

# BACK RIVER SECTION 1135 ENVIRONMENTAL RESTORATION STUDY, SAVANNAH RIVER GEORGIA/SOUTH CAROLINA

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**Abstract.** A Section 1135 Environmental Restoration Study has been authorized under the Corps Continuing Authorities Program (CAP) directing the US Army Corps of Engineers to study and develop a restoration plan for Striped Bass in the Back River, Savannah River, Georgia. Georgia Department of Natural Resources - Fisheries Division (GADNR) is the local sponsor for this study. Funds for the Feasibility Phase have been appropriated, a scope of work developed, and a feasibility level study is well underway. Working in partnership with Georgia DNR, University of Georgia - Fisheries Unit, US Fish & Wildlife Service, the Feasibility Study will be completed by December 1999.

The goal of this joint effort between Federal and State agencies is to determine remaining impediments to restoration of a self-sustaining population of striped bass in the Savannah River estuary. A recommended plan will be developed that offers striped bass the best opportunity for revitalization as possible. Recommendations to be implemented will be cost shared between the Corps and GADNR.

## HISTORICAL BACKGROUND

The Savannah River estuary has historically supported the largest natural spawning population and sport fishery for striped bass of any Georgia river system. Previous reports have concluded that the Back River segment of this estuary -- which is located almost totally within the Savannah National Wildlife Refuge -- has traditionally functioned as the primary spawning habitat for striped bass. Minor amounts of spawning occurred in the Savannah River, but the vast majority occurred in Back River.

Until the early 1980's, the Georgia Department of Natural Resources (GADNR) relied almost solely on wild striped bass broodstock from the Savannah River population to support the state's artificial propagation and stocking programs throughout the inland reservoirs across

the entire state. Starting in 1980, the Savannah River striped bass population underwent a precipitous decline due to reproductive failure, immediately following initial operation of the Tidegate structure in Back River. Previous studies have demonstrated that the reproductive failure resulted, at least partially, from (1) increased salinity in the Back River spawning grounds stemming from operation of the Tidegate, and (2) accelerated transport of eggs and larvae to areas in the Savannah Harbor navigation channel which contains salinity levels which are toxic to those life stages.

Both the GADNR and the U.S. Fish and Wildlife Service (USFWS) initiated emergency measures in 1988 to protect and restore the striped bass population while habitat issues affecting the Back River spawning grounds were being resolved. These measures included the following actions, some of which are discussed in subsequent paragraphs:

1. A Savannah River fishing moratorium for striped bass, which remains in effect.
2. Continuation of a 75-day annual dredging moratorium in the Front River navigation channel during the spawning season (15 March to 31 May) due to concerns about the effects of suspended sediments and contaminants on the health and survival of striped bass eggs and larvae from a remnant portion of the striped bass population which had always spawned in the Front River above the maintained navigation channel.
3. An intensive stocking program to re-establish a spawning broodstock.
4. A comprehensive research effort to gather additional information on population structure, recruitment processes, habitats used for spawning, juvenile nursery areas, and year-round adult distribution needed to develop a plan to achieve a management goal of re-establishing a self-maintaining striped bass fishery.

In 1988, GADNR began an intensive striped bass stocking program in Back River. The goal of the program was to re-

establish a self-sustaining fishery in what was once highly productive habitat for the species.

Over the years, GADNR has conducted research to identify the best size fingerlings to stock and the best location to release those fish to produce the highest stocking survival. GADNR is now using the results of that research to optimize the survival of the fish they stock.

### **Bass Population Monitoring**

In 1990, GADNR funded the Georgia Cooperative Fish and Wildlife Research Unit (a component of the US Geological Service located at the University of Georgia, Athens (USGS)) to monitor the striped bass population in the Savannah River estuary. The study's final reports were issued in September 1995. The study determined that the intensive stocking program had been successful in increasing the number of adult and subadult striped bass in the estuary. The capture rates for young age classes are now close to levels reached before the 1980 collapse in the striped bass fishery. However, natural reproduction and recruitment have not been restored. Results of egg sampling and mark/recapture studies indicated these biological functions remain at very low levels in the estuary. Only minimal spawning of striped bass was occurring in the Back and Front Rivers.

### **Tidegate**

In 1991, in response to continued concerns by various environmental agencies about unacceptable adverse salinity impacts to habitat within the Savannah National Wildlife Refuge, the Corps decided to cease operating the Tidegate. The Corps decision was related to a proposed deepening of the harbor -- which was implemented in 1993/1994 -- that was projected to further increase salinity levels in Back River.

The purpose of the tidegate is to trap water on the incoming tide, hold it in the Back River area, and allow the water to flush the front river navigational channel on the out going tide. This greatly reduced the amount of sediment that accumulated in the navigation channel and allowed sediments to be trapped in an adjacent sediment basin. Significant O&M funds were saved as distance to disposal areas was reduced, and dredges could operate uninterrupted by calling vessels.

When the Tidegate was in operation, it reduced tidal velocities in Back River, causing suspended sediment to settle in that river. Shoaling upstream of the Tidegate was probably caused by sediment dropping out of suspension in that reach of the river during periods of low

velocity. Shoaling downstream of the Tidegate resulted in the sediment accumulating in the Sediment Basin, as designed. Although the Tidegate is not currently being operated, the Sediment Basin is still functioning, but with a reduced sediment trapping efficiency. The Basin still concentrates the deposition of maintenance sediments outside the authorized navigation channel dimensions and allows removal of those sediments from the aquatic environment at the lowest economic cost of any reach in the harbor.

### **The Closure of New Cut**

In 1992, New Cut was closed to sever the connection between Back, Middle, and Front Rivers across Argyle Island. The Cut had been constructed as part of the sediment control features to allow tidal waters retained by the Tidegate to flow to Front River on the ebb tide. Once in Front River, the additional flow would increase velocities in the shipping channel, thereby decreasing shoaling in a portion of that river. New Cut was closed as a Section 1135 Project to improve the fresh water vegetation and associated fish and wildlife populations in the Savannah National Wildlife Refuge by reducing salinity levels in the Back River system. The closure of New Cut was also intended to improve the striped bass population in the Back River system by preventing the premature flushing of eggs and larvae from Back River through New Cut to the more saline Front River. The closure was completely successful in isolating striped bass eggs and larvae from the upper reaches of Front River, where more saline waters -- which are toxic to those critical life stages -- exist. Note: Successful spawning still occurs in the front river upstream of the Interstate 95 bridge. The eggs and larvae now travel the longer distance to where Back River discharges into the Savannah River. The longer distances provide more time for those life stages to develop so they can better tolerate higher salinity levels.

### **Effectiveness of New Cut Closure and Tidegate Removal**

In 1993, Savannah District funded the USFWS to evaluate the recovery of tidal marshes in the Refuge and lower Savannah River stemming from to the closure of New Cut and removal of the Tidegate from operation. The USFWS conducted field investigations in 1993 and 1994. Their 1996 report states the following conclusions: "These results indicate that the freshwater conditions in the river channels and marsh soils are being followed by a gradual return to freshwater vegetation characteristic of the area before construction of the tide gate. Field observations indicated substantial increases in species diversity and

significant changes in IV (importance values) for five species.”

The 1993 study documented a two to six mile upstream displacement of salt-water in the (Back) river when the tide gate was in operation. With the tide gate out of operation, the model predicted that freshwater marsh would increase in the area by 340 percent.”

The USFWS report documented the success which removing the Tidegate from operation had on (1) decreasing the salinity levels in Back River and in upper portions of Front River, and (2) the resulting restoration of freshwater marsh to those portions of the estuary.

Cultural resource surveys were conducted in Back River to monitor potential impacts to resources in the river from removal of the Tidegate from operation. The higher flow rates in portions of Back River appeared to produce a temporary expansion of upper portions of the cross-section, as several areas of new erosion were observed along the shoreline. Later surveys revealed that the erosion had ceased and no further expansion of the upper cross-section was occurring.

Hydrographic surveys were conducted from April to December 1992, roughly the same period as the cultural resource surveys. The hydro surveys revealed that the thalweg of the Back River channel had essentially returned to its pre-Tidegate depths after the gates were locked open in 1990. A deepening of the thalweg was observed in six of eleven stations over the April to December evaluation period. Only two of the stations remained shallower than was observed in 1978.

### **Monitoring Striped Bass Reproduction**

Since 1994, Savannah District has funded monitoring of striped bass egg and larvae in the Savannah River estuary. The Georgia Cooperative Fish and Wildlife Research Unit (a component of the US Geological Service located at the University of Georgia, Athens (USGS)) has performed that work. Those investigations have identified a small increase in the number of eggs in Back River over the recent years, but the densities presently experienced are still only 7 percent of those common before the population decline. In the late 1970's, there had been about 300 percent as many eggs in Back River as in Front River. Presently, Back River supports only 6 percent of the egg densities found in Front River. In addition, no larval striped bass have recently been found in Back River, indicating the population is not yet self-sustaining. There may be survival of hatched eggs into larvae, but since the number of eggs are so few, the smaller number of larvae produced

may be missed by the incomplete field sampling methodology.

**Existing Conditions:** Based on salinity levels and flow patterns, Back River now would appear to provide suitable habitat for this species. The USFWS vegetative study indicates that salinity levels upstream of the Tidegate have been restored to pre-Tidegate conditions. Closing New Cut removed the connection to Middle and Front River, thereby restoring the original Back River tidal flow patterns.

However, ongoing monitoring reveals that successful spawning is not occurring. Adult individuals are present in the estuary during the spawning season, but very little spawning activity seems to be taking place. Since salinity levels are now acceptable in Back River, it appears that hydraulic flow conditions (quantity, velocity or depth) are not adequate to stimulate spawning of striped bass. Sometimes the required flow conditions can be very site-specific, with a certain velocity and depth of water required over a sand bar (specific substrate). Unless the required biological triggers are present, fish will not conduct certain activities, with spawning being one of those activities.

**Potential Alternatives:** The most extensive alternative being considered consisted of excavating Back River upstream of the Tidegate to the approximate cross-section that existed in the late 1970's or earlier condition when the river supported a large reproducing population of striped bass. Excavation of only a pilot channel would be less expensive, and may not result in future natural erosion and expansion of the channel cross-section to a shape that would produce the flow characteristics required to trigger spawning. Excavation of the full cross-section in only a portion of the length of the channel would not be sufficient as the unexcavated portion would control the hydraulic flow through the river, thereby keeping the required flow characteristics from developing in the river. It appears that excavation of the full channel cross-section is required throughout the entire length of the river to produce the flow characteristics required to trigger spawning. No excavation would occur in the marshes that line the channel to ensure the project has no adverse impact on wetlands. The dredging is expected to be accomplished using a portable hydraulic dredge. There are three bridges that cross Back River and the vertical and horizontal clearances are not sufficient to allow large construction equipment to pass.

**Feasibility Studies:** During the feasibility phase, the following activities would be conducted.

- Historic records for the Savannah and the near by Ogeechee River will be searched and reviewed to identify

the river bathymetry which was present when the striped bass fishery was doing well. This review would include both bathymetry information and fishery population records.

- Egg sampling will continue to be done. A new approach to look at the ability of female fish to produce eggs will also be accomplished through the use of fish imaging and ultrasound technology.
- A hydraulic model -- developed by navigation interests for the Savannah Harbor Deepening Study -- will be used to determine the flow volumes and conditions necessary to reproduce the desired velocities and habitat in the river.
- Modification of the upstream and downstream ends of Back River would be evaluated to determine if improvements will be warranted to ensure those sites do not restrict the flows of freshwater determined to be necessary in Back River. Modifications to flows through Middle River will also be evaluated to determine if changes in flow patterns or volumes will improve the striped bass fishery in the estuary.
- Sediment quality evaluations will be performed to determine both (1) the acceptability of the shoaled material for dredging and disposal activities, and (2) the physical characterization of the sediments to be dredged.
- The expected river velocities after project implementation will also be analyzed to determine the stability of the cross-section based on the sediment material that would comprise the channel surface. This design process will ensure the new flow conditions would not result in areas of excessive erosion or siltation in Back River.
- Alternate dredged material disposal techniques would be evaluated to identify the most cost-effective disposal procedure.
- A detailed construction plan would be developed and any resulting real estate needs would then be identified.

The proposed project would be a joint venture between the Corps, the GADNR, and the USFWS. The Corps of Engineers would be responsible for excavation of Back River. GADNR would be the non-Federal sponsor. The USFWS would allow the restoration activities to be performed within the boundaries of the Savannah National Wildlife Refuge.

On 3 April 1997, Savannah District held a meeting to discuss the issues concerning the minimal amount of striped bass in the Back River. Attendees included

GADNR, SCDNR, UGA Co-op, USFWS and the Corps. The evidence gathered by the UGA Co-op team over the past several years shows that egg production has not improved to the level which should be expected by the number of sexually mature striped bass which are present in the estuary. Because of the environmental agencies' concerns for this issue, everyone agreed that a Section 1135 Study should be initiated with the purpose of restoring the striped bass fishery in the Savannah River estuary.

## COSTS AND BENEFITS

**Costs:** The estimated costs to restore historic flow conditions in Back River would total \$6,400,000. The feasibility phase of the study (preparation of a Project Modification Report) would cost \$300,000. Preparation of plans and specifications would cost \$100,000. The channel excavation would cost roughly \$5.00 per cubic yard including mob and demob, for a dredging cost of \$6 million. No maintenance dredging is expected to be required since the Back River cross-section would be modified from its upstream beginning down to the Tidegate. No costs are included for the use of storage capacity within existing CDFs, as we expect the Navigation Project's non-Federal sponsor to continue its current practice of not charging harbor-related users for depositing sediments in those CDFs. Hydraulic modeling performed during the feasibility phase would confirm that flows through the improved channel would adequately self-maintain the new bathymetry. The design process would ensure that the new flow conditions would not result in areas of excessive erosion or siltation in Back River.

**Benefits:** Restoration of the historic flow conditions is expected to result in the spawning of striped bass in this river, which was historically the best spawning site in Georgia and the entire Savannah River estuary. Spawning by the present striped bass population would allow this population to become self-sustaining. This would fulfill a long-standing goal of both the USFWS and GADNR. In addition, the National Marine Fisheries Service has designated the striped bass as a national species of significance. Restoration of a self-sustaining population in this estuary would fulfill a major goal of that Federal agency.

Re-establishment of a self-sustaining Savannah River striped bass population would provide the following additional benefits:

- (1) Allow GADNR to use Back River -- as it had in the past

-- as its source of wild broodstock for artificial propagation in inland reservoirs across the state. In those reservoirs, the fish are not migratory and do not spawn.

(2) Allow GADNR and SCDNR to remove the fishing moratorium that they have in effect on this species in Congressional Districts 1 and 10 in Georgia, and Congressional District 2 in South Carolina. Sport fishermen would again be able to catch striped bass in the Savannah River estuary.

(3) Allow GADNR to cease annual expenditures in excess of \$100,000 for striped bass stocking in the Savannah River, and free up warmwater hatchery pond production space to rear endangered species and other high priority species for stocking.

(4) Eliminate the requirement for the seasonal dredging moratorium imposed by the GADNR in the Savannah Harbor navigation channel to protect developing striped bass eggs and larvae from dredge-related water quality impacts. Removal of the window would have Corps-wide cost saving implications.