



Indian Point would withdraw about 2650 cubic feet per second of water from the Hudson River for cooling purposes. An important issue in that proceeding involves the effect of the nuclear plant on the Hudson River fishery as a result of the withdrawal of water.

3. In its Final Environmental Statement, the AEC Staff concluded:

The staff analysis indicates that during June and July of most years from 30 to 50% of the striped bass larvae which migrate past Indian Point from upstream spawning areas are likely to be killed by entrainment (See Appendix V-3). In addition, large numbers of older striped bass will be killed by impingement. The combined effect of these two sources of mortality will decrease recruitment to the adult population of striped bass which depend upon the Hudson River for spawning. As a result, there is high probability that there will be an initial 30 to 50% reduction in the striped bass fishery which depends upon the Hudson for recruitment. Final Environmental Statement, Volume I at V-48.

The Final Environmental Statement also indicated that the total capacity of the three units at Indian Point will be 2,123 MW, the total capacity of the two units at Bowline Point will be 1,240 MW and the total capacity of the two units at Roseton will be 1,200 MW. Final Environmental Statement, Volume I at III-9.

4. Also in connection with the fishery issue, a Study Report entitled "Hudson River Fisheries Investigations 1965-1968: Evaluation of a Proposed Pumped Storage Project at Cornwall, New York in Relation to Fish in the Hudson River"

(hereinafter "Study Report") has been analyzed by expert witnesses during the hearings at the AEC. The Study Report has also been referred to as the Carlson-McCann Report.

5. During the hearings, Dr. C. Philip Goodyear testified with respect to the Hudson River fishery on behalf of the AEC Regulatory Staff. Dr. Goodyear is a research ecologist in the Aquatic Thermal Effects Program in the Ecological Sciences Division, Oak Ridge National Laboratory and the principal author of those parts of the AEC Staff's Final Environmental Statement which deal with the effects of the plant on fish and the fishery. Dr. Goodyear received a Doctor of Philosophy from Mississippi State University in 1969 with a zoology major and physiology minor. He received a NIH Postdoctoral traineeship from the Institute of Ecology of the University of Georgia in 1969 for education and research at the University's Savannah River Ecology Laboratory on the AEC Savannah River Plant in South Carolina. Following the expiration of the fellowship, he remained at the laboratory as research associate until joining the Oak Ridge National Laboratory in 1971. Dr. Goodyear is a member of several scientific societies and has published a number of scientific papers in the open literature.

6. Dr. Goodyear testified as follows with respect to the Study Report and its relation to the Storm King and Indian Point projects:

---

Con Edison presently has a motion pending to strike parts of this testimony.

BY MR. MACBETH:

Q Now, the Indian Point's number 1 and 2 plants withdraw approximately 2700 cubic feet per second of water from the Hudson River, do they not?

A I have deduced that from Table III-1 on page III-1 of the Final Statement.

[Dr. Goodyear]

A / Approximately.

Actually, in the analysis the figure 2650 was used.

Q On page 40 of the Hudson River Fisheries investigation, the Carlson-McCann Report, it is reported that the Cornwall pump storage project would withdraw an average of 18,000 cubic feet per second when it is pumping.

A I will show you the package so you can be sure of it.

(Handing to witness.)

Is that correct.

A Yes.

Q On the other hand, the plant would only be pumping through an eight-hour period of the day.

Is that also correct, and reflected on page 40?

A Yes.

Q So that if we averaged it out over the day, the Cornwall project, Cornwall pump storage project, would withdraw an average of 6000 cubic feet per second, is that correct?

A Yes.

Q And that would be more than twice as much as is

mm3 1 withdrawn by Indian Point Units 1 and 2, is that correct?

2 A. Yes.

3 Q Now at page A V 22 of the Final Environmental  
4 Statement -- no, that is the wrong page. I think SA-222, p. 22.  
5 There you discuss the details of the spawning distribution of  
6 striped bass in the Hudson River and you say that the species  
7 spawns from Kingston to Bear Mountain, with the greatest  
8 concentrations of eggs in the vicinity of West Point, although  
9 the exact location varies from year to year.

10 And further down in the paragraph you turn to a  
11 discussion of the larvae and you say that in that stage  
12 of development, the larvae are still unable to move effectively  
13 against the currents and will settle to the bottom in quiet  
14 water despite efforts to approach the surface.

15 These larvae are reported to be concentrated above  
16 the Haverstraw Bay area, with the greatest abundance between  
17 Peekskill and Newburgh.

18 Now, does the Storm King pump storage project lie  
19 within both of those areas, the area between Kingston and Bear  
20 Mountain, and between Peekskill and Newburgh?

21 [Attorney for Con Edison]  
MR. TROSTEN/ I object to the question, Mr. Chairman.

22 I don't see what the relationship of the Storm  
23 King project has to this proceeding.

24 MR. MACBETH: I will connect this up in a moment  
25 to the Carlson-McCann report. I just want to demonstrate that

1 the Cornwall project is in a heavy spawning and larval area.

2 And since there has been heavy reliance on the  
3 Carlson-McCann report, I just want that as a foundation.

4 CHAIRMAN JENSCH: All right. Proceed.

5 I think, though, when you say where is Bear Mountain,  
6 there must be a map that can tell you where that is, and tell  
7 you where Cornwall is. So if you can use some documentary  
8 background as a predicate, I think it will move it along,  
9 because the witness may have to stop and review a map or  
10 something.

11 MR. MACBETH: All right.

12 I think I can find a map which will indicate that.

13 THE WITNESS: I have one here.

14 BY MR. MACBETH:

15 Q Does the map that you are looking at indicate  
16 that the Cornwall pump storage project is between Bear  
17 Mountain and Kingston, and also between Peekskill and Newburgh?

18 A Yes.

19 Q Let me draw your attention to some of the conclusions  
20 reached in the Carlson-McCann report.

21 On page 41 of the report, the authors indicate that  
22 in 1966, .6 percent of the eggs, and in 1967, .6 or .5 percent  
23 of the eggs of striped bass in the Hudson would be withdrawn  
24 by the plant.

25 I show you page 41. Is that correct?

1045

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25

A Yes.

Q On page 42 of the report they indicate that in these two years, 1966 and 1967, up to 2.8 percent of the larva in the estuary, striped bass larvae, would be withdrawn by the plant.

I show you page 42. Is that correct?

A Yes.

Excuse me for a moment. I would like to get my copy.

Q Finally, on page 44, they indicate that between .4 percent and 6.2 percent of the young of the year striped bass would be withdrawn by the project.

Is that correct?

A Yes.

Q Now, Dr. Goodyear, is it correct also that it is the eggs and the larvae which would be withdrawn by the method equivalent to entrainment at Indian Point?

A Withdrawal with the water?

Q Yes.

A Yes.

Q Now, Carlson-McCann thus estimate that something like 3.5 percent of the stiped bass eggs and larvae from the Hudson would be withdrawn by the Cornwall project, and additional .4 percent to 6.2 percent of the young of the year would be withdrawn.

1

At most, that seems to come to approximately 10

2

percent.

3

MR. TROSTEN: Mr. Macbeth, what page are you reading

4

from, please?

5

MR. MACBETH: Those are pages 41, 42, and 44.

6

It is summarized on page 45 in the conclusions, and the top

7

of page 46.

8

MR. TROSTEN: Thank you.

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

1 BY MR. MACBETH:

2 Q At most, that seems to come to approximately  
3 ten percent of the striped bass eggs and larvae in the  
4 estuary. And the Cornwall project, as you indicated earlier  
5 on, withdraws somewhat more than twice as much water from the  
6 estuary. Could you explain to me how it is that you have come  
7 to an estimate that the Indian Point Plant would withdraw  
8 30 to 50 percent of the striped bass eggs and larvae, while  
9 Carlson-McCann, a report on which you have relied, came  
10 to the conclusion that a plant withdrawing twice as much water  
11 would only withdraw only ten percent of the eggs, larvae and  
12 young-of-the-year?

13 A The answer to your question is very simple. The  
14 evaluation of the withdrawal of larvae and eggs that was done  
15 in this report --

16 Q This report meaning the Carlson-McCann Report.

17 A Carlson-McCann Report, yes, assumed that eggs  
18 and larvae which passed the plant with the tide had a net  
19 transport past the plant equal to that tidal current.

20 In other words, they allowed no organisms to be exposed more  
21 than once. This effectively made a very substantial error  
22 in their calculations.

23 Q How substantial an error?

24 A Something on the order of magnitude -- it would  
25 depend again on the flow conditions, the relationship between

- ek2
- 1 the net transport through the zone of withdrawal and the
  - 2 magnitude of the tidal flow which they used as net flow.

7. Derek C. Bok, the President of Harvard University, asked three professors, Alfred W. Compton (Professor of Biology, Harvard University), William E. Reifsnnyder (Professor of Forest Meteorology and Public Health (Biometeorology), Yale University) and Richard Wilson (Professor of Physics, Harvard University) to report to him on the position which Harvard University as owner of the Black Rock Forest, in part of which Con Edison plans to build the Storm King reservoir, should take vis-a-vis the Storm King project. The report was presented to President Bok in January 1973 and released to the public on January 18, 1973.

8. The Report to President Bok, "The Cornwall Pumped Storage Project and the Black Rock Forest", discussed the effect of the project on fisheries as follows:

## VI. Effect on Fisheries

A major environmental concern has been intensified since the FPC ruling and the Court of Appeals decision. The area of the Hudson between Croton and Newburgh is the area where salt water and fresh water meet. This is a major spawning ground for striped bass, a major sport and commercial fish that migrates from the Hudson River spawning grounds to Long Island and New England.

The bass and larvae drift into this region of the "salt wedge" where a wedge of fresh water goes over a wedge of salt water. Due to day-night vertical movements the larvae go upstream with the salt by day at the bottom of the river and downstream at the top of the river by night. As the river flow changes, the salt wedge moves downstream during the year and the fish with it, from Newburgh in the north to Haverstraw in the south.

Along this reach of the river there are many power stations, some built and others under construction or planned, all of which circulate or are planned to circulate water from the Hudson. These are listed in Table I together with their water intakes. Bass eggs probably will not be affected by passing through the power stations, but larvae may be killed. To prevent fish entering the condensers, screens of 3/4 inch mesh are used; these also cause trouble. In a test (February 1972) of one of the six pumps at Indian Point 2, a hundred thousand young fish were caught on the screens in one day and killed. Older fish are stronger and can swim away except when water temperatures are very cold. The major problem is not the oft-quoted problem of thermal pollution, except insofar as fish larvae going through the temperature rise on the condensers of a steam-generating power station are more likely to die.

At the present, no one knows a good simple solution. Con Ed is trying "virtual" screens of air bubbles; these sometimes work but at other times seem to attract instead of repel the fish. The steam-generating power plants can avoid the problem by installa-

tion of cooling towers ponds\*, although the expense of all the plants shown would be about \$100 million. This of course would not apply at Cornwall, and if we examine the Table in Appendix II we see that Cornwall circulates nearly half the total water. If bass larvae are killed by a pass through the turbines, and no one knows whether this will be the case, an appreciable effect on the bass population would occur. Calculations indicate that all the power stations potentially could reduce the bass population at Croton to 25 percent of its present population, or 40 percent at Cornwall alone. If the 100 percent mortality rate turns out to be correct, Cornwall should be switched off during the spawning season, June to mid-July.

Experience at other comparable sumped storage plants is not available. For example at Muddy Run on the Susquehanna, no fish kills are observed and there are no fish screens. But Muddy Run is not at the salt wedge; also, the Susquehanna is badly polluted, whereas this part of the Hudson is not, and larvae may be killed without people noticing.

Therefore, the Cornwall project might result in a major change in the bass and perhaps other fisheries, without any reasonable possibility of reversing the effects during plant operations. This seems to be the major environmental problem caused by the Cornwall project. This must be compared with the advantages claimed.

We note that the salt wedge at Chesapeake Bay is close to the Calvert Cliffs nuclear power station, and the Surry power plant on the James River in Virginia is also close to the salt wedge. A similar problem to that on the Hudson could occur. These plants are located on the only major spawning rivers for striped bass in the eastern U.S., and the operation of all plants could have substantial effects on the total striped bass populations, and perhaps on other fish as well.

The uncertainty in the effect on the fish is great; naively, we could calculate the fraction of fish larvae entering Cornwall from a formula

$$\frac{\text{Fraction of time Cornwall operates}}{\text{Flow through Cornwall}} \times \frac{\text{Mean downstream river flow}}{\text{Mean downstream river flow}} = 40 \text{ percent maximum}$$

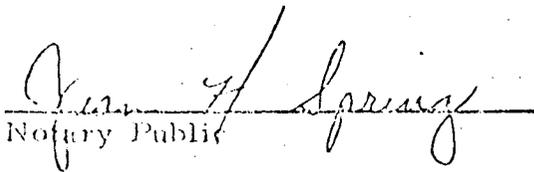
\*since the above was written, the AEC regulatory staff have recommended (in their environmental statement) that a closed circuit cooling system be constructed for Indian Point 2 by 1978.

The Hudson River Fisheries Commission report corrects this by the fraction of eggs or larvae in the area of the Cornwall plant as measured in 1965-68, and finds a value of 7 percent. This correction seems very unreliable and could change with time.

It is therefore not obvious whether the effect on fish populations is tolerable or not; it takes a detailed study beyond the scope of this committee to determine this. "The Cornwall Pumped Storage Project And the Black Rock Forest" at 12-14.

  
Angus Macbeth

Signed and sworn to before me  
this 1<sup>st</sup> day of February, 1973.

  
Notary Public

My commission expires June 30, 1976