Task SEGP314
Field Study of the Distribution of Shortnose Sturgeon in the Lower Savannah River

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TASK SEGP314

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The following outline of Task SEGP314, Distribution Of Shortnose Sturgeon in the Lower Savannah River, is being presented to the Stakeholder Evaluation Group (SEG) as a draft task statement for review, modification, and approval. The particular components of this task are based on the findings of the Tier I Environmental Impact Statement (EIS).

1.0 TASK GOALS

The following presents a field program in support of a Study to ascertain the Distribution of Shortnose Sturgeon in the Lower Savannah River. The goal of this study is to develop:

- a baseline estimate of shortnose sturgeon abundance;
- abundance and age distribution of juveniles;
- verification of recruitment;
- use of telemetry to establish the behavior of adults and juveniles within the impacted areas; and,
- water quality monitoring to accompany samples and the use of such water quality data for evaluating potential impact of salinity increases and dissolved oxygen (D.O.) decreases on adult and juvenile shortnose sturgeon within the lower Savannah River.

2.0 PROJECT NEED

The shortnose sturgeon (SNS), Acipenser brevirostrum, occurs from southern Canada to northern Florida and is known to occur in the Savannah River within the areas proposed for harbor deepening. The species was listed as endangered by the USF&W on March 11, 1967 (32 CFR 4001). The early listing of the shortnose sturgeon made access to the fish difficult and hence left many aspects of its biology and environmental tolerances unstudied. In the Savannah River serious gaps in the knowledge of shortnose movement and habitat exist for the location of larval habitats, larval survival and growth rates, as well as early juvenile habitat. Other unknowns are the lethal and sub lethal effects of hypoxic waters for different age groups; the location of adults during summer and fall and the extent to which the lower estuarine and coastal ocean saline waters are used by adults. Adult use of saline waters is unknown since the radio telemetry signal that has been used to track the fish is lost once they enter saline waters. Furthermore, prediction of project impacts is made extremely difficult by the absence of recent baseline data on the shortnose sturgeon population in the Savannah River.

The Tier I EIS performed model simulations in order to obtain predicted values of change in dissolved oxygen and salinity concentrations for the project deepening conditions. Because of the potential impacts on the shortnose sturgeon, and the lack of site specific information concerning this species, a study will be valuable in providing the information required to grossly determine the impacts of harbor deepening and assess the potential for mitigation actions. The monitoring effort aims at a determination of trends in population size, verification of continuing juvenile recruitment, and a determination of sturgeon behavior relative to the areas that have been deepened and are expected to undergo higher salinity and lower dissolved oxygen conditions. The resource agencies have recommended a monitoring effort to be conducted upon completion of the deepening project, which would have a five-year duration. The average

age at first maturity is 5-6 years, so 5 years is the minimum that would permit verification of survival of the first post-deepening year class to maturity. It is necessary to get pre-deepening baseline data so as to determine what impact, if any, project deepening may have on this species, and hence to evaluate pre-emptive strategies, including possible mitigation strategies. The study must be funded to coincide with the field water quality study that is scheduled to occur in August/September 1999.

3.0 PROJECT SCOPE

Under the Tier II EIS, a portion of the work conducted under this task will be coordinated and occur concurrently with the following three water quality data collection efforts:

- Task SEGP311: Chloride Study Field Data Collection
- Task SEGP312: Dissolved Oxygen Field Data Collection
- Task SEGP313: Marsh Salinity Field Data Collection

The purpose of performing the Shortnose Sturgeon study concurrently will be the availability of detailed measurements of the spatial and temporal concentrations of dissolved oxygen, temperature and salinity. This will allow direct correlation between the biological measurements and the physical conditions that existed at the time of the measurements.

3.1 MOVEMENTS AND HABITATS IN THE SAVANNAH RIVER TO BE MONITORED

The shortnose sturgeon is considered andromous, but tagging studies indicate that SNS generally do not leave their natal river. Females spawn every two or three years, rather than annually like most fishes. Spawning takes place upriver in late winter or early spring. Adults spend the rest of the year in the estuary, using a large portion of it when temperatures are low, but concentrating in the vicinity of the fresh/brackish water interface during the summer. Juveniles apparently inhabit the fresh/brackish water interface area during all months.

More specifically, the geographic areas of special concern that will be monitored in the course of this study were established by previous studies. In 1991 Hall et al. concluded telemetry studies to determine seasonal movements and habitat areas of adult and juvenile shortnose sturgeon in the Savannah River. The freshwater-saltwater boundary was found to be a region that was used by adult and juvenile sturgeon during both fall and winter as a feeding ground. Three sites at RM 24.6, RM 22.3, and RM 22.2 were identified by Hall et al. (1991) as feeding areas. A probable nursery area for juvenile shortnose and Atlantic sturgeon was identified, approximately 1.2 to 3.1 miles downriver of the freshwater-saltwater boundary region. A subsequent study was undertaken by Collins and Smith (1993) in order to characterize the adult Savannah River shortnose sturgeon population. The study reported that nonspawning fish remained in the vicinity of the fresh-brackish water transition zone (RM 18.6-25) throughout the spawning season. The study's findings supported the hypothesis of the important habitat function of the fresh-brackish water interface area and the downriver portion of the lower Savannah River. These two areas were found to serve as a staging area for the spawning migration and a holding area for fish that do not participate in the upriver migration. Most shortnose sturgeon left the freshwater portion of the Savannah River by mid-April. However, juvenile and adult sturgeon use the area located 1 to 3 miles from the freshwater-saltwater transition zone throughout the year as a feeding ground. During the summer, this species tends to use deep holes at or just above the freshwater-saltwater transition zone (Flournoy et al., 1992; Rogers and Weber, 1994; Hall et al., 1991). It is not known to what degree the juvenile fish feed during the summer months when they visit these

deeper pockets. However, it is believed that shortnose sturgeon in the Savannah River show evidence of weight loss and stress during summer months. This boundary was thought to occur in the Savannah River between river miles 20.5 and 23.6 in 1987 (Hall et al., 1991). Data also indicate that Kings Island Turning Basin at about river mile 19.3 (an area of intense dredging) is used as a nursery area for juvenile sturgeon and as a habitat for all shortnose sturgeon during parts of the year (Hall et al., 1991). Sturgeon therefore can be expected throughout the year somewhere within the area from about River Mile 17.5 to 26.6.

In these previous studies of shortnose sturgeon in the Savannah River, juveniles and adults were captured and water quality parameters measured at various locations. In summary, capture and telemetry data indicated that adults made extensive use of the estuary, especially during periods of low to moderate water temperatures, including the Front, Middle, Back, and Little Back rivers. Juveniles were captured only in the Front River, primarily in Kings Island Turning Basin. Water quality data, when related to preliminary bioassay results, suggested that temperature and DO levels during summer were sometimes marginal for survival of juvenile shortnose sturgeon. Although adult shortnose sturgeon can tolerate high salinities and relatively low dissolved oxygen (DO) concentrations for at least short periods, juveniles have been shown to be less tolerant of those conditions in laboratory studies. Even though seemingly "better" conditions were available upriver, the fish did not utilize the upriver areas. Research has shown that high temperatures exacerbate the stress induced by low DO, so summer conditions are of particular concern. It is believed that shortnose sturgeon populations in several southern rivers were extirpated when declining water quality compromised the habitability of the fresh/brackish water nursery area. Two objectives of this study are to ascertain to what extent SNS juveniles make use of areas such as the KITB which are projected to undergo DO decreases and whether the fish are prone to make use of higher DO, lower salinity stretches of the river north of the deepening.

No information on the distribution of juvenile shortnose sturgeon has been obtained since the tide gate was decommissioned and New Cut was closed. The effects of these modifications on the location and movements of juvenile sturgeon is presently unknown. Further, low DO events have apparently become more frequent in Savannah Harbor. The status of the juvenile segment of the Savannah River population of shortnose sturgeon should be determined prior to further modifications to the upper estuary so that impacts can be predicted and minimized.

The movements and the habitats of the shortnose sturgeon in the Savannah River are not well documented and not well understood, especially relative to continued harbor modifications. Determination of impacts of the deepening, especially within the area of the King's Island Turning Basin, are vital to determining the effects of deepening and the efficacy of any related mitigation on the shortnose sturgeon population.

Of special concern in this project are the following serious gaps in the knowledge of shortnose sturgeon movement and habitat:

- early juvenile habitat,
- lethal and sub lethal affects of hypoxic waters for different age groups,
- the location of adults during summer and fall,
- the extent to which the lower estuarine and coastal ocean saline waters are used by adults (adult use of saline waters is unknown since the telemetry signal which was used to track the fish was lost once they enter saline waters).

3.2 METHODS

Field efforts will be initiated as soon as funding is in place and logistical preparations (e.g., hiring personnel, purchasing nets) have been completed. It is hoped that this will be prior to the critical summer period. Core field personnel will consist of one Biologist and one Technician, with participation by the PI for QA/QC purposes. In addition, two temporary employees will be added during the summer, each to be paired with one of the core personnel, in order to form two field teams and thus double sampling efforts during this season.

Sinking gill nets and/or trammel nets will be utilized to sample the oligohaline and tidal freshwater portion of the Savannah River estuary. While trammel nets are preferred due to reduced size selectivity relative to gill nets, they are more affected by the strong tidal currents in the area and can only be used around slack tide at many locations. Mesh sizes will be chosen to target shortnose sturgeon juveniles and subadults that are approximately 20-50 cm TL (approximately ages 1-4). Although highly dependent upon the characteristics of specific collection sites (e.g., vessel traffic, currents, substrate), each field team can usually fish three nets at once. In addition, during months of low to moderate water temperatures it is often possible to make overnight gill net sets in selected locations without endangering the fish.

Primary collection sites will initially be in the vicinity of Kings Island Turning Basin and just upriver in order to maximize the likelihood of acquiring telemetry specimens. Regardless of whether specimens are encountered immediately, however, collection efforts will be expanded geographically (especially upriver) to determine the distribution of the juvenile/subadult segment of the shortnose sturgeon population. The Front, Middle, Back, and Little Back rivers will be considered candidate sampling areas, with specific locations to be determined by existing knowledge of juvenile shortnose sturgeon preference/tolerance of salinity and dissolved oxygen levels. Sampling will continue regardless of whether specimens are collected, and sampling areas not originally considered candidates will be incorporated into the sampling universe if fish are not present in the candidate areas.

All sturgeons captured will be identified to species, measured (total and fork lengths), a barbel removed (for genetic studies), a pectoral fin ray removed (for age determination), tagged, and released. Both externally visible and PIT tags will be utilized. Catch-per-unit-effort (CPUE) and mark-recapture population estimates (if sample sizes are adequate) will be used to determine juvenile population status.

Juvenile/subadult shortnose sturgeon habitat utilization patterns will be studied telemetrically during all seasons, with emphasis on summer, beginning as soon as the first specimen is acquired. Although more labor intensive than radio telemetry, the likelihood of fish entering brackish water (which attenuates radio signals) will require the use of acoustic telemetry equipment. Emphasis of telemetry work will be on movements of juveniles in relation to low DO events and salinity changes in Savannah Harbor. Because of the range of sizes of fish likely to be encountered, more than one size (and therefore longevity and range) of transmitter will likely be needed. Plans will be made to telemeter 15 shortnose sturgeon, depending on specimen availability, with 5 of the 15 transmitters being depth-indicating models. Due to the shortnose sturgeon's propensity for shedding externally attached transmitters, transmitters will be surgically implanted in healthy specimens acquired during months of low to moderate water temperatures. External attachment will be utilized during periods of high water temperatures (and if transmitters with very short life spans are used). At least two fish will be tracked continuously for 25 hr periods to examine behavior over complete diel and tidal cycles. If

concentrations of sturgeon are found through telemetry or collection efforts, a sample of the substrate will be collected with a Ponar grab for qualitative examination.

Depth, salinity, conductivity, temperature, and dissolved oxygen at the bottom and 1 m below the surface will be measured at each collection site and telemetry siting using a YSI 85 meter. This meter will be regularly zeroed and tested to ensure accuracy. In addition, depending on their availability (i.e., whether they are in use by the projects to which they belong), water quality recorders may be deployed in areas of specific interest at no additional cost to the project. Finally, pertinent water quality data to be collected synoptically by ATM will be requested for incorporation into the sturgeon data set.

In summary, the tasks of the proposed study include: (1) monitoring abundance of juvenile shortnose sturgeon; (2) monitoring the age distribution of juveniles; (3) verifying continued recruitment; (4) telemetry work to determine behavior and habitat utilization patterns; and (5) water quality monitoring to accompany all samples.

4.0 EVALUATIONS REQUIRED

The project design as currently envisioned consists of 1 year of pre-deepening study, which may be followed by a post-deepening monitoring effort if required. The later monitoring effort, if determined to be necessary, would be dedicated to determining the effects of deepening and the efficacy of any related mitigation on the shortnose sturgeon population.

Year 1 results will be utilized in a number of ways. First of all, they provide a very important baseline to which later monitoring data may be compared. However, the results will have more immediate value in the pre-deepening decision making process. Because no sturgeon research has been conducted in the critical summer/nursery habitat portion of the Savannah River since early 1992, it is not known whether the recent harbor deepening affected the behavior or status of the shortnose sturgeon population. We may find that the portion of the river used as this habitat has changed (i.e., the sturgeon have simply moved upriver in response to the deepening).

This result would help diminish the concerns of state and federal natural resource agencies that the planned deepening would extirpate the population. It is likely that diminishment of these concerns would facilitate the planning process.

At the other extreme, it may be found that shortnose sturgeon are not behaviorally flexible enough to shift upriver, and that the population is now highly stressed and is experiencing recruitment failure due to habitat alteration. This would indicate that the potential demise of the population was due to past events and not to the imminent deepening, and this could obviously affect the planning process.

Another possible outcome is that the previous deepening has not had any effect whatsoever on shortnose sturgeon. This might indicate that juvenile sturgeon are more tolerant of high salinity and low dissolved oxygen than suggested by preliminary laboratory bioassays. More complete bioassays using a wider range of ages might then be in order.

While the results of year 1 cannot be predicted, they will obviously be of value in the harbor deepening planning process. Further, the results of year 1 may provide insight into potential mitigation methods, which are now essentially lacking.

5.0 DELIVERABLES

The deliverable for this task will be a report that summarizes the work performed under Sections 3.1 and 3.2. The report will include all assumptions, methodologies, and procedures used in the sampling and monitoring program. In addition, the report will address the goals outlined in Section 1.0, summarize the findings, and draw conclusions from this work task.

6.0 SCHEDULE

The following schedule is recommended for this project task.

- Approval of task scope: April 1, 1999
- Prepare detailed study plan and order equipment: April 1, 1999 to May 31, 1999
- Field Implementation of the sampling and monitoring program: July 1, 1999 to June 30, 2000
- Prepare field study report: August 1, 2000

7.0 RELATED ISSUES

This task will provide the baseline information for the project-related shortnose sturgeon evaluations, and therefore must be consistent with the goals and objectives of this work. The NMFS is responsible for dealing with this endangered species and must be coordinated with in this effort. In addition, the information must be applicable to be addressing the NEPA and ESA requirements for the Tier II EIS.