

Status and Distribution of Alabama Shad (*Alosa Alabamae*) in the Little Missouri, Ouachita, Arkansas, and White Rivers

Project Summary - The Alabama Shad (*Alosa alabamae*) is a diadromous fish that ascends Gulf Coastal Plain rivers as adults to spawn, and juvenile individuals remain in freshwater rivers through late summer/fall before returning to marine environments. Migratory runs of Alabama Shad were historically extensive in coastal plain rivers, but the species is currently threatened throughout its range, primarily due to barriers preventing access to spawning locations. Shad runs still occasionally occur in the Ouachita, Little Missouri, and White rivers, but few data exist allowing assessment and conservation of these migrations. Our overall purpose is to better understand the distribution and status of Alabama Shad in Arkansas by sampling for both adult and age-0 individuals in selected rivers. Ultimately, we would like to establish a baseline sampling approach that can be used to assess status in the future. Also, by understanding migration ecology of adults (e.g., timing, temperature, and flow regimes) and potential barriers to migration, fish passage options can be explored, particularly in the Ouachita River system. These measures will aid conservation of Alabama Shad and possibly other diadromous species such as American Eel (SGCN), Striped Mullet (SGCN), and Ohio Shrimp.

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Project Budget -

Total Project Cost: \$95,634

Total Requested from SWG: \$59,852 (Year 1 - \$30,476; Year 2 - \$29,376)

Matching Funds from UCA: \$35,786



Need – The Alabama Shad (*Alosa alabamae*) is a diadromous clupeid that ascends Gulf Coastal Plain rivers as adults during late winter/early spring (19-22 °C) to spawn in flow near sand and gravel substrates (Robison and Buchanan 1988; Ross 2001). Age-0 individuals remain in freshwater rivers through late summer/fall before returning to marine environments. Runs of Alabama Shad were historically common and extensive in coastal plain rivers. Coker (1929) reported the species supported commercial food fisheries in the Upper Mississippi River, and individuals were “many” at Keokuk, Iowa during 1915, enough to “support a substantial fishery.” Since the mid 1900’s, Alabama Shad has experienced extensive range reduction and extirpation of populations (reviewed by Meadows et al. 2008; Hammerson 2010). It is reportedly extirpated from over half of the 14 states where it formerly occurred (Meadows et al. 2008) and its occurrence in the Mississippi River basin is considered “sporadic” and populations “depleted” by Page and Burr (1991). The most robust population exists in the Apalachicola River, Florida, but yearly abundance is highly variable and size of spawning runs is relatively low (Ely and Young 2008). Range-wide declines are mostly attributed to dams that impede access to spawning habitat, but changes in hydrology, water quality, sedimentation, water temperature, and bycatch rates have also been hypothesized (Meadows et al. 2008). Concern over the status of Alabama Shad has initiated many state-level and broader-scale conservation designations: “Threatened” by the American Fisheries Society, “Species of Concern” by the U.S. National Marine Fisheries Service, and “Data Deficient” by the IUCN Red List of Threatened Species. Consequences of this loss/reduction of Alabama Shad runs to productivity and trophic dynamics of inland rivers is unknown but potentially substantial given research conducted on other diadromous species.

Alabama Shad has been a known member of the Arkansas fish fauna for over 100 years, but relatively little research has targeted this fish in our state’s rivers. Most collections are incidental, comprised of few individuals. Alabama Shad was first documented in Arkansas in the late 1800’s in the Ouachita and Mulberry rivers by early collectors (reviewed by Buchanan et al. 1999), and was most recently collected by Robert Hrabik (Missouri Department of Conservation) who seined 5 individuals on 25 October 2014 at Tate’s Bluff Access, Ouachita River (personal communication). Arkansas Natural Heritage Commission designates Alabama Shad S1 status, “extremely rare” and “especially vulnerable to extirpation”. Indeed, only ~ 30 collections have been made in Arkansas and abundances ranged from 1 to 178 individuals, mostly age-0 fish (AGFC database). A majority of these collections are from the Ouachita and Little Missouri rivers (27 of 30), where juvenile fish were seined on multiple occasions during summer by Dr. Tom Buchanan and others during the late 1990’s (Buchanan et al. 1999) and as recently as 2014 by Robert Hrabik. Alabama Shad has not been collected in the Arkansas River system since the late 1800’s and is only known from the White River based on two collections of three age-0 individuals during August 2006 near Newport, Arkansas (Buchanan et al. 2012). Targeted sampling of adult and age-0 Alabama Shad is needed to better understand the status, distribution, and threats in Arkansas to guide conservation and management of a species threatened throughout its range and to better understand diadromous organisms using Arkansas rivers to complete their life cycles.

Alabama Shad is a highly ranked SGCN species (Priority Score of 52), and this proposal will address and/or partly address the following currently listed priorities for 2017:

1. **Status and Distribution of Alabama Shad** – The bulk of our data collection will directly address this priority.

2. **Water Temperature Monitoring of Ouachita and Little Missouri rivers** – We will place temperature loggers in these rivers for the duration of the project.
3. **Maintain, Protect, Restore Habitat for Ouachita Madtom (46), Crystal Darter (38), and Stargazing Darter (38)** – These species could be collected during our sampling which would contribute data to this priority.

Purpose and Objectives – The overall purpose of this project is to better understand the distribution and status of Alabama Shad in Arkansas by sampling for both adult and age-0 individuals in the Ouachita, Little Missouri, Arkansas, and White rivers. Ultimately, we would like to establish a baseline sampling approach that can be used to assess status in the future. Also, by understanding migration ecology of adults (e.g., timing, temperature, and flow regimes) and potential barriers to migration, fish passage options can be explored, particularly in the Ouachita River system. Specific project objectives include: 1) quantification of abundances based on standardized collecting methods, 2) determine timing of spawning migration and spawning based on collections of adults and back-calculated ages of juveniles, 3) relate spawning time with environmental variables such as river discharge and temperature, and 4) opportunistically provide additional life history data on adults and juveniles.

Location - Sampling for this project will include reaches of the Little Missouri, Ouachita, Arkansas, and White rivers, and will include parts of the Ouachita and Ozark Highlands and the lowlands of the Mississippi Alluvial Plain and West Gulf Coastal Plain. Adults will be targeted mostly downstream of potential barriers and age-0 individuals will be sampled along sand/gravel bars in selected reaches within each river (Figure 1).

Approach – Both adult and age-0 Alabama Shad will be monitored in the Little Missouri, Ouachita, Arkansas, and White rivers for two years. Adults will be targeted primarily with boat electrofishing, but supplemental methods (e.g., cast nets and seining) may be used under certain conditions. Electrofishing effort will be standardized to 10-minute runs per location, where the number per location will vary based on habitat size. Priority sampling locations will be the tailwaters of dams within each river system that may concentrate adults (Figure 1): Narrows Dam (Little Missouri), Rammel Dam and Caddo Reregulation Dam (Ouachita River), Wilbur D. Mills Dam (Arkansas River), and Lock and Dam 1 (White River). Additional locations may be added as we identify potential spawning or staging areas based on personal observation and communications with local fishers. Sampling for adults will begin in approximately mid February to early March and continue opportunistically through May. Length and mass will be measured and sex determined (gamete expression method) for all fish

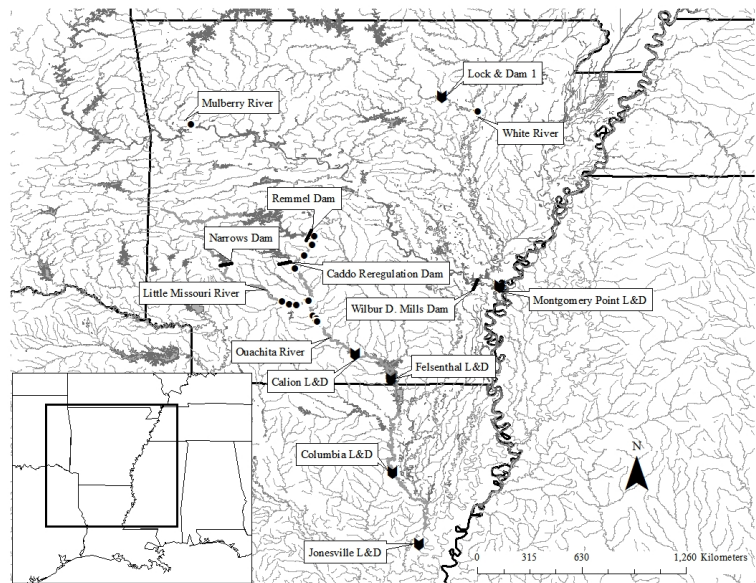


Figure 1. Priority sampling locations (●) with dams (–) and lock and dams (♥) noted.

collected. A fin-clip marking method will be used on fish released to try and ascertain spawning population size if the opportunity exists. Clipped tissue will be preserved in 95% ethanol for future genetic analyses. A subset of adults will be sacrificed to determine age via otolith analysis to establish length/age relationships.

Age-0 individuals will be sampled in each system along sand/gravel bars primarily using seines (supplemental methods may also be employed) from approximately late May to September. We will target sand/gravel bars where age-0 individuals have been previously collected based on the Arkansas Game and Fish Commission fish database, and we will sample additional locations opportunistically, particularly in the White River and lower Arkansas River. Sampling interval will be 2-3 weeks initially in each year and will be adjusted based on captures. Abundance per seine haul will be recorded, and most fish will be released. Length and mass will be measured on a subset of individuals, and a subset will be sacrificed to determine age from daily growth rings on otoliths. These ages will be used to estimate spawning dates which in turn will be related to temperature and hydrology regimes. Water temperature will be measured with Hobo data loggers placed within study systems, and discharge data will be gathered from existing gages.

Expected Results and Benefits - Based on previous collection histories, we expect Alabama Shad continue to make spawning migrations and successfully reproduce in the Ouachita and Little Missouri rivers which necessitates passing lock and dams in the lower Ouachita River (Figure 1). We will quantify these events for future monitoring and will relate spawning to specific temperature and hydrology regimes. These data, in concert with information that can be gleaned from historic years of known reproduction, should help understand conditions necessary for migrating adults to pass lock and dams on the lower Ouachita River. Alabama Shad have been successfully passed through Jim Woodruff Lock and Dam, Apalachicola River, Florida (Young et al. 2012). Knowing the timing of migration in the Ouachita system could facilitate purposeful passage of Alabama Shad (encouraging more regular reproduction and recruitment) and other diadromous organisms such as American Eel (SGCN), Striped Mullet (SGCN), and Ohio Shrimp that we have been studying. This project will address the importance and size of potential spawning runs in the lower Arkansas and White rivers that could lead to conservation measures.

Budget -

Item	Year 1		Year 2	
	SWG	Match UCA	SWG	Match UCA
Faculty (salary + fringe)	8,946	13,927*	8,946	13,927*
Graduate Student (salary + tuition)	10,523		10,523	
Student worker	3,009		3,009	
Travel	3,000		3,000	
Supplies	2,500		1,500	
F&A	2,498		2,398	
F&A unrecovered		3,859		3,959
Total	\$30,476	\$17,896	\$29,376	\$17,886

* represents cash match, otherwise in-kind

Dr. Reid Adams, MS University of Mississippi, PhD Southern Illinois University, greater than 20 years as a researcher of river ecosystems that includes publication of approximately 19 peer-reviewed papers, numerous presentations given at professional meetings (> 100), and mentoring of many undergraduate and graduate student projects (> 40). He has extensive experience collecting fishes in Arkansas using seines and has directed research on three other diadromous organisms in Arkansas: Striped Mullet, American Eel, and Ohio Shrimp. He has successfully completed the objectives and reporting requirements for two previously funded State Wildlife Grant proposals.

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 100 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.

Lindsey Lewis, He has a M.S. degree from the University of Central Arkansas and a B.S. from Arkansas Tech University. He has worked for the Service since 2001 and as an aquatic scientist in Arkansas since 1992. His duties include providing consultations on federal actions and the conservation and recovery of federally listed species and species of concern. He is coordinating species conservation and research in Arkansas and regionally on large river species such as Alligator Gar, American Eel, Ohio Shrimp, Pallid Sturgeon, Ohio Shrimp, and Striped Mullet.

Jason Phillips, B.S. Arkansas Tech University, 20+ years of experience sampling fishes in small to large riverine environments in Arkansas and Missouri. Experience using seines, trawls, gill/trammel nets, and electrofishing. He has been involved in fisheries studies in the private sector and for over 15 years as a biologist with the U.S. Fish and Wildlife Service. Assisted with previous field collection attempts for Alabama Shad in the Saline River drainage and other diadromous aquatic organisms throughout Arkansas.

Casey Cox, MS Biology University of Central Arkansas, more than 5 years research experience in multiple streams, rivers, and lakes in Arkansas, including extensive backpack electrofishing. Casey has published two peer reviewed scientific papers, has given greater than 20 presentations at a variety of professional and stakeholder meetings, and has three years of experience managing sportfish. Casey currently works for the Arkansas Game and Fish Commission as a Fisheries Biologist in northeast Arkansas. His contribution to the project will be assisting graduate students with access and sampling, as well as various other aspects of the project.

Aaron Kern is a Fisheries Biologist for the Arkansas Game and Fish Commission's District 6 office in Camden, AR. He received a Master's Degree in Fisheries Management from Auburn University in 2016. His thesis research was centered on habitat use and movement patterns of Alabama Shad during the spawning migration. Previously, he had worked as a Fisheries Researcher for both Auburn University and Southern Illinois University, and as a Fisheries Biologist for the Arizona Game and Fish Department and Wyoming Game and Fish Department.