Project Title: Use of Historical and Current Collections to Assess the Distribution and Status of Fishes in the Ouachita, Strawberry and White River Drainages.

Project Summary: Arkansas ranks fifth in the nation in fish biodiversity, yet the current status of many of our Species of Greatest Conservation Need (SGCN) is often unknown or incomplete. In addition, the distribution of SGCN species is concentrated in a small number of identified river basins including the Ouachita, Little River, Strawberry River and middle White River basins. This project will examine fish assemblages, concentrating on SGCN species, in three of the four priority basins: Ouachita, Strawberry and middle White. We will take a unique approach enabling us to compare our data to historical data collected 35-45 years ago, and examine potential correlations with changes in land use/land cover over time in the watersheds. Historical fish surveys conducted by Arkansas State University and University of Louisiana at Monroe (formerly Northeast Louisiana University) will be repeated, using similar techniques, revitalizing these data sets and unlocking the information they hold about potential change and status of Arkansas stream fish assemblages. Additional sites in the basins will be added to target SGCN species based on occurrence data from state and federal agencies. This project will provide critical conservation data not only to Arkansas Game and Fish Commission and Arkansas Natural Heritage Commission, but will provide data to allow the U.S. Fish and Wildlife Service to respond to the recent mega-petition. We will determine the status and long-term abundance trends of SGCN species and help prioritize watersheds or stream reaches for conservation and restoration.

Project Leaders:

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Budget Summary:
Total Project Cost: $ 131,538 (Year 1 - $65,419; Year 2 - $66,119)
   Total Requested from SWG: $85,844 (Year 1 - $42,537; Year 2 - $43,307)
   Matching Funds from UCA: $45,694

Project Statement

Need – The proposed project addresses multiple needs identified by the SWG Fish Taxa team during Fall 2014 including determining current distribution and status of aquatic biota in the Ouachita River and middle White River and assessing distribution and abundance of SGCN species within these watersheds. These two watersheds hold the highest abundance of species of SGCN and are in critical need of evaluation using both historical data and a repeatable method (Figure 1). In addition, no studies have addressed changes in the assemblages over time in relation to land use data. Aquatic ecosystems are both directly and indirectly influenced by their surrounding land use. Increases in agricultural and urban land use and loss of forested riparian zones increase sedimentation, alter riparian and in-stream habitat, increase nutrient input and alter stream flow (Jones III et al., 1999; Allan, 2004). Increased sedimentation decreases habitat heterogeneity and results in a loss of spawning substrata for sensitive fish and invertebrate taxa (Sutherland et al., 2002). Hrodey et al. (2009) found a higher proportion of sensitive fish genera (e.g. *Notropis, Etheostoma, Percina*) in watersheds with undisturbed, forested land compared to agricultural land use that supported an assemblage with a higher proportion of tolerant fish species. Long-term research is often lacking but necessary to determine natural variance in fish assemblages within a watershed and to properly monitor identified Species of Greatest Conservation Need (SGCN). In addition, Matthews et al. (1988) suggested long-term data are necessary to determine the stability and persistence of fishes within an individual stream.
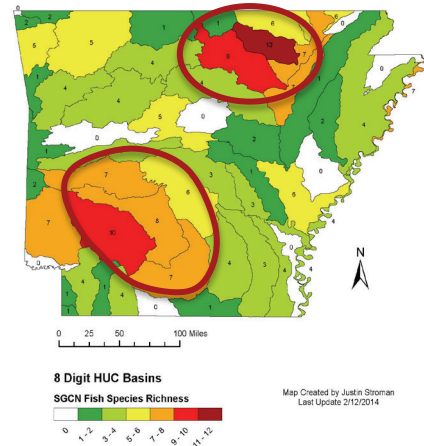

Figure 1. Graphical representation of watersheds containing fishes of greatest conservation need in Arkansas (those in darker red). The red circles encompass the watersheds to be sampled.

Purpose and Objectives – The primary objective of this research is to provide critical data on the status and distribution of SGCN species in two of the highest priority watersheds identified as "biodiversity centers" by the SWG Fish Taxa Team. The sampling will also encompass the identified need for distribution and abundance surveys for *Noturus taylori* and *Etheostoma pallididorsum* (another listed priority). In addition, we will examine changes in fish assemblage structure compared to data collected in the 1970's to determine if landscape–level changes (land use/land cover) have impacted stability of fish assemblages. Additional sites will be added as needed from additional agency records. Our approach will also allow us to assess temporal changes in target SGCN species and prioritize watersheds or stream reaches in need of conservation and restoration.

Location – The project will take place in the middle White River drainage and the Ouachita River drainage (Table 1), drainages identified by the Fish Taxa SWG team as priority drainages

for status and distribution studies. The counties and specific streams to be sampled are listed in Table 1, and a majority of the sampling will occur in 1st, 2nd and 3rd order streams, although several samples sites are on the mainstem of the Ouachita. Ecoregions to be targeted include the Ouachita Mountains, South Central Plains, and Ozark Highlands (Figure 1).

Table 1. Historical data sets collected at Arkansas State University (ASU) and University of Louisiana, Monroe (ULM). All of the sample sites are located in Arkansas except for portions of Fourche River (Ripley Co.), which is also found in Missouri. Additional sites will be added as necessary.

Stream	Drainage	Counties	# Sites	Citation
Big Creek	White	Fulton	13	Jackson, 1972
Jane's Creek	White	Randolph	10	Fowler, 1972
Piney Creek	White	Izard	10	Matthews, 1973
Sylamore Creek	White	Stone	10	Frazier, 1977
Fourche River	White	Randolph, Ripley	15	Bounds, 1977
Strawberry River	White	Fulton, Izard, Sharp, Lawrence	11	Hilburn, 1987
Caddo River	Ouachita	Montgomery, Pike, Clark,	10	Fruge, 1971
Little Missouri River	Ouachita	Montgomery, Pike, Ouachita	20	Myers, 1977
Ouachita River	Ouachita	Hot Springs, Clark, Dallas, Ouachita, Calhoun, Union	20	Raymond, 1975
Saline River	Ouachita	Saline, Grant, Cleveland, Bradley, Drew	20	Reynolds, 1971 Stackhouse, 1982

Approach – Historical data sets were obtained from theses completed at Arkansas State University and the University of Louisiana, Monroe (Table 1). With the exception of Piney Creek, remaining systems have not been resampled with similar techniques (Matthews, 1988). Our methods will replicate original studies, as much as possible, in both methodology and sample locations. Seining technique among investigators can vary; however, we have collected at Piney Creek with Dr. Matthews and are familiar with the ASU field approach. Dr. Douglas' approach at ULM was similar; we have both previously collected in the field with him, and we will invite Dr. Douglas and his previous students to the field sites. A 200-m reach at each site will be opportunistically sampled for fish and will include all available habitat within the site. Fish samples will be obtained primarily using seines matching dimensions used in the previous corresponding study and when appropriate, backpack electrofishing. Before sampling at each site, dissolved oxygen (mg/L), conductivity (uS/cm), water temperature (°C) and pH will be measured. A maximum sampling effort will be employed for a period of approximately one hour in accordance with Matthews (1998). Fish will be preserved in 10% formalin (IACUC #14-005). Species of conservation concern will be measured in the field and released at the point of capture. Following collection, habitat measurements will be taken at three equidistant transects.

Along each transect, total stream width will be measured, and depth and substrate will be determined at five locations. The second transect will include five velocity measurements using a Marsh-McBirney flow meter. In the laboratory, fishes will be identified to species, and mass and standard length measured and recorded. Historical aerial photographs and historical USGS maps will be used to construct a land use model for each stream system for historical data. Current land use data will be determined using GIS software. Data will be used for comparison purposes as well as to analyze the fish assemblage data. We have spoken with Dr. Brook Fluker about his proposed complimentary project and all sites containing either *Etheostoma pallididorsum* or *Noturus taylori* will be shared as they are encountered.

Expected Results and Benefits – This project will contribute to a multi-decade data set for six northcentral and five southeastern Arkansas streams determined to be priority watersheds for data gaps in fishes (Arkansas Wildlife Action Plan, Figure 1). It will also provided needed data to the US. Fish and Wildlife Service for response to the mega-petition for the southeast. The incorporation of land use/land cover change will establish a foundation for continued long-term monitoring and research of these understudied but important Arkansas watersheds. Specifically the sampling will provide insight into the current status and distribution of over 25 species of conservation concern including almost half of the species with a priority score over 30: *Ammocrypta clara, Crystallaria asprella, Etheostoma fragi, Etheostoma pallididorsum, Notropis ortenburgeri, Notropis ozarcanus, Notropis perpallidus, Noturus lachneri,* and *Noturus taylori.*

Budget – A majority of costs associated with this project are in salary and travel. It will be a very field intensive project during the summer and the samples will then be processed and data analyzed during the academic year. One of the two PIs will be in the field at all times to provide continuity in the data collection.

Year 1

Item	SWG	Match UCA
Faculty salary	9,170	14,646*
Graduate Student (salary + tuition)	18,000	
Student worker	6,000	
Travel	4,000	2,000*
Supplies	1,500	
F&A	3,867	
F&A unrecovered		6,236
Total	**$42,537**	**$22,882**

Year 2

Item	SWG	Match UCA
Faculty salary	9,170	14,646*
Graduate Student (salary + tuition)	18,000	
Student worker	6,000	
Travel	4,700	2,000*
Supplies	1,500	
F&A	3,937	
F&A unrecovered		6,166
Total	**$43,307**	**$22,812**

* represents cash match, otherwise in-kind

Dr. Ginny Adams, MS University of Arkansas, PhD Southern Illinois University, more than 20 years as a researcher in a variety of ecosystems. Ginny has published over 20 papers, including 13 while at the University of Central Arkansas and contributed to over 50 presentations at professional meetings. Her research has focused on the conservation of sensitive and endangered species in relation to anthropogenic disturbance. She has taught Ichthyology biannually since coming to Arkansas and has served on both the Fish Taxa Team for SWG and the Fish GAP analysis and ANHC fish ranking teams. Her responsibilities on this project will include mentoring of undergraduate and graduate students in fish collection and identification.

Dr. Reid Adams, MS University of Mississippi, PhD Southern Illinois University, greater than 15 years as a researcher of river and floodplain ecosystems that includes publications of approximately 10 peer-reviewed papers, numerous presentations (> 35) given at professional meetings, and mentoring of many undergraduate and graduate student projects. He has twenty years of experience as a fish ecologist/ichthyologist, 11 of those spent studying fishes in Arkansas. He has extensive experience collecting fishes in Arkansas using seines and backpack electrofishing. He has successfully completed the objectives and reporting requirements for two previously funded State Wildlife Grant proposals, and is currently working with a group of collaborators to complete ongoing research on fish responses to natural gas development in Arkansas.

Ginny and Reid have collectively mentored over 20 graduate students since coming to Arkansas on a wide variety of projects. In addition, both PIs have worked directly in the field with Dr. Bill Matthews (principal investigator of Piney Creek and peer of previous collectors from Arkansas State) and Dr. Neil Douglas (mentor of historical surveys from University of Louisiana at Monroe).