Hearings # 4160

Ex. 271

UNITED STATES OF AMERICA
BEFORE THE
U.S. Environmental Protection Agency
Region II

TESTIMONY OF Dr. Michael J. Dadswell
on Behalf of
The National Marine Fisheries Service

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My name is Dr. Michael J. Dadswell. While I am presently employed at the Biological Station of Fisheries and Oceans Canada, St. Andrews, New Brunswick, as a Fisheries Research Scientist, I am submitting this testimony on behalf of the U.S. National Marine Fisheries Service (NMFS). The testimony has been reviewed and approved by appropriate employees of the NMFS and constitutes the NMFS opinion on the impact of the once-through cooling systems of the relevant utilities on the shortnose sturgeon. This opinion is required by sections 7(a) and (b) of the Endangered Species Act of 1973 as amended. My testimony does not necessarily represent the view of my employer.

The Shortnose Sturgeon

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 (Scott and Crossman, 1973). 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 ~~are~~ is poorly understood.

Three species of sturgeons occur in eastern North America. Of these, the shortnose sturgeon attains the smallest maximum size but occurs in the greatest diversity of habitat. Both the lake sturgeon (*Acipenser fulvescens*) and the Atlantic sturgeon (*Acipenser oxyrhynchus*) grow to sizes in excess of 200 cm and 100 kg. The former species is confined to freshwater and the latter spends the majority of its adult life at sea, returning to freshwater only to spawn. The shortnose sturgeon, on the other hand, has a maximum known total length of 143 cm and weight of 23 kg (Dadswell, in press). It lives mainly in estuarine or nearshore marine habitats but some populations migrate annually into fresh water and may remain there for over a year. One partially landlocked population is known (Taubert, pers. comm.) in Holyoke Pool, Connecticut River, Massachusetts.

Shortnose sturgeon, like other species of sturgeons, have an integument of thick, tough skin embedded with small denticles and five rows of large bony plates called scutes (Vladykov and Greeley, 1963). In young specimens the scutes project along their median line in a knife-edge, approximately 1 cm high, terminating in a hook. The scutes become progressively lower and smoother as the sturgeon ages. The sharp scutes of young sturgeon possibly serve as a form of predator defense.

All sturgeon have an effective hydrodynamic design well suited for their bottom-dwelling mode of existence. The body 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, 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 and a seaward migration takes place in fall (Dadswell, in press). 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 (Heidt and Gilbert, 1978).

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.

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 length after 9,25 and 35 years of age respectively (Dadswell, in press). In the Hudson River it attains 50 cm and 90 cm after 5 and 15 years of age respectively (Greeley, 1937), whereas in the Altamaha River, Georgia it attains 50 cm after 2 years and 90 cm by 10 years of age (Heidt and Gilbert, 1978). Maximum known age is 67 years for females, but males seldom exceed 30 years of age (Dadswell, in press).

Female shortnose sturgeon mature between 50 and 60 cm fork length and spawn for the first time between 55 and 75 cm. Among northern populations 50 percent maturity and age of first spawning correspond with 15 and 18 years of age respectively (Dadswell, in press) but for southern populations the relative ages are 5 and 8 years old (Heidt and Gilbert, 1978). 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 (Hedit and Gilbert, 1978). The minimum duration between spawnings of individual females is about 3 years but males may spawn yearly or every other year (Dadswell, in press). Fecundity of females is between 40,000 and 200,000 eggs and is directly correlated with total weight. The ratio among young adults is 1:1 but 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 thirteen days at 10°C. (Meehan, 1910). On hatching the larvae are about 7 mm in length, grey in color, and demersal (Taubert and Reed, in press). 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 (Tauhert and Reed, in press). Recent studies have shown that mid-stream, bottom current speeds of 40-65 cm/sec caused few larvae to enter the drift (Taubert and Reed, in press). The morphology and biology of shortnose sturgeon indicate that the species is well adopted to environmental situations characterized by large flow regimes.

The Shortnose Sturgeon in the Hudson River

Present knowledge of the biology of shortnose sturgeon in the Hudson River is based on work done there by the New York Conservation Department during the 1930's (Greeley, 1935, 1937; Currian and Ries, 1937), and by Texas Instruments (Hoff et al., 1977) and the Boyce Thompson Institute (Dovel, 1978) during the 1970's. In general the combined findings support the statement that shortnose sturgeon in the Hudson River behave similarily to other studied populations (Dadswell, in press): spawning occurs in the upper estuary and nursery grounds and juveniles are concentrated there; with age and maturity the shortnose sturgeon exploit the lower estuary and the Atlantic Ocean in the approaches to the river; migration upstream occurs to overwintering sites and for feeding and spawning.

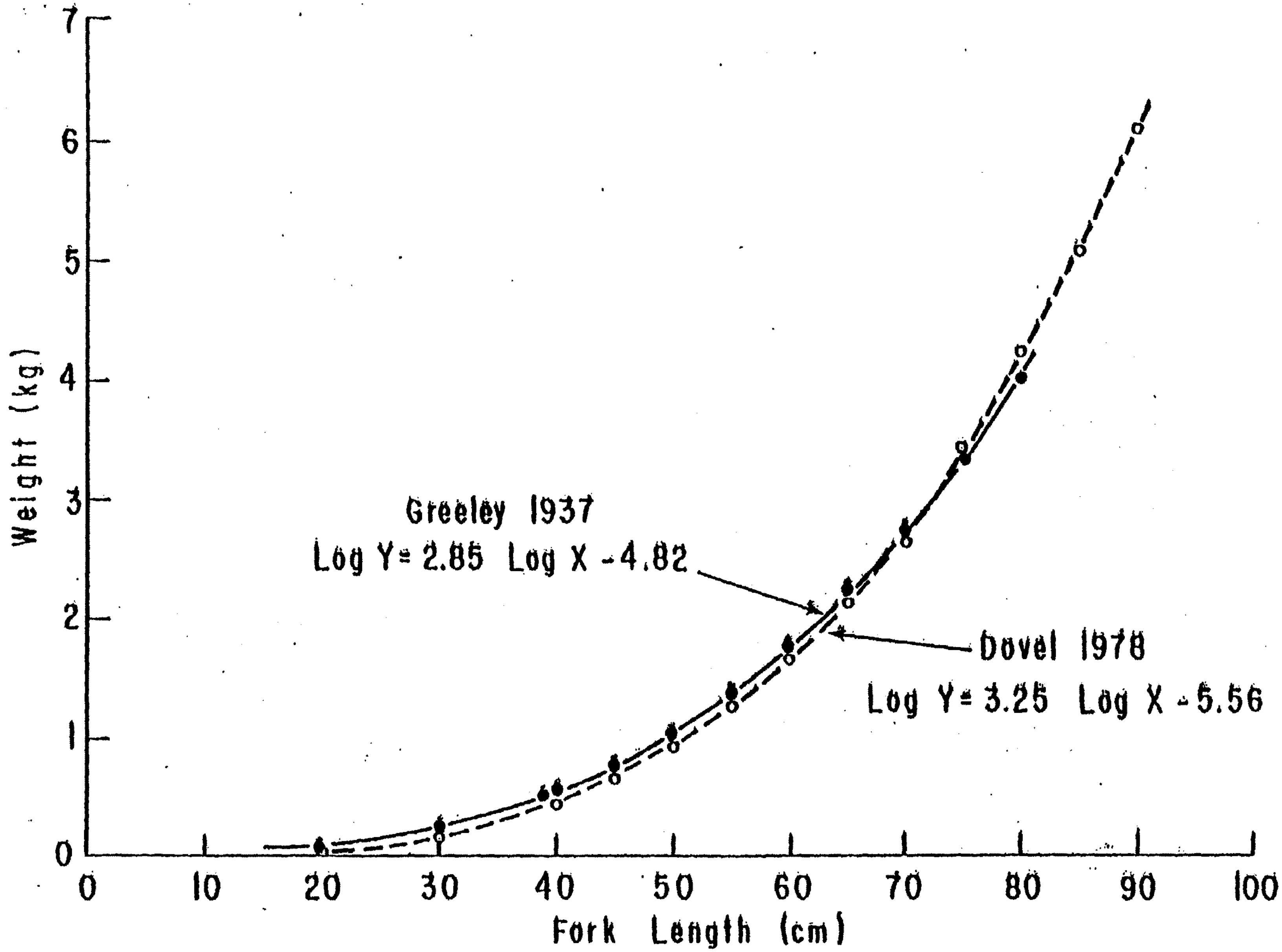
Dovel (1978) found that adult shortnose sturgeon overwinter in the deepwater of the estuary between Tappan Zee (Rm 24) and Kingston (Rm 93). Greeley (1935) reported a ripe shortnose female taken from the Albany region during February and it seems likely that overwintering sites occur throughout the estuary wherever conditions are right. When water temperatures exceed 9°C in spring, ripe fish move onto spawning grounds in the upper estuary between Kingston (Rm 93) and Coeymans (Rm 132) (Greeley, 1937; Dovel, 1978). Spawning occurs in this region during the last weeks of April and the first weeks of May (Greeley, 1937; Dovel, 1978). Larval and young-of-the-year shortnose sturgeon are found in this region during May, June and July (NALCO, 1977; Dovel, 1978). Juvenile shortnose sturgeon occur seaward as far as Haverstraw Bay but are generally concentrated inland of the salt-freshwater interface (Rm 52-82 seasonally). Seaward migration to brackish and salt water probably occurs at about 45 cm fork length or 4-6 years of age.

Adult shortnose sturgeon are found over the entire estuary throughout the year (Hoff et. al., 1977; NALCO, 1977; Dovel, 1978). During spring and summer adults are commonly found in shallow water (Hoff et. al., 1977), especially at night (Dovel 1978). Adults occur in the sea around the mouth of the Hudson and have been reported in Sandy Hook Bay (Wilk and Silverman, 1976) and off Long Island (Schaefer, 1967).

The population size of shortnose sturgeon in the Hudson is apparently at least 6,000 sub-adults and adults [Dovel, 1978;

Dadswell, independent estimate based on Texas Instruments' (TI) data (Hoff et. al., 1977)]. Further study is likely to reveal that the population is larger than estimated since the majority of collecting effort has been concentrated in regions considered less than optimal shortnose habitat. In addition, a substantial portion of the population may be ocean migratory, reducing the number of individuals in the study area. Finally, recapture levels in both population estimates were insufficient to meet the validity requirements of the Peterson population estimate (i.e. MC >4N; Robson and Regier 1964). There is no evidence the population has or is declining. Comparison of Greeley's 1937 findings and Dovel's early findings (1976-77) indicate the population was probably stable during that forty year period. Both studies used the same method for obtaining shortnose sturgeon (i.e., commercial fishermen gillnet by-catch) and in both cases catches during the shad season averaged about 100 shortnose sturgeon per year.

Comparision of the weight-length data for shortnose sturgeon from the Hudson obtained by Greeley (1937) and Dovel (1978) indicate there has been little or no change in this relationship during the forty-year period (Fig. 1). The two curves are significantly different at the 95% level (Student's t-test) but the difference is probably due largely to the collecting methods used in each study. The 1937 data



Weight (kg)
0
1
2
3
4
5
6
7
Greeley 1937
Log Y= 2.85 Log X -4.82
Dovel 1978
Log Y= 3.25 Log X -5.56
0
10
20
30
40
50
60
70
80
90
100
Fork Length (cm)

Figure 4

come solely from the commercial fishermen gillnet by-catch and as a result contain a gillnet selectivity bias. The 1978 data was collected with a greater range of gear and is probably nearer to the true relationship. Similar weight-length relationships mean that physical condition of shortnose sturgeon in the Hudson River has probably not changed during the forty-year period.

Hudson River Plants Involved in this Hearing

A number of power plants use water from the Hudson River as a source of cooling water for steam electric power plant condensers. Of these, the Bowline Point Generating Station (Rm 37.5) the Indian Point nuclear Units 2 and 3 (Rm 43) and Roseton Generating Station (Rm 65.4) are involved in this hearing. The Indian Point Plants are nuclear power plants while the Bowline and Roseton plants use fossil fuel as their fuel stock. All four plants use once-through cooling.

The different impingement rates of shortnose sturgeon for each of the plants (Table 1) is probably based primarily on intake structure location. In both Bowline and Roseton the intake location is situated on a lagoon or at the end of an intake channel away from the main channel and is therefore separated in space from the primary habitat of the juvenile

Orange and Rockland, and Central Hudson, Hudson River power plants, 1972 through 1976.

TABLE I

From Hoff, et al, 1977; McFadden, et al, 1978 and personal communication with Dr. William Kutz

Date	Plant/Unit	Total Length (mm)	Weight (gm)	RM
1972				
6-7	Danskammer	---	1500	64
6-27	Indian Point/2	174	12	42
7-6	Danskammer	---	1075	64
8-3	Danskammer	---	320	64
8-6	Indian Point/1	248	36	42
8-12	Indian Point/1	98	3	42
8-24	Danskammer	---	910	64
1973				
1-16	Bowline	625	1017	37
3-28	Indian Point/2	310	85	42
5-17	Danskammer	---	---	64
7-20	Indian Point/2	479	407	42
9-5	Danskammer	---	---	64
1974				
3-20	Bowline	254	---	37
4-2	Roseton	---	---	64
5-5	Indian Point/2	493	532	42
6-20	Indian Point/2	805	1702	42
8-8	Indian Point/2	707	1588	42
8-20	Indian Point/1	122	7	42
1975				
6-20	Indian Point/2	---	84	42
1976				
2-16	Indian Point/2	307	253	42
4-30	Indian Point/2	283*	---	42
12-27	Bowline	---	---	37

*Standard Length

RM = river mile

1977 1/23 Indian Point/1
2/23 Indian Point/2
4/2 (2) Indian Point/2
5/25 Indian Point/2
9/23 Indian Point/3
— Danskammer
1978
1/9 Indian Point/2
1/27 Indian Point/3
3/2 Indian Point/3
3/27 Indian Point/3
11/14 Indian Point/2

shortnose sturgeon. Indian Point, on the other hand, has its intake location adjacent to a deep channel and this may account for its higher rate and consistency of shortnose sturgeon impingement.

Impact of Hudson River Power Plants on the Shortnose Sturgeon

A. ENTRAINMENT

Spawning grounds for the shortnose sturgeon are found between Kingston (Rm 93) and Coeymans (Rm 132) (Dovel, 1978). The power plants are located to the south of these grounds (Rm 37-65.4). Eggs are demersal and adhesive (Meehan, 1910) and seldom enter river drift (Taubert and Reed, in press). Studies have also shown that very few sturgeon larvae ever enter the river drift in the Hudson River (Dovel, 1978; Hoff et. al., 1977). Finally, shortnose sturgeon larvae grow very rapidly and are only available for entrainment for a limited number of weeks. For these reasons, there is no known entrainment and little, if any, can reasonably be anticipated.

B. IMPINGEMENT

Data from the utilities show that the highest level of recorded impinged shortnose sturgeon in any year since 1972 was 7 (Hoff et al., 1977) although McFadden et al., 1978, show 1 more shortnose impinged at Indian Point in 1972, which would make this number 8 (Table 14.3-32)). These data, however, must at the very least be corrected for collection efficiencies. Utility data show that the collection efficiencies from these power plants are Indian II - 15%, Indian III - 80% and Roseton and Bowline 100% each. Assuming that this efficiency is correct, and discounting for the time being impingement at Danskammer and Lovett for which we do not have collection efficiencies, during the period 1972-1978, 1977 appears to be the year when the largest number of shortnose (35) were impinged and 1975 the year when the smallest number of shortnose were impinged (7).

EPA has advised us on how its experts would scale up the sample numbers of impinged shortnose sturgeon (Attachment 1). The factors used for Indian Point II & III correspond to the utilities' collection efficiencies. For Bowline & Roseton, EPA recommends, in the absence of data on flow rates, using a crude scaling factor of 7 to account for weekly rather than daily collections ~~in the absence of data on flow rates~~, but ~~EPA~~ cautions that this factor may ~~be an~~ underestimate impingement because sampling ~~frequency~~ was not always as frequent as once per week. EPA then recommends scaling this estimated count by 1.2 at Bowline and 1.4 at Roseton. EPA also cautions, however, that it is not useful to focus of any one year at these two plants because impingement of shortnose is sufficiently rare that weekly sampling might lead to collection errors. Between 1972 and 1978, 3 shortnose were recorded impinged at Bowline and 1 at Roseton. Using EPA's scaling figures, 25 shortnose or 4 per year can be estimated to have been impinged at Bowline and 9 shortnose or 1 per year were impinged at Roseton between 1972 and 1978.

In McFadden et al. (1978) estimates are made of shortnose impingement at Bowline, Roseton, Danskammer and Lovett between 1973-1977. These estimates apparently are based on flow rates. The estimates are summarized as follows:

		IMPINGEMENT ESTIMATE
Table 14.3-33	Bowline	20
Table 14.3-34	Roseton	16
Table 14.3-35	Lovett	0
Table 14.3-36	Danskammer	31

This impingement averages out to 4/yr. at Bowline, 3/yr. at Roseton, 0 at Lovett and 6/yr. at Danskammer. Assuming the accuracy of all of this data, impingement of shortnose may run as high as 50 fish a year.

The only written evidence of direct mortality from impingement comes from a TI Report submitted as required under its Endangered Species Act permit (Sept. 26, 1978). TI reported that in the first half of 1978 there was 1 shortnose dead when collected at Indian Point II and 2 shortnose dead when collected at Indian Point III. This TI Report does not indicate the cause of death of any shortnose. Dr. William Kirk of TI has indicated in a personnel communication that none of the three collected dead shortnose exhibited any external injury and that cause of death could not be determined. Evidence presented by the utilities indicates that no shortnose impinged at Bowline or Roseton were dead when collected and I am aware of no contrary evidence. I have no information on the status of impinged shortnose at Danskammer.

On April 10, 1979, Counsel for the NMFS called Dr. William Kirk of TI to inquire about the causes of death of these fish and levels of impingement during the last half of 1978 and 1979 to date. Dr. Kirk indicated in response to a question about why mortality occurred for the first time in 1978 that records he had available showed other mortalities at the Indian Point plants as follows:

1972 2 shortnose sturgeon dead when collected from Indian Point I

1973 2 shortnose sturgeon dead when collected from Indian Point II

1979 1 shortnose sturgeon dead when collected from Indian Point III

Dr. Kirk also indicated that 1978 was the first year that complete records were kept at the Indian Point plants on the status of shortnose sturgeon when collected. Dr. Kirk indicated that prior to 1977, no notations were recorded whether any shortnose sturgeon collected at the Indian Point plants were dead or alive except for those recorded dead in 1972 and 1973. In 1977, two of the six impinged sturgeon were recorded alive while no record was made of the other four. Dr. Kirk indicated, however, that at least as of April, 1977, TI had a policy of preserving all dead shortnose.

Because of the lack of recorded data on the status of collected impinged shortnose at the Indian Point plants prior to 1978 only 1978 data can be used in evaluating the impact of impingement. Assuming that 1978 was an average year, 60% of collected impinged shortnose are dead when collected. Assuming that all of these shortnose died because of impingement, we can hypothesize that 60% of collected impinged shortnose die as a result of impingement. I lack confidence in this figure, however, because of its potential error from small sample size.

The assumption that 1978 was an average year appears to be reasonable based on the level of impingment of shortnose in other years (Hoff _et_. _al_., 1977). However, the assumption that all shortnose that were dead when collected died as a result of impingement may not be entirely reasonable. _Sturgeon may be injured and released in a weakened or dying condition from handling during incidental catch in commercial fisheries_ and in scientific collecting thus being made more susceptible to impingement. Reports sent to NMFS as a part of Endangered Species permit responsibilities indicate a low level of mortality from handling for scientific research. (NALCO, Dec. 12, 1977; Dovel, 1978; TI Sept. 28, 1978, Dadswell, personnel information).

Taking a worst case scenario, with a 60% death rate from impingement at Indian Point and 35 shortnose impinged at Indian Point per year, 21 shortnose sturgeon die on impingement screens per year. A few more deaths may occur which have gone unreported at the other plants. With an estimated population of adult shortnose in the Hudson River of 6,000, about 0.3-0.4% of the shortnose population in the Hudson die as a result of impingement. Natural mortalities of shortnose sturgeon are between .12-.15 (Dadswell, 1979 in press) or in the case of the Hudson population about 800 adults per year. The level of impingement mortality described above is, therefore, a very small percentage (2%) of the normal level of natural mortality and I do not believe that even this additional impingement mortality will appreciably reduce the likelihood of the survival and recovery of the shortnose sturgeon.

The indirect effect of impingement on shortnose sturgeon is unknown. Sturgeon weakened on the screens may die after release or be more susceptible to predation but data to support these assumptions are lacking. Even assuming, however, that all impinged shortnose which do not die on screens later die because of being weakened when impinged, the level of mortality is still relatively insignificant (3% of natural levels). 6

Conclusion

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 endangered 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..."

It is my opinion that the once through cooling system of the power plants involved in this case is not likely to jeopardize the continued existence of the shortnose sturgeon because, even assuming 100% mortality of impinged fish, its contribution to the natural annual mortality is negligible. In addition, the biology of the shortnose sturgeon effectively isolates the species from most of the effects of power plant intakes.

Because no critical habitat has yet been determined for the shortnose sturgeon, the use of once through cooling systems will not destroy or modify any critical habitat.

On the other hand, there is no evidence that impingement has any positive benefit for the shortnose sturgeons. As previously mentioned, there are mortalities of shortnose from impingement and there may be indirect effects on the shortnose from impingement. Therefore, reducing the level of impingement will aid in the conservation of the shortnose sturgeon.

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OAK RIDGE NATIONAL LABORATORY
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April 25, 1979

Eric Erdheim, Esq.
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Dear Mr. Erdheim:

In response to your request regarding the way to treat the raw numbers impinged at Hudson River Power Plants, the following information is provided.

The numbers of short-nose sturgeon impinged at Hudson River Power Plants which are currently available to us were obtained from the regular counts of impinged fish. At Indian Point, an attempt is made to count the fish every day. At Bowline and Roseton, on the other hand, the counts are generally made weekly and were made less often in the early years of operation.

For other species, we apply scaling factors to the counted numbers which are designed to reflect what we believe to be a more accurate estimate of the number impinged. These scaling factors are designed to take account of the inability of the collection procedure to collect and count all fish impinged (collection efficiency) and of the fact that counts were made only on certain days. If survival is not considered, the numbers at all plants should be scaled up to reflect collection efficiency. The following factors should be applied:

Indian Point Unit 2	6.7 x # counted
Indian Point Unit 3	1.4 x # counted

Bowline (factor considers collection efficiency and offsetting reimpingement) 1.2 x # estimated

Roseton 1.4 x # estimated

In addition to application of these collection efficiency factors, the raw values at Bowline and Roseton must be scaled up to reflect the fact that counts occured weekly or less often. Ordinarily, we and the utilities do this scaling by reference to the rate of flow on the days of collection and by assuming that impingement is directly proportional to flow. In the absence of flow data for the days on which short-nose sturgeon were impinged, a very crude scaling of these numbers could be achieved by multiplying by 7. We are inclined to believe this would, if anything, be an underestimate because sampling was not always as frequent as once per week. (Some more frequent than weekly collections at Bowline in 1976 and 1977 do not appear to alter this conclusion.) The collection of zero shortnose sturgeon at Bowline or Roseton during any particular year should not be taken as evidence that none were impinged during that year. The impingement of shortnose sturgeon is sufficiently rare that sampling this infrequently (i.e., weekly) might be expected to lead to the collection of no fish if the actual number impinged in that year was only a few but greater than zero.

Sincerely,

Lawrence W. Barnthouse, Ph.D.
Research Associate

LWB:im

cc: M. Mulkey
W. Van Winkle