UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

August 31, 2000

Charles A. Oravetz, Assistant Regional Administrator
Southeast Regional Office
National Marine Fisheries Service
9721 Executive Center Drive
St. Petersburg, FL 33702

SUBJECT: BIOLOGICAL ASSESSMENT FOR LICENSE RENEWAL AT E. I. HATCH NUCLEAR PLANT, UNITS 1 AND 2 AND REQUEST FOR INFORMAL CONSULTATION (TAC NOS. MA8330 AND MA8332)

Dear Mr. Oravetz:

The NRC staff has prepared the enclosed biological assessment to evaluate whether the proposed renewal of the Edwin I. Hatch Nuclear Power Plant, Units 1 and 2 operating licenses for a period of an additional 20 years would have adverse effects on a listed species. This biological assessment is for the Hatch Nuclear Power Plant, located on the Altamaha River at river kilometer (rkm) 180, in Appling County, Georgia, slightly southeast of the U.S. Highway 1 crossing of the Altamaha River.

The shortnose sturgeon, *Acipenser brevirostrum*, was considered in this biological assessment. The staff has determined that the proposed action is not a major construction activity and that it may affect, but is not likely to adversely affect the shortnose sturgeon. No designated critical habitat for this listed species is located near the proposed action. We are placing this biological assessment in our project files and are requesting your concurrence with our determination.

In reaching our conclusion, the NRC staff relied on information provided by the licensee, on the geographical information system (GIS) date base information provided by the Georgia Natural Heritage Program, on research performed by the NRC staff, and on current listings of species provided by St. Petersburg, Florida office of the National Marine Fisheries Service.

C. Oravetz - 2 -

If you have any questions regarding this biological assessment or the staff's request, please contact the environmental project manager, Jim Wilson, by telephone at (301) 415-1108 or by e-mail at jhw1@nrc.gov

Sincerely,

/RA/ Signed by Barry Zalcman for

Cynthia A. Carpenter, Chief
Generic Issues, Environmental, Financial
And Rulemaking Branch
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos. 50-321 and 50-366

Enclosure: As stated

cc w/ enclosure: See next page

BIOLOGICAL ASSESSMENT OF THE POTENTIAL IMPACT ON SHORTNOSE STURGEON RESULTING FROM AN ADDITIONAL 20 YEARS OF 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

August 2000

I. INTRODUCTION

The U.S. Nuclear Regulatory Commission (NRC) is considering renewal of the operating licenses for the Edwin I. Hatch Nuclear Plant, Units 1 and 2 (HNP) for a period of an additional 20 years. The purpose of this assessment is to provide information to the U.S. National Marine Fisheries Service concerning the impacts of continued operation of the HNP on the shortnose sturgeon, *Acipenser brevirostrum*. The assessment summarizes plant information and existing data and discusses the consequences of the proposed action for the shortnose sturgeon. Based on life history information, siting and operational characteristics of the plant, existing data for impingement and entrainment, and the known thermal plume characteristics, the continued operation of the HNP during the proposed 20-year license renewal period may affect, but is not likely to adversely affect, the shortnose sturgeon.

II. PROJECT DESCRIPTION

The proposed action includes the continued operation and maintenance of the Edwin I. Hatch Nuclear Plant, Units 1 and 2 on the Altamaha River in southeastern Georgia under a renewed licence from the NRC. HNP Unit 1 began commercial operation December 31, 1975, and is currently licensed to operate through August 6, 2014. HNP Unit 2 began commercial operation September 5, 1979, and is currently licensed to operate through June 13, 2018. NRC regulations (10 CFR Part 54) allow license renewal for periods of up to 20 years, which would extend the operation of Unit 1 through August 6, 2034, and extend the operation of Unit 2 through June 13, 2038. All facilities associated with this action were constructed during the early 1970s and no new construction will be performed as part of the license renewal action.

III. DESCRIPTION OF PROJECT AREA

A. General Plant Information

The HNP is a steam-electric generating facility operated by Southern Nuclear Operating Company (SNC). HNP is located in Appling County, Georgia, at river kilometer (rkm) 180, slightly southeast of the U.S. Highway 1 crossing of the Altamaha River. It is approximately 11 miles north of Baxley, Georgia; 98 miles southeast of Macon, Georgia; 73 miles northwest of Brunswick, Georgia; and 67 miles southwest of Savannah, Georgia (Figure 1).

HNP is a two-unit 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 were originally rated at 2,436 megawatt-thermal and designed for a power level corresponding to approximately 2,537 megawatt-thermal. Both units are now licensed for 2,763 megawatt-thermal. HNP uses a closed-loop system for main condenser cooling that withdraws from and discharges to the Altamaha River via 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 (References 1 and 2). In 1972, the Atomic Energy Commission (AEC)[a] issued a Final Environmental Statement (FES) for Units 1 and 2.

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[a]. Predecessor agency to NRC.

- 2 -

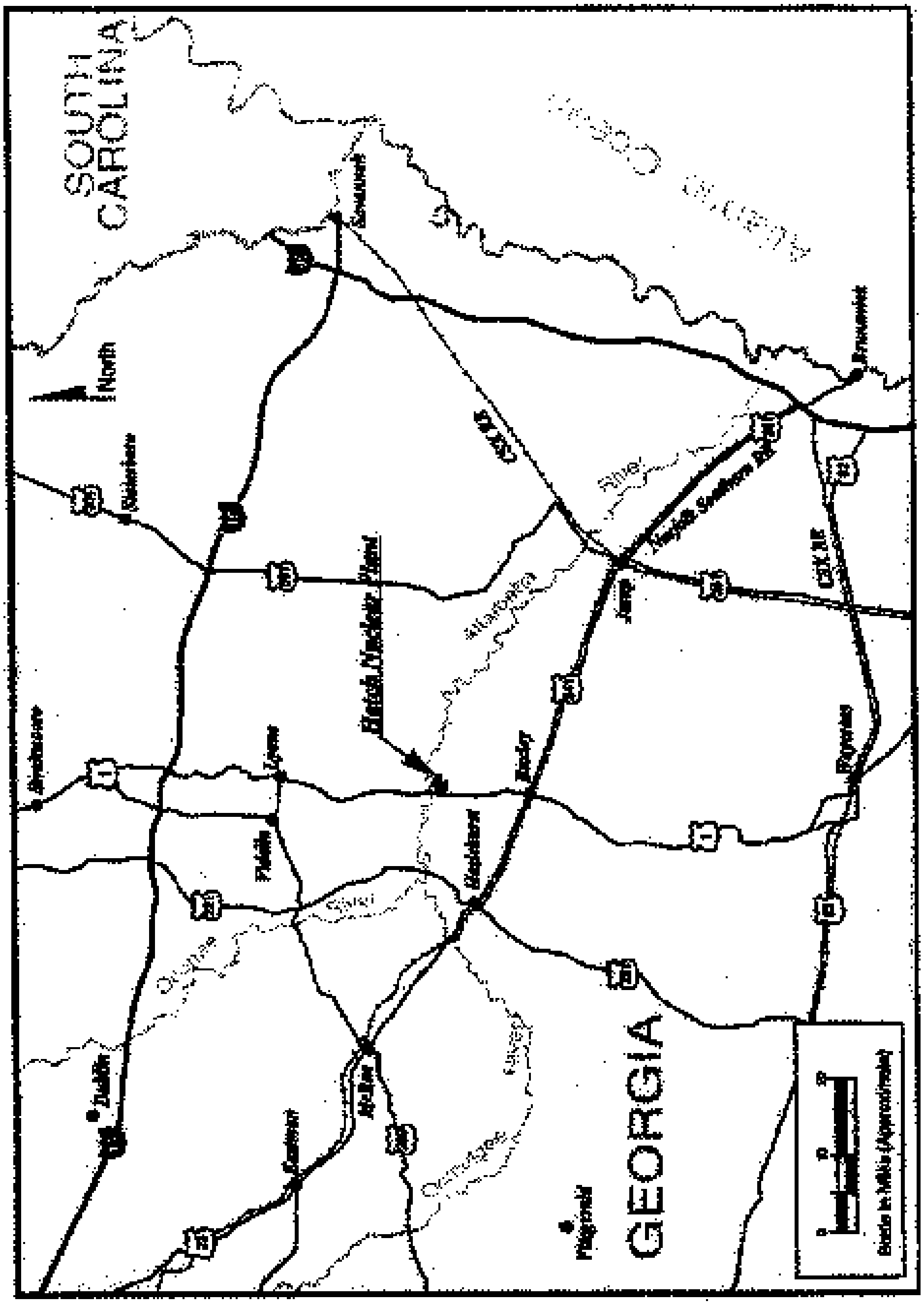

Figure 1 – Plant Hatch Location Map

(Reference 3), and in 1978, NRC issued a FES for Unit 2 (Reference 4). The FESs evaluate the environmental impacts from plant construction and operation in accordance with the National Environmental Policy Act (NEPA).

The property at the HNP site totals approximately 2,240 acres and is characterized by low, rolling sandy hills that are predominantly forested. A property plan is shown in Figure VI-3. Figure VII-4 provides a more detailed site plan. The property includes approximately 900 acres north of the Altamaha River in Toombs County and approximately 1,340 acres 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 300 acres. Approximately 1,600 acres are managed for timber production and wildlife habitat.

B. 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 (Figure 2). The main river channel (thalweg) is located closer to the northern shoreline. The intake is approximately 150 feet long, 60 feet wide, and the roof is approximately 60 feet above the water surface at normal river level. The water passage entrance is about 27 feet wide and extends from 16 feet below to 33 feet above normal water levels. Large debris is removed by trash racks, while small debris is removed by vertical traveling screens with a 3/8 inch mesh. Water velocity through the intake screens is 1.9 feet per second (fps) at normal river elevations and decreases at higher river flows. End Note 1

Water is returned to the Altamaha River via a submerged discharge structure that consists of two 42-inch lines extending approximately 120 feet out from the shore at an elevation of 54 feet mean sea level. The point of discharge is approximately 1,260 feet down-river from the intake structure and approximately 4 feet 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 62 °F in winter to 94 °F in summer.

-4-

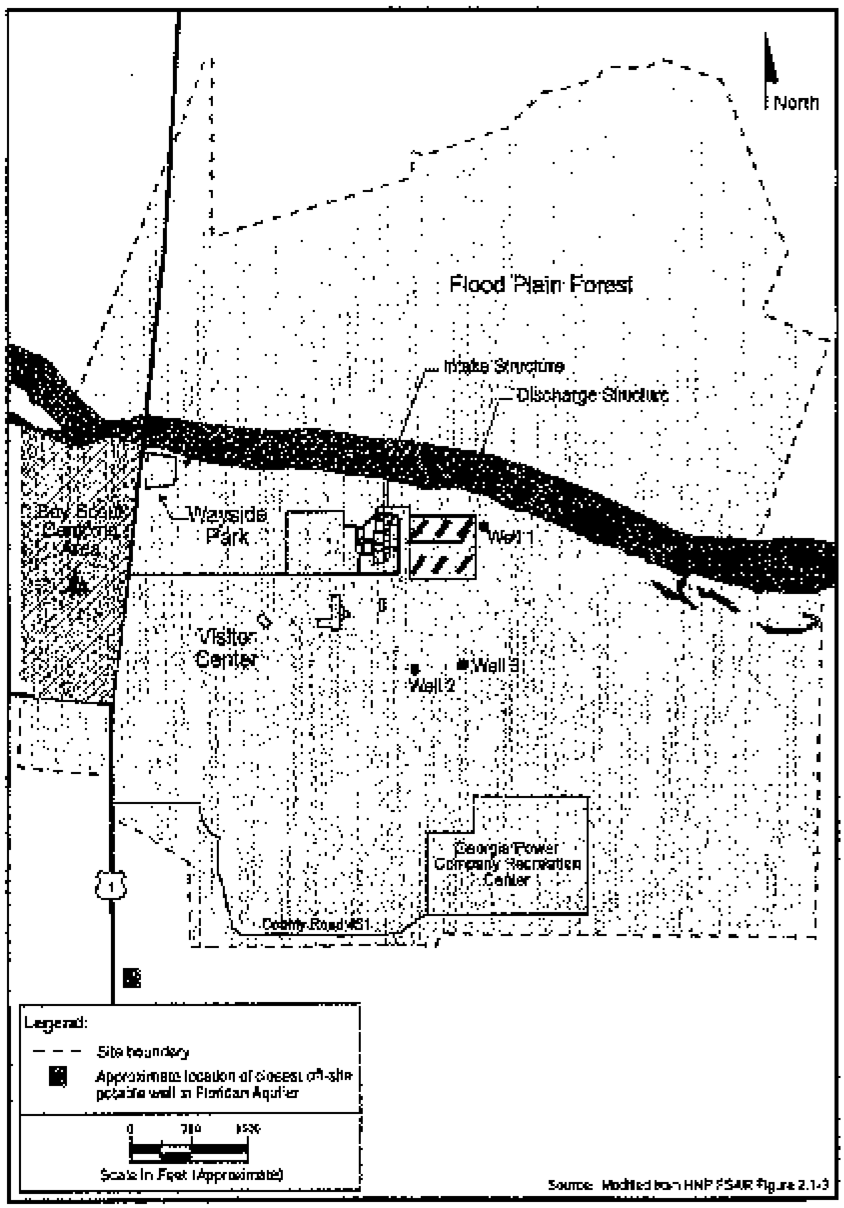

Figure 2 - Plant Hatch Site Plan

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- 5 -

C. 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 loads and makeup water to the cooling towers. SNC is permitted to withdraw a monthly average of up to 85 million gallons per day with a maximum 24-hour rate of up to 103.6 million gallons. As a condition of this permit, SNC is required to monitor and report withdrawals. HNP withdraws an annual average of 57.18 million gallons per day (88 cubic feet per second [cfs]).

The evaluation of surface water use in the FES concluded that the consumptive losses would be approximately 46 percent of the total water withdrawn from the River. In its environmental assessment for an extended power uprate, the NRC staff concluded that the necessary increase in makeup water to support the higher heat load would be insignificant and that cooling tower blowdown would decrease by approximately 626 gallons per minute (1.4 cfs). Consumptive water use for the plant operating at the extended power level is expected to be 57 percent of the total withdrawal.

The thermal discharge plume 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 (Reference 5). 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 one foot, three feet, and five feet. 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 average projected fully mixed excess temperature under average summer conditions (average river flow of 3000 cfs, ?T of 4.7 °F) is 0.09 °F. During the 1980 field surveys, the period of lowest river flow and greatest cooling tower heat rejection (3220 cfs, and ?T of 4.5 °F, respectively) resulted in a fully mixed excess temperature of 0.05 °F. The NRC modeled average expected thermal conditions and extreme thermal conditions under conservative assumptions in the Unit 2 Final Environmental Impact Statement (FES) (Reference4). 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 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.

IV. STATUS REVIEW OF SHORTNOSE STURGEON

A. 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 population segments inhabiting Atlantic coast rivers from New Brunswick, Canada to northern Florida (Reference 6). Most shortnose sturgeon populations have their greatest abundance in the estuary of their respective river (Reference 7). The species is protected throughout its range.

The distribution of shortnose sturgeon strongly overlaps that of the Atlantic sturgeon, 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. Shortnose sturgeon are not known to move among or between different river drainages (References 8 and 6).

Seasonal migration patterns and some aspects of spawning may be partially dependent on latitude. In northern rivers, shortnose sturgeon move to estuaries in summer months. In southern rivers, movement to estuaries usually occurs in winter (Reference 6). Shortnose sturgeon spawn in freshwater like the Atlantic sturgeon, but then return to the estuaries and spend much of their lives near the fresh/salt water interface. Fresh tidewaters and oligohaline areas serve as nurseries for shortnose sturgeon (Reference 9). Availability of spawning and rearing habitats may be limited throughout the range of shortnose sturgeon (Reference 7).

Shortnose sturgeon exhibit faster growth in southern rivers, but will reach larger adult size in northern rivers (Reference 6). Thus, shortnose sturgeon will reach sexual maturity (45-55 cm FL, [Reference 7]) at a younger age in southern rivers. Spawning by individual fish may only occur at intervals with frequencies of a few to several years. Dadswell, et al. (Reference 10) composed a detailed summary of the known biology of shortnose sturgeon.

Rivers of the deep south are on the edge of the natural range of the shortnose sturgeon and present somewhat unique problems for the species. The majority of southern rivers and estuaries regularly reach temperatures unfavorable to shortnose sturgeon. Intolerant of saline environments and limited to riverine habitats, shortnose sturgeon must seek thermal refuges during most summers in the south. The refuges are found in lower river reaches and consist usually of a few deep holes, possibly cooled by springs or seeps. The fish concentrated in a few of these thermal refuges quickly exhaust local food supplies and appear to just be surviving the summer (Reference 9). 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. Sturgeons 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 (Reference 6). 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 (Reference 11).

- 7 -

Although the shortnose sturgeon was severely overharvested in the past, the greatest threats to survival presently include barriers to its spawning grounds created by dams, loss of habitat for other life history stages, poor water quality, and incidental capture in gill net and trawl fisheries targeting other species (References 8 and 10). 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 (References 8 and 6).

B. Status in Altamaha River

The Altamaha River is large, with the largest watershed east of the Mississippi River. The Altamaha River is located entirely within the state of Georgia. It flows over 800 km 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 (Reference 8).

The incidences of catch and overharvest of sturgeons from Georgia rivers paralleled the trends of other states. From 1888 through 1892, sturgeon catches in Georgia averaged 71,000 kg per annum (Reference 12). "As recently as 49 years ago, a dealer in Savannah (GA) was shipping 4,500 kg of carcasses per week (6,500 kg in the round) during the peak three to five weeks of the spring run"(Reference 12). Similar harvests were recorded from the Altamaha River (Reference 9).

Catch rate data for sturgeons in Georgia are just as startling. In 1880, and 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 (Reference 13, as presented in Reference 9). These data indicate a 97-99% decline in the sturgeon fishery (Reference 9).

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 (Reference 11). Some of these events were an increasing US domestic demand for all seafood products, decreased supplies of sturgeon products as fisheries closed in the US, and sturgeon stocks worldwide were becoming more depleted by overharvest and habitat degradation, particularly in the republics of the old Soviet Union (Reference 11).

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 (Reference 11). Another study indicated shortnose sturgeon in the Altamaha River may be experiencing lower juvenile mortality rates than in the Ogeechee River, Georgia (Reference 7). The Shortnose Sturgeon Recovery Team indicated that the Altamaha River population was the largest and most viable population south of Cape Hatteras, North

Carolina (Reference 6). 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 (Reference 9).

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 in physiological refugia. 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. The majority of adults and a few large juveniles remain in oligohaline waters near the fresh/salt water interface and may be very active (Reference 8).

Several suspected spawning sites for shortnose sturgeon have been located within the Altamaha River system. Much of the spawning activity occurs in a 70-kilometer section of the Altamaha River centered about Doctortown, Georgia. Spawning is also suspected in the lower Ocmulgee River, which is several kilometers upstream of the shoals marking the transition to the upper coastal plain (Reference 8). This reach is about 40 rkm upstream of HNP.

Suspected spawning areas in the Altamaha River system were often adjacent to river bluffs with gravel, cobble, or hard rock substrate (Reference 11). Shortnose sturgeon eggs are demersal and adhesive after fertilization, sinking quickly and adhering to sticks, stones, gravel, and rubble on the stream bottom.

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, 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 be quickly exhausted (Reference 9). Flournoy, et al. (Reference 9) 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.

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 (Reference 6). Recent evidence of illegal directed take of shortnose sturgeon in South Carolina indicate that poaching may also be a significant source of mortality (Reference 7).

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

- 9 -

are commercial harvest and limited oversummering habitat. Dahlberg and Scott (Reference 14) 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. (Reference 11) 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 (Reference 7).

Several authors suggested the Altamaha River population of shortnose sturgeon may be healthier than the Savannah River population (Reference 8). 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 (Reference 11).

Previous research has shown 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 other remain upstream (Reference 8).

C. Low Potential for HNP to affect Shortnose Sturgeon

Biological, hydraulic, and physical factors affect the rates of impingement and entrainment. The shortnose sturgeon's known behavior and use of the Altamaha River indicates a low potential for impingement or entrainment with the cooling water for HNP. The low potential for impingement or entrainment is further reduced by siting, design, and operational characteristics of HNP. This is discussed in greater detail, below.

Available literature suggests there is little opportunity for shortnose sturgeon eggs or larvae to encounter the cooling water intakes at HNP. Much of the available spawning habitat for shortnose sturgeon in the Altamaha River is well downstream of HNP. Eggs and larvae from these spawning locations are not available for entrainment by HNP.

There is a suspected spawning area in the lower Ocmulgee River about 40 rkm upstream from HNP, but entrainment of eggs or larvae of from this site is also unlikely. Fertilized shortnose sturgeon eggs sink quickly and adhere tightly to rough substrates, even under high flow conditions. Shortnose sturgeon larvae seek bottom cover quickly upon hatching and seldom stray from cover (Reference 15). The larvae grow quickly and are able to maintain bottom contact without being swept downstream (Reference 15), and may linger near the spawning area for the first year of life (Reference 6). Some authors, after attempting to capture shortnose sturgeon larvae, speculated the larvae of shortnose sturgeon, contrary to larvae of Atlantic sturgeon, do not spend much time in the drift (References 16 and 17). These early life history behaviors suggest a very low potential for entrainment effects at HNP.

- 10 -

The location of the cooling water intake at HNP should further reduce the potential for entrainment and impingement. 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 shortnose sturgeon encountering the intake structure.

Entrainment and 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 3 mechanical draft cooling towers per unit as described in Section III B of this assessment. Cooling towers have been suggested as mitigative measures to reduce known or predicted entrainment and impingement losses (see, for example, Reference 18). EPA has endorsed closed cycle cooling towers as the "best available technology" for minimizing entrainment and impingement mortality (Reference 19). The relatively small volumes of makeup and blowdown water needed for closed-cycle cooling systems result in concomitantly low entrainment, impingement, and discharge effects. In the GEIS for license renewal (Refernce 20), the staff noted that studies of intake and discharge effects of closed-cycle cooling systems have generally judged the impacts to be insignificant.

D. Existing Monitoring Data for HNP

This section briefly describes the methods and results of previous studies conducted at HNP. Initial preoperational surveys were conducted at HNP as required by the Unit 1 and 2 Final Environmental Statement (Reference 3) to "perform preoperational measurements of aquatic species to establish base-line data". During these surveys, one adult shortnose sturgeon was collected by gill net on March 13, 1974, in the vicinity of HNP. Three additional specimens of *Acipenser* sp. (two juveniles and one larva) were collected but could not be identified to species (Reference 4). No adult, juvenile, or larval shortnose sturgeon were collected during subsequent impingement and entrainment sampling conducted following startup of either Unit 1 or Unit 2. End Note 2

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 quadrates for transect 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 ichthyoplanton families collected. Commercially important fish in these collections included *Alosa sapidissima* eggs, with mean densities approaching 0.3 per 1000 m^3 in March. *Alosa sapidissima* 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.

- 11 -

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 (Reference 21). 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.

The entrainment estimates assume a uniform distribution of fish eggs and larvae, while the cross section measurements suggest that the greater densities would occur in the channel furthest from the intake. Under normal flow and pumping conditions, the intake velocity is 1.9 fps. The measured range of intake velocities was from 0.3 fps to 2.7 fps. Estimated percent of river flow entrained in Plant Edwin I. Hatch cooling water has remained less than one percent with the exception of the months of July, August, and September, 1980. The increase in estimated percent flow entrained during this period was due to extremely low river elevations resulting from the lack of rainfall.

Impingement data 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 highest number impinged per year, 61 fish, was in 1975, while the lowest, 14 fish, was in 1980. 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 during the operation of the plant.

E. Comparison with other power generation facilities

The staff has performed an assessment (Reference 22) of the potential impact of the of operation of the Delaware River nuclear power plants, Salem 1 and 2 (once-though) and Hope Creek 1 (closed cycle), 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 (Reference .

The Hudson River, New York, supports a large sturgeon population including both shortnose and Atlantic species. There are six fossil-fueled and one nuclear electricity generating plants located along the Hudson River, and much research has been conducted to address

- 12 -

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 (Reference 17). 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 MWe 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 MWe 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 MWe 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 (Reference 20) 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, white perch, Atlantic tomcod, American shad, bay anchovy, alewife, blueback herring, and spottail shiner. Other species were considered, including Atlantic sturgeon (*Acipenser oxyrhynchus*) 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 (Reference 17). 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 (Reference 17). In fact, some recent research suggests that the shortnose sturgeon population in the Hudson River has increased during the last ten years and is now more numerous than the commercially exploited Atlantic sturgeon (Reference 23).

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 finding that no impacts are known to occur to shortnose sturgeon from entrainment and impingement at HNP.

V. CONCLUSION

There are no construction modifications of the intake structure, effluent pipes, or changes in operation proposed for the license renewal period for HNP, therefore, the proposed project is not a major construction activity. The proposed project is not located near designated critical habitat of the shortnose sturgeon. Based on the life history characteristics of shortnose sturgeon, siting and operational characteristics of the plant, existing data for impingement and entrainment, and the known thermal plume characteristics, the continued operation of the Edwin I. Hatch Nuclear Plan, Units 1 and 2 during the proposed 20-year license renewal period may affect, but is not likely to adversely affect, the shortnose sturgeon, *Acipenser brevirostrum*.

REFERENCES

1. Georgia Power Company, Edwin I. Hatch Nuclear Plant Environmental Report: Construction Permit Stage, February, 1971.

2. Georgia Power Company, Edwin I. Hatch Nuclear Plant Unit No. 2 Environmental Report Operating License Stage, July 1975.

3. Final Environmental Statement for the Edwin I. Hatch Nuclear Plant Unit 1 and Unit 2; Georgia Power Company; Docket Nos. 50-321 and 50-366, Atomic Energy Commission, October 1972.

4. NUREG-0147, Final Environmental Statement for the Edwin I. Hatch Nuclear Plant Unit 2; Georgia Power Company; Docket Nos. 50-366, U. S. Nuclear Regulatory Commission, March 1978.

5. Nichols, M. C., and S. D. Holder, 1981. Plant Edwin I Hatch Units 1 and 2 Thermal Plume Model Verification, Georgia Power Company, Environmental Affairs Center, March, 1981.

6. National Marine Fisheries Service. 1998. Recovery plan for the shortnose sturgeon (*Acipenser brevirostrum*). Prepared by the Shortnose Sturgeon Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland. 104 pp.

7. Weber, W. 1996. Population size and habitat use of shortnose sturgeon, *Acipenser brevirostrum*, in the Ogeechee River system, Georgia. Master’s Thesis, University of Georgia. Athens, Georgia. 82 pp.

8. Rogers, S.G., and W. Weber. 1995. Movements of shortnose sturgeon in the Altamaha River system, Georgia. Contribution Series No. 57. Coastal Resources Division, Georgia Department of Natural Resources, Brunswick, Georgia. 78 pp.

9. Flournoy, P.H., S.G. Rogers and P.S. Crawford. 1992. Restoration of shortnose sturgeon in the Altamaha River, Georgia. Final Report to the U.S. Fish and Wildlife Service Project AFS-2, Coastal Resources Division, Georgia Department of Natural Resources. 51 pp.

10. Dadswell, M.J., B.D. Taubert, T.S. Squiers, D. Marchette, and J. Buckley. 1984. Synopsis of biological data on shortnose sturgeon, *Acipenser brevirostrum* LeSueur 1818. NOAA Technical Report. National Marine Fisheries Service 14:1-45.

11. Rogers, S.G., P.H. Flournoy, and W. Weber. 1994. Status and restoration of Atlantic sturgeon in Georgia. Final Report to the National Marine Fisheries Service for Anadromous Grant Number NA16FA0098-01, -02, and –03 to the Georgia Department of Natural Resources, Brunswick, GA. 121 pp.

12. Smith, T.I.J. 1985. The fishery, biology, and management of Atlantic sturgeon, *Acipenser oxyrhynchus*, in North America. 61-72 in F.P. Binkowski and S.I. Doroshov (eds.) North American Sturgeons: Biology and Aquaculture Potential. 163 pp. DR J. W. Junk, Dordrecht, Germany.

13. Essig, R.J. 1984. Summary of biological and fishery information important for the management of sturgeon in Georgia. Internal Report, Coastal Resources Division, Georgia Department of Natural Resources, Brunswick, GA.

14. Dahlberg, M.D., and D.C. Scott. 1971. The freshwater fishes of Georgia. Bulletin of the Georgia Academy of Sciences 29:1-64.

15. Washburn and Gillis Associates, Ltd. 1980. Studies of the early life history of the shortnose sturgeon (*Acipenser brevirostrum*). Final report to the Northeast Utilities Service Company. 120pp.

16. Pottle, R. and M.J. Dadswell. 1979. Studies on larval and juvenile shortnose sturgeon (*Acipenser brevirostrum*). Edited by Washburn and Gillis Associates, Ltd. Report to the Northeast Utilities Service Company. 87pp.

17. Central Hudson Gas and Electric, 1999. Draft Final Environmental Impact Statement for State Pollutant Discharge Elimination System Permits for Bowline Point, Indian Point Units 2 and 3, and Roseton Steam Electric Generating Stations. Submitted to New York State Department of Environmental Conservation, December 14, 1999.

18. Barnthouse, L. W., and W. Van Winkle, "Analysis of Impingement Impacts on Hudson River Fish Populations," American Fisheries Society Monograph, 4, 182-190, 1988.

19. Barnthouse, L. W., J. Boreman, T. L. Englert, W. L. Kirk, and E. G. Horn, “Hudson River Settlement Agreement: Technical Rationale and Cost Considerations”, American Fisheries Society Monograph, 4, 267-273, 1988.

20. NUREG-1437, “Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants,” U.S. Nuclear Regulatory Commission, May 1996.

21. Bain, M, and S. Nack. 1995 Population status of shortnose sturgeon in the Hudson River, in Sturgeon Notes Issue # 3. Cornell University, New York. Cooperative Fish and Wildlife Research Unit. Sponsored by the Hudson River Foundation.

22. Masnik, M. T. and Wilson, J. H., “Assessment of the Impacts of the Salem and Hope Creek Stations on the Shortnose Sturgeon, *Acipenser brevirostrum* LeSueur,” U.S. Nulclear Regulatory Commission, NUREG-0671, May, 1980.

23. Wiltz, J. W., 1981. Plant Edwin I. Hatch 316(b) demonstration on the Altamaha River in Appling County, Georgia. Georgia Power Environmental Affairs Center, March, 1981.

End Notes for the August 31, 2000, Letter

These end notes were added for the appendix and are not part of the original letter.

Note 1- The licensee provided corrected information on approach and screen velocities in its April 25, 2001 letter. The value for the screen velocity during normal river flow conditions is actually around 0.72 fps.

Note 2- The adult shortnose sturgeon that was caught by a gill net was caught in the river channel (i.e., away from the intake structure).