

Project Title: Reproductive and Population Ecology of Alligator Gar in the Sulphur/Red River System and Fourche La Fave River

Project Summary: Building upon our previous efforts that have already led to conservation and restoration measures, we propose to further develop a river hydrology/reproductive success model for the Fourche La Fave River to guide management of river hydrology to enhance recruitment of alligator gar and other river fishes. Spawning and rearing habitat will be located in the Sulphur/Red River System as well. We propose to provide the first comprehensive view of population size and size structure of alligator gar in Arkansas by implementing a standardized sampling approach in these two river systems.

Project Leader: **Dr. Reid Adams**
Associate Professor, Department of Biology
180 Lewis Science Center
University of Central Arkansas
Conway, AR 72035
501-450-5915
radams@uca.edu

Project Partners: **Lindsey Lewis**, Fisheries Biologist, United States Fish and Wildlife Service,
Conway Field Office, Conway, Arkansas
501-581-6068
norforklake@yahoo.com

Eric Brinkman, District Fisheries Biologist, Arkansas Game and Fish
Commission, Camden, Arkansas
877-836-4612
elbrinkman@agfc.state.ar.us

Budget Summary: **This is a two-year project and budget.**

Total Requested from SWG: **\$51,700**

Matching Funds (In-kind @ 35%): **\$18,095**

Total Project Cost: **\$69,795**

Need: Alligator gar, *Atractosteus spatula*, is a denizen of large river ecosystems and is in need of biological study, conservation, and management. It is a species of special concern in 11 of 13 states in the U.S., and the topic of ongoing discussions of more stringent regulation given its precipitous, large-scale decline. As indicated in Attachment A, migration barriers, particularly those impeding access to floodplain spawning habitats, likely contribute to the decline and inhibit recovery of alligator gar (ALG) populations. We have made substantial progress identifying spawning and rearing habitats, overwintering habitats, and channel microhabitats of alligator gar in the Fourche La Fave River (FLR) over the past 3 years. In fact, our research has already led to implementation of statewide changes in fishing regulations for ALG, and a restoration project was completed during fall 2010 to enhance fish passage beyond a county road to facilitate access to important spawning habitat in the FLR system. Using the FLR as a model approach, we can and need to expand ALG studies to additional rivers. The Sulphur and Red rivers are known hotspots for alligator gar; however, this population has not been studied. We have already conducted scouting trips to the area and made contact with a local commercial fisherman that can help us locate ALG. ***The overall goals of this project are to identify spawning and rearing habitats of ALG in the Sulphur/Red River and continue collection of similar data in the FLR and to conduct a comparative population assessment (e.g., population size and size structure) of the Sulphur/Red River and FLR populations.*** Status of most ALG populations in Arkansas is unknown, and the proposed study will expand this knowledge and may identify doable restoration projects similar to the FLR. Additionally, a comparative study between two populations is enticing given they are probably regulated by variable factors (e.g., differing floodplain area, rate of adult mortality, latitude, etc.).

Regarding other SWG funding priorities, alligator gar should be viewed as an “umbrella species” for other fishes inhabiting floodplain river systems. Hydrology and access to floodplain wetlands for spawning and rearing are important to ALG as well as a majority of fishes in these systems. For example, important game species (e.g., largemouth bass and crappies) and other fishes of conservation concern (e.g., pallid shiner and cypress minnow) utilize the same floodplain areas during flooding as ALG. Ongoing research indicates the fish passage restoration project in the FLR targeting ALG should benefit numerous other species. Hydrology for fishes adapted to spawning on the floodplain is very important; floods must provide access to spawning habitats and remain flooded long enough for critical early life stages to pass. Reproductive ecology data can be used to provide guidelines for management of water levels on the FLR and Sulphur/Red River to benefit ALG and other fishes. What we are learning about alligator gar resource requirements epitomizes the connectivity of watersheds (large river to small, headwater tributary) and associated terrestrial/semi-aquatic environments and the need to broaden our spatial scale of management and conservation.

Priorities Addressed:

1. Identify barriers to connectivity of alligator gar and other large river species
2. Determine environmental flow needs for aquatic species
3. Restore, enhance and/or maintain wetland integrity

Objectives:

1. Continue to collect reproductive ecology data on the FLR population to understand and model the relationship between hydrology and reproductive success of alligator gar
2. Determine location and timing of spawning and rearing of ALG in the Sulphur/Red River system of Arkansas
3. Determine and compare population size and size structure of ALG populations in the Fourche La Fave River and the Sulphur/Red River

Expected Results and Benefits:



Figure 1. *In situ* underwater photograph of alligator gar larvae attached to debris on the floodplain of the Fourche La Fave River. This life stage has rarely been observed in the field. Over the last four years, we have made novel, important discoveries of reproduction in the Fourche La Fave River system, including how reproductive success varies with river hydrology during the spawning season. Continued collection of these data will allow us to provide critical information to hydrology managers that could benefit alligator gar and other river fishes. We would like to expand these efforts to the Sulphur/Red River population.

We have been monitoring reproductive success of ALG in the Fourche La Fave River system since 2007. Reproductive success was high during 2007, corresponding with a high magnitude, long-duration flood event. In subsequent years, however, reproductive success has been low; either flooding did not correspond with the ideal temperature range or, more commonly, recently spawned eggs were stranded due to sudden, untimely lowering of water levels. Continued data collection will allow a better understanding of the interplay of hydrology and reproductive success. ***Our plan is to deploy water-level loggers in known ALG spawning locations to more accurately quantify the relationship between water levels at the floodplain spawning locations and nearby stage gauges on the FLR and Arkansas River. These data will provide managers specific information on how to manage water levels to benefit reproduction in ALG and other river fishes.*** Using what we have learned on the FLR, we hope to identify ALG spawning habitat in the Sulphur/Red River system. This would expand our knowledge of reproduction of ALG in inland river systems of Arkansas and may provide management and restoration opportunities similar to the FLR.

We have tagged and released over 50 adult alligator gar and over 120 juvenile alligator gar (all from the 2007 cohort) in the FLR. We have learned how to capture ALG and already have some abundance and size data. ***However, to get an accurate picture of population structure, we plan to implement a standardized sampling regime to get the best estimate of population size and relative size structure. This information does not exist for any ALG population in Arkansas, yet is important to guide management and conservation decisions.*** Population structure data collected from the FLR and Sulphur/Red River system provide opportunities for interesting comparisons within Arkansas, but it also allows comparisons with similar data collected in Louisiana and Texas. Age structure would provide the best indication of population structure; however, accurate, non-lethal aging techniques have not been developed for ALG. Investigating and developing aging techniques for ALG would be great student thesis topics to compliment this proposed study. For example, tagged, known-aged fish from the 2007 cohort should be recruiting to our sampling gear and will provide unique opportunities.

Approach:

Reproductive Ecology - Since 2007, we have made multiple direct *in situ* observations of alligator gar spawning and have inferred spawning time and location from the capture of recently-hatched larvae (< 15 mm total length). Initiation of spawning is correlated with the ascending limb of flood events, mostly a result of back-flooding from the Arkansas River. Alligator gar adults ascend small, first to second order

tributaries of the Fourche LaFave River to spawn. Season of spawning generally corresponds with other research, but our data indicating spawning habitat and correlation with hydrology are novel findings.

We will continue established methodology on the FLR to further evaluate the relationship between hydrology and reproductive success on the FLR. Additionally, water level loggers will be deployed at known ALG spawning locations to provide more specific stage data that can be related to mainstem river gauges. Based on knowledge from the FLR system, we will conduct visual searches and monitoring of targeted habitats in the Sulphur/Red River system during the ALG spawning period to identify critical habitats for spawning and rearing. Reproductive data will be collected over two spawning seasons, spring 2012 and spring 2013.

Population Ecology – Alligator gar of multiple sizes will be captured with gill nets having various mesh sizes. A sampling array will be developed and standardized for each sampling trip in both river systems. We have been previously successful capturing ALG with gill net arrays fished in deep holes during winter on the FLR. Similar tactics are used to capture ALG by a commercial fisherman on the Sulphur/Red River system. Population assessment sampling will be most intense during the cold months (December to February) when fish are aggregated based on previous sampling and telemetry data. Length and weight of the gar will be measured. A fin clip will be taken and preserved in 95% ethanol for future genetic analyses. Fish will be tagged with multiple techniques (e.g., PIT tags and floy tags) and released. Population sizes will be estimated with multiple census mark-recapture methodology. Population structure assessments will occur during winter 2010-2011 and winter 2011-2012.



Figure 2. We have caught over 50 adult alligator gar using gillnets during winter in the Fourche La Fave River. Over the past two years, we completed a telemetry study where we collected seasonal movement and microhabitat data on 27 tagged adult gar. Preliminary investigations suggest our techniques will be successful on the Sulphur/Red River system as well.

Location of Work: The Fourche La Fave River is a tributary of the Arkansas River upstream of Little Rock in the Ouachita Mountains. The Sulphur/Red River system is located in the southwestern corner of Arkansas near Texarkana.

Two-year Budget:

Item	SWG Funds	Matching Funds
Salary: 2 Graduate Students	40,000	
Travel	3,000	
Equipment and Supplies	4,000	
UCA Overhead 10% of total direct cost (\$47,000)	4,700	
In-kind Match (35%) (PI Salary & Equipment)		18,095
Total	\$51,700	18,095

Qualifications:

Dr. Reid Adams: MS University of Mississippi, PhD Southern Illinois University. Greater than 15 years as a researcher of large river ecosystems that includes publication of approximately 10 peer-reviewed papers, numerous presentations (> 35) given at professional meetings, and mentoring of many undergraduate and graduate student projects, including two MS students that conducted research on alligator gar.

Lindsey Lewis: MS University of Central Arkansas. Greater than 10 years as an aquatic biologist/fisheries biologist, including extensive knowledge of fisheries and restoration issues in Arkansas.

Eric Brinkman: MS Oklahoma State University. Seven plus years experience as a fisheries biologist/researcher, including 3 years conducting research on alligator gar in the Red River system.