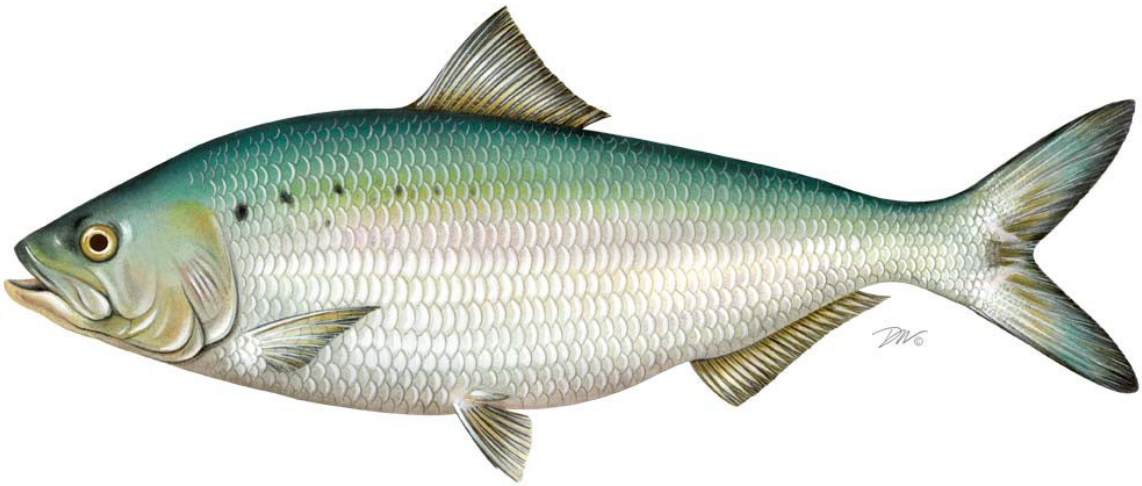
American Shad Habitat Plan for the Savannah River



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Savannah River American Shad Habitat Plan
submitted by
Georgia and South Carolina

Habitat Assessment

Tributaries of the Savannah River begin in the Appalachian Mountains in Georgia, North Carolina, and South Carolina. The Savannah River begins at the confluence of the Tugaloo River and the Chattooga River and flows 506 kilometers (km) across the piedmont and coastal plain before emptying into the Atlantic Ocean. The river serves as the border between Georgia and South Carolina throughout its entire length and has a watershed of approximately 27,255 km^2. Tidal influence typically extends to km 56 and the fresh/saltwater interface occurs approximately 22 km upstream from the mouth of the river.

There are no physical obstructions to the amount of historical estuarine habitat available to migrating adults or young-of-the-year fish in the Savannah River. However, major river channel modifications for shipping and commerce have occurred since colonial times. The impacts from these actions have altered salinity, decreased dissolved oxygen at depth, increased flushing rates in the lower estuary, and reduced freshwater tidal wetlands (Reinert 2004). For example, the installation and operation of a tide gate on the Back River channel and harbor deepening projects altered salinity and dissolved oxygen in a section of the lower river. Due to these impacts, the tide gate was removed in 1991, thus restoring a more natural flow regime. A major project to deepen the harbor in Savannah, GA to accommodate larger ships in the future was partially completed in 2018-2019.

The first barrier to upstream migration on the Savannah River is the New Savannah Bluff Lock and Dam (NSBLD) located at km 301 near Augusta, Georgia. The lock at NSBLD was designed for navigation and initially provided very limited fish passage. In the late 1980s, identification and documentation of more efficient passage methodologies were completed at the NSBLD and were implemented annually until 2014, when the lock was permanently closed. Consequently, the NSBLD is now the first true barrier with no dedicated fish passage. The next true barrier with no dedicated fish passage is the Augusta Diversion Dam located at km 333.

Historic Habitat

American shad had access to the entire Savannah River and its tributaries throughout the 27,255 km^2 watershed (South Carolina's portion of the watershed occupies 11,864 km^2). According to Welch (2000), the only record that could be found describing the inland distribution of American shad was from Stevenson's 1899 report where he firmly places the historical inland migration of American shad at "Tallulah Falls, 617 km by the river course from the sea".

Current Useable Habitat

Spawning - American shad begin spawning in tidal freshwater near km 64 (McCord 2003) and have about 237 km of suitable riverine channel habitat for spawning in the Savannah River below the New Savannah Bluff Lock and Dam. Between the late 1980's and 2014, efficient passage methodologies were implemented annually allowing American shad access to an additional 32 km of the Savannah River to the base of the Augusta Diversion Dam (km 333), the first barrier with no dedicated fish passage. This has changed with the permanent closure of the lock at NSBLD in 2014.

Rearing - Suitable rearing habitats are similar to the listed waterways for suitable spawning habitat with the addition of 10,031 ha of estuary in the Savannah River basin (DHEC).

Threats Assessment

a. Barriers to migration inventory and assessment

There are currently 6 dams on the main stem of the Savannah River. The US Fish and Wildlife Service developed a diadromous fish restoration plan (Hill 2005) for the middle Savannah River that includes establishing fish passage at the next two main stem Savannah River barriers and barriers within the Stevens Creek tributary system. Additionally, plans to improve fish passage at NSBLD have been developed as a part of the mitigation plan for deepening the Savannah shipping harbor and would enhance passage to approximately 33 km of the Savannah River below the Augusta diversion dam. If fully implemented, approximately 77 km miles of main-stem river, and 72 km of tributary reaches would be made available through provision of fish passage at the Augusta Diversion Dam and Stevens Creek Dam. This includes approximately 2,917 acres of potential new habitat. The lowermost dam in the Savannah River is the New Savannah Bluff Lock and Dam (NSBL&D at km 301).

Name	Pupose	Owner	Height (ft.)	Width (ft.)	Length (ft.)	Impoundment size	Water storage capacity	Location	River Kilometer	Fish Passage	Method
NSBL&D	Hydro	USACE	~25	~45	4109	2,866 acre	30,893 acre/ft.	34.982947°N/79.877540°W	301	Yes	Lock

Action 1: Improve fish passage at the New Savannah Bluff Lock and Dam

Regulatory Agencies/Contacts: The United States Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), United States Army Corps of Engineers (USACE), Georgia Department of Natural Resources (GA DNR), South Carolina Department of Natural Resources (SC DNR), City of Augusta, and federal and state legislators.

Goal/Target: Construct a fishway that will effectively pass diadromous fish species.

Progress: Mitigation plans for expansion of the Savannah River harbor included construction of a new fish passage system at NSBLD. USACE completed design work for the new fish passage, however changes to the NMFS biological opinion dredging has already been initiated in the harbor. These plans call for the construction of a series of terraced rock ramps on the South Carolina side of the river. During periods of low flow, the gates could be closed to divert the total flow of the river to the off-channel rock ramp. Legal action is currently underway, thus all NSBLD changes are being suspended until such legal measures are decided.

Cost: $30,000,000

Timeline: Dependent upon funding

Action 2: Fish passage at the Augusta Diversion Dam and Stevens Creek Dam

Regulatory Agencies/Contacts: The USFWS, NMFS, USACE, GA DNR, SC DNR, City of Augusta, and federal and state legislators.

Goal/Target: The National Marine Fisheries Service (NMFS) goal is to concurrently initiate construction and operation of fishways at both the Augusta Diversion Dam and the Stevens Creek Dam to ensure fish passage above both projects, allowing access to the main-stem Savannah River, and major tributaries.

Progress: The relicensing of the Augusta Diversion Canal and Stevens Creek projects provided an opportunity to consider diadromous fish needs and resulted in a fishway prescription from the Secretaries of Interior and Commerce. Upstream passage at Stevens Creek Dam is required following the construction of a fishway at the Augusta Diversion Dam.

Augusta Diversion Dam

In August 2004 the USFWS and NMFS submitted a preliminary fishway prescription for the Augusta Canal Hydropower Project that included a vertical slot fishway on the Georgia side of the river. Based on comments received from the City of Augusta, and additional evaluation and review by the USFWS and NMFS, the fishway prescription was modified to include a vertical slot fishway on the South Carolina side of the Savannah River. Negotiations between the USFWS and NMFS and project operator are still ongoing and construction of the fishway has not been initiated.

Stevens Creek Dam

The Section 18 prescription in the current license for the Stevens Creek project includes a requirement to refurbish the navigation lock, which will be operated using attraction flows or other fish attraction mechanisms to provide a minimum of 30 lockages during the shad migration season. The prescription requires construction and operation of the USFWS and NMFS approved final fishway design following construction of fish passage facilities at the Augusta Diversion Dam. The USFWS and NMFS also reserve the authority to further evaluate alternative fishway designs.

Cost: Unknown

Timeline: Unknown

Action 3: Fish passage at the Stevens Creek Mill Dams

Regulatory Agencies/Contacts: The USFWS, NMFS, USACE, SC DNR, dam owners, and federal and state legislators.

Goal/Target: Establish fish passage on the Stevens Creek tributary to the Savannah River following the establishment of fishways at the Augusta Diversion Dam and Stevens Creek Dam.

Progress: Two historical mill dams have been identified on the mainstem of Stevens Creek. Price's Mill Dam is located just downstream of SSR 138, and Parks Mill Dam is located just upstream of Hwy 23 both in Edgefield County, South Carolina. Although both dams are less than 15 feet in height and operate as run-of-river, each is a barrier to movements of anadromous and riverine fish. Future anadromous fish restoration efforts may include evaluating potential alternatives at the dams to provide fish passage to upstream habitats including access to Stevens Creek, Cuffytown Creek and Hard Labor Creek. Possible passage alternatives include full removal, notching, or construction of fish passage facilities.

Cost: Unknown

Timeline: Unknown

b. The following is a list of point source and nonpoint source activities that occur in the Savannah River

Nonpoint Source Management Program				
Landfill Facilities	***Status***	***Permit #***	***Section Number***	***Section Name***
SRS 632-G C&D LANDFILL	Solid Waste	065800-1901	03060106-08	(Savannah River)
USDOE WESTINGHOUSE SRS	Solid Waste	025800-1901	03060106-08	(Savannah River)
Active NPDES Facilities	***Facility Type***	***Permit Number***	***Section Number***	***Section Name***
BJW&SA/HARDEEVILLE CHURCH ROAD	MAJOR DOMESTIC	SC0034584	03060109-03	(Savannah River)
RINKER MATERIALS/DEERFIELD PIT	MINOR INDUSTRIAL	SCG730624	03060109-03	(Savannah River)
REED-HTI/SAVANNAH LAKE MINE	MINOR INDUSTRIAL	SCG731042	03060109-03	(Savannah River)
TOWN OF ALLENDALE WWTP	MAJOR DOMESTIC	SC0039918	03060106-09	(Savannah River)
CLAIRIANT CORP./MARTIN PLT	MAJOR INDUSTRIAL	SC0042803	03060106-09	(Savannah River)
USDOE WESTINGHOUSE SRS	MAJOR INDUSTRIAL	SC0000175	03060106-08	(Savannah River)
USDOE WESTINGHOUSE SRS	MAJOR INDUSTRIAL	SC0000175	03060106-08	(Savannah River)
USDOE WESTINGHOUSE SRS	MAJOR INDUSTRIAL	SC0000175	03060106-08	(Savannah River)
USDOE WESTINGHOUSE SRS	MAJOR INDUSTRIAL	SC0000175	03060106-08	(Savannah River)
USDOE WESTINGHOUSE SRS	MAJOR INDUSTRIAL	SC0000175	03060106-08	(Savannah River)
ECW&SA/WTP	MINOR INDUSTRIAL	SCG645036	03060106-06	(Savannah River)
KIMBERLY-CLARK CORP./BEECH ISLAND	MAJOR INDUSTRIAL	SC0000582	03060106-06	(Savannah River)
SCE&G/URQUHART STEAM STATION	MAJOR INDUSTRIAL	SC0000574	03060106-06	(Savannah River)
AIKEN PSA/HORSE CREEK WWTP	MAJOR INDUSTRIAL	SC0024457	03060106-06	(Savannah River)
US ARMY CORPS./LAKE THURMOND	MINOR INDUSTRIAL	SC0047317	03060106-01	(Savannah River/Stevens Creek Reservoir)

All point source and nonpoint sources that occur in the Savannah River are closely monitored by the South Carolina's Department of Health Environmental Control (DHEC) and Georgia Environmental Protection Division (GAEPD). All discharges are held to water quality standards for the states. Therefore, it is highly unlikely these programs impact American shad migration and utilization of historic habitat. In addition, all programs are currently undergoing 316a to assess the likelihood of impingement or entrainment.

c. Toxic and thermal discharge inventory and assessment-none

d. Channelization and dredging inventory and assessment

The following is a list of historic dredging programs that occurred in the Savannah River System:

Start_Date	River	DA_Number	Action_Typ	Project_Na	County	Latitude	Longitude
11/4/1993	Savannah	SAC-1993-10125	SP	RAW WATER CANAL MODIFICATION	Jasper	32.342970	-81.130920

The Savannah River Harbor Expansion Plan (SHEP) includes dredging the Inner Harbor from a depth of 42-foot to a depth of 48-foot and could exacerbate low seasonal dissolved oxygen levels in this portion of the river.

Dissolved Oxygen-Low dissolved oxygen levels have been documented in a portion of the lower Savannah River, particularly during low flow periods in summer months.

Action 1: Mitigate potential impacts on dissolved oxygen levels due to SHEP.

Regulatory Agencies/Contacts: The USFWS, NMFS, USACE, GA DNR, SC DNR, Georgia Ports Authority, South Carolina Coastal Conservation League, Savannah Riverkeeper, and South Carolina Wildlife Federation, Savannah River Maritime Commission (SRMC) and the South Carolina Department of Health & Environmental Control (DHEC).

Goal/Target: Install oxygenation system to mitigate dissolved oxygen impacts of the SHEP.

Progress: The USACE has agreed to install and evaluate a "Speece Cone" oxygen injection system (Tetra Tech 2010) prior to commencement of dredging activities on the inner harbor. The final settlement agreement (USACE 2013) states the oxygen injection system must be operated and instream dissolved oxygen must be monitored continuously for a period of 59 days (2 lunar cycles). Continuous daily water quality monitoring must be conducted during this period at specified locations. If the Corps determines that the oxygen injection system test meets "success criteria", it will commence inner harbor channel dredging. Following the installation of the entire oxygen injection system, a second analysis will be completed for a "start-up run". The second round of testing will follow very similar protocols to the initial evaluation, but stipulates that at least one 29.5 day testing period (one lunar cycle) must occur in July, August, or September immediately following the installation of the oxygen injection system.

Following both the test run and "start-up run" the USACE, conservation groups, SRMC and DHEC each will independently evaluate the results report and other relevant

information to assess achievement of "success criteria". DHEC, SRMC, and the conservation groups each reserves the right to take any appropriate action if its independent determination is that the "success criteria" has not been met, including but not limited to suspension, rescission, and revocation of the state approvals, initiation of an enforcement or other legal action, and/or termination of this agreement. The USACE does not waive any objection or defense to such actions, including any objection or defense based on federal preemption, sovereign immunity, or immunity from state regulation.

Cost: $16,000,000

Timeline: Dependent upon funding

Action 2: Develop a TMDL implementation plan.

Regulatory Agencies/Contacts: GADNR-Georgia Environmental Protection Division (GAEPD), Wildlife Resources Division (WRD), and Coastal Resources Division (CRD), USFWS, NMFS, USACE, Federal Energy Regulatory Commission (FERC), US EPD, federal and state legislators, and local municipalities

Goal/Target: Reduce organic loads to sustain acceptable DO levels.

Progress: The Savannah River and Harbor have been extensively studied over the last ten years and a TMDL has been proposed for DO. The Savannah River and Harbor TMDL indicates a need for substantial reductions in organic loads for all dischargers from Augusta to the harbor (GAEPD 2011). Groups from South Carolina and Georgia representing the Central Savannah River Area (CSRA) as well as harbor dischargers have been tasked to develop a TMDL implementation plan.

Cost: Unknown

Timeline: Unknown

Salinity-Dredging/deepening the Savannah Harbor has altered salinity levels in the lower Savannah River and the current SHEP could exacerbate saltwater intrusion.

Action 1: Mitigate potential impacts of SHEP on salinity levels.

Regulatory Agencies/Contacts: The USFWS, NMFS, USACE, FERC, GADNR, SC DNR, Georgia Ports Authority, South Carolina Coastal Conservation League, Savannah

Riverkeeper, and South Carolina Wildlife Federation, Savannah River Maritime Commission (SRMC) and the South Carolina Department of Health & Environmental Control (DHEC).

Goal/Target: Develop and implement plans that would mitigate the effects of the SHEP on the salinity levels in the lower Savannah River.

Progress: USACE utilized models to determine appropriate measure to mitigate for salinity and tidal wetland impacts. Mitigation plans call for series of actions that include a diversion structure, closure of cuts, filling a sediment basin, and removal of tide gate abutments and piers (Tetra Tech 2010). While these plans do not fully mitigate for all impacts, they are expected to provide substantial benefits to the fresh water marsh ecosystems by providing additional fresh water flows to the Back River System and will limit saltwater intrusion to the Back River area.

Cost: Unknown

Timeline: Unknown

Detailed information concerning the SHEP project can be found at the following website: http://www.sas.usace.army.mil/Missions/CivilWorks/SavannahHarborExpansion.aspx

e. Land use inventory and assessment-none

f. Atmospheric deposition assessment

Atmospheric deposition is measured as a cooperative effort between many different groups, including federal, state, tribal and local governmental agencies, educational institutions, private companies, and non-governmental agencies as part of the National Atmospheric Deposition Program (NADP). This organization uses many networks (NTN, AIRMoN, MDN, AMNet, and AMNoN) to monitor methyl mercury, ammonia, etc. Detailed information concerning atmospheric deposition in SC can be found at the following website: http://nadp.sws.uiuc.edu/data/annualmaps.aspx

It does not appear that current levels of atmospheric deposition are impacting American shad migrations or utilization of historic habitat.

g. Climate change assessment

A changing climate will present water-related challenges for American shad in several areas including: water quality, water quantity and changes in sea level. Current climate models predict

continued warming across the southeast, with the greatest temperature increases projected in summer. Average annual temperatures are projected to rise 4.5°F by the 2080s under a lower emissions scenario and 9°F under a higher emissions scenario with a 10.5°F increase in summer. The frequency, duration and intensity of droughts are likely to continue to increase with higher average temperatures and a higher rate of evapotranspiration. Drought conditions could potentially impact American shad recruitment and long duration drought could negatively impact multiple year classes. Sea level rise is of concern because of the expected change in location of the saltwater/freshwater interface. As sea level rises, saltwater will move further up the river systems of the state thus reducing the amount freshwater spawning habitat available. The amount and distribution of aquatic vegetation also will change in response to increases in salinity, limiting cover and food sources for aquatic organisms. A changing climate will impact the water resources of South Carolina and will present challenges for American shad management.

Action: Develop a climate change plan.

Regulatory Agencies/Contacts: SC Department of Natural Resources (SCDNR)

Goal/Target: Establish recommendations to address climate change.

Progress: A "draft" plan has been developed and is still under review. It can be accessed at the following weblink:

http://www.dnr.sc.gov/pubs/CCINatResReport.pdf

Cost: Unknown at this time.

Timeline: Unknown

h. Competition and predation by invasive and managed species assessment

Aquatic invasive species occur throughout South Carolina's coastal rivers, and non-native ictalurids are some of the most ubiquitous invasive species. Flathead catfish (*Pylodictis olivaris*) and blue catfish (*Ictalurus furcatus*) were introduced into South Carolina in 1964 and are now found in all of South Carolina's coastal rivers. A significant portion of blue catfish and especially flathead catfish diet is comprised of fish, and due to their large adult size (>60 lbs) they have the potential to consume both adult and juvenile American shad. Ictalurid population information is currently unavailable for South Carolina's coastal rivers; however current studies are occurring in South Carolina and other neighboring states to assess the potential impacts of non-native catfish on American shad.

Action: Develop an invasive species plan.

Regulatory Agencies/Contacts: SCDNR and GADNR

Goal/Target: Establish recommendations to address invasive species.

Progress: SCDNR programs are currently monitoring catch rates of invasive catfish as part of non-targeting sampling and any flat head catfish captured during these activities are being removed from the system. In addition, current eradication programs, such as those that occurred on the Satilla River, GA, are being reviewed by SCDNR staff to determine if such programs are feasible for SC Rivers.

GA DNR completed experimental electro-fishing removals of flathead catfish from the Altamaha River system during the 1990s in an effort to restore native fish redbreast sunfish and bullhead spp populations that had been adversely impacted. These efforts were discontinued due to the large nature of the river, budget reductions, and shifts in angler attitudes. Current practices in the Satilla River have been reviewed to assess the feasibility of such programs for GA Rivers, including the Savannah and Ogeechee rivers. While GA DNR staff have thus far not initiated efforts to remove flatheads discovered in recent years in the Savannah due, in part, to the size and depth of the river, GA DNR staff have developed a response plan to address any potential introductions that may occur in the nearby Ogeechee River, a smaller coastal blackwater river just south of Savannah. Additionally, GA DNR has developed a Statewide Aquatic Nuisance Species Management Plan, which can be found at https://georgiawildlife.com/sites/default/files/wrd/pdf/management/ANSPlan_Final_rev.pdf.

Cost: Unknown at this time.

Timeline: Unknown

Final Thoughts (As Recommended and Supported by the TC)

The 2020 Atlantic States Marine Fisheries Commission's American Shad Stock Assessment and Peer Review Report provides an extensive review of available literature and discussion on the topic of fish passage (ASMFC 2020). Specifically, it highlights the issues with lack of evaluation and performance from decades-old approaches, facilities designs/operations that are not effective, and therefore cannot reasonably be expected to achieve management and restoration goals without significant changes. The Assessment Report also provides an important quantitative modeling approach examining shad habitat and passage barriers, and the need to address status quo fish passage performance. The impacts of these barriers and status quo passage are described and also modeled as effects on spawner population size under three scenarios, 1) no barriers, 2) first barrier with no passage, and 3) realistic fish passage performance measures applied to barriers (e.g., upstream passage efficiency of 50%).

The Assessment Report used standardized data and modelling approaches that quantified the impacts of barriers and fish passage as significant in all three management areas examined based on shad life history and habitat (New England, Mid-Atlantic, and South Atlantic). The assessment determined that overall, dams completely or partly block nearly 40% of the total habitat once used by American Shad. The model results of the "no barriers" scenario yielded an estimated spawner production potential 1.7 times greater than that yielded by the scenario assuming no passage at the first barrier: 72.8 million versus 42.8 million fish. The results of the third model scenario, which applies "realistic" (i.e., current) fish passage efficiencies, resulted in a gain of less than 3 million fish. Conclusions include "losses in (spawner production) potential are significant in each state and region." The Assessment Report provides a strong justification for the need and benefits of requiring improved fish passage performance measures. Additionally, meeting such improved passage performance standards is now an achievable goal given the current state of knowledge on fish behavior, swimming performance, and fish passage engineering expertise.

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