July 9, 2004

Dr. Roy E. Crabtree
NOAA Fisheries
Southeast Regional Office (SERO)
9721 Executive Center Drive North
St. Petersburg, FL 33702

SUBJECT: BIOLOGICAL ASSESSMENT FOR THE EDWIN I. HATCH NUCLEAR PLANT, UNITS 1 AND 2 (TAC NOS. MC1172 AND MC1173)

Dear Dr. Crabtree:

On November 3, 2003, members of the U.S. Nuclear Regulatory Commission (NRC) staff and representatives from the U.S. Army Corps of Engineers (USACE) met with you and your staff to discuss the status of the informal Section 7 review for the Hatch Nuclear Plant (HNP). The HNP is a two unit steam-electric plant located on the Altamaha River near Baxley, Georgia. The NRC staff had submitted a Biological Assessment (BA) prepared in conjunction with the license renewal application for the HNP by letter dated August 31, 2000. The letter of transmittal and the BA requested NOAA Fisheries concurrence in the staff's assessment. The species of concern is the Federally protected endangered shortnose sturgeon, *Acipenser brevirostrum*. At the November 3, 2003, meeting your staff informed the NRC that the August 31, 2000, BA required revisions. Specifically, you requested that the BA consider the potential impact on shortnose sturgeon of periodic maintenance dredging in the river in the vicinity of the intake structure. The NRC and the USACE agreed at the meeting to collaborate in developing a revision to the August 31, 2000, BA addressing the issues raised by NOAA Fisheries. The NRC and the USACE agreed to submit the revised assessment to NOAA Fisheries by separate transmittal letter, each requesting concurrence on the conclusions contained in the revised BA. Your staff agreed with this approach.

Enclosed is the revised BA, dated June 2004. The revised BA includes recent data on shortnose sturgeon life history and habitat preferences. The staff believes that the extensive physical and biological data from the river in the vicinity of the plant, the well understood plant operating characteristics, and our more general understanding of shortnose sturgeon life history are sufficient to evaluate the impacts of the HNP on this species.

The staff has evaluated the potential for impact to the shortnose sturgeon from continued operation of the HNP. The staff specifically evaluated the potential impacts from impingement, entrainment, thermal effects, and periodic river maintenance dredging associated with continued plant operation. After reviewing the operating characteristics of the plant, the Altamaha River environment, shortnose sturgeon life history and the shortnose sturgeon data from the Altamaha River, the staff has concluded that HNP may affect, but that the effects would be discountable effects, and therefore, not likely to adversely affect the shortnose sturgeon. Consistent with Section 3.5 of the March 1998 Consultation Handbook, we request NOAA Fisheries concurrence with our conclusion.

The technical point of contact for this BA is Dr. Michael T. Masnik, who can be contacted at MTM2@NRC.GOV or 301-415-1191.

Sincerely,

/RA/
Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos.: 50-321 and 50-366

Enclosure: As stated

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BIOLOGICAL ASSESSMENT OF THE POTENTIAL IMPACT ON SHORTNOSE STURGEON RESULTING FROM CONTINUED OPERATION OF THE EDWIN I. HATCH NUCLEAR POWER PLANT, UNITS 1 AND 2

Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

July 2004

I. INTRODUCTION

In November 1999, Southern Nuclear Operating Company (SNC), the licensee, prepared and submitted to the U.S. Nuclear Regulatory Commission (NRC) a Biological Information Update to address the impacts of continued operation of Edwin I. Hatch Nuclear Plant (HNP) on the Altamaha River population of the Federally endangered shortnose sturgeon *Acipenser brevirostrum.* The biological information update was utilized by the NRC to prepare the "Hatch Biological Assessment under the Endangered Species Act for the Shortnose Sturgeon." The biological assessment (BA) was submitted to the U.S. National Oceanic and Atmospheric Administration - Fisheries (NOAA Fisheries) on August 31, 2000, in support of informal consultation conducted under Section 7 of the Endangered Species Act of 1969.

The informal consultation was prompted by the licensee's request (SNC 2000a) to renew the operating licenses for the HNP for an additional 20 years. The NRC staff prepared, and issued in May 2001, a site-specific supplemental environmental impact statement (SEIS) entitled "Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 4, Regarding the Edwin I. Hatch Nuclear Plant, Units 1 and 2." The NRC staff concluded in the SEIS, consistent with its conclusions in the August 2000 BA, that operation of the HNP may affect, but is not likely to adversely affect, the shortnose sturgeon in the Altamaha River. In February 2002, the NRC renewed the operating licenses for the HNP, Units 1 and 2 for an additional 20 years. The operating license for Unit 1 now extends through August 6, 2034, and the operating license for Unit 2 extends through June 13, 2038.

Based on discussions between the NRC, NOAA Fisheries and the U.S. Army Corps of Engineers, (NRC 2003) the August 2000 BA, originally developed for the HNP relicensing process, has been revised. This revision, which supersedes the August 2000 BA in its entirety, provides additional information on the shortnose sturgeon in the Altamaha River, and considers recent developments in the knowledge of shortnose sturgeon early life history, distribution, and behavior. The BA provides an assessment of continued plant operation on shortnose sturgeon, including periodic dredging in the vicinity of the intake. Dredging is conducted under the Corps of Engineers Maintenance Dredging Permit issued under Section 404 of the Federal Water Pollution Control Act of 1977.

2. DESCRIPTION OF PROJECT AREA

2.1 General Plant Information

The HNP is a steam-electric generating facility operated by SNC. HNP is located in Appling County, Georgia, at river kilometer (rkm) 180 (river mile[rm] 112), slightly southeast of the U.S. Highway 1 crossing of the Altamaha River. It is approximately 18 km (11 mi) north of Baxley, Georgia; 158 km (98 mi) southeast of Macon, Georgia; 117 km (73 mi) northwest of Brunswick, Georgia; and 108 km (67 mi) southwest of Savannah, Georgia (Figures 1and 2).

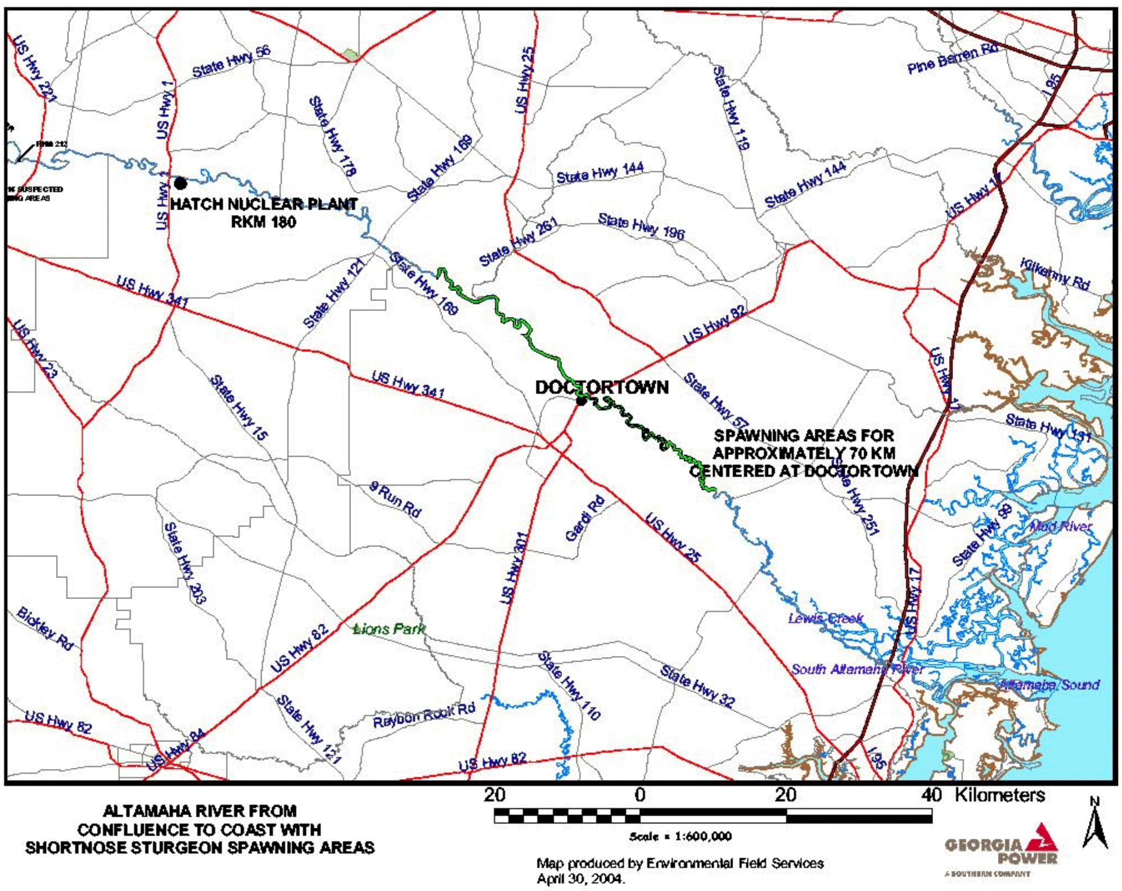

Figure 1: Altamaha River Drainage Below the Edwin I. Hatch Nuclear Plant

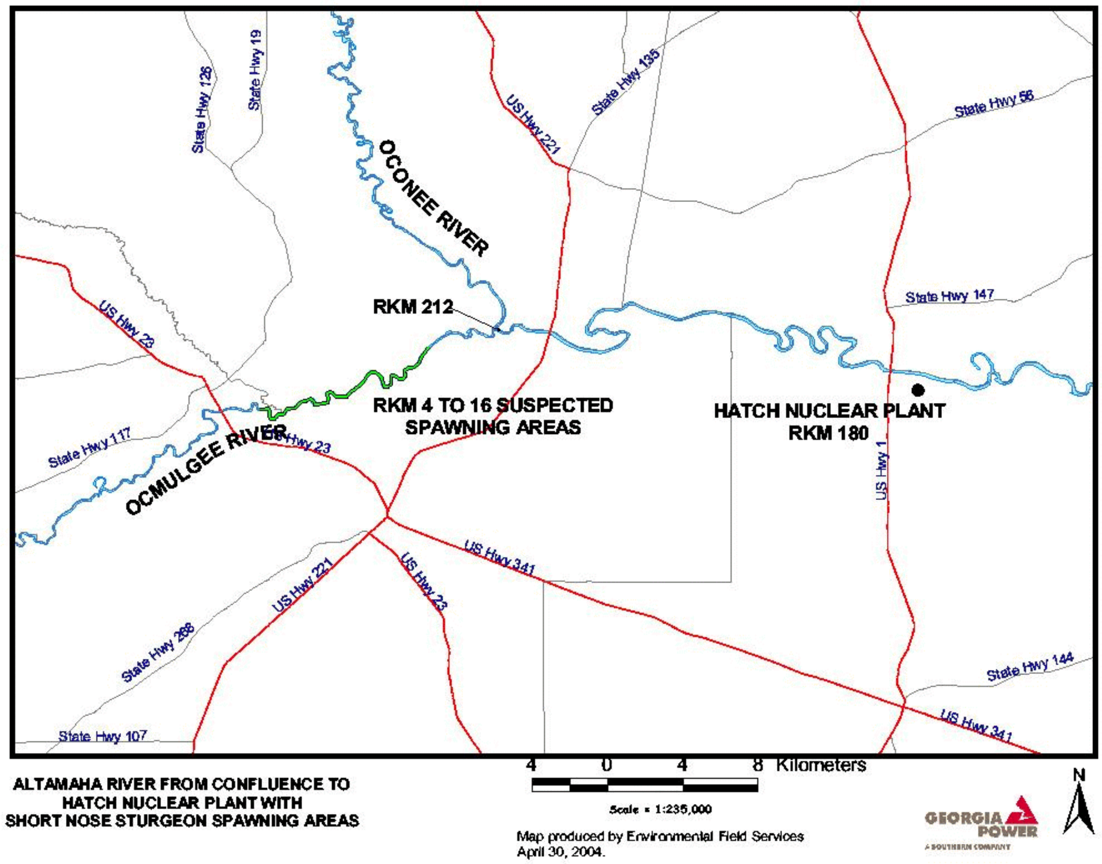

Figure 2: Altamaha River Drainage Above the Edwin I. Hatch Nuclear Plant

HNP is a two-unit nuclear plant. Each unit is equipped with a General Electric Nuclear Steam Supply System that utilizes a boiling-water reactor with a Mark I containment design. Both units are licensed for 2,763 megawatt-thermal (MW(t)). HNP uses a closed-loop cooling system for main condenser cooling that withdraws from and discharges to, the Altamaha River via a shoreline intake and offshore discharge structures. Descriptions of HNP can be found in documentation submitted to the NRC for the original operating license and subsequent license amendments. Georgia Power Company (GPC) submitted environmental reports for the construction stage and operating license stage for HNP in 1971 and 1975, respectively (GPC 1971, 1975). In 1972, the Atomic Energy Commission (AEC)[1] issued a Final Environmental Statement (FES) for Units 1 and 2 (AEC 1972), and in 1978, NRC issued a FES for Unit 2 (NRC 1978). On October 13, 1974, the NRC issued an operating license for Unit 1 with an expiration date of August 6, 2014. On June 13, 1978, the NRC issued an operating license for Unit 2 with an expiration date of June 13, 2018.

By letter dated February 29, 2000, SNC submitted an application to the NRC to renew the operating licenses for HNP, Units 1 and 2, for an additional 20-year period (SNC 2000a). On January 15, 2002, after the completion of a safety review, an environmental review, inspections

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[1]Predecessor agency to the NRC.

of the facility, and an independent assessment by the Advisory Committee on Reactor Safeguards the NRC renewed the licenses for HNP, Units 1 and 2, for an additional twenty years (NRC 2002). The current expiration dates for the Unit 1 and 2 operating licenses are August 6, 2034, and June 13, 2038, respectively.

The property at the HNP site totals approximately 907 hectares (ha) (2,240 ac) and is characterized by low, rolling sandy hills that are predominantly forested. The property includes approximately 364 ha (900 ac) north of the Altamaha River, on the other side of the river, in Toombs County and approximately 542 ha (1,340 ac) south of the river in Appling County. All industrial facilities associated with the site are located in Appling County. The restricted area, which comprises the reactors, containment buildings, switchyard, cooling tower area and associated facilities, is approximately 121 ha (300 ac). Approximately 648 ha (1,600 ac) are managed for timber production and wildlife habitat (NRC 2001).

2.2 Heat Dissipation System

The excess heat produced by HNP’s two nuclear units is absorbed by cooling water flowing through the condensers and the service water system. Main condenser cooling is provided by mechanical draft cooling towers. Each HNP circulating water system is a closed-loop cooling system that utilizes three cross-flow and one counter-flow mechanical-draft cooling towers for dissipating waste heat to the atmosphere.

For both Units 1 and 2, cooling tower makeup water is withdrawn from the Altamaha River through a single intake structure. The intake structure is located along the southern shoreline of the Altamaha River and is positioned so that water is available to the plant at both minimum flow and probable flood conditions. The main river channel (thalweg) is located closer to the northern shoreline on the opposite side of the river from the plant and its intake structure. The intake is approximately 46 m (150 ft) long, 18 m (60 ft) wide, and the roof of the intake structure is approximately 18 m (60 ft) above the water surface at normal river level. The water passage entrance is about 8.2 m (27 ft) wide and extends from 4.9 m (16 ft) below to 10 m (33 ft) above normal water levels. Large debris is removed by trash racks, while small debris is removed by vertical traveling screens with a 1 cm (3/8 inch) mesh. Water velocity through the intake screens is 0.6 meter per second (m/s) (1.9 feet per second [fps]) at normal river elevations and decreases at higher river flows (SNC 2000b). The U.S. Army Corps of Engineers issued permit Number 940003893 under Section 404 of the Water Pollution Control Act (Clean Water Act) of 1977 to support maintenance dredging in front of the HNP intake structure to remove accumulated sand, silt, and debris and ensure adequate water supply for plant operation. The specifics of this permit and the maintenance dredging process are discussed in detail in Section 2.4.

Water is returned to the Altamaha River via a submerged discharge structure that consists of two 1.1 m (42-inch) lines extending approximately 37 m (120 ft) out from the shore at an elevation of 16 m (54 ft) mean sea level. The point of discharge is approximately 384 m (1,260 ft) down-river from the intake structure and approximately 1.2 m (4 ft) below the surface when the river is at its lowest level. The National Pollutant Discharge Elimination System (NPDES) Permit for HNP, issued by the Environmental Protection Division (EPD) of the Georgia Department of Natural Resources (GA DNR) in 1997 requires weekly monitoring of discharge temperatures, but does not stipulate a maximum discharge temperature or maximum temperature rise across the condenser. Maximum discharge temperatures measured at the mixing box, which are reported to EPD on a quarterly basis, range from 17°C (62°F) in winter to 34°C (94°F) in summer.

2.3 Surface Water Use

The Altamaha River is the major source of water for the plant. Water is withdrawn from the river to provide cooling for certain once-through service water loads and makeup water to the cooling towers. SNC is permitted to withdraw a monthly average of up to 321 million liters per day (85 million gallons per day) or 3.8 cubic meters per second (m^3/sec) (132 cubic feet per second [cfs]) with a maximum 24-hour rate of up to 392 million liters (103.6 million gallons). As a condition of this permit, SNC is required to monitor and report withdrawals. Historically, HNP withdraws an annual average of 216 million liters per day (57.18 million gallons per day) or 2.5 m^3/sec (88 cfs).

The U. S. Geological Survey maintains a gauging station (Number 02225000) on the right bank of the river 121 m (400 ft) downstream from the U.S. Highway 1 bridge, approximately 160 m (530 ft) upstream from HNP (NRC 2001). An analysis of surface water monthly stream flow statistics are provided in Appendix A. The mean of monthly stream flows for the Altamaha River at the Baxley, GA gauging station for the period 1971 through 2002 with discontinuous data as far back as 1949 ranges from 4,683 cfs in September to 24,620 cfs in March.

The evaluation of surface water use by SNC determined that the consumptive losses through evaporation from the HNP cooling towers would be approximately 57 percent of the total water withdrawn from the river (SNC 1997).

The thermal discharge plume in the Altamaha River at the HNP cooling water discharge has been modeled using the Motz-Benedict model for horizontal jet discharges. The predictive thermal plume model was field verified during 1980 following commencement of Unit 2 operation (Nichols and Holder 1981). Twelve thermal plume monitoring surveys were conducted during 1980 and compared to model predictions. During each of the twelve surveys, temperatures were taken at depths of 0.3 m (1 ft), 0.9 m (3 ft), and 1.5 m (5 ft). All temperatures measurements were made from a boat moving along a pre-selected transects in the river using a temperature probe and continuous recorder. Monitoring equipment was calibrated in the laboratory before each survey and rechecked in the field before and after each survey. The model predicted that the fully mixed excess temperature, under historical average summer conditions (average river flow of 85 m^3/s [3000 cfs], and a plant ΔT of 2.6°C [4.7°F]), would be 0.05 °C (0.09°F). During the 1980 field surveys, during the period of lowest river flow (91 m^3/s [3220 cfs]), greatest cooling tower heat rejection, and a ΔT of 2.5°C (4.5°F), a fully mixed excess temperature of 0.03°C (0.05°F) was measured confirming the model's predictions. The NRC modeled average expected thermal conditions and extreme thermal conditions under conservative assumptions in the Unit 2 Final Environmental Impact Statement (FES) (NRC 1978). In that environmental statement, the NRC noted the small size of the thermal plume even under the conservative assumptions, and concluded thermal blockage in the Altamaha River from the plant discharge was not possible.

To control biofouling of cooling system components such as condenser tubes and cooling towers, an oxidizing biocide (typically sodium hypochlorite or sodium bromide) is injected into the system as needed to maintain a concentration of free oxidant sufficient to kill most microbial organisms and algae. When the system is being treated, blowdown to the river is secured to prevent the discharge of residual oxidant into the river. After biocide addition, water is recirculated within the system until residual oxidant levels are below discharge limits specified in the NPDES permit.

2.4 Maintenance Dredging of Intake

In order to ensure adequate depth of water at the HNP intake structure to provide a dependable water supply for continued plant operation, the river bottom in the area of the intake structure must be maintained to remove accumulated sand, silt, and debris. Periodic maintenance is performed by dredging with a hydraulic dredge, clamshell, or dragline. Permit Number 94003873 has been issued by the Savannah District – U. S. Army Corps of Engineers under Section 404 of the Federal Water Pollution Control Act. The permit authorizes periodic maintenance dredging by hydraulic dredge, clamshell, or dragline for a ten year period. Removed material is spoiled in an upland disposal area with no return of material to the river. The permit contains numerous special conditions to ensure protection of aquatic habitat. Special Conditions 1, 2, and 3 limit dredging to a specific time of the year (August 15 – November 31) and specifically prohibit dredging from December 1 through June 30 to ensure protection of anadromous fish. The permit also requires monitoring of dissolved oxygen (DO) during dredging and requires suspension of dredging operations if DO levels fall below 3.0 mg/L. The permit also specifies recordkeeping for each dredge event and reporting to the Corps of Engineers. The licensee has dredged the area in front of the HNP intake structure 13 times since 1983. The last time the area was dredged was October 2001.

HNP routinely conducts surveys of the river bottom in front of the intake structure to evaluate the need for dredging. Recently, HNP applied for a permit modification to support a change in the size and shape of the dredge footprint. This modification was based on hydraulic engineering studies that indicated removal of the upstream sandbar area would enhance natural scouring properties of the river and ultimately reduce the amount of dredging required to maintain the intake structure. This permit modification is currently under consideration by the Savannah District Corps of Engineers. The requested modification proposes an increase in the current L-shaped profile to a larger L-shaped profile. The increase in profile size produces a maximum increase of 6,553 m^3 (8,571 yd^3) in the amount of material removed during each dredging event to maintain the footprint. The increase in profile size is recommended as a mechanism to reduce the frequency of dredging by making the profile more amenable to natural flushing during high flow events. SNC states that removal of material on the upstream side of the current footprint will expose the area near the intake structure to the effects of high flows and naturally flushing of accumulated material. Less frequent dredging provides an economic benefit to the plant and also benefits the environment by disturbing the river habitat less often. The increase in profile size does not have any relationship to the amount of water withdrawn by HNP. No changes in the withdrawal, discharge, or treatment of water are associated with the modification request. The primary purpose of maintenance dredging at HNP is to ensure adequate water depth for the river water intake pumps and to minimize the amount of silt entrained by pump operation. The proposed modification will support the required dredging on a less frequent basis. Conditions contained in the permit to protect the environment, as described above, would be required by the revised permit.

3. STATUS REVIEW OF SHORTNOSE STURGEON

3.1 Life History

The shortnose sturgeon, *Acipenser brevirostrum,* is a member of the family Acipenseridae, a long-lived group of ancient anadromous and freshwater fishes. The species is currently known by at least 19 distinct populations inhabiting Atlantic coast rivers from New Brunswick, Canada to northern Florida (NMFS 1998). Most shortnose sturgeon populations have their greatest abundance in the estuary portion of their respective river (Weber 1996). The species is Federally protected throughout its range.

The distribution of shortnose sturgeon strongly overlaps that of the Atlantic sturgeon, *Acipenser oxyrhinchus*, but life histories differ greatly between the two species. The Atlantic sturgeon is truly anadromous with adults and older juveniles spending large portions of their lives at sea. Shortnose sturgeon, however, are restricted to their natal streams. Evidence of inter-riverine movement of individuals by way of the Atlantic Ocean is highly speculative and populations seem to be isolated in each river system that supports a population. (Rogers and Weber 1995; Flournoy et al. 1992).

Seasonal migration patterns and some aspects of spawning may be partially dependent on latitude. In northern rivers, shortnose sturgeon move to the estuarine portion of rivers in the summer months. In southern rivers, movement to estuaries usually occurs in winter (NMFS 1998). Shortnose sturgeon spawn in freshwater like the Atlantic sturgeon, but then return to the estuaries and spend much of their lives near the fresh water/salt water interface. Fresh tidewaters and oligohaline areas serve as nurseries for shortnose sturgeon (Flournoy et al. 1992). There is some indication that populations of shortnose sturgeon in a river may be limited by the availability of spawning and rearing habitats (Weber 1996).

Shortnose sturgeon eggs are demersal and adhesive after fertilization, sinking quickly and adhering to sticks, stones, gravel, and rubble on the stream bottom. E. Parker,[(2)] based on unpublished laboratory behavioral studies on shortnose sturgeon larvae, found that the yoke-sack larvae spend about five days in gravel after hatching. After 5 days the larvae become positively phototrophic and enter the water column. They remain in the water column for approximately one week. They are actively feeding during this semi-planktonic phase. After about a week, they again become closely associated with the bottom. Based on the results of Parker's work, it is this one week period that the larvae would be in the water column, moving downstream as a result of the semi-planktonic behavior, and presumably would be subject to entrainment.

Parker E., et al. (unpublished ms.) conducted a laboratory study to determine substrate preference and water velocity preference of post-larval year-0 shortnose sturgeon. The species preferred fast water over a sand substrate and individuals were negatively phototrophic.

Shortnose sturgeon exhibit faster growth in southern rivers, but will reach larger adult size in northern rivers (NMFS 1998). Thus, shortnose sturgeon will reach sexual maturity (45-55 cm fork length, [Weber 1996]) at a younger age in southern rivers. Spawning by individual fish may

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[2] Personnal communication with Erika Parker, University of Massachusetts. August 13, 2003.

only occur at intervals with frequencies of a few to several years. Dadswell, et al. (1984) composed a detailed summary of the known biology of shortnose sturgeon.

Rivers of the deep south are thought to be on the edge of the natural range of the shortnose sturgeon and present somewhat unique problems for the species. A commonly held theory is that sturgeon, originally thought to be a freshwater northern species, gradually adapted to spending time in the marine environment and that the end of the last ice age trapped many populations of anadromous sturgeon in southern rivers with a gradually warming environment. The theory proposes that, shortnose sturgeon are present in southern Atlantic coastal rivers as relic populations that are severely heat stressed in the summer and close to extinction. Activities by man, habitat destruction, overfishing and water quality degradation have further stressed the species. It has been suggested that the populations of southern shortnose sturgeon are restricted to deep spring-fed refugia, with many individuals crowded into a small cool area of the river. Within this thermal refugia, they eat everything available and then no longer feed when the food supply is depleted. The sturgeon are confined to this refugia by the high water temperatures found in the main stem of the river (Flournoy et al. 1992). Sulak et al. (unpublished ms), devised a study to test these hypotheses for Gulf sturgeon (*Acipenser oxyrhinchus desotoi*). A summer aggregation of adult Gulf sturgeon were found in the Suwannee River. The researchers determined that the cold water refugia did not exist, and mixing of nearby spring flow was quick and complete. There was no significant depletion of benthos in the vicinity of the aggregation by the end of summer, the fish appear to move in and out of the areas of concentration, and they are not inactive. This study seems to refute the “cold spring-fed refugia theory.” The aggregation of Gulf sturgeon in the deep holes with low river water velocity may be as simple as sturgeon wanting to inhabit the deep water with reduced current where they do not have to expend much energy. This hypothesis may be applicable to the shortnose sturgeon as well. Therefore the old hypothesis of fish seeking out deep holes in the lower reaches of the rivers may be still true, but for a different reason, not to escape the elevated summer temperatures at the expense of feeding.

A life history that restricts the species to individual drainages, combined with seasonally restricted use of habitats, may be directly related to the species’ current endangered status. Sturgeon have long been commercially important species, which may be a leading cause in their rapid decline worldwide. For more than a century, Atlantic and shortnose sturgeon populations were subjected to extensive fishing, likely contributing to the massive population declines along the east coast (NMFS 1998). Prior to 1900, sturgeon catches were averaging over 3.0 million kg per annum, but this harvest was sustained for less than a decade. Prior to the closure of most east coast fisheries during the 1980s, catches had decreased to less than 1% of historical levels (Rogers et al. 1994).

Although the shortnose sturgeon was severely overharvested in the past, the greatest threats to the survival of the species include barriers to its spawning grounds created by dams, loss of habitat, poor water quality, poaching, and incidental capture in gill net and trawl fisheries targeting other species (Rogers and Weber 1995; Rogers et al. 1994). Shortnose sturgeon was listed as endangered in 1967 by the U.S. Fish and Wildlife Service. In 1974, the National Marine Fisheries Service reconfirmed this decision under the Endangered Species Act of 1973 (Rogers and Weber 1995; NMFS 1998).

3.2 Status of Shortnose Sturgeon in the Altamaha River

The Altamaha River watershed is one of the three largest river basins on the Atlantic Seaboard. The Altamaha River is located entirely within the state of Georgia. It flows over 800 km (497 mi) from its headwaters to the Atlantic Ocean. The main body of the Altamaha is formed by the confluence of the Oconee and Ocmulgee rivers in the central coastal plain at Altamaha rkm 212 (132 rm) (Rogers and Weber 1995).

The incidences of catch and overharvest of sturgeon from Georgia rivers paralleled the trends of other states. From 1888 through 1892, sturgeon catches in Georgia averaged 71,000 kg per annum (157,000 lbs/yr) (Smith 1985). "As recently as 49 years ago, a dealer in Savannah, Georgia was shipping 4,500 kg (10,000 lbs) of carcasses per week (6,500 kg [14,500 lbs] in the round) during the peak three to five weeks of the spring run" (Smith 1985). Similar harvests were recorded from the Altamaha River (Flournoy et al. 1992).

Catch rate data for sturgeon in Georgia show a major declines from historic levels. In 1880, an average seasonal catch was 100 fish per net. During a 20-year period from the late 1950s through the late 1970s, net fishermen in the lower Altamaha River caught just 1.1 to 3.2 fish per net per season (Essig 1984, as presented in Flournoy et al. 1992). These data indicate a 97-99% decline in the sturgeon fishery (Flournoy et al. 1992).

There is a continuing high demand for sturgeon roe and flesh. From 1962 to 1994 the source of the majority of sturgeon catches has shifted among the Savannah, Ogeechee, and Altamaha Rivers. The Altamaha River has been the focus of a "much-throttled" fishery from 1982 to present. Certain recent events have kept prices for sturgeon products high or rising, fueling commercial fisheries and some poaching (Rogers et al. 1994). Some of these events were an increasing U.S. domestic demand for all seafood products, decreased supplies of sturgeon products as fisheries closed in the U.S., and sturgeon stocks worldwide were becoming more depleted by overharvesting and habitat degradation, particularly in the republics of the former Soviet Union (Rogers et al. 1994).

The Altamaha River population of shortnose sturgeon has been the focus of much recent research to assess abundance and distribution, determine migration patterns, and describe habitat utilization. Some authors suggested the Altamaha River population of shortnose sturgeon was in better shape than the population in the Savannah River, Georgia-South Carolina (Rogers et al. 1994). Another study indicated shortnose sturgeon in the Altamaha River may be experiencing lower juvenile mortality rates than in the Ogeechee River, Georgia (Weber 1996). The Shortnose Sturgeon Recovery Team indicated that the Altamaha River population was the largest and most viable population south of Cape Hatteras, North Carolina (NMFS 1998). Relative abundance data from one sampling station during 1986-1991 appear to demonstrate a relatively stable population with little trend in the abundance of juveniles (Flournoy et al. 1992).

Telemetry studies have revealed much information about the seasonal migrations of shortnose sturgeon in the Altamaha River and the importance of certain habitats. During summer in the Altamaha River, most fish ages 1+ and older are concentrated at or just upstream of the fresh/salt water interface. Cooling water temperatures in the fall spur a movement of all sizes of fish to generally more saline waters. Some adult and most large juvenile fish move back to fresh tidewater near the end of autumn to overwinter with little movement or activity. In preparation for spawning in late winter-early spring, some adults will move upstream to locations near spawning sites. It is believed that spawning occurs during the February to March time frame (Rogers et al. 1994). The majority of adults and a few large juveniles remain in oligohaline waters, near the fresh/salt water interface, and may be very active (Rogers and Weber 1995).

Shortnose sturgeon are suspected to spawn in two reaches of the Altamaha River system. A suspected spawning area is defined as a section of river in which fish in spawning condition (both males and females present, female fish ripe with eggs) have been found, but actual spawning has not been visually observed nor has the presence of fertilized eggs been documented.(3) One area is a 70-km (43-mi) section of the Altamaha River centered about Doctortown, Georgia (Rogers and Weber 1995). Doctortown, Georgia is located at RK 72 (RM 45) some 108 km (67 mi) downstream of the HNP site.

A second spawning area has also been suspected in the lower Ocmulgee River, which is several kilometers upstream of the shoals marking the transition to the upper coastal plain. Heidt and Gilbert (1978) reported the collection of two male shortnose sturgeon and, in February, a female shortnose sturgeon ripe with eggs from the lower Ocmulgee River. This reach is about 40 rkm (25 river mi) upstream of HNP. They also reported collecting in February a ripe female at rkm 185.9 (rm 115.5) approximately 6 rkm (3.7 rm) upstream of HNP. Recent discussions with Dr. Doug Peterson(4), a Professor at the University of Georgia currently conducting a study entitled "Population Dynamics and Critical Habitats of Shortnose Sturgeon in the Altamaha River" for the NOAA Fisheries, indicate that there is no data that conclusively demonstrates the location of active spawning sites used by shortnose sturgeon in the Altamaha or Ocmulgee Rivers.

In addition, discussions with Mr. Jimmy Evans(5), Fisheries Biologist with the Georgia Department of Natural Resources, confirm that no data exist to support the viability of the Ocmulgee site. However, it is likely that there was and still is suitable spawning habitat for sturgeon in the Altamaha River above HNP since a single larva of the genus *Acipenser* was collected by the licensee in the early 1970s during the preoperational larval drift study for the plant. Identification of the collected larva to species was not possible. A map indicating the suspected two spawning areas in relation to HNP is provided as Figures 1 and 2.

Based on historical data there appear to be at least two potential spawning areas in the Altamaha River system that are suitable for sturgeon: the lower spawning area near Doctortown, GA, and an upper spawning area, located some distance upstream of HNP. Suspected spawning areas in the Altamaha River system are thought to be adjacent to river bluffs with gravel, cobble, or hard rock substrate (Rogers et al. 1994).

Shortnose sturgeon, especially juveniles, appear severely restricted to certain habitats near the fresh/salt water interface of the lower Altamaha River. During summers when the water temperature exceeds 28°C (82°F), the fish are further restricted to a few deep holes near the interface. Recaptures of tagged fish indicate that the fish move little and lose weight during this time, which indicates the oversummering habitat is very important, and that food resources may

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[3]Personnal communication with Gordon Rogers, Satilla Management Associates, May 7, 2003.
[4]Personnal communication with Douglas Peterson, University of Georgia, May 7, 2004.
[5]Personnal communication with Jimmy Evans, Georgia Department of Natural Resources, December 9, 2003.

be quickly exhausted (Flournoy et al. 1992) or the fish may not be feeding. Flournoy, et al. (1992) proposed that shortnose sturgeon were using a few deep holes in the lower Altamaha as physiological refuges, and that these holes may constitute critical habitat. They further hypothesized that the Altamaha River population of shortnose sturgeon existed only because the physiological refugia were available.

Previous research has shown that shortnose sturgeon, ages one year and older, aggregate in the Altamaha River at or just upstream of the fresh/saltwater interface during the summer. These fish appear to move downstream into more saline water at the end of summer. During late fall and early winter, movement to less saline water occurs and some adults may move upstream toward spawning areas. Spawning is thought to occur during February through March. Some spawning fish move downstream immediately, while others remain upstream (Rogers and Weber 1995).

The Shortnose Sturgeon Recovery Team has identified numerous factors that may affect the continued survival and potential recovery of the species. Some of these factors may be habitat degradation or loss from dams, bridge construction, channel dredging, and pollutant discharges, as well as mortality from cooling water intake systems, dredging, and incidental capture in other fisheries (NMFS 1998). Evidence of illegal directed takes of shortnose sturgeon in South Carolina indicate that poaching may also be a significant source of mortality (Weber 1996).

All of the above factors may contribute to mortality in shortnose sturgeon populations, and the significance of each may vary with latitude and individual circumstances. However, the prevailing evidence seems to indicate, at least for the Altamaha River, that the primary threats to the population are commercial harvesting, poaching, and possibly limited oversummering habitat. Dahlberg and Scott (1971) recognized that shortnose sturgeon were often caught in gill nets by shad fishermen in the Altamaha River. The threat of bycatch remains real, as many of the individual shortnose sturgeon used in recent studies were captured or recaptured with shad fishing gear. Rogers, et al. (1994) stated that at least one of their tagged fish released in the estuary was captured in commercial shad gear, and six of the 36 individuals telemetered were initially collected with shad gear. Even if the fish are recognized as protected shortnose sturgeon and returned to the river, the capture may result in abandonment of spawning activity (Weber 1996) or death.

The Altamaha River population of shortnose sturgeon may be healthier than the Savannah River population (Rogers and Weber 1995). Both rivers have discharges of similar magnitude and neither is dammed below the fall line. Both the Savannah and Altamaha are moderately industrialized, including paper mills and nuclear generating stations along their reaches from the fall line to the coast. Only the Savannah, however, is heavily altered and industrialized in its estuarine zone (Rogers et al. 1994).

3.3 Impact Assessment of HNP on the Shortnose Sturgeon Population

Operation of the HNP has the potential to impact the shortnose sturgeon population in the Altamaha River. Impingement of young and adults, entrainment of larva, disruption of intra-river movement through dredging and the discharge of heated effluents all have the potential to impact the species.

3.3.1 Impingement

The impingement of healthy juvenile and adult shortnose sturgeon on the intake trash racks or traveling screens of nuclear plants has not been a concern throughout the range of the species. Although occasional impinged shortnose sturgeon are reported from other nuclear plants, those plants are of once-through cooling design and located in the reach of the river where large aggregations of shortnose sturgeon are known to exist. Often, specimens that are taken on the trash racks or traveling screens are injured or weakened individuals. Typically this bottom oriented species with a preference for deep water makes interaction with a shoreline intake structure unlikely. Also the preference of adults and juvenile shortnose sturgeon for high velocity water suggests that escape by healthy fish from the surface of the intake is likely. Under normal flow and pumping conditions the velocity of water through the HNP intake structure is 0.6 m/s (1.9 fps). The measured range of intake velocities was from 0.09 to 0.8 m/s (0.3 to 2.7 fps) (SNC 2000b).

The intake structure was constructed flush with the shallow, southern shoreline of the Altamaha River. The deep river channel (thalweg) hugs the northern bank opposite of the intake structure. Literature indicates that shortnose sturgeon migrate along the bottom of river channels, often seeking the deepest water available. This behavior and the cooling water intake location on the shoreline opposite the river channel should minimize the probability of juvenile and adult shortnose sturgeon encountering the intake structure. The plant and intake structure are also located in a reach of the Altamaha River where large aggregations of shortnose sturgeon are not known to occur. Shortnose sturgeon in the vicinity of the plant would likely be individuals migrating between up- and down-river.

During the preoperational surveys, conducted as part of the initial licensing of HNP, one adult shortnose sturgeon was collected by gill net on March 13, 1974, in the vicinity of HNP. Two additional juvenile specimens of *Acipenser* sp. were collected but could not be identified to species (NRC 1978).

Impingement data, taken from the HNP intake once the station began operation, are available for five years, including 1975, 1976, 1977, 1979, and 1980. Impingement samples include weekly samples in 1975, 1976, and 1977 and monthly samples for 1979 and 1980. Each sample represents impingement for at least a 24-hour period. A total of 165 fish representing 22 species were collected. The data indicate low impingement estimates per day and per year. The 1975 estimates are 1.2 fish per day and 438 per year; 1976 estimates are 0.4 fish per day and 146 per year; 1977 estimates are 1.1 fish per day and 401.5 per year; 1979 estimates are 1.3 fish per day and 474.5 per year; and 1980 estimates are 1.2 fish per day and 438 per year. The hogchoker, *Trinectes maculatus*, was the most abundant and the only species collected consistently each year. Most species were collected only once during the five years. No sturgeon were collected in impingement samples during five years of sampling. In addition, no adult sturgeon has been reported impinged by the intake structure since HNP began operation.

Impingement effects are also a function of withdrawal rates, which are reduced for facilities with closed cycle cooling systems in comparison to once through cooling systems. HNP is operated using mechanical draft cooling towers for cooling. Cooling towers have been suggested as mitigative measures to reduce known or predicted impingement losses (see, for example, Barnthouse and Van Winkle 1988). EPA has endorsed closed cycle cooling towers as the “best available technology" for minimizing impingement mortality (Barnthouse et al. 1988). The relatively small volumes of makeup and blowdown water needed for closed-cycle cooling systems result in concomitantly low impingement rates. In the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996), the staff noted that studies of intake and discharge effects of closed-cycle cooling systems have generally judged the impacts to be insignificant.

Both the design of the plant (location, shoreline intake, closed cycle cooling) and the behavioral characteristics of juvenile and adult shortnose sturgeon lead to the conclusion that impingement of healthy adult and juvenile fish unlikely. This conclusion is supported by the results of the above described impingement study as well as the lack of any reported impingement events involving shortnose sturgeon since both Units 1 and 2 began operation in the latter half of the 1970s.

3.3.2 Entrainment

Available literature suggests there is little opportunity for shortnose sturgeon eggs or larvae to be entrained in the cooling water intakes at HNP. One of the suspected spawning areas for shortnose sturgeon in the Altamaha River is well downstream of HNP. Eggs and larvae from the downstream Doctortown, Georgia, spawning site are not available for entrainment by HNP. Spawning upstream of the site has been suspected but no evidence of actual spawning by shortnose sturgeon has been found except for a single larval specimen of the genus *Acipenser* collected during drift sampling in the 1970s. Identification of the specimen to species was not possible so we are unable to conclude that upstream spawning of shortnose sturgeon currently occurs or does not occur. It is likely that the specimen was a Atlantic sturgeon, *Acipenser oxyrhinchus*, the more common species.

Should future studies determine in fact that spawning of shortnose sturgeon occurs in the lower Ocmulgee River, upstream of HNP, the staff does not believe that continued operation of the plant is significantly affecting the species. As was stated, fertilized shortnose sturgeon eggs sink quickly and adhere tightly to rough substrates, even under high flow conditions. Eggs therefore are not subject to entrainment by HNP. Shortnose sturgeon larvae initially seek bottom cover quickly upon hatching and seldom stray from cover for the first five days. After five days the larva become positively phototrophic and enter the water column and float downstream for about a week. It is this semi-planktonic phase of the sturgeon life cycle that is vulnerable to plant induced mortality. Any larvae that become entrained into the cooling water flow would experience 100 percent mortality.

Factors that effect entrainment of the semi-planktonic larvae are density and distribution of the organisms in the water column in the vicinity of the intake, the location and design of the intake structure, and the amount of water withdrawn by the plant.

Little is known about the distribution in the water column of shortnose sturgeon larvae during this planktonic phase. We know that the larvae seem to be positively phototropic so they are probably up off the bottom and actively feeding. It is unknown if they prefer the slack water areas or attempt to remain in the thalweg. If they prefer the swift deep channel then they would be preferentially excluded from entrainment into the intake because the swifter water is in the far side of the river from the intake structure. If they prefer areas of lower velocity typical of the river near the intake it is unlikely that many larvae would be present since the suspected upper spawning grounds are some 40 km (25 rm) upstream and there are many backwaters and areas of slack current for the larvae to inhabit between that area and the plant site during their semi-planktonic life stage. It would not be expected that a large number of larvae would preferentially seek out slack water in the vicinity of the site over other slack water areas between the suspected spawning grounds and the HNP.

If we assume that the larvae are evenly distributed throughout the water column the loss would also be inconsequential. Spawning of shortnose sturgeon in the Altamaha River is thought to occur during February through March. A comparison of Altamaha River flows for the months of February, March, and April from 1971 to 2002 to the annual daily average HNP water withdrawal rate is presented in table 1. Both the average flow in m^3/sec (cfs) and the percent of that flow withdrawn by HNP, assuming a withdrawal rate of 2.5 m^3/sec (88 cfs), is given for each month for historical average, maximum, and minimum flow rates.

Table 1. Percent Water Withdrawal from the Altamaha River by HNP Two unit Operation at 100 Percent Power for the Months of February, March, and April[1]

	February	March	April
Mean flow[2]	626 m^3/sec (22,110 cfs) (0.4%)	697 m^3/sec (24,620 cfs) (0.4%)	526 m^3/sec (18,590 cfs) (0.5%)
Max flow[3]	1710 m^3/sec (60,419 cfs) (0.1%)	1845 m^3/sec (65,210 cfs) (0.1%)	1174 m^3/sec (41,490 cfs) (0.2%)
Min flow[4]	136 m^3/sec (4,803 cfs) (2%)	226 m^3/sec (7,977 cfs) (1%)	159 m^3/sec (5,635 cfs) (2%)

Stream flow data from USGS 2004

1) Assumes an average plant withdrawal rate of 2.5 m^3/sec (88 cfs)
2) The mean of monthly mean stream flows in m^3/sec (cfs) from available data from 1950 to 2002
3) The maximum monthly mean stream flow in m^3/sec (cfs) from available data from 1950 to 2002
4) The minimum monthly mean stream flow in m^3/sec (cfs) from available data from 1950 to 2002

Based on the stream flow analysis, HNP withdraws about 2% of the river flow under extreme low flow conditions during the period of time that shortnose sturgeon larvae may be drifting by the plant and vulnerable to impingement. Typically it is 0.5 percent or less of the flow. Assuming a uniform distribution within the water column, few, if any, larvae would be impinged in any given cohort.

The paucity of shortnose sturgeon larvae, and for that matter any entrainable fish larvae, in the vicinity of HNP was confirmed by both preoperational studies and postoperational entrainment sampling. Preoperational drift surveys where conducted weekly from February through May in 1973, and every 6 weeks June through December 1973. Samples were collected at four quadrants from transects above and below the plant intake and two locations close to the plant intake. Typical sample sets consisted of 14 individual samples from 15-minute collections. Drifting organisms were collected with a one-meter diameter 000-mesh nylon plankton net, set 6-12 inches above the river bottom. Samples were washed into a quart container and preserved with formalin.

Cataostomids, cyprindis, and centrarchids were the dominant ichthyoplankton families collected. Commercially important fish in these collections included American shad*, Alosa sapidissima,* eggs, with mean densities approaching 0.3 per 1000 m^3 in March. American shad larvae were present in drift samples from May through June, with the density never exceeding 0.03 individuals per 1000 m^3. A sturgeon larva was collected during this sampling and sent to Dr. Donald Scott for identification of species, but could not be identified beyond the genus *Acipenser.* This is the only record of larval sturgeon found in the vicinity of HNP.

Entrainment samples at HNP were collected for the years 1975, 1976, and 1980 following unit startup. Samples were collected weekly during 1975 and 1976, and monthly in 1980 (Bain and Nack 1995). Additional ichthyological drift data are available for 1974 (weekly collection) and 1979 (monthly collection), but were not used in summarizing entrainment rates. Monthly entrainment data for each taxa for 1975, 1976 represent entrainment estimates for Unit 1 operation. The 1980 data include entrainment estimates for Unit 1 and Unit 2 operation. There was no increase in fish eggs and larvae entrainment at HNP with both units operating. The differences in numbers of fish eggs and larvae reported in the studies are due to differences in species abundance from year to year, spawning activity upstream from the plant, river discharge, and time of year. No sturgeon larvae were found in any entrainment samples collected during operational monitoring.

Entrainment effects are a function of withdrawal rates, which are reduced for facilities with closed cycle cooling systems in comparison to once through cooling systems. HNP is operated using mechanical draft cooling towers for cooling. Cooling towers have been suggested as mitigative measures to reduce known or predicted entrainment losses (see, for example, Barnthouse and Van Winkle 1988). EPA has endorsed closed cycle cooling towers as the “best available technology” for minimizing entrainment mortality (Barnthouse et al. 1988). The relatively small volumes of makeup and blowdown water needed for closed-cycle cooling systems result in concomitantly low entrainment rates. In the GEIS for license renewal (NRC 1996), the staff noted that studies of intake and discharge effects of closed-cycle cooling systems have generally judged the impacts to be insignificant.

The design and location of the plant (shoreline intake on the opposite side of the thalweg, closed cycle cooling, and the plant not located in any known spawning areas) and the lack of a confirmed upstream spawning grounds leads the staff to conclude that the site has a very low potential for entrainment of shortnose sturgeon larvae. Even if upstream spawning areas for shortnose sturgeon are identified, the staff believes that the impact would still be inconsequential because of the location of the intake structure and the very low withdrawal rates of HNP during and immediately after the suspected spawning period in the Altamaha River. This conclusion is supported by the results of the entrainment sampling study.

3.3.3 Thermal Related Impacts

Operation of steam electric power facilities results in the release of waste heat. Typically that heat is dumped into a nearby watercourse (once-through cooling) or into the atmosphere by evaporative cooling (closed-cycle cooling). HNP utilizes closed-cycle cooling and disposes most of its waste heat into the atmosphere. However, to maintain water quality in the circulating water system a portion of the heated water that is circulated between the plant and the cooling tower is discharged to the Altamaha River. This discharge is commonly referred to as blowdown. The waste heat discharged to the river is of concern because, depending on the volume relative to the river, and the rise in temperature of the discharged water over the ambient river water, the discharge could have adverse effects on aquatic life. Approximately one half of the water withdrawn from the Altamaha River by the HNP is evaporated and not returned to the river as blowdown. With respect to the shortnose sturgeon the concern is that the heated blowdown could cause a thermal blockage across the river limiting or eliminating upstream and downstream migrations. As stated in Section 2.3 above, thermal modeling of the discharge demonstrated that thermal blockage of the river will not occur. The area of temperature rise in the river of a few degrees is limited to a small area just below the outfall even during low flow conditions. Therefore, the staff concludes that thermal discharges from the plant will not adversely affect the migration of shortnose sturgeon in the Altamaha River.

3.3.4 Dredging Related Impacts

Periodic dredging of riverine habitat has the potential for adversely affecting shortnose sturgeon in a number of different ways, such as entrainment of juveniles or adults in hydraulic dredging operations, physical damage to individuals during clamshell or dragline operations, and burial of juveniles. Additionally the potential exists to adversely affect the species particularly if dredging is conducted on habitat that is critical to the species (i.e. feeding or spawning areas) or during periods when intra-riverine migrations are occurring. Dredging of seasonal aggregational sites may also be harmful to the species. Also, dredging during the spawning migration may also be harmful by discouraging or preventing fish from reaching the spawning grounds.

Based on the known life history of the species and telemetry data from the Altamaha River population, the older fish congregate at or just upstream of the fresh/saltwater interface significantly downstream of HNP during the summer months. Cooling temperatures in the fall result in fish moving towards the ocean. The Doctorville, Georgia suspected spawning site is some 108 river kilometers (67 rivermiles) downstream of HNP and would not be affected by dredging. A second spawning site is suspected, but is upstream of HNP, and would be unaffected by dredging. There is the possibility that if an upstream spawning site is utilized by shortnose sturgeon that dredging operations at HNP could discourage upstream migration of adults to the spawning grounds during the early spring spawning migration.

The area in front of the HNP intake does not appear to be habitat critical to the existence of the species. Extensive sampling in the vicinity of the station has not indicated that significant numbers of adults or juveniles use this stretch of the river. The bottom consists primarily of accumulated sand deposits that shift constantly with changes in river flow.

Although dredging in front of the intake structure is not expected to impact habitat critical to the existence of the species, the permit that authorizes periodic maintenance dredging contains numerous special conditions to ensure protection of aquatic habitat. These conditions are currently specified by the existing permit and will continue to be required whether or not the requested revision to the permit for the expanded dredging footprint is approved by the U.S. Corps of Engineers. Special Conditions 1, 2, and 3 of the Corps of Engineers Dredging Permit Number 94003873 limit dredging to a specific time of the year (August 15 –November 31) and specifically prohibit dredging from December 1 through June 30 to ensure protection of anadromous fish, including shortnose sturgeon. This prohibition would eliminate the potential for dredging operations to affect the upstream spawning migration of adults and the downstream movement of larva. Additionally, the permit has the following restriction: "Each time the hydraulic dredge pipeline is cleared, the dredge cutterhead shall be removed from the river bottom, promptly lifted to near the surface and kept as close to the surface as practicable while water is pumped for pipeline cleaning." By raising the cutterhead to the surface prior to cleaning, the potential impact to juvenile shortnose sturgeon and other bottom dwelling fish is minimized.

The permit also requires monitoring of dissolved oxygen (DO) during dredging and requires suspension of dredging operations if dissolved oxygen levels fall below 3.0 mg/L. The permit specifies recordkeeping for each dredge event and reporting to the Corps of Engineers. In the past, dredging at HNP has been conducted during the time of the year that shortnose sturgeon are not spawning and are thought to inhabit the in the lower reaches of the Altamaha River near the fresh/saltwater interface. Limiting the time of year that dredging can occur to protect the shortnose sturgeon is consistent with other consultations with NOAA Fisheries. For example, the 1992 Biological Opinion (BO) (NMFS 1992), issued to the Army Corps of Engineers, for maintenance dredging the channel in the Connecticut River from the mouth in Long Island Sound to river kilometer 85 (river mile 53) restricted dredging to about 7.5 months a year. Other restrictions in the BO placed prohibitions on the location for the disposal of spoils and the type of dredging equipment that could be employed by the Corps. The Connecticut River has one of the largest shortnose sturgeon populations of any U.S. river.

The combination of the lack of habitat critical to the shortnose sturgeon in the vicinity of the intake and the limitations placed on the licensee by the Corps of Engineers permit (prohibiting dredging from December 31 to June 30, cutterhead restrictions, no in-river disposal of dredged materials, recordkeeping and periodic monitoring of DO during dredging) assure that the species will not be adversely affected by HNP dredging.

3.4 Comparison with other power generation facilities

The staff has performed an assessment (Masnik and Wilson 1980) of the potential impact of the operation of the Delaware River nuclear power plants, Salem 1 and 2 (once-through) and Hope Creek 1 (closed cycle) on shortnose sturgeon, and concluded that plant operation was unlikely to adversely affect shortnose sturgeon. This conclusion was based on a combination of life history information, plant siting considerations, and engineering design to mitigate potential adverse impacts (Masnik and Wilson 1980).

The Hudson River, New York, supports a large sturgeon population including both the shortnose and Atlantic. There are six fossil-fueled and one nuclear electricity generating stations located along the Hudson River, and much research has been conducted to address impingement and entrainment concerns. Results for entrainment and impingement at the power generation facilities Bowline, Indian Point, and Roseton have been recently summarized for the period from 1972 through 1998 (CHGE 1999). These three facilities withdraw 62% of the maximum permitted water withdrawal from this reach of the Hudson River. Bowline Units 1 and 2 are two fossil fuel steam electric plants with combined capacity of 1200 MW(e) and utilize an intake structure located on an embayment off of the Hudson River. The maximum pumping rate is 384,000 gpm. Indian Point Units 2 and 3 are separate pressurized water reactors with combined capacity of 2042 megawatts electric (MW(e)) utilizing two separate shoreline intake structures. Predicted condenser cooling water flow rates are 840,000 gpm and 870,000 gpm for Indian Point Units 2 and 3, respectively. Roseton is a two-unit fossil-fueled steam electric plant with combined capacity of 1248 MW(e) and utilizes a shoreline intake structure. Maximum pumping rate is 641,000 gpm. Unlike HNP, all three of these facilities use once-through cooling. For comparison, the maximum pumping rate for HNP is 72,000 gpm. The GEIS for license renewal (NRC 1996) notes that "Water withdrawal from adjacent bodies of water for plants with closed-cycle cooling systems is 5 to 10 percent of that for plants with once-through cooling systems, with much of this water being used for makeup of water by evaporation." The operation of the HNP cooling system is consistent with this description.

One of the environmental impacts identified for the three facilities on the Hudson River is entrainment and impingement of aquatic organisms, including striped bass, *Morone saxatilis*, white perch, *Morone americana*, Atlantic tomcod, *Microgadus tomcod*, American shad, bay anchovy, *Anchoa mitchilli*, alewife, *Alosa pseudoharengus*, blueback herring, *Alosa aestivalis*, and spottail shiner, *Notropis hudsonius*. Other species were considered, including Atlantic sturgeon and shortnose sturgeon. No shortnose sturgeon eggs or larvae were collected in entrainment samples for these facilities over periods ranging from 5 to 14 years. As a result, entrainment effects on shortnose sturgeon are believed to be negligible.

Adult shortnose sturgeon, however, were collected in impingement samples at these facilities. Indian Point Unit 2 reported shortnose sturgeon in impingement samples for 10 of 19 years reported (ranging from 1 to 6 individuals per year). Indian Point Unit 3 reported shortnose sturgeon in impingement samples for 7 of 15 years reported (ranging from 1 to 3 individuals per year). The size of impinged shortnose sturgeon ranged from 12 to 18 inches. The low rate of impingement and the return of impinged fish to the Hudson River alive lead to the conclusion that impingement effects were negligible (CHGE 1999). Even though sampling has documented large numbers of affected fish at intakes along the Hudson River, and a large resident population of sturgeon exists, shortnose sturgeon are a very small component of the impingement and entrainment numbers (CHGE 1999).

The use of closed cycle cooling minimizes water withdrawals from the Altamaha River. As a result, the probability is much lower of impinging shortnose sturgeon, particularly when compared to similarly situated facilities using once-through cooling systems. In addition, the existing monitoring data support the conclusion that no impacts are known to occur to shortnose sturgeon from entrainment and impingement at HNP.

4. CONCLUSION

The staff evaluated the potential for impact to the shortnose sturgeon, *Acipenser brevirostrum*, from continued operation of the HNP; specifically evaluating impacts related to impingement, entrainment, thermal effects, and periodic river dredging in the vicinity of the intake structure. After reviewing the operating characteristics of the HNP, the Altamaha River environment, the shortnose sturgeon life history, and data from the Altamaha River, the staff has concluded that HNP may affect the shortnose sturgeon. However, the staff has determined that the effects are discountable and extremely unlikely to occur, and therefore, not likely to adversely affect the species.

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Appendix A Monthly Streamflow Statistics

YEAR	Monthly mean streamflow, in ft^3/s											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1949									13,860	6,434	5,945	6,499
1950	6,487	7,121	14,750	9,769	5,739	6,116	4,993	4,204	5,028	5,179	4,560	6,533
1951	10,130	9,138	10,530	14,760	6,545	3,719						
1970										2,625	5,421	5,933
1971	16,320	20,430	42,630	23,880	16,640	6,393	6,879	12,870	7,735	5,050	5,252	16,280
1972	30,520	34,170	16,250	11,670	7,252	6,749	6,418	4,436	3,268	2,597	3,663	10,210
1973	23,210	41,600	24,310	41,490	16,960	19,380	8,219	7,668	4,179	4,209	3,496	5,694
1974	13,819	31,950	16,490	21,160	6,596	6,070	4,314	7,554	6,599	2,912	3,474	6,871
1975	18,250	26,540	47,260	41,730	20,630	14,660	11,440	12,160	7,419	11,210	8,366	8,516
1976	14,590	16,180	20,970	13,070	16,720	14,490	8,429	4,157	3,968	7,206	6,808	22,430
1977	24,320	11,640	28,980	22,270	5,586	4,273	3,284	5,205	4,297	4,623	11,020	8,182
1978	18,180	34,260	17,820	10,250	16,660	5,820	3,774	5,779	2,877	2,224	2,336	4,486
1979	8,723	18,790	34,890	22,330	14,640	5,177	5,102	3,666	4,582	6,106	6,810	7,056
1980	10,800	15,900	38,300	39,450	11,150	10,240	6,049	3,053	2,468	3,018	3,094	4,089
1981	3,395	14,670	10,310	14,490	3,665	3,666	2,211	2,874	2,484	1,864	2,115	3,202
1982	22,220	27,080	15,270	13,610	12,280	8,321	6,153	6,112	3,464	3,992	3,932	11,690
1983	18,790	29,049	34,410	38,390	10,280	5,602	4,395	2,933	3,309	2,731	4,571	25,140
1984	22,790	22,970	29,809	24,710	18,970	8,064	6,274	16,580	3,597	2,665	4,048	4,821
1985	5,721	20,230	9,112	5,711	5,225	2,932	3,301	5,440	3,928	4,186	8,722	14,700
1986	8,503	14,800	10,770	5,635	2,576	2,406	1,810	2,093	3,129	2,133	4,530	15,650
1987	30,540	28,210	31,830	18,770	6,421	5,634	5,677	2,692	2,597	1,903	2,193	2,763
1988	7,281	11,870	11,290	9,252	6,040	2,302	1,796	1,902	4,272	3,286	3,191	3,495
1989	5,068	4,803	11,080	15,970	7,685	7,304	12,900	6,613	4,193	16,030	6,086	12,600
1990	24,000	24,890	31,550	14,900	6,298	3,830	2,666	2,765	2,975	4,952	5,538	4,915
1991	14,580	28,930	32,690	20,410	17,980	8,625	12,030	13,150	6,415	2,750	3,021	4,123
1992	12,889	20,900	23,680	13,500	4,406	7,088	5,355	8,880	11,050	11,350	12,120	29,870

YEAR	Monthly mean streamflow, in ft^3/s											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1993	36,550	23,380	38,020	34,840	8,955	5,634	3,484	2,821	2,759	2,373	5,158	7,806
1994	10,380	18,370	21,950	16,530	5,651	5,401	32,470	19,600	10,570	24,560	12,440	21,550
1995	20,470	37,360	31,550	9,998	5,479	11,550	4,364	4,211	5,748	9,150	14,480	9,693
1996	11,940	29,970	30,190	18,540	9,603	6,536	3,430	4,028	3,297	4,415	3,767	7,034
1997	14,290	24,790	25,970	6,286	10,560	6,672	4,942	4,377	2,228	6,541	19,540	31,920
1998	46,750	60,419	65,210	35,290	20,520	6,713	3,547	4,968	7,308	6,099	4,481	3,784
1999	7,933	17,160	8,597	5,817	3,950	2,753	4,741	2,106	1,643	3,140	2,522	4,312
2000	6,949	11,120	10,470	9,326	2,813	1,877	1,666	1,683	3,133	2,542	2,471	4,488
2001	6,860	5,805	32,020	19,850	3,956	10,600	5,981	4,074	2,685	2,064	1,870	2,424
2002	3,504	7,193	7,977	8,436	4,035	2,285	1,880	1,627	2,170			
Mean of monthly stream flows	15,790	22,110	24,620	18,590	9,484	6,732	6,060	5,827	4,683	5,356	5,795	9,964

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