Project Title: Movements, Habitat Use, and Reproduction of Alligator Gar in the Fourche LaFave River

Project Summary: During the past two years, we have collected important data on reproduction and recruitment of alligator gar in the Fourche LaFave River. We have learned how to capture adult individuals and have already attached 26 radio transmitters. UCA has provided initial funds for purchase of telemetry equipment. SWG funds are requested to facilitate tracking and data collection from adults and continue our evaluation of reproduction and recruitment. Biological data will be used to guide improved fish passage restoration, water-level management, and floodplain wetland management.

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Budget Summary:

Total Requested from SWG: $27,500

Matching Funds (Cash & Inkind) from UCA: $27,500

Total Project Cost: $55,000

Funding Priority Addressed by Proposal: 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. Regarding other SWG funding priorities listed below, interestingly, our preliminary data indicates alligator gar in the Fourche LaFave River require access to flooded, wetland habitat near the headwaters of 1st and 2nd order tributaries for reproduction. Flooding facilitates access to these headwater, wetland habitats having high amounts of vegetation for egg attachment. Additional biological data will guide potential future implementation projects to improve fish passage in headwater tributaries, provide guidelines for management of water levels on the Arkansas River and discharges from Nimrod Dam, and restoration/maintenance of bottomland hardwood ecosystems and associated wetlands. 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.

1. Improve understanding of the distribution and abundance of large river fishes
2. Environmental flow needs for aquatic species
3. Survey headwater aquatic biodiversity
4. Restore, enhance and/or maintain wetland integrity

Ecoregion/Study Area: The study will be conducted in the lower reach and associated floodplain of the Fourche LaFave River and areas of Pool 7, Arkansas River.

Figure 1. *In situ* underwater photograph of alligator gar larvae attached to debris. This life stage has rarely been observed in the field. Over the last two years, we have made novel, important discoveries of reproduction in the Fourche LaFave River system. These data are not only unique for Arkansas but for alligator gar throughout its range. Difficult logistics often hamper alligator gar research, however, due to our discoveries, the Fourche LaFave River population provides great opportunities for data collection and conservation that could serve as a model for other populations.

Methods: Hampering conservation and management (and thus implementation projects) of alligator gar is lack of published information on reproductive biology and resource requirements of alligator gar, especially requirements for successful spawning and recruitment. A breakthrough in knowledge of the reproductive ecology of alligator gar was made by my research team during 2007 and 2008 in the Fourche LaFave River system of Arkansas. We made two 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) during two additional instances. Initiation of spawning was correlated with the ascending limb of flood events, either a result of back-flooding from the Arkansas River or flooding from directly within the watershed. Alligator gar adults ascended small, first to second order tributaries of the Fourche LaFave River to spawn. Season of spawning generally corresponded with other research, but our data indicating spawning habitat and correlation with hydrology are novel findings. These data have

been presented at four professional meetings and the topic of Tommy Inebnit's master's thesis at UCA.

The primary objective is to determine location and movement patterns of adult alligator gar relative to season, river habitat, time of spawning, and variation in hydrology and temperature in the Fourche LaFave River. Addressing this objective should allow for the identification of critical overwintering habitat, spawning habitat, and summer/fall habitat. Additionally, a description of how changes in hydrology and temperature influence gar use of the river should provide insight into management of the river system.

Adult gar will be captured with gill nets, and we have been previously successful with these methods of capture. Gar will be placed in an aerated bath of river water and lightly sedated with carbon dioxide following Bowser (2001). Length and weight of the gar will be measured. A blood sample will be taken to attempt sex determination following Alfaro et al. (2008). A fin clip will be taken and preserved in 95% ethanol for future genetic analyses. A radio transmitter will be attached externally to the gar inferior of the dorsal fin as described by Sakaris et al. (2003) and based on discussions with other alligator gar researchers (personal communication, Lee Holt and Eric Brinkman, Arkansas Game and Fish Commission). Following transmitter attachment, gar will be held in river water until they exhibit natural swimming motions (~ 15 minutes) and then they will be released at the point of capture. Our goal is to attach transmitters to 27 individuals (at the writing of this pre-proposal, we have successfully attached 15).

Individuals will be tracked every 3-4 weeks throughout the year dependent on weather and hydrology. Tracking will occur at shorter time intervals during the spawning season and during periods of dynamic hydrology. Upon locating an individual, GPS coordinates will be recorded and a standard set of habitat variables will be measured (e.g., standard water quality, water depth, river width, river habitat type, and water velocity). The typical study or tracking reach will be in the river from Perryville, AR to the confluence with the Arkansas River and in major tributaries. Searching will be conducted mostly from a boat, but some terrestrial tracking will be necessary to sample smaller tributaries. Searching outside of the target study reach (e.g., upstream of Perryville and/or in the mainstem Arkansas River) may be necessary if individuals cannot be re-located. Monitoring for spawn events and sampling of larvae and juveniles during late summer/fall will be conducted using methodology already established.

Measurable Products or Outcomes: Our initial research has indicated that a spawning population of alligator gar exists in the Fourche LaFave River, that smaller tributaries are providing valuable spawning and rearing habitat, and that hydrology patterns are important in initiating spawning and providing access to spawning areas. However, a study of adult movement patterns is warranted to elucidate movements in response to variable hydrology and temperature, to identify additional spawning areas, and to study other unknown aspects of alligator gar biology (e.g., spawning aggregation size, winter habitat, staging dynamics, etc.). The proposed study is unique regarding habitat template, generizability, and probability of success relative to other research on alligator gar. The Fourche LaFave River is a medium-sized river without a leveed floodplain that seemingly has ample number of gars. For example, we collected 24 adult alligator gar during just three sampling trips in December of 2007. Because gars have access to the floodplain, it allows us to examine issues of connectivity within river systems that can be applied to other rivers. Culverts and low water road crossings might be impeding gar movements to spawning areas and movement data will help elucidate this issue. Data collected will guide potential management of water levels and restoration of floodplain

wetlands. Describing movement of gars in response to the complex, managed hydrology within our study system (e.g., flooding from the Arkansas River and releases from Nimrod Dam) will have applications to other managed rivers and river fishes. For example, we have observed that low-order tributaries are providing nursery habitat for other river fishes (blue catfish, crappies, black basses).

Figure 2. This telemetry project has a high probability of success. We have already attached 26 radio transmitters to adult alligator gar in the Fourche LaFave River (December 2008 – January 2009). We are requesting SWG funds to facilitate maximum data collection from these individuals and further our collection of spawning and recruitment data.

Monitoring: Performance measures include identification of alligator gar spawning areas, habitat use/needs, and movement patterns. If applicable, we will include our methodology in the Natural Resources Monitoring Partnership effort.

Updating the Comprehensive Wildlife Conservation Strategy: Our data will be incorporated into the existing database at the conclusion of the project.

Updating the Scientific Community: Research findings will be presented at multiple scientific meetings, including the Arkansas Wildlife Action Plan workshop.

Making a Public Connection: We will work closely with local landowners regarding this project. When possible, we will work to educate the public on the values of biodiversity and conservation of alligator gar.

Timeline:

August 1, 2009 to June 30, 2010	Data collection every 3-4 weeks on tagged individuals
July 1, 2010 to December 30, 2010	Data analysis and Report preparation
May 2011	Final Report Submission

Existing Resources and Budget Justification: Boats, nets, field meters (e.g., velocity meter and hydrolab) and laboratory equipment (e.g., microscopes) already exist at the University of Central Arkansas. Additional nets, personnel, and boats are available from the USFWS in Conway and AGFC in Mayflower. UCA has already provided some cash funding for this project

($7,970) that has been used to purchase telemetry equipment and defray some travel costs. Other than some equipment/consumable needs (e.g., a generator to conduct night sampling for evaluation of recruitment and temperature data loggers and deployment material), we need funds for travel and personnel.

Budget Item	SWG Funds	UCA Funds
Salaries		
Graduate Student Stipend (1 yr)	15,000	
Principal Investigator	3,000	
Operating Expenses		
Travel	2,000	
Equipment & Supplies		
Generator, temperature loggers,		
meter calibration solutions, etc.	5,000	
UCA Overhead		
10% of total direct cost ($25,000)	2,500	
UCA Match		
Cash Match (University Research Council)		7,970
Cash Match (Sponsored Programs Office)		4,000
In-Kind Existing Equipment Match		
Boat, motor, and trailer		10,000
Velocity meter		4,500
Nets and other tagging supplies		1,030
	SWG Total $27,500	**UCA Total $27,500**

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.

Lindsey Lewis: MS University of Central Arkansas. Greater than 8 years as an aquatic biologist/fisheries biologist, including extensive knowledge of fisheries and restoration issues in Arkansas.

Jeff Quinn: MS University of Arkansas. Greater than 8 years as a fisheries biologist, including extensive knowledge of river fisheries and management in Arkansas.

Tommy Inebnit and Edward Kluender: MS students University of Central Arkansas. Previous experience with netting and tagging alligator gar, boat operation, and working with landowners.