Endangered Species Act

Section 7 Consultation - Threshold Examination and Biological Opinion

Agency: Nuclear Regulatory Agency

Activity of Program: Cooling Water Intake of Salem Nuclear Generating Station, Unit 1, on the Delaware River, New Jersey.

Consultation Conducted by: Office of Marine Mammals and Endangered Species, National Marine Fisheries Service.

Summary of Consultation:

The staff of the Nuclear Regulatory Commission (NRC) requested informal consultation with the National Marine Fisheries Service (NMFS) concerning existing and potential problems regarding impingement of endangered shortnose sturgeon on the intake trash bars and screens of the Salem Nuclear Generating Station, Unit 1.

Further interagency communications during the week of October 22-26, 1979, led to an informal meeting on October 29, 1979, at the Bethesda, Maryland, offices of the NRC. Present at the meeting were representatives of the NMFS, NRC, Environmental Protection Agency (EPA), the States of Delaware and New Jersey, the Public Service Electric and Gas Company that operates the Salem plant and its consultants, Ichthyological Associates, as well as members of the interested public, including Mr. and Mrs. Alfred C. Coleman, Pennsville, New Jersey, petitioneers to the NRC in the matter of the continued operation of the Salem plant. By letter dated October 31, 1979, the NRC requested a formal consultation with the NMFS concerning the effects of the

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operation of Salem Nuclear Generating Station, Unit 1, and the construction and operation of Salem Nuclear Generating Station, Unit 2, and Hope Creek Nuclear Generating Station, Units 1 and 2, on the shortnose sturgeon in the Delaware River, in accordance with regulations promulgated under Section 7 of the Endangered Species Act of 1973, as amended.

We have not reviewed the construction and operation phase of Salem Unit 2 and of Hope Creek Unit 1 and Unit 2. Therefore, we cannot render an opinion on the possible impact of those activities on the shortnose sturgeon in the Delaware River. However, after reviewing the information available in published accounts, unpublished reports, as well as that presented at the October 29, 1979 meeting, the NMFS has concluded that the continuation of the existing water intake activities at Salem Unit 1 is not likely, by itself, to jeopardize the continued existence of shortnose sturgeon nor destroy or adversely modify habitat which may be critical to it.

Life History of Shortnose Sturgeon.

The shortnose sturgeon, Acipenser brevirostrum (LeSueur, 1818), occurs in rivers, estuaries and the sea along the east coast of North America from the Indian River, Florida, north to the Saint John River, New Brunswick, Canada. In recent years reproducing populations have been studied in the Altamaha River, Georgia, the Hudson River, New York, the upper Connecticut River, Massachusetts, the Kennebec River, Maine, and the Saint John River, New Brunswick, Canada. The status of other populations elsewhere in its range is poorly understood, including that in the Delaware River for which no quantitative population estimates are available.

All stages [illegible] design well suited for their bottom-dwelling mode of existence. The body cross-sectional outline is semicircular, with the broad flat surface being ventral. The wide, sharp-nosed, concave snout of the juvenile shortnose sturgeon is possibly an adaptation creating a depressor effect, and allows the sturgeon to utilize currents for holding itself against the substrate, thereby maintaining its river bottom position with only a small expenditure of energy. The mouth is ventral and protrusible, and well suited for benthic feeding.

Habitat preference and migratory behavior of shortnose sturgeon are influenced by latitude and the physical nature of each river system. In northern locations the majority of the populations occur within the influence of estuaries. The populations move upstream during spring and summer to spawn and feed, while a seaward migration takes place in fall. Southern shortnose sturgeon populations appear to enter rivers only in spring to spawn and then return to coastal waters for the remainder of the year.

Juveniles spend at least their first year in freshwater. In the Saint John River, Canada, they do not begin migratory behavior until reaching about 45 cm fork length (approximately 8 years).

Growth varies greatly depending on latitude, with the fastest growth occurring among southern populations. In the Saint John River, Canada, shortnose sturgeon attain 50 cm, 90 cm and 100 cm in fork length after 9, 25, and 35 years of age respectively. In the Hudson River it attains 50 cm and 90 cm after 5 and 15 years of age respectively, whereas in the Altamaha River, Georgia, it attains 50 cm after 2 years and 90 cm by 10 years of age. Maximum known age is 67 years for females, but males seldom exceed 30 years of age.

Female shortnose sturgeon [illegible] fork length and spawn for the first time between 55 and 75 cm length. Among northern populations 50 percent maturity and age of first spawning correspond with 15 and 18 years of age respectively, but for southern populations the relative ages are 5 and 8 years. Males mature between 45 and 50 cm fork length. Among northern populations males mature about age 10 but among southern populations maturity may occur as early as age 2. The minimum duration between spawnings of individual females is about 3 years but males may spawn yearly or every other year. Fecundity of females is between 40,000 and 200,000 eggs and is directly correlated with total weight. The sex ratio among young adults is 1:1 but this changes to a predominance of females among fish longer than 90 cm fork length.

Shortnose sturgeon spawn during early spring in the freshwater portions of estuaries or in rivers. Spawning is initiated at water temperatures of 10-12°C. Eggs are probably broadcast, and fertilization is external. Upon fertilization the eggs become adhesive and attach to bottom materials. Hatching takes place in 13 days at 10°C. On hatching the larvae are about 7 mm in length, grey in color, and demersal. Early life history after yolk sac absorption is poorly known but limited studies indicate larvae and juveniles are demersal, remain in the deeper parts of river channels, and seldom enter the drift component of the river. Recent studies have shown that mid-stream bottom current speeds of 40-65 cm/sec caused few larvae to enter the drift. The morphology and biology of shortnose sturgeon indicate that the species is well adopted to environmental situations characterized by large flow regimes.

Estimates of adult shortnose sturgeon populations have been made in four relatively well studied river systems, but not in the Delaware River. These estimates have no direct bearing on the abundance of the species in the Delaware River since movement between these rivers and the Delaware is unrecorded. However, they do provide an idea of the population levels of adults that can be expected in similar areas, and are as follows: 18,000 in the Saint John River, New Brunswick; 5,400 in the Kennebec River, Maine; 500 in the land-locked Holyoke Pool, Connecticut River, Massachusetts; 7,000-9,000 in the Hudson River, New York.

Shortnose Sturgeon in the Delaware River.

There are no population estimates available of shortnose sturgeon in the Delaware River. However, the original scientific description of the shortnose sturgeon in 1818 was based on specimens collected in the Delaware River, and there have been numerous other recordings of shortnose sturgeon in the Delaware over the past 150 years up until and including the present. Evidence indicates that the shortnose sturgeon is more closely tied to fresh and brackish waters than is the related Atlantic sturgeon, and that it remains closer inshore in estuarine habitats during its seaward migrations than does the Atlantic sturgeon. This indicates that shortnose sturgeon may have relatively discrete and separate stocks from one river system to another, especially in areas where the estuarine influences of adjacent river systems do not overlap. This suggests that there is less stock intermingling and river interchange through sea migration with shortnose sturgeon than is the case with Atlantic sturgeon. Therefore, the populations of shortnose

there of other river systems, with [illegible] levels of [illegible], if any, into the Delaware. Since there have been periodic [illegible] of shortnose sturgeon in the Delaware since its original description, it is apparent that viable populations of this species have been present in that river continuously over a long period of historic time.

Description of Salem Nuclear Generating Station, Unit 1.

1. Site Location.

Salem Unit 1 is located on about 220 acres at the southern end of Artificial Island in Lower Alloways Creek Township, Salem County, New Jersey. The island (in actuality, an artificial peninsula) projects from the eastern shore about one-third of the way across the Delaware River estuary, which has a width of about 2.5 miles at this location. The plant station is essentially midway between Wilmington and Dover, Delaware, which are 20 miles north and south of the site, respectively. Philadelphia, Pennsylvania, is about 30 miles and Salem, New Jersey, is 7.5 miles north of the site.

2. Water Usage.

The once-through cooling system draws its water from the Delaware estuary and serves to condense the spent secondary steam in the heat exchangers (condensers) following the turbine-generators. The waste heat from the power generation is removed by heat transfer to the circulating water system and returning it to the Delaware River estuary. Approximately 15.3×10^9 Btu/hr are removed by this system.

The cooling water, which represents less than 1% of the net tidal flow, is withdrawn from the Delaware River estuary through an intake system on the south end of Artificial Island. The intake is designed to

passages, stop gates and traveling screens. [illegible] velocity at the screens is less than 1.0 fps.

During the summer of 1976, the traveling screens and screen wash water system of Salem Unit 1 were modified to return fish to the Delaware River, using a Ristroph fish return system. This system collects fish from the screens in buckets attached to the screens. The screens, which are continuously moving, are washed by a low pressure spray system. Fish are continuously washed off the screens into an upper trough and returned to the river. Debris is removed by a high pressure spray and also returned to the river. Fish and debris are returned either to the north or south of the plant depending on the tidal flow, to avoid reimpingement. The fish return system operates continuously all day long, seven days a week. Sampling of impinged fishes takes place during periodic short diversions of the return system, lasting from one to three minutes each on ten samplings per day, six days a week.

Impact of Plant on Shortnose Sturgeon Population.

1. Entrainment.

Based on what is known about the spawning habits of shortnose sturgeon in other river systems, it is unlikely that there is any entrainment of shortnose sturgeon eggs and larvae at Salem Unit 1, for the following reasons: spawning grounds for shortnose sturgeon usually are found relatively far upstream in river systems and the location of Salem Unit 1 appears to be well south of these grounds; sturgeon eggs are demersal and adhesive and seldom enter river drift; the larval and juvenile fish are closely associated with the substrate and seldom enter

river drift; the larvae grow very rapidly and will be [illegible] for entrainment for only a limited number of weeks; and the young of the larval fish are not believed to move great distances from the spawning area. Finally, no eggs or larvae of either the Atlantic or shortnose sturgeon have been found in the entrainment samples at Salem Unit 1 or in ichthyoplankton sampling in the nearby river. Therefore, for all these reasons, we conclude that there is no known entrainment of shortnose sturgeon and little, if any, can reasonably be anticipated.

2. Impingement.

Only two specimens of shortnose sturgeon are known to have been involved in any way with impingement at Salem Unit 1. On January 12, 1978, one specimen, measuring about 54 cm total length and described as being in a state of moderate decomposition, was collected from the trash bars at the Salem Unit 1 intake. The presumption of prior death was based on several factors: the eyes were clouded; the body was soft; the intestines in the abdominal cavity had begun to lose their integrity; and putrefaction was advanced to the point that there was a noticeable odor. Furthermore, the large mesh size of the trash screen precludes the possibility of anything but a comatose or otherwise totally unresponsive fish from becoming impinged on it. This evidence of decomposition, which had begun even though water temperature was about 0.5°C and the trash bars were being cleaned one to three times daily, indicated that this particular specimen was already dead when collected at the plant.

A second specimen, measuring about 62 cm total length, was recovered from the screen wash water on June 26, 1978. Because this specimen was in such poor condition that it would not survive if

returned to the river, an attempt was made to revitalize it in a flowing ambient water bath. In the water bath, it was unable to maintain equilibrium and its respiratory movements were irregular. It died after 15 hours. A presumption of poor physiological condition was based on observations that the abdomen was retracted and the fish was very thin and did not exhibit the more robust shape typical of the species.

These two specimens are the only known individuals to have been collected at the Salem Unit 1 intake since operation commenced in mid 1976. No specimens of the usually relatively more common Atlantic sturgeon have been recorded from the Salem Unit 1 intake.

Studies of shortnose sturgeon indicate that the sustained swim speed for juveniles is in excess of 2 body lengths per second. Estimates of cruising speed from radio tagging studies indicate that the adults cruise at speeds greater than 33 cm/sec (the burst speed can be expected to be much higher), which is more than the intake velocity at the traveling screens. Thus, for these reasons alone, impingement of healthy adult fish is considered to be an unlikely and relatively rare event. Additionally, the bottom dwelling habits of all stages and the migratory behavior of adults indicate that individuals only rarely would encounter the intake flow of the plant. Even in the unlikely event that a healthy shortnose sturgeon was impinged, there is a good chance that it would be returned to the river alive by the fish return system.

Conclusion of Biological Opinion.

Section 7 (a) of the Endangered Species Act requires that all Federal agencies "...insure that any action authorized, funded or carried out by such agency...does not jeopardize the continued existence

of any listed species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary...to be critical..."

Regulations implementing this section (43 F.R. 870) define "jeopardize the continued existence of" to mean "...to engage in an activity or program which reasonably would be expected to reduce the reproduction, numbers or distribution of a listed species to such an extent as to appreciably reduce the likelihood of the survival and recovery of that species in the wild..."

We have reviewed the information available in the scientific literature and in other published and unpublished reports, as well as that presented during the informal consultation period and at the meeting of October 29, 1979. It is the opinion of the NMFS that the present water intake program of the once-through system at Salem Unit 1 is not likely to jeopardize the continued existence of the shortnose sturgeon, nor is it likely to destroy or adversely affect habitat that may be critical to the shortnose sturgeon. The reasons for this conclusion are stated in the above section entitled Impact of Plant on Shortnose Sturgeon Population.

Recommendations.

We strongly recommend that the NRC take steps to sponsor and encourage research on the basic life history of the shortnose sturgeon in the Delaware River, especially as it relates to the seasonal distribution of all stages of the species. Studies to determine the preferred habitats of all of these stages, as well as reproductive cycles, migrations and population dynamics of the species should be initiated. The aim of the research should be to establish population

[redacted] shortnose sturgeon status of the Delaware River that will permit more precise estimates of the impacts of incidental mortalities in that river system. The lack of information about the status of the shortnose sturgeon in the Delaware River may result in future activities in that river being delayed because of an inability to meet the requirements of the Endangered Species Act. The NMFS is prepared to assist you or anyone else in planning research activities. Research activities will require a permit and applications must be sent to the NMFS.

Finally, should more data become available indicating a potential or real adverse impact on the shortnose sturgeon from the activities of Salem Unit 1, or should those operations be modified in a way likely to adversely impact that species, we recommend that consultation be reinitiated.

cc:

F, Fx31, F3, FNE62 (Doug Beach), NEFC, F6, GCF, FWS (John Spinks), NRC (James Wilson), FNE72 (Dick Whitaker), EPA (Morales-Sanchez)