farther upstream and diptera larvae dominating the stomach contents at lower sites. A positive linear trend between lipid content with gutted mass and a positive exponential trend for fish length exists for age-0 sturgeon but these trends vary in their explanatory ability depending on longitudinal position in the river. Whole body lipid content accumulated at faster rates at upstream sites than downstream sites.

FUNDING
U.S. Army Corp of Engineers

FACULTY INVESTIGATORS
James M Long, Andrew R. Dzialowski, Jason Belden

STAFF INVESTIGATOR
Alin González-Barnes, Senior Research Specialist

EXPECTED COMPLETION
December 2020

Accuracy of clupeid population data collected by hydroacoustics

Shad (*Dorosoma* spp.) are an important prey species that can effect growth and survival of sportfish. Therefore, it is important to accurately estimate shad densities to properly manage piscivore populations. Current methods for estimating shad abundance are time and labor intensive, imprecise, and may lack accuracy. Horizontal hydroacoustics may provide a more accurate and precise alternative to current shad sampling techniques. To test this, we created 22 known densities of shad in a 15-m x 15-m x 4.5-m deep enclosure made from 6-mm square mesh and imaged them with a Simrad EK-60 120 kHz echosounder oriented horizontally. Shad density estimates from hydroacoustic samples scaled accurately with known density and were more precise (6.8% coefficient of variation of the mean) than has been reported for other shad-sampling gear. Therefore, we recommend horizontal hydroacoustics for sampling shad.

FUNDING
Oklahoma Department of Wildlife Conservation

FACULTY INVESTIGATOR
Dan Shoup

STUDENT INVESTIGATOR
Garrett R. Johnson, M.S. Candidate

EXPECTED COMPLETION
June 2018

Quantifying seining detection probability for small-bodied fishes of Great Plains sand-bed rivers

Shifting sand-bed streams of the Great Plains represent a challenge to address stream fish detection error. We quantified seining detection probability for diminutive fishes across a range of sampling conditions in Great Plains rivers of Oklahoma. We observed a quadratic relationship between water depth and detection probability, which varied among species and was dependent on water clarity. Similarly, the direction of the relationship between water clarity and detection probability was species specific and dependent on water depth. The relationship between water temperature and detection probability was also species dependent. Our results support that differentiating between a true and false species absence can be obtained with 2-6 spatially-replicated seine hauls under average sampling conditions. However, detection probability was extremely low for the federally-threatened Arkansas River Shiner and >10 seine hauls per 200-m of stream would be needed to assess its presence.

FUNDING
U.S. Geological Survey, South-Central Climate Science Center

FACULTY INVESTIGATOR
Shannon K. Brewer

STUDENT INVESTIGATOR
Daniel Logue, M.S. Candidate

COMPLETED
December 2016
Influence of land use and the Conservation Reserve Program on native pollinator communities

This study determined how land use affects native invertebrate pollinator diversity in the Southern High Plains of Texas. The targeted land uses were playas and their associated uplands in cropland, Conservation Reserve Program, and native grasslands/rangeland. We collected pollinators using blue vane traps set out for ~24h in playas and uplands immediately surrounding wetlands. Pollinator diversity was measured and compared among land uses, and then between playas and uplands to determine playa contribution to pollination service. We also collected vegetation data every six weeks including vegetation species present, ground cover composition, plant height, and canopy gap. An additional component of the project determined the plant species on which pollinators were feeding. Through targeted hunting techniques, we captured pollinators feeding on flowers and documented these visits over the six-month field period.

FUNDING
U.S. Department of Agriculture, Farm Service Agency

FACULTY INVESTIGATORS
Loren Smith and Scott McMurry

STUDENT INVESTIGATOR
Angela Begosh, Ph.D. Candidate

COMPLETED
December 2016

Impact of fragmentation and habitat heterogeneity on lesser prairie-chickens

We assessed lesser prairie-chicken (LPC) movement and habitat selection in relation to anthropogenic features. We found that LPC selected CRP land cover and avoided cropland. CRP also facilitated LPC road crossings. We found no evidence that LPCs avoided power lines, residential areas, or oil or gas wells. However, movements that crossed powerlines or roads were longer than expected, indicating that LPCs minimized time spent under/crossing these features. The anthropogenic landscape, including human-created vegetation types (CRP and cropland) and anthropogenic features, was a primary driver of LPC habitat selection and movement patterns. Human policy and management decisions can greatly impact the anthropogenic landscape for this sensitive species, therefore conservation planning should account for the arrangement of vegetation and anthropogenic features on the landscape.

FUNDING
Oklahoma Department of Wildlife Conservation

FACULTY INVESTIGATORS
Dwayne Elmore, Sam Fuhlendorf, Craig Davis, and Mark Gregory

STUDENT INVESTIGATOR
Ashley Tanner, Ph.D. Candidate

COMPLETED
December 2015
Range expansion of black bears in eastern Oklahoma

Populations of black bears are expanding in eastern Oklahoma. To better understand this process, we captured and marked 47 black bears (14 females, 33 males) in Sequoyah, Cherokee, and Adair counties in east-central Oklahoma. We also conducted hair snare surveys to develop a genetics based population estimate. The population estimate was 69.7 ± 13.2 based on capture-recapture and 100.9 bears ± 23.5 (95% CI) based on genetics. Fecundity in this population was 0.36 female cubs/adult female/year. From population parameters measured in this study and data from neighboring Arkansas, projection matrices indicated growth rate ($\lambda$) of 0.98. The heavily male-biased sex ratio and young age structure indicates east-central Oklahoma is the expansion front of this black bear population. Based on reproduction alone, this population is not yet self-sustaining.

FUNDING
Oklahoma Department of Wildlife Conservation

FACULTY INVESTIGATORS
Sue Fairbanks and David M. Leslie, Jr.

STUDENT INVESTIGATORS
Sara Lyda, Senior Research Specialist; Emily Artz, M.S. Candidate; Connie Teschner, Field Technician

COMPLETED
June 2016

Arthropod availability and bobwhite quail nesting success

Bobwhite quail feed on arthropods in early spring, and chicks rely almost exclusively on insects and other invertebrates until at least 4 weeks of age. Hens may use available arthropod prey in assessing potential nesting sites because it is critical to survival of chicks in their first weeks of life. Vegetation and landscape structure may also relate to preferred arthropod abundance as a determinate of brood habitat quality. Spring and summer arthropod sampling was coordinated with habitat manipulation and radio telemetry studies. Up to 14 species of ants and 43 species of grasshoppers have been documented and their abundances were associated with differences in vegetation gradients in study areas.

FUNDING
Oklahoma Department of Wildlife Conservation

FACULTY INVESTIGATORS
Carmen Greenwood and David M. Leslie, Jr.

STUDENT INVESTIGATORS
Valerie O'Brien, Postdoctoral Fellow; Alli Giguere, Kenneth Masloski, and Shane Foye, M.S. Candidates; John Baggerly, Colby Gregg, Cassie Hamilton, and Ariel Richter, Field Technicians

COMPLETED
July 2015

Effects of Fragmentation on small mammal communities in the Lower Rio Grande Valley, Texas

The Lower Rio Grande Valley National Wildlife Refuge includes >147 tracts, many in the Rio Grande’s threatened riparian corridor. We determined responses of small mammals to habitat fragmentation, measured connectivity among small mammal use of the native-agricultural matrix surrounding refuge tracts, and used landscape genetics to determine the potential for long-term persistence of small mammal species in tracts of varying size and quality. Small mammals were sampled over 4 seasons on 15 tracts of varying size and extant riparian vegetation for 8,250 trap-nights with an overall 62% trapping success. The small mammal community was dominated by white-footed mice, but also included Coues’ rice rat, a species considered threatened in Texas. Urbanization affected gene flow of white-footed mice, whereas no gene-flow effect was found in agricultural areas.

FUNDING
U.S. Fish and Wildlife Service, Oklahoma Cooperative Fish and Wildlife Research Unit

FACULTY INVESTIGATORS
David M. Leslie, Jr., Monica Pape, Timothy J. O’Connell, and Ron A. Van Den Bussche

STUDENT INVESTIGATOR
Richard Dolman, Ph.D. Candidate

COMPLETED
July 2015
Range-wide lesser prairie-chicken spatial targeting tool

This project assisted with finalizing the cooperative 5-state Lesser Prairie Chicken (LPC) Spatial Model and Western Governors’ Association Crucial Habitat Assessment Tools (CHAT) Project. We helped to expand the first version of the Southern Great Plains (SGP) CHAT and create a more robust spatial planning tool (SPT) for directing conservation for the lesser prairie-chicken. This tool was a critical component for agency planning, because it was important that agencies providing conservation for lesser prairie-chicken worked from the same source data for maximum benefit to the species and its habitat. The 5-state wildlife conservation agencies in the lesser prairie-chicken’s distribution (Colorado, New Mexico, Kansas, Oklahoma, and Texas), the Natural Resources Conservation Service, and the U.S. Fish and Wildlife Service adopted the first version of the SGP-CHAT as their primary planning tool for LPC conservation.

FUNDING
Oklahoma Department of Wildlife Conservation

FACULTY INVESTIGATOR
David M. Leslie, Jr.

STUDENT INVESTIGATORS
Brian Cunningham and Cara Caricato-Michalke, Senior Research Specialists

COMPLETED
May 2014

Conservation status of the Lower Rio Grande Valley, Texas

Twenty-six years ago, Jahrsdoerfer and Leslie synthesized existing data and literature for the Lower Rio Grande Valley (LRGV) of extreme southern Texas, providing natural-history descriptions of plant and animal communities with a focus on human impacts and management options. The U.S. Fish and Wildlife Service maintains 3 national wildlife refuges in the LRGV, and conservation of critical habitats and species has been an ongoing challenge in the past 26 years relative to the greatly expanded human population and resulting urbanization, homeland security, escalating land prices, etc. Nearly 500 peer-reviewed publications, published since 1988, with specific focus on some aspect of the ecology, management, and conservation of the LRGV were synthesized in an updated report with scientific and managerial insights gained in the past 26 years to enhance understanding and highlight conservation needs of the LRGV.

FUNDING
U.S. Fish and Wildlife Service

FACULTY INVESTIGATOR
David M. Leslie, Jr.

COMPLETED
December 2016

Biases of collision mortality data from wind energy development on U.S. wildlife

Hundreds of thousands of bats die annually by colliding with U.S. wind turbines, yet little is known about factors causing variation in mortality. We conducted a quantitative synthesis of 218 studies at 100 wind facilities. This data set, the largest compiled for bats to date, indicates that collision mortality is greatest for migratory tree-roosting species (Hoary Bat, Eastern Red Bat, Silver-haired Bat) and from July to October. Based on studies meeting inclusion criteria and analyzed under a common statistical framework, we found an inverse relationship between bat mortality and grassland cover surrounding wind facilities. Grassland cover is associated with reduced activity and abundance of tree-roosting bats, which may also reduce turbine collisions. Further representative sampling of wind energy facilities is required to validate this pattern. Ecologically informed placement of wind facilities involves not only consideration regarding bat mortality, but also factors associated with bird mortality and indirect ecosystem impacts.

FUNDING
U.S. Geological Survey

FACULTY INVESTIGATOR
Scott Loss

STUDENT INVESTIGATOR
Maureen Thompson, M.S. Candidate

COMPLETED
December 2015
**Influence of spatial distribution of predators on northern bobwhite quail**

Northern bobwhite quail are susceptible to predation from multiple avian and mammalian predators. In addition to direct losses, the recurring presence of predators in certain areas might cause quail to avoid those areas, rendering otherwise suitable habitat to be unsuitable. We modeled the annual spatial distribution of carnivores and raptors to create overlays that can be compared with the spatial distribution of quail from companion research. Results suggested that high-use areas of mammalian predators might be avoided by nesting quail, but raptors overlap more broadly with quail occurrence, especially in winter. Numerous conference presentations were delivered, one student investigator successfully defended a thesis, and all field work was completed during the reporting period.

**FUNDING**  
Oklahoma Department of Wildlife Conservation

**FACULTY INVESTIGATORS**  
Timothy J. O’Connell and David M. Leslie, Jr.

**STUDENT INVESTIGATORS**  
Fidelis Atuo, Ph.D. Candidate; Jonathan Harris, M.S. Candidate; Case Wyatt, Nathan Hillis, Alicia Maple, and Jodie Crose, Field Technicians

**COMPLETED**  
July 2017

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**Wildlife exposure to aflatoxins in supplemental feed**

Wildlife can be exposed to aflatoxins in contaminated grain during supplemental feeding. Greenhouse trials were conducted in 2013 to compare the environmental factors that contribute to aflatoxin formation. Results suggested that aflatoxins in wildlife feed can be reduced by selecting milo instead of corn, broadcasting grain instead of distributing in piles, and limiting the length of time that grain persists before ingestion. Feeding should be avoided during wet conditions when daily temperatures exceed 18°C. Those involved in wildlife feeding/baiting are urged to weigh the possible benefits with the known risks that supplemental feeding may pose to wildlife species. An Extension Fact Sheet was developed, providing guidelines to landowners for supplemental wildlife feeding.

**FUNDING**  
Oklahoma Department of Wildlife Conservation

**FACULTY INVESTIGATORS**  
Timothy J. O’Connell, Dwayne Elmore, and Jason Belden

**STUDENT INVESTIGATOR**  
Leah Dale, M.S. Candidate

**COMPLETED**  
June 2014

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**Western fence lizards as a reptile model to assess ingestion of depleted uranium**

We conducted a collaborative research project with the U.S. Army Engineering Research and Development Center. Many wildlife species, including reptiles, may be exposed to compounds found on military bases, including depleted uranium (DU). Reptiles have been largely neglected in ecological risk assessment analyses primarily due to the lack of a laboratory reptile model. The western fence lizard was evaluated as a possible reptile model for estimating the potential for trophic transfer of DU from terrestrial invertebrates to terrestrial vertebrates. Understanding how DU travels through the food web and where burdens are likely to be found within the subject’s body is ultimately critical for assessing environmental risks. Mealworms were exposed to DU contaminated food, allowed to bioaccumulate, and fed to the fence lizard via forced ingestion.

**FUNDING**  
U.S. Army Corps of Engineers

**FACULTY INVESTIGATOR**  
Larry Talent

**STUDENT INVESTIGATORS**  
Anissa Delecki, Ph.D. Candidate; Scott Talent, Lab Technician

**COMPLETED**  
September 2014
Bobwhite quail population and habitat studies

Northern bobwhite populations have declined considerably throughout most of their distribution over the last 40-50 years. Within Oklahoma, the bobwhite is an economically important game bird that contributes to local economies. Loss and degradation of habitat has played a significant role in the decline of bobwhite populations not only in Oklahoma, but also throughout their distribution. In this 6-year study, we found that northern bobwhite respond to extreme temperature during the breeding season by seeking thermal refugia; landscape heterogeneity promotes thermally favorable thermal environments for nesting and brooding; and northern bobwhite space was minimally influenced in the near-term by time-since-fire, although long-term effects of fire help maintain habitat. Development of artificial water sources appeared to act primarily as an attractant for quail. Northern bobwhite response to anthropogenic features (e.g., oil well development, roads) was minimal in terms of influencing movement patterns and habitat selection as well as harvest rates.

FUNDING
Oklahoma Department of Wildlife Conservation

FACULTY INVESTIGATORS
Craig Davis, Dwayne Elmore, Sam Fuhlendorf, and David M. Leslie, Jr.

STUDENT INVESTIGATORS
Eric Thacker, Postdoctoral Fellow; Kent Andersson, Senior Research Specialist; Evan Tanner and Matt Carroll, Ph.D. Candidates; Jeremy Orange, Rachel Beytke, and Cameron Duquette, M.S. Candidates

EXPECTED COMPLETION
July 2017

Thermal ecology and impacts of fragmentation and prescribed fire of Rio Grande wild turkey in Oklahoma.

We assessed movement and space use of 25 female Rio Grande wild turkeys during June-August, 2016 using GPS transmitters on which recorded locations every 2 hours from 0800-2000 daily. We also measured temperatures for turkey locations and random locations. We found that during peak heating (1200-1600 hours), locations where turkeys loaf (1400 hour turkey locations) were up to 6°C cooler than the locations at which turkeys feed (0800 hour turkey locations). Additionally, turkeys moved an average of 90m less between successive locations during the hours of peak heating (1200-1600 hours) on days >30°C than on days where temperature remained <30°C. These findings suggest that turkeys may be using the thermal variation across the landscape to help mitigate thermal extremes during the hours of peak heating and are modifying behavior to minimize exposure to high heat.

FUNDING
Oklahoma Department of Wildlife Conservation

FACULTY INVESTIGATORS
Dwayne Elmore, Craig Davis, and Sam Fuhlendorf

STUDENT INVESTIGATOR
Allison Rakowski, M.S. Candidate

EXPECTED COMPLETION
June 2018
Investigation of shinnery oak propagation and establishment as a framework for restoration.

Shinnery oak contributes to an ecologically unique biotic community in the Southern Great Plains, yet little research exists related to its management and restoration. We are 1) examining environmental constraints on germination and transplanting, 2) assessing environmental parameters that influence seedling survival, 3) identifying target areas for restoration, and 4) conducting surveys to examine the influence of vegetation structure on density of Bell’s vireo and Cassin’s sparrow in a shinnery oak community. Ultimately, we will address key factors that may currently be limiting the ability of land managers to restore and maintain shinnery oak on the landscape in order to benefit wildlife species of conservation concern. Preliminary results indicate that acorns have higher germination rates than rhizome sprouting rates, cold stratification increases acorn germination, and shading decreases seedling survival.

FUNDING
Oklahoma Department of Wildlife Conservation

FACULTY INVESTIGATORS
Dwayne Elmore, Craig Davis, and Sam Fuhlendorf

STUDENT INVESTIGATOR
Matt Carroll, Postdoctoral Fellow

EXPECTED COMPLETION
December 2018

Reassessing black bear status in southeastern Oklahoma

Black bears have been hunted in southeastern Oklahoma since 2009, following extensive research demonstrating an expanding, harvestable population. To investigate impacts of the hunting season, we captured and marked 122 individual bears (65 females, 57 males) and estimated population level parameters. From winter dens surveys, fecundity was estimated at 0.58 ± 0.11 female cubs/adult female/year. The population estimate for the core area was 175.0 ± 79.2 bears (95% CI). Expanded efforts to include all 4 counties in which black bear hunting occurs will ultimately provide a population estimate for this expanding population. Using population parameters from this study, the estimated asymptotic growth rate (\( \lambda \)) was 1.06. Some evidence suggested prescribed fire affected habitat selection at the landscape level, but was more equivocal at the home range level.

FUNDING
Oklahoma Department of Wildlife Conservation

FACULTY INVESTIGATORS
Sue Fairbanks and David M. Leslie, Jr.

STUDENT INVESTIGATORS
Sara Lyda, Senior Research Specialist; Dani Techentin, Ph.D. Candidate; Morgan Pfander, Erica Perez, and Elliot Lustig, M.S. Candidates

EXPECTED COMPLETION
June 2018
Ecological Assessment of Ozark watersheds using breeding birds

This project aims to increase our understanding of riparian forest and watershed condition that supports a suite of priority, riparian-associated songbirds in the Oklahoma portion of the Ozark Mountains ecoregion. Focusing on first- and second-order streams, we aim to refine information on the distribution and abundance of songbirds in Ozark forests, using a combination of broad land cover and fine-scale vegetation cover and composition in small watersheds. During the reporting period, we established the field sampling protocol and completed year 1 surveys. We surveyed 150 points along 30 stream reaches Adair, Delaware, and Cherokee counties. We documented at least 60 species of breeding birds in rich forests where we found at least 48 species of canopy trees. Preliminary analysis suggested that distribution of riparian-associated songbirds was determined largely by fine scale horizontal cover.

FUNDING
Oklahoma Department of Wildlife Conservation

FACULTY INVESTIGATOR
Tim O’Connell

STUDENT INVESTIGATORS
Samantha Cady, M.S. Candidate; Katie Schwartz, Kasey Goins, and Alex James, Field Technicians

EXPECTED COMPLETION
June 2018

Monitoring for priority grassland birds in the Oklahoma Oaks and Prairies

With partners from the Oaks and Prairies Joint Venture, we began in 2014 a monitoring program for priority grassland birds across 10 Oklahoma counties supporting cross timbers and tallgrass prairie land cover. As part of an intended 10-year effort, we conducted roadside point counts for breeding birds using an established method to account for differences in detectability among species and observers. We paired survey locations, modeled after the North American Breeding Bird Survey, with land cover data to analyze habitat use and selection for multiple species, including northern bobwhite quail. The objective is to provide data at fine and regional scales to reveal benefits from and suggest modifications to habitat protection incentive programs on private lands.

FUNDING
American Bird Conservancy, Oaks and Prairies Joint Venture

FACULTY INVESTIGATOR
Timothy J. O’Connell

STUDENT INVESTIGATORS
Nicolas Jaffe, M.S. Candidate; Kelly Boyer, Abbey Ramirez, Callan Pope, Zoe Cooper, Jonathan Harris, and Katie Schwartz, Field Technicians

EXPECTED COMPLETION
December 2024
Awards And Honors

Fidelis Atuo (Ph.D. student; advisor, O’Connell) received the Robert L. Lochmiller II Endowed Scholarship in Wildlife Ecology, Oklahoma State University (2014), travel award to attend the joint annual meeting of the Wilson Ornithological Society and Association of Field Ornithologists (2014), Williams Distinguished Graduate Student Fellowship, Oklahoma State University (2016), Best Poster Presentation Award, Fall 2016 Technical Meeting of the Oklahoma Ornithological Society (2016), and a travel award to attend the 6th North American Ornithological Conference (2016).


Matt Carroll (Ph.D. student; advisor, Davis), Craig Davis, Sam Fuhlendorf, and Dwayne Elmore (Unit Cooperating Faculty) received the Outstanding Peer-Reviewed Publication Award from the Oklahoma Chapter of The Wildlife Society (2016).

Anthony Civiello (M.S. student; advisor, Long) received the Robert A. Klumb Student Travel Grant from the Missouri River Natural Resources Committee (2015).

Leah Dale (M.S. student; advisor, O’Connell) was a semifinalist at the 3-minute thesis competition, College of Agricultural Science and Natural Resources, Oklahoma State University (2014).

Craig Davis (Unit Cooperating Faculty) received the Texas Tech University, Department of Natural Resource Management, Outstanding Alumnus Award (2016).

Joseph Dyer (Ph.D. student; advisor, Brewer) received Bridge to Doctorate Fellowship, National Science Foundation (2014), Jimmie Pigg Travel Scholarship, Oklahoma Chapter of the American Fisheries Society (2014), Best Student Presentation, Oklahoma Chapter of the American Fisheries Society (2014), and the Murray-Gray Unit Service Award, Oklahoma Cooperative Fish and Wildlife Research Unit (2015).

Jonathan Harris (M.S. student; advisor, O’Connell) received a travel award to attend the Joint Annual Meeting of the American Ornithologists’ Union, Cooper Ornithological Society, and Society of Canadian Ornithologists (2014).

Richard Hatcher (ODWC Director [retired]) received the Murray-Gray Unit Service Award, Oklahoma Cooperative Fish and Wildlife Research Unit (2016).

Chip Leslie (Unit Scientist [retired]) received a performance award from U.S. Geological Survey (2014, 2015).


Kenneth Maslowski (Ph.D. student; advisor, Greenwood) received a 3rd place oral presentation award from the Entomological Society of America, Southwest Branch meeting (2014).

Cheryl McKnight (Unit Senior Administrative Support Specialist) received the Murray-Gray Unit Service Award, Oklahoma Cooperative Fish and Wildlife Research Unit (2016).

Bob Mollenhauer (Ph.D. student; advisor, Brewer) received Outstanding Oral Presentation, Awarded by the Oklahoma Water Science Center (2015), Williams Distinguished Graduate Student Fellowship, Oklahoma State University (2015), Skinner Memorial Travel Award, American Fisheries Society (2016), Best Student Presentation, Oklahoma Chapter of the American Fisheries Society (2016), and Outstanding Graduate Student in Fisheries Scholarship, Oklahoma State University (2016).

Trevor Starks (M.S. student; advisor, Long) received the Jimmie Pigg Memorial Outstanding Student Achievement Award from the Southern Division American Fisheries Society Warmwater Streams Committee (2016), the Outstanding Graduate Student in Fisheries, Oklahoma State University, NREM Department (2015), the Otto S. Cox Graduate Fellowship for Genetics Research, Oklahoma State University (2014), the Jimmie Pigg Travel Scholarship, Oklahoma Chapter of the American Fisheries Society (2014), and the Don L. Brumbaugh Scholarship, Sonotronics Inc. (2014).

Theses and Dissertations

Emily Artz. 2016. Genetic mark-recapture abundance estimate and dietary preferences in a recently re-established American black bear population. Master’s Thesis. Oklahoma State University, Stillwater. (Advisor, Fairbanks)

Matt Carroll. 2015. Connecting environmental factors with northern bobwhite quail (Colinus virginianus) movement and habitat use patterns under a fire and grazing management regime in a semiarid region. Doctoral Dissertation. Oklahoma State University, Stillwater. (Advisor, Davis)


Joseph J. Dyer. 2014. The impact of flow alterations to crayfishes in southeastern Oklahoma, with an emphasis on the mena crayfish (Orconectes mena). Master’s Thesis, Oklahoma State University, Stillwater. (Advisor, Brewer)

Nicole Farless. 2015. The influence of flow alteration on instream habitat and fish assemblages. Master’s Thesis. Oklahoma State University, Stillwater. (Advisor, Brewer)


Reid Morehouse. 2014. Species distributions and trait-environment correlations: Implications for the evolutionary ecology of crayfish (Decapoda: Cambaridae). Doctoral Dissertation, Oklahoma State University, Stillwater. (Advisor, Tobler)

W. Chris Musselman. 2014. The importance of maintaining shallow-water habitats for the movement and survival of stream fishes. Master’s Thesis. Oklahoma State University, Stillwater. (Advisor, Brewer)

Jeremy Orange. 2015. Northern bobwhite (Colinus virginianus) and scaled quail (Callipepla squamata) chick survival and alternative reproductive strategies in western Oklahoma. Master’s Thesis. Oklahoma State University, Stillwater. (Advisor, Davis)


Trevor Starks. 2015. Larval fish ecology in restored habitats in the lower Missouri River. Master’s Thesis. Oklahoma State University, Stillwater. (Advisor, Long)

Christopher D. Tanner. 2014. The effects of water quantity on water quality and fish community composition in the upper Cimarron River, Oklahoma. Master’s Thesis. Oklahoma State University, Stillwater. (Advisor, Long)


Artz, E., S. Lyda, and W.S. Fairbanks. 2016. An overview of genetic mark-recapture population estimates in the southern Ozark region by the USGS, Oklahoma Natural Resources Conference, Oklahoma City, OK.


Atuo, F. and T. O’Connell. 2014. Predator abundance and community composition at two quail recovery sites: potential predation risk for Northern Bobwhite. Joint annual meeting of the Wilson Ornithology and Association of Field Ornithologists, Newport, RI.


Atuo, F. and T. O’Connell. 2015. A robust approach to estimating spatially explicit resource selection by a gregarious raptor in a mixed-grass prairie landscape. Annual Technical Meeting of the Oklahoma Ornithological Society, Durant, OK.


Atuo, F. and T. O’Connell. 2016. Potential influence of raptor density on quail in two western Oklahoma landscapes. Oklahoma Natural Resources Conference, Oklahoma City, OK.


Atuo, F. and T. O’Connell. 2016. The influence of landscape heterogeneity on raptor community assemblages and niche characteristics in mixed-grass prairie ecosystems. 50th Anniversary Raptor Research Foundation Annual Conference, Cape May, NJ.


Brewer, S.K. 2014. Aquatic challenges, issues and options for bridging the conservation and management of stream and reservoir fisheries. Gulf Coast Prairie Steering Committee Meeting, Arcadia, OK.


Begosh, A., T.A. Worthington, R. Mollenhauer, D.R. Stewart, and P. Kemp. 2014. Synthesizing ecohdrology models as a management tool for landscape conservation under climate change. 23rd Annual Oklahoma Clean Lakes and Watersheds Association, Stillwater, OK.


Farless, N. and S.K. Brewer. 2014. Critical thermal maximum of fishes occupying spring-fed systems. 23rd Annual Oklahoma Clean Lakes and Watersheds Association, Stillwater, OK.

Farless, N. and S.K. Brewer. 2014. Temperature tolerances of fishes from spring-fed and non spring-fed streams. 25th Research Symposium, Oklahoma State University, Stillwater, OK.

Farless, N. and S.K. Brewer. 2014. Temperature tolerances of fishes from spring-fed and non spring-fed streams. 3rd Annual Student Water Conference, Stillwater, OK.


Farless, N. and S.K. Brewer. 2015. Comparing long-term temperature tolerance study with critical thermal maximum for fishes. Student Water Conference, Oklahoma State University, Stillwater, OK.


Harris, J. and T. O’Connell. 2014. Spatial overlap of Northern Bobwhite with potential nest predators. Joint annual meeting of the American Ornithologist’s Union, the Cooper Ornithological Society, and the Society of Canadian Ornithologists, Estes Park, CO.
Harris, J. and T. O’Connell. 2014. Habitat use of ground-based predators: understanding risk for nesting quail. Annual meeting of the American Society of Mammalogists, Oklahoma City, OK.


Harris, J. and T. O’Connell. 2014. Habitat use of ground-based predators: understanding risk for nesting quail. Joint Annual Meeting of the Oklahoma Chapter of The Wildlife Society and the Oklahoma Section of the Society for Range Management, Edmond, OK.

Hill, J., R. Mollenhauer, and S.K. Brewer. 2016. Synthesizing our current understanding about the effectiveness of gear types for sampling fish populations. Oklahoma Natural Resources Conference, Oklahoma City, OK.


Jaffe, N., T. O’Connell, and M. Papes. 2016. Impact of climate extremes on bird populations. OSU Research Week Graduate Student Symposium, Stillwater, OK.


Johnson, G.R. and D.E. Shoup. 2016. Hydroacoustic sampling in shallow reservoirs. 27th Annual Research Week Symposium, Oklahoma State University, Stillwater, OK.


Miller, A. and S.K. Brewer. 2016. Interactive effects of hydrology and channel characteristics on densities of age-0 Smallmouth Bass in the Ozark Highlands. Oklahoma Natural Resources Conference, Oklahoma City, OK.


Mollenhauer, R. and S.K. Brewer. 2016. Linking fish species through common traits to optimize stream-monitoring protocols. 25th Research Symposium, Oklahoma State University, Stillwater, OK.


Mollenhauer, B. and S.K. Brewer. 2016. Linking fish species through common traits to optimize stream-monitoring protocols. 3rd Annual Student Water Conference, Stillwater, OK.

Mollenhauer, R. and S.K. Brewer. 2014. All-star stream fish: uncovering the qualities of successful competitors. Natural Resources Ecology and Management Newsletters, Oklahoma State University, Stillwater, OK.


Mollenhauer, R. and S.K. Brewer. 2015. Using capture-efficiency models to standardize stream-fish monitoring across an ecoregion. Student Water Conference, Oklahoma State University, Stillwater, OK.


Mollenhauer, R., A. Miller, and S.K. Brewer. 2016. One fish, two fish, what a lot of fish there are: comparison of Smallmouth Bass abundance estimates in wadable streams using multiple sampling methods. Oklahoma Natural Resources Conference, Oklahoma City, OK.


O’Connell, T., J. Harris, and F. Atuo. 2016. What we think we’ve learned about predators and quail. Oklahoma Natural Resources Conference, Oklahoma City, OK.


Tchentchin, D. and W.S. Fairbanks. 2015. A maximum entropy approach to predict black bear seasonal habitat use. Oklahoma Natural Resources Conference, Tulsa, OK.
Chip Leslie Retirement

December 2016, Chip retired from federal service, which included 31 years to the Oklahoma Unit. Chip came to the OK Unit in 1985 as an Assistant Unit Leader and became Unit Leader in 1989. Chip, along with his faculty cooperators and graduate students, worked on a variety of wildlife species and topics such as white-tailed deer; elk; endangered interior least terns and Ozark big-eared bats; black bears; bobwhite quail; effects of herbicides and fire on small mammals, mesocarnivores, and birds. Interestingly, Chip bookended his career at the OK Unit on borderland conservation concerns in the Lower Rio Grande Valley of south Texas.

Throughout his professional career, Chip contributed over 300 publications to scientific outlets and continues to do so in post-retirement.

The graduate students and mentees Chip had the privilege to work with are considered his greatest professional contribution. Chip directly advised 9 PhD students, 28 MS students, and 1 Honor’s student, although he was also involved in nearly 100 other graduate student committees.

Chip’s students have gone on to hone the wildlife profession in positions as Dean, Distinguished Professor, Full Professors, USGS Coop Unit Assistant Unit Leader, USFWS refuge managers, FWS Wildlife Biologists, NPS Biologist/Supervisor, USFS Research-grade Biologist, State Biologists/Supervisors, private consultants, and even a private equity investor!

Chip had a tremendous impact to science, Oklahoma, and the Coop Unit. For his meritorious service to the American Society of Mammalogists (ASM), including time as Journal Editor of the Journal of Mammalogy and Chair of the Publications Committee, Chip was awarded the Hartley H. T. Jackson Award. With the Oklahoma Chapter of the Wildlife Society, Chip served as President and was the recipient of the Oklahoma Award, which is the chapter’s most prestigious award.


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69 YEARS
OF SERVICE

Oklahoma Cooperative
Wildlife Research Unit
(est. 1948)

UNIT LEADERS
Walter P. Taylor, 1948–51
Adolph M. Stebler, 1951–67
John A. Morrison, 1967–75
Paul A. Vohs, Jr., 1976–79
Frank Schitoskey, Jr., 1980–83
O. Eugene Maughan, 1983–84
(acting)

ASSISTANT UNIT LEADERS
Fred Baumgartner, 1948–65
George A. Moore, 1953–65
Robert I. Smith, 1965–67
James C. Lewis, 1967–77
John A. Bissonette, 1977–81

Oklahoma Cooperative
Fishery Research Unit
(est. 1965)

UNIT LEADERS
Bradford E. Brown, 1965–66
(acting)
Robert C. Summerfelt, 1966–76
O. Eugene Maughan, 1977–84

ASSISTANT UNIT LEADERS
Bradford E. Brown, 1966–70
Austin K. Andrews, 1970–75
Michael D. Clady, 1976–81

Oklahoma Cooperative
Fish and Wildlife
Research Unit
(combined 1984)

UNIT LEADERS
O. Eugene Maughan, 1984–87
Phillip J. Zwank, 1987–89

ASSISTANT UNIT LEADERS
David M. Leslie, Jr., 1985–89
Alexander V. Zale, 1985–93
William L. Fisher, 1991–08
Dana L. Winkelman, 1998–03
James M. Long, 2009–present
Shannon K. Brewer, 2010–present