ATTACHMENT 1

TO

"NRC STAFF's ANSWER TO
'RIVERKEEPER, INC. CONSOLIDATED MOTION FOR LEAVE TO FILE AMENDED
CONTENTION RK-EC-8A AND AMENDED CONTENTION RK-EC-8A'"

((Biological Assessment of the Potential Effects on Federally
Listed Endangered or Threatened Species from the Proposed Renewal of
Indian Point Nuclear Generating Plant, Unit Nos. 2 and 3
(Appendix E to DSEIS (Exhibit NYS00132A-D)
(ADAMS Accession No. ML083570601))

Biological Assessment

Indian Point Nuclear Generating Plant Unit Nos. 2 and 3
License Renewal

December 2008
Docket Nos. 50-247 and 50-286

U.S. Nuclear Regulatory Commission
Rockville, Maryland

Biological Assessment of the Potential Effects on Federally Listed Endangered or Threatened Species from the Proposed Renewal of Indian Point Nuclear Generating Plant, Unit Nos. 2 and 3

1.1 Introduction and Purpose

The U.S. Nuclear Regulatory Commission (NRC) prepared this biological assessment (BA) to support the draft supplemental environmental impact statement (SEIS) for the renewal of the operating licenses for Indian Point Nuclear Generating Unit Nos. 2 and 3 (IP2 and IP3), located on the shore of the Hudson River in the Village of Buchanan, in upper Westchester County, NY. The current 40-year licenses expire in 2013 (IP2) and 2015 (IP3). The proposed license renewal for which this BA has been prepared would extend the operating licenses to 2033 and 2035 for IP2 and IP3, respectively.

The NRC is required to prepare the draft SEIS as part of its review of a license renewal application. The draft SEIS supplements NUREG-1437, Volumes 1 and 2, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS)," (NRC 1996, 1999)[c] for the license renewal of commercial nuclear power plants. The draft SEIS covers specific issues, such as the potential impact on endangered and threatened species, that are of concern at IP2 and IP3 and that could not be addressed on a generic basis in the GEIS.

Pursuant to Section 7 of the Endangered Species Act of 1973 (ESA), as amended, the NRC staff requested, in a letter dated August 16, 2007 (NRC 2007), that the National Marine Fisheries Service (NMFS) provide information on federally listed endangered or threatened species, as well as on proposed or candidate species, and on any designated critical habitats that may occur in the vicinity of IP2 and IP3. In its response, dated October 4, 2007 (NMFS 2007), NMFS expressed concern that the continued operation of IP2 and IP3 could have an impact on the shortnose sturgeon (*Acipenser brevirostrum*), an endangered species that occurs in the Hudson River. NMFS also noted that a related species that also occurs in the Hudson River, the Atlantic sturgeon (*Acipenser oxyrinchus*), is a candidate species for which NMFS has initiated a status review to determine if it should be listed as threatened or endangered.

Under Section 7, the NRC is responsible for providing information on the potential impact that the continued operation of IP2 and IP3 could have on the federally listed species, the shortnose sturgeon. In addition, the NRC has prepared information regarding the potential impact on important species, including the Atlantic sturgeon; this information can be found in Chapters 2 and 4 of the draft SEIS.

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a The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

2.0 Proposed Action

The current proposed action considered in the SEIS is the renewal of the operating licenses for IP2 and IP3 for an additional 20-year term beyond the period of the existing licenses. The applicant has indicated that it may replace reactor vessel heads and control rod drive mechanisms during the period of extended operation. (For a description of these activities and potential environmental effects, see Chapter 3 of the draft SEIS.) If the NRC grants the operating license renewals, the applicant can operate and maintain the nuclear units, the cooling systems, and the transmission lines and corridors as they are now until 2033 and 2035.

3.0 Site Description

IP2 and IP3 are located on a 239-acre (97-hectare) site on the eastern bank of the Hudson River in the Village of Buchanan, Westchester County, NY, about 24 miles (mi) (39 kilometers [km]) north of New York City, NY (Figures 1 and 2). Privately owned land bounds the north, south, and east sides of the property (Figure 3). The area is generally described as an eastern deciduous forest, dominated by oak (*Quercus*), maple (*Acer*), and beech (*Fagus*) species. The lower Hudson River is a tidal estuary, flowing 152 miles (244 km) from the Federal Dam at Troy, NY, to the Battery in New York City. IP2 and IP3 are located at River Mile (RM) 43 (RKM 69), where the average depth is 40 feet (ft) (12 meters [m]), and the average width of the river is 4500 ft (1370 m). The Hudson River is tidal all the way to the Federal Dam, and the salinity zone in the vicinity of the facility is described as oligohaline (low salinity, ranging from 0.5 to 5 parts per thousand (ppt)), with the salinity changing with the level of freshwater flow. Water temperature ranges from a winter minimum of 34 degrees F (1 degree Celsius (C)) to a summer maximum of 77 degrees F (25 degrees C) (Entergy 2007a).

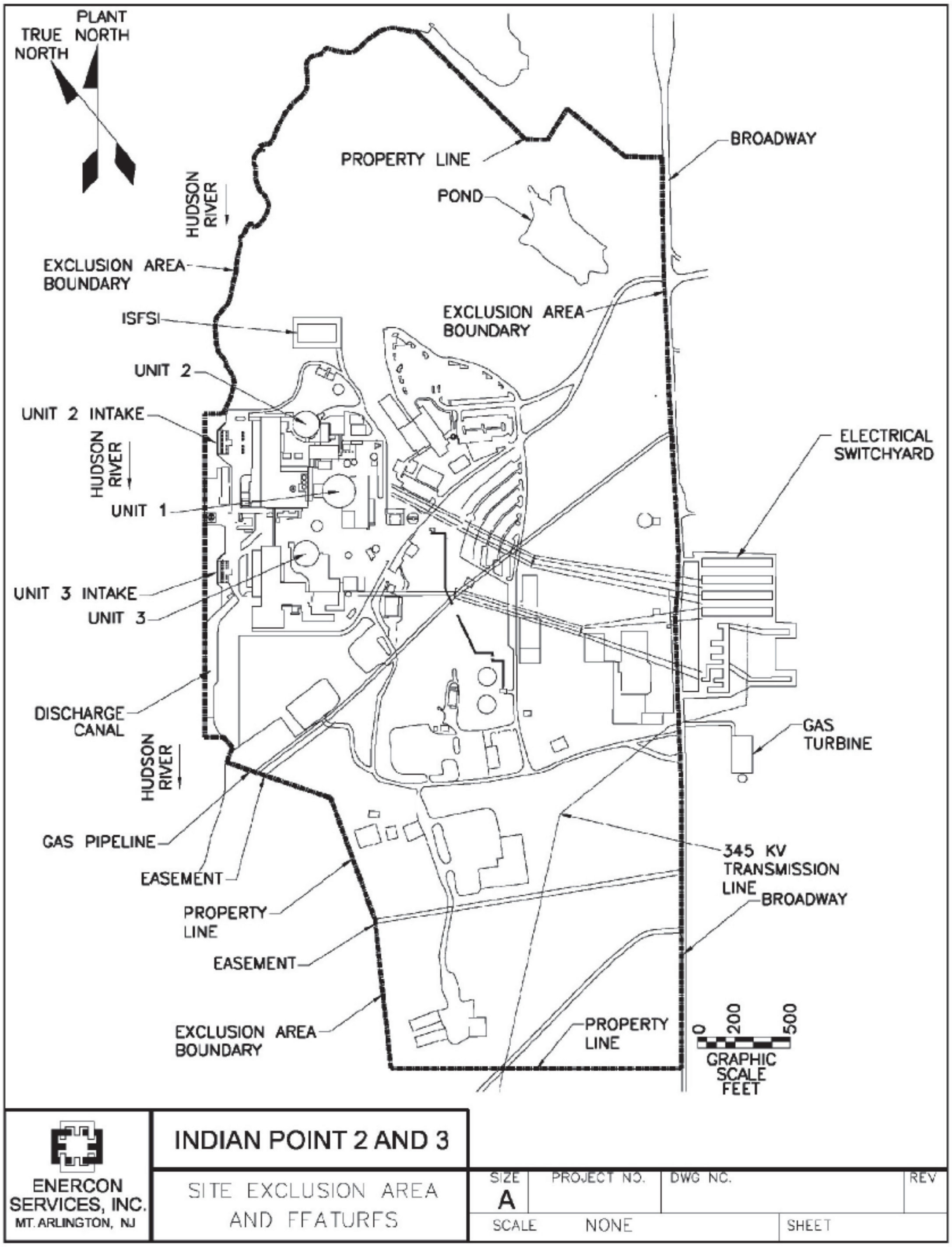
The mid-Hudson River provides the cooling water for four other power plants: Roseton Generating Station, Danskammer Point Generating Station, Bowline Point Generating Station, and Lovett Generating Station; all four stations are fossil-fueled steam electric stations, located on the western shore of the river, and all use once-through cooling. Roseton consists of two units and is located at RM 66 (RKM 106), 23 mi (37 km) north of IP2 and IP3. Just 0.5 mi (0.9 km) north of Roseton is Danskammer, with four units. Bowline lies about 5 mi (8 km) south of IP2 and IP3 and consists of two units (Entergy 2007a; CHGEC 1999). Lovett, almost directly across the river from IP2 and IP3, is no longer operating.

Source: Entergy 2007a

Figure 1. Location of IP2 and IP3, 50-mile (80-km) radius

Source: Entergy 2007a

Figure 2. Location of IP2 and IP3, 6-mile (10-km) radius

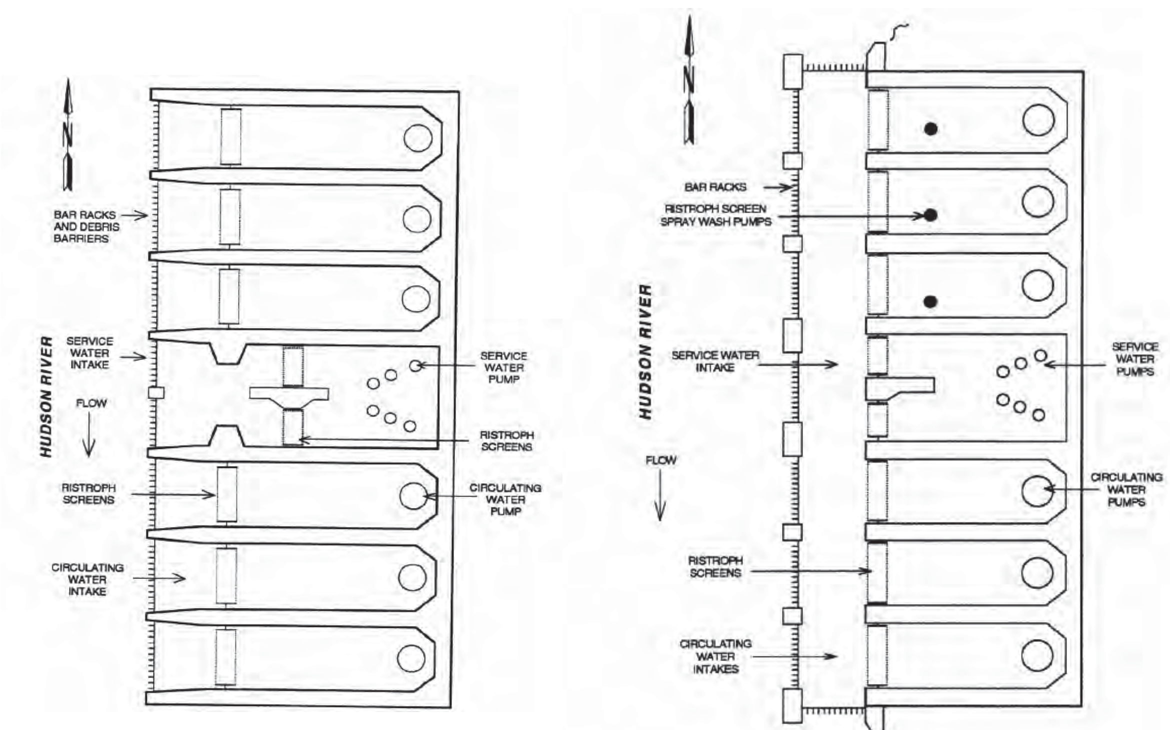


Source: Entergy 2007a

Figure 3. IP2 and IP3 property boundaries and environs

3.1.1 Description of Plants and Cooling Systems

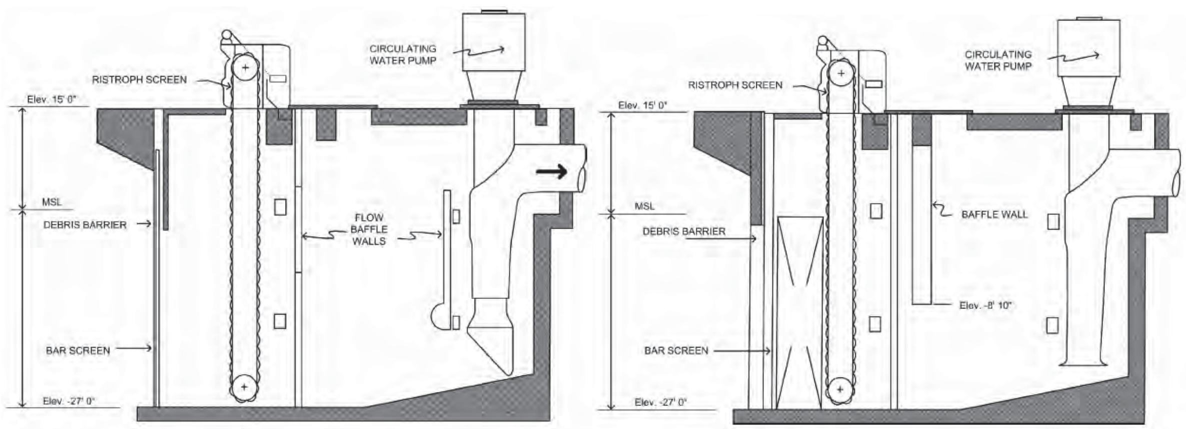
IP2 and IP3 are pressurized-water reactors with turbine generators that produce a net output of 6432 megawatts-thermal and approximately 2158 megawatts-electrical. Both IP2 and IP3 use water from the Hudson River for their once-through condensers and auxiliary cooling systems. Each unit has seven intake bays (Figure 4), into which the river water flows, passing under the floating debris skimmer wall and through Ristroph traveling screens (Figure 5). IP2 has six dual-speed circulating water pumps that can each pump 140,000 gallons per minute (gpm) (8.83 cubic meters per second [m^3/s]) at full speed and 84,000 gpm (5.30 m^3/s) at reduced speed; at full speed, the approach velocity is approximately 1 foot per second (fps) (0.30 meters per second [m/s]) and at reduced speed, the approach velocity is 0.6 fps (0.2 m/s). IP3 also has six dual-speed circulating water pumps. The full speed flow rate of each of these pumps is 140,000 gpm (8.83 m^3/s), with a 1 fps (0.30 m/s) approach velocity; the reduced speed is 64,000 gpm (4.04 m^3/s), with a 0.6 fps (0.2 m/s) approach velocity (Entergy 2007a).



Source: Entergy 2007a

Figure 4. IP2 intake structure (left) and IP3 intake structure (right)

The traveling screens employed by IP2 and IP3 are modified vertical Ristroph-type traveling screens installed in 1990 and 1991 at IP3 and IP2, respectively. The screens were designed in concert with the Hudson River Fishermen’s Association, with screen basket lip troughs to retain water and minimize vortex stress (CHGEC 1999). Studies indicated that, assuming the screens continued to operate as they had during laboratory and field testing, the screens were “the screening device most likely to impose the least mortalities in the rescue of entrapped fish by mechanical means" (Fletcher 1990). The same study concluded that refinements to the screens would be unlikely to greatly reduce fish kills.



Source: Entergy 2007a

Figure 5. IP2 intake system (left) and IP3 intake system (right)

There are two spray-wash systems—the high-pressure spray wash removes debris from the front of the traveling screen mechanism; the low-pressure spray washes fish from the rear of the mechanism into a fish sluice system to return them to the river. A 0.25 x 0.5-inch (in.) (0.635 x 1.27-centimeter [cm]) clear opening slot mesh on the screen basket panels was included to minimize abrasion as the fish were washed into the collection sluice. The sluice system is a 12-in.-diameter (30.5-cm–diameter) pipe that discharges fish into the river at a depth of 35 ft (10.7 m), 200 ft (61 m) from shore (CHGEC 1999).

4.0 Status Review of Shortnose Sturgeon

4.1 Life History

The shortnose sturgeon (*Acipenser brevirostrum*, family Acipenseridae) is amphidromous, with a range extending from the St. Johns River, FL, to the St. John River, Canada. Unlike anadromous species, shortnose sturgeons spend the majority of their lives in freshwater and move into salt water periodically without relation to spawning (Collette and Klein-MacPhee, 2002). From colonial times, shortnose sturgeons have rarely been the target of commercial fisheries but have frequently been taken as incidental bycatch in Atlantic sturgeon and shad gillnet fisheries (NEFSC 2006; Dadswell et al. 1984). The shortnose sturgeon was listed on March 11, 1967, as endangered under the ESA. In 1998, NMFS completed a recovery plan for the shortnose sturgeon (NMFS 1998).

Shortnose sturgeons can grow up to 143 cm (56 in.) in total length and can weigh up to 23 kilograms (kg) (51 pounds [lb]). Females are known to live up to 67 years, while males typically do not live beyond 30 years. As young adults, the sex ratio is 1:1; however, among fish larger than 90 cm (35 in.), measured from nose to the fork of the tail, the ratio of females to males increases to 4:1. Throughout the range of the shortnose sturgeon, males and females mature at 45 to 55 cm (18 to 22 in.) fork length, but the age at which this length is achieved varies by geography. At the southern extent of the sturgeon's range, in Florida, males reach maturity at age 2, and females reach maturity at 6 years or younger; in Canada, males can reach maturity as late as 11 years, and females, 13 years. In 1 to 2 years after reaching maturity, males begin to spawn at 2-year intervals, while females may not spawn for the first time until 5 years after maturing and, thereafter, spawn at 3- to 5-year intervals (Dadswell et al. 1984).

Shortnose sturgeons migrate into freshwater to spawn during late winter or early summer. Eggs sink and adhere to the hard surfaces on the river bottom, hatching after 4 to 6 days. Larvae consume their yolk sac and begin feeding in 8 to 12 days, as they migrate downstream away from the spawning site, remaining close to the river bottom (Kynard 1997; Collette and Klein-MacPhee 2002). The juveniles, which feed on benthic insects and crustaceans, do not migrate to the estuaries until the following winter, where they remain for 3 to 5 years. As adults, they migrate to the near-shore marine environment, where their diet consists of mollusks and large crustaceans (Dadswell 1984).

4.2 Status of Shortnose Sturgeon in Hudson River

Shortnose sturgeons inhabit the lower Hudson; the Federal Dam creates a physical barrier preventing the species from swimming farther north. They are found dispersed throughout the river-estuary from late spring to early fall and then congregate to winter near Sturgeon Point (RM 86). Spawning occurs in the spring, just downstream of the Federal Dam at Troy, between RM 118 and 148 (between Coxsackie and Troy) (Bain et al. 2007; NMFS 2000). According to the NMFS environmental assessment (2000) for a permit for the incidental take of shortnose sturgeons at the nearby power plants, Roseton and Danskammer, larvae are typically found upstream of the intakes of all five power plants along the mid-Hudson.

The Hudson River population of the shortnose sturgeon was estimated to be approximately 13,000 adults in 1979–1980. Based on population studies done in the mid-1990s, the population has apparently increased 400 percent since then, up to almost 57,000 adult fish. Additional data suggest that the total population of the shortnose sturgeon in the Hudson River is approximately 61,000, including juveniles and nonspawning adults (Bain et al. 2007). The population growth has been ascribed to several strong year-classes, as well as 2 decades of sustained annual recruitment (Woodland and Secor 2007). Bain et al. (2007) maintains that the annual trawl surveys conducted by the electric utilities (CHGEC 1999) show an increase in abundance between the mid-1980s and mid-1990s, supporting the finding that the Hudson River population has increased. Staff assessed the population trend for yearling and older shortnose sturgeons in the fall juvenile survey data provided by the applicant and found an overall increase in the catch-per-unit-effort from 1975 to 2005.

4.3 Impact Assessment of Indian Point on the Shortnose Sturgeon Population

4.3.1 Entrainment

The southern extent of the shortnose sturgeon spawning area in the Hudson River is approximately RM 118 (RKM 190), about 75 RM (121 RKM) upstream of the intake of IP2 and IP3 (NMFS 2000). The eggs of shortnose sturgeons are demersal, sinking and adhering to the bottom of the river, and, upon hatching, the larvae in both yolk-sac and post-yolk-sac stages remain on the bottom of the river, primarily upstream of RM 110 (RKM 177) (NMFS 2000). Shortnose sturgeon larvae grow rapidly, and, after a few weeks, they are too large to be entrained by the cooling intake (Dadswell 1979). Because the egg and larval life stages of the shortnose sturgeon (the life stages susceptible to entrainment) are not found near the intake for IP2 and IP3, the probability of their entrainment at IP2 and IP3 is low.

IP2 and IP3 monitored entrainment from 1972 through 1987. Entrainment monitoring became more intensive at Indian Point from 1981 through 1987, and sampling was conducted for nearly 24 hours per day, 4 to 7 days per week, during the spawning season in the spring (NMFS 2000). Entrainment monitoring reports list no shortnose sturgeon eggs or larvae at IP2 and IP3. NMFS (2000) lists only eight sturgeon larvae collected at any of the mid-Hudson power plants (all eight were collected at Danskammer, and four of the eight may have been Atlantic sturgeons). Entrainment sampling data supplied by the applicant (Entergy 2007b) include large numbers of larvae for which the species could not be determined, and, therefore, one cannot conclude that there was no entrainment of shortnose sturgeons at IP2 and IP3. Entergy Nuclear Operations, Inc. (Entergy) currently conducts no monitoring program to record entrainment at IP2 and IP3, and any entrainable life stages of the shortnose sturgeon taken in recent years would go unrecorded.

Based on the life history of the shortnose sturgeon, the location of spawning grounds within the Hudson River, and the patterns of movement for eggs and larvae, the number of shortnose sturgeons in early life stages entrained at IP2 and IP3 is probably low or zero. The available data from past entrainment monitoring do not indicate that entrainment was occurring. Therefore, the staff concludes that the continued operation of Indian Point for an additional 20 years is not likely to adversely affect the population of shortnose sturgeons in the Hudson River through entrainment.

4.3.2 Impingement

IP2 and IP3 monitored impingement daily until 1981, reduced collections to a randomly selected schedule of 110 days per year until 1991, and then ceased monitoring in 1991 with the installation of the modified Ristroph traveling screens. As described in Section 2.1, these screens were designed in a collaborative effort with the Hudson River Fishermen's Association to minimize the mortality of impinged fish.

In 2000, NMFS prepared an environmental assessment (EA) for the incidental take of shortnose sturgeons at Roseton and Danskammer (NMFS 2000). The EA included the estimated total number (Table 1) of shortnose sturgeons impinged at Roseton, Danskammer, Bowline Point, Lovett, and IP2 and IP3, with adjustments to include the periods when sampling was not conducted.

Table 1. Estimated Total and Average Shortnose Sturgeon Impinged by Mid-Hudson River Power Plants, Adjusted for Periods Without Sampling

	1972–1998		1989–1998	
Power Plant	**Total**	**Average No. Impinged/Year**	**Total**	**Average No. Impinged/Year**
Bowline Point	23	0.9	0	0
Lovett	0	0	0	0
IP2	37	1.4	8	0.8
IP3	26	1.0	8	0.8
Roseton	49	1.8	15	1.5
Danskammer Point	140	5.2	44	4.4
Total	275	10.2	75	7.5

Source: Adapted from NMFS 2000.

Impingement data provided by Entergy (2007b), which are available through the NRC's online Agencywide Documents Access and Management System (ADAMS), include the raw number of shortnose sturgeons collected at IP2 and IP3 during impingement monitoring (Table 2). Some blank entries in historical results do not differentiate between "no samples analyzed" and "samples analyzed but no individuals found." Since it is unknown if there were any impinged shortnose sturgeons for those time periods, counts must be considered minimal. The NRC staff notes, however, that data submitted by Entergy indicate that a larger number of shortnose sturgeons were impinged at IP2 and IP3 in the 7 years with reported data (1974–1979, 1984, and 1987 for IP2; 1977–1980, 1984, 1987, and 1988 for IP3) than NMFS data indicate were impinged by all mid-Hudson power plants from 1972 through 1998. The NRC staff finds that the numbers provided by NMFS (2000) in its EA for IP2 and IP3 cannot be accurate. In this case, the applicant-supplied data indicate a greater effect than the NMFS-supplied data.

An increase in the population of shortnose sturgeons in the Hudson River would most likely result in an increase in impinged shortnose sturgeons at IP2 and IP3. If the population data presented by Bain et al. (2007) and Woodland and Secor (2007) are accurate, then a four-fold increase in population between the mid-1980s and mid-1990s could result in a similar increase in impingement rates. However, this population increase would also mean that the impact of taking an individual shortnose sturgeon would decrease. Without current impingement data, the NRC staff cannot determine how changes in the shortnose sturgeon population have affected impingement rates.

When considering the effects of impingement, it is important to consider the affected species' impingement mortality rate. For IP2 and IP3, however, there are few data regarding the survival of the shortnose sturgeon after impingement. In 1979, NMFS issued a biological opinion (BO) relating to the take of shortnose sturgeons at Indian Point (Dadswell 1979). At the time, there was only 1 year in which records describing the status of impinged shortnose sturgeons were kept. In that year, 60 percent of collected impinged shortnose sturgeons were dead when collected. The BO assumes both that all dead sturgeons died as a result of the impingement and that no impingement-related mortality occurred after the impinged sturgeons were released.

Table 2. Numbers of Shortnose Sturgeons Collected During Impingement Monitoring at Indian Point Units 2 and 3

Year	Unit 2	Unit 3
1975	3	-
1976	2	-
1977	11	2
1978	5	5
1979	4	3
1980	-	2
1981	-	-
1982	-	-
1983	-	-
1984	176	154
1985	-	-
1986	-	-
1987	116	55
1988	-	186
1989	-	-
1990	-	-
Total	317	407

Source: Enclosure 3 to NL-07-156

The BO estimated that, in a worst-case scenario, 35 shortnose sturgeons would be impinged at IP2 and IP3 per year, and that 60 percent (21 individuals) would die on the impingement screens. At the time, the population of adult shortnose sturgeons in the Hudson River was estimated to be 6,000, and this level of mortality would result in a 0.3 to 0.4 percent death rate caused by impingement at IP2 and IP3 (Dadswell 1979).

Because all monitoring of impingement ceased after the Ristroph screens were installed in 1991, no updated mortality rate estimates for impinged shortnose sturgeons exist at IP2 and IP3. The NRC staff does not know the current level of impingement or the level of mortality. Although the laboratory and field tests (Fletcher 1990) performed on the modified Ristroph screens were not conducted using the shortnose sturgeon, the tests did show that injury and death were reduced for most species when compared to the first version of screens that were proposed (and rejected, based on their ”unexceptional performance”) (Fletcher 1990). If the NRC staff assumes that the modified Ristroph screens performed as well as the Fletcher’s 1990 results indicated, then mortality and injury from impingement would be lower than reported by the NMFS in its BO (Dadswell 1979), and the impact to the species would be less. Without current monitoring, however, the NRC staff cannot confirm this.

Based on the limited amount of data from the years before the installation of modified Ristroph screens at IP2 and IP3, and the lack of data from the years following screen installation, including any potential changes in rates of mortality caused by impingement, the NRC staff concludes that the continued operation of IP2 and IP3 for an additional 20 years could adversely affect the population of shortnose sturgeons in the Hudson River through impingement but cannot assess the extent to which the installation of modified Ristroph screens might reduce the impact.

4.3.3 Thermal Impacts

The discharge of heated water into the Hudson River can cause lethal or sublethal effects on resident fish, influence food web characteristics and structure, and create barriers to migratory fish moving from marine to freshwater environments.

State Pollution Discharge Elimination System (SPDES) permit NY-0004472 regulates thermal discharges associated with the operation of IP2 and IP3. This permit imposes effluent limitations, monitoring requirements, and other conditions to ensure that all discharges are in compliance with Article 17 of the Environmental Conservation Law of New York State, Part 704 of the Official Compilation of the Rules and Regulations of the State of New York, and the Clean Water Act. Specific conditions of the SPDES permit related to thermal discharges from IP2 and IP3 are specified in NYSDEC (2003) and include the following:

- The maximum discharge temperature is not to exceed 110 degrees F (43 degrees C).
- The daily average discharge temperature between April 15 and June 30 is not to exceed 93.2 degrees F (34 degrees C) for an average of more than 10 days per year during the term of the permit, beginning in 1981, provided that it not exceed 93.2 degrees F (34 degrees C) on more than 15 days during that period in any year.

The final environmental impact statement (FEIS) associated with the SPDES permit for IP2 and IP3 (NYSDEC 2003) concludes that “Thermal modeling indicates that the thermal discharge from Indian Point causes water temperatures to rise more than allowed.” The thermal modeling referred to in the FEIS appears to represent a worst-case scenario. Available modeling indicates the potential for the discharges from IP2 and IP3 to violate the conditions of the IP2 and IP3 SPDES permit, which could result in a negative impact on the shortnose sturgeon. IP2 and IP3 have not performed any triaxial thermal studies to completely assess the size and nature of the thermal plume created by the discharge from IP2 and IP3 and the possible impact on the sturgeon.

According to the NMFS Final Recovery Plan for the Shortnose Sturgeon (NMFS 1998), “During summer months, especially in southern rivers, shortnose sturgeons must cope with the physiological stress of water temperatures that often exceed 82 degrees F (28 degrees C).” Although the area closest to the discharge from IP2 and IP3 can exceed these temperatures, the summer maximum temperature of the Hudson River in the area of IP2 and IP3 is 77 degrees F (25 degrees C) (Entergy 2007a). The combined discharge from both Indian Point units is about 1.75 million gpm (110 m^3/s), including the service water (Entergy 2007a). Table 3 presents the net downstream flows caused by freshwater inflow. From these data, it can be seen that 20 percent of the time, the discharge from IP2 and IP3 would be, at most, 15 percent of the net flow; however, 98 percent of the time, the discharge would be, at most, 97 percent of the net flow. This means that, at given times, the discharge from IP2 and IP3 would not necessarily be well mixed into the Hudson River.

Table 3. Cumulative Frequency Distribution of Net Downstream Flows of Hudson River

Million gallons per minute (gpm)	Cumulative percentile
11.7	20
6.8	40
4.71	60
3.1	80
1.8	98

Adapted from Entergy 2007a

The NRC staff cannot determine—based on available information—whether a shortnose sturgeon in the Hudson River would experience any prolonged physiological stress from the thermal plume caused by the discharge from IP2 and IP3. Shortnose sturgeons could be forced to seek refuge from elevated water temperatures as they are forced to do in southern rivers, and this could limit their available habitat. If studies reveal that the plume is buoyant, shortnose sturgeons could pass underneath the plume on their passage past the facility, but there are no data to indicate that this is the case.

As noted earlier, the NYSDEC thermal modeling of the Hudson River suggests that the discharge from IP2 and IP3 could exceed the limits specified in the SPDES permit, but without a triaxial thermal study, the exact size and nature of the thermal plume is unknown. Information about the species, based on the NMFS recovery plan, suggests to the NRC staff that increased temperatures can have a significant effect on the shortnose sturgeon. Therefore, the NRC staff concludes that the continued operation of IP2 and IP3 for an additional 20 years could adversely affect the population of shortnose sturgeons in the Hudson River through thermal discharge, but the staff is unable to determine the extent to which the population would be affected.

5.0 Conclusion

Renewal of the operating licenses of IP2 and IP3 to include another 20 years of operation could adversely affect the population of shortnose sturgeon in the Hudson River through impingement and thermal impacts. At this time, the NRC staff cannot quantify the extent to which the population could be affected.

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