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Redirect - Rebuttal Testimony of

Dr. C. P. Goodyear

Population Trends in White Perch of the Hudson River

TTTRAN

February 22, 1973

Reference: Testimony of Dr. Gerald J. Lauer (5 February 1973): "New York University Seine Fish Data on Hudson Fishes"

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## Population Trends in White Perch of the Hudson River

This discussion is in response to the applicant's objections to the staff use of N. Y. University seine haul data in evaluating the white perch population in the Hudson River. The importance of an evaluation of this population is related to the possible effects of impingement. In general, there were 3 sets of relevant data available to the staff. These data included 1) the seining data from N.Y.U. studies from 1964 through 1969, 2) The Raytheon trawl data from 1969 and 1970 and 3) impingement data from IP Unit 1 from about 1962 to the present. These data are presented in IP 2 Environmental Impact Statement p. V-61, paragraph 2, and on p. V-62, Fig. V-16, which graphs the annual average abundance of white perch in the Hudson as estimated by NYU seine haul data for the years 1965 through 1969.

> Many of the Hudson River fish populations may have the ability to compensate for Plant-caused increases in mortality. However, available information on shad and on striped bass along the Atlantic coast shows fairly conclusively that compensatory capabilities in these species are not the factors which presently determine the population level. Furthermore, the 1965-1969 NYU fish collection data[12-15] indicate that the high mortality of white perch which has resulted from entrainment and impingement at Indian Point Unit No. 1 could be adversely affecting the white perch in the Hudson (Fig. V-16) and is supported by Raytheon Company data[18,46] which indicate that the downward trend continued into 1970. FES V-61

As was indicated previously, the staff makes no assertion as to the adequacy of the data presented in Fig. V-16; however, it was the stated intent of the N.Y.U. investigators to gather quantitative data that could be used in the manner of Fig. V-16. This intention is clear from the abstract of an article summarizing much of the data:

Abstract: New York University biologists have carried out a 3-month summer study of fish species abundance and distribution along the western shore of the lower Hudson River during each of the preceding 5 years. The intent of the study was to collect enough data for the establishment of a relative fish population base-line against which major population deviations could be measured. Once established, the base-line could be used to monitor and detect any major fish population shift due to natural or man-made influences.

Collections were restricted to the shore-line, where fish populations are composed primarily of resident, young-of-the-year fish, rather than transient individuals.

Individual species numbers at each station were converted from a catch-per-actual-area-seined to a calculated standard 100,000 $ft^2$-unit-area, designated P.U.A. The five years' data revealed a difference in species that predominate in the northern and southern sectors.

The total abundance P.U.A. data for the individual species, from station to station and year to year, show considerable variation. The ranking order of abundance of some species is found to rise and fall annually in what appears to be natural, random cycles. The techniques developed and employed were adequate only to determine a relative fish productivity level for the river which would reflect a serious major environmental alteration. These techniques could not detect purely local environmental alterations. (1)

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(1) A. Perlmutter, R. F. Heller and H. Hermo, Jr. Fluctuations of Fish Populations, Part I. As a Monitor of Environmental Changes in the Hudson River. In: Howells, G. P. and G. J. Lauer, eds. Hudson River Ecology, Proceedings of a Symposium. New York Dept. of Envir. Conserv., Albany (1969). p. 357.

It is important to note that the three sources of data are consistent in indicating a reduction in the population of white perch in the Hudson River. The NYU data indicated a decline between 1965 and 1969. Raytheon trawl sampling Table 1 showed an additional decrease from 1969 to 1970. Impingement data which is available from IP 1 indicate a substantial reduction in the number of white perch impinged during the latter part of the 1960's. This reduction in numbers of impinged fish could have been due to 1) an intake design change which would have changed the ratio of the number of fish caught to the number of fish which are available, 2) a reduced number of fish available in the river, or 3) a combination of the two factors. If the NYU and Raytheon data accurately portray reduction in the white perch population, then the reduced number of fish impinged at IP Unit 1 would be largely a consequence of the lower number in available stock. Unfortunately, present evidence is not adequate to evaluate the accuracy of the various possible explanations. As a result, there is no clear way to evaluate the cause and effect relationship and no clear conclusion can be reached. Therefore, the staff has not used these data to project the future of the white perch population in the Hudson River.

On page 1 of his comments on the staff analysis, Dr. Lauer asserted,

> "The staff's use of the 1965-1969 New York University fish collection data as support for their conclusion that mortalities related to operation of Indian Point Unit 1, could be adversely affecting the white perch in the Hudson," is an invalid use of that New York University data. (Feb. 5 testimony)

## *Table 1 Average Number Caught Per Seven Minute Bottom Trawl (Common Species), Grand Average of Station Averages*

| Species Code | Species Name | 1969 | | | | | | 1970 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | June/ July | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | April | May | June | July | Aug. | Sept. | Oct. |
| 01 | *Alewife | 43 | 138 | 72 | 50 | 11 | 1 | | | | P | 6 | 2 | 6 | 3 | 2 | 5 |
| 02 | Bay anchovy | 41 | 783 | 691 | 26 | P | P | | | | | 2 | 2 | 48 | 197 | 142 | 59 |
| 03 | *American shad | P | P | P | P | P | | | | | | | | P | P | P | P |
| 04 | Bluefish | P | P | P | P | | | | | | | | P | P | P | P | |
| 05 | Bluegill | | P | P | | P | P | | | | | | P | | | | |
| 06 | Brown bullhead | P | P | P | P | 1 | P | P | | | 1 | P | P | | P | P | |
| 07 | Pumpkinseed | P | P | P | P | | P | | | | | | P | | | | P |
| 09 | Carp | | P | P | P | P | | | | | | | | P | | P | |
| 10 | American eel | 11 | 10 | 9 | 17 | 6 | P | | | P | 5 | 7 | 22 | 15 | 24 | 8 | 9 |
| 11 | Goldfish | | | | P | P | | | | | P | | | | P | | |
| 12 | Golden shiner | | P | P | P | | | | | | | | | | | | |
| 13 | Hogchoker | 5 | 10 | 38 | 31 | 157 | 12 | 2 | 1 | P | 10 | 13 | 7 | 5 | 35 | 80 | 222 |
| 14 | Tessellated darter | 1 | 1 | P | P | 2 | 3 | 2 | | 1 | 3 | P | 1 | | P | P | P |
| 15 | Banded killifish | | | | | | | | | | | | | P | | | |
| 18 | Mummichog | | | | | | | | | | | | | | | | |
| 19 | Menhaden, Atlantic | | P | 2 | 10 | P | | | | | | | | | | P | 1 |
| 22 | *Blueback herring | 1 | 34 | 3 | 56 | 11 | P | | | | | | 4 | P | 2 | 1 | 6 |
| 23 | White sucker | P | P | | | 1 | 1 | | | | P | | P | | | | |
| 24 | Atlantic silverside | | P | | P | P | | | | | | | | | | | |
| 25 | Rainbow smelt | 14 | 18 | 5 | 4 | 9 | 1 | 1 | 2 | 2 | P | 6 | 12 | 16 | 6 | 4 | 3 |
| 27 | Shortnose sturgeon | | P | | | P | | P | | | P | | P | P | | P | |
| 28 | Spottail shiner | 2 | 6 | 6 | 2 | 4 | 35 | 2 | | 2 | 4 | 1 | 1 | 2 | 3 | | P |
| 29 | Atlantic sturgeon | P | P | P | 1 | 1 | P | P | | P | P | P | P | P | P | P | P |
| 30 | *Striped bass | 118 | 84 | 55 | 86 | 23 | 6 | 41 | 2 | 4 | P | 4 | 7 | 34 | 63 | 70 | 51 |
| 31 | Fourspine stickleback | | P | | | | | | | | | | | | | | |
| 32 | *Atlantic tomcod | 115 | 76 | 34 | 35 | 76 | 38 | 89 | 5 | 1 | 1 | 105 | 265 | 135 | 136 | 93 | 40 |
| 34 | White catfish | P | P | P | P | 2 | P | 4 | | 1 | 2 | P | P | P | P | P | P |
| 35 | *White perch | 35 | 52 | 56 | 80 | 117 | 117 | 243 | 20 | 81 | 36 | 50 | 30 | 21 | 21 | 23 | 28 |
| 36 | Yellow perch | P | P | P | P | P | 1 | 1 | | P | P | P | P | P | P | | P |
| 39 | Northern pipefish | 1 | P | P | P | | | | | | | | | | 20 | P | P |
| 42 | Crevalle jack | P | P | 1 | P | | | | | | | | | | | | |
| 45 | Weakfish | 1 | 1 | 2 | 1 | P | | | | | | | | | P | | |
| 70 | Sturgeon, unident. | P | P | | | | | | | | | | | | | | |
| 78 | Threespine stickleback | | | | | | | | | | | | | | | | |
| 17 | Largemouth bass | | | | | | | | | | | | | | | | |
| 73 | Tidewater silverside | | | | | | | | | | | | | | | | |
| Total of Species Listed | | 22 | 29 | 25 | 26 | 24 | 18 | 12 | 5 | 11 | 16 | 14 | 20 | 18 | 20 | 19 | 18 |

Note: unidentified sturgeon not included in total species count

* = "key" species

P = Present, average less than 1

Species code used for automatic data processing and same as one used for Hudson River Fisheries Investigations 1965-1968 except for new species.

It is assumed that the basis of this conclusion is the information which was presented beginning on the bottom of p. 2 as follows:

> Statistical analyses of the seine data did not reveal any significant differences in the catch of fish during the years (1965-1969) of collection. Analyses of variance failed to reveal any significant change from year to year in the fish population. Comparison of each of the five means with the other four resulted in no "t" values that were significant at the 0.05 level (critical value 3.20). It was concluded that, there was no significance observable change in the population, against the background of natural fluctuations of populations, which might be attributed to natural or other causes. (Dr. Lauer Feb. 5 testimony)

and further summarized on p. 4 of his testimony:

> In summary, the AEC staff used New York University and Raytheon seine data on white perch to draw conclusions about trends in white perch population abundance; although the New York University study has been discontinued in 1969 because statistical analyses of the data by New York University clearly showed that data collected by seining alone to be so variable as to be useless for judging whether the Indian Point plant operation was affecting population size.

Although the staff does not believe that the data themselves are adequate, a statistical analysis of such data cannot be conclusive because all the sources of variation are not included in the analytical technique. However, the applicant grossly misrepresented the analysis done by NYU investigators. In his testimony, as quoted above, Dr. Lauer utilized the statistical analysis for the summed abundance of 11 species rather than for white perch alone. This is clearly indicated in the following quotation:

The marked changes in species abundance and distribution indicate the very dynamic nature of life within the river. The abundance of all species for all stations sampled from 1965-1969 supports the view that, although there are many fluctuations due to local and seasonal changes, the river as a whole is a relatively stable ecosystem, since for the 11 major species, their summed abundance (P.U.A.) varied only from 1,945/100,000 $ft^2$ in 1965, to 4,152/100,000 $ft^2$ in 1966 (Table 4). At the same time, abundance for any single species at a single sampling site might vary by one or two orders of magnitude (Table 2).

The mean ($\overline{X}$) catch for the eleven most commonly caught species from 1965-1969 was calculated from the summed abundance for the 11 species per unit-area per year. Analysis of variance of the means yielded an F value of 0.69. This value is not significant at the 0.05 level of significance (critical value 2.56 for 4.50 degrees of freedom). Furthermore, a comparison of selected means by the Scheffe' method, was calculated for each of the five means, against the other four. The calculated "t" values are shown in Table 5. None of the calculated "t" values were significant at the 0.05 (critical value 3.20). (2)

The statistical analysis was summarized in the following table: (3)

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(2) A. Perlmutter, R. F. Heller, and H. Hermo, Jr. Fluctuations of Fish Populations, Part. I. As a Monitor of Environmental Changes in the Hudson Raiver. In: Howells, G. P. and G. J. Lauer, eds. Hudson River Ecology, Proceedings of a Symposium. New York Dept. of Envir. Conserv., Albany (1969). p. 368.

(3) Ibid. p. 370.

TABLE 2

Statistical Analysis of the Total Abundance P.U.A. for 1965-1969

| Year | Mean Catch/Year | t (analysis of selected Means) | Analysis of of Variance |
|---|---|---|---|
| 1965 | 236 ($\bar{X}_1$) | 0.52 ($\bar{X}_1$ vs. 2,3,4,5) | F = 0.69 |
| 1966 | 377 ($\bar{X}_2$) | 1.31 ($\bar{X}_2$ vs. 1,3,4,5) | |
| 1967 | 311 ($\bar{X}_3$) | 0.40 ($\bar{X}_3$ vs. 1,2,4,5) | |
| 1968 | 211 ($\bar{X}_4$) | 0.98 ($\bar{X}_4$ vs. 1,2,3,5) | |
| 1969 | 274 ($\bar{X}_5$) | 0.11 ($\bar{X}_5$ vs. 1,2,3,4) | |

During the 5 year period that was analyzed in this study, white perch represented an average of 7.7% of the fish collected. Of the 11 most common species which were present, white perch ranged from a rank of 3, comprising 15.1% of the fish caught in 1965, to a rank of 10 out of 11, for 1.8% of the fish caught in 1969. The following table from Perlmutter et al. (p. 365-66) shows this clearly. This reduction in relative composition, is consistent with the estimated reduced total abundance of white perch which were caught over the period.

Contrary to the applicant's comments on page 4 concerning the Raytheon seining data, these seining data were not used by the staff because of the change in seining techniques described by Dr. Lauer. In contrast, the staff used trawl data which showed that the white perch abundance decreased between 1969 and 1970 (Table 1).

Dr.Lauer also made comments on page 5 concerning the use of commercial catch data for white perch and striped bass in the Hudson River. Utilization of any commercial catch data for estimating population trends must be preceded by an evaluation of that data for that purpose. In its evaluation the staff concluded that commercial catch of white perch in the Hudson was not indicative of population levels.

Although the staff believes the white perch data to be less reliable than was desired, it recognizes the availability of this information. The staff has analyzed the impacts of the Indian Point Plants in a manner that would be consistent with such available data, despite acknowledged limitations.

In its evaluation, the staff endeavored to present both sides of any controversy. However, the time and space available precluded lengthy development of each topic, such that in many cases the alternative hypotheses were not fully described. In the case of the white perch, the staff concluded that the NYU seine haul data were not fully adequate to establish a reduction in numbers in the Hudson, and thus the staff extrapolated past impingement data to estimate impingement for Unit 2. This methodology assumed that there would be no population effect from impingement and entrainment of white perch and therefore may have favored the applicant's position. However, if we accept the alternative hypothesis of a reduced white perch

population as is supported by the available data, then the impingement estimate which were presented in the IP 2 FES are much too high. However, the importance ascribed to these estimates may be grossly underestimated in the FES.

Either of the two alternatives could be real, and the data do not completely justify acceptance of one over the other. The staff presented information concerning the fish collection data of NYU in the second paragraph on p. V-61 and in Fig. V-16 on p. V-62 as an effort to present the data base for both sides of a controversial situation. With the data and the alternatives in mind, the staff made its conclusion concerning the future of the white perch population.

# Appendix 6 (Continued)

Day: 6/30-7/6/68

| Depth (ft) | West 15 | West 30 | West 45 | West 60 | Center 75 | East 60 | East 45 | East 30 | East 15 | East 5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.54 |
| 15 | 0.08 | 0.04 | 0.00 | 0.06 | 0.00 | 0.00 | 0.11 | 0.22 | 0.31 | |
| 30 | | 0.17 | 0.00 | 0.00 | 0.00 | 0.20 | 0.00 | 0.46 | | |
| 45 | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.18 | | | |
| 60 | | | | 0.00 | 0.00 | 0.00 | | | | |
| 75 | | | | | 0.00 | | | | | |

Night: 6/30-7/6/68

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.00 | 0.14 | 0.20 | 0.00 | 0.57 | 0.00 | 1.01 | 0.00 | 0.00 | 0.00 |
| 15 | 0.00 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 0.11 | 0.00 | |
| 30 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.49 | 0.00 | | |
| 45 | | | 0.26 | 0.00 | 0.00 | 0.00 | 0.26 | | | |
| 60 | | | | 1.97 | 0.00 | 0.00 | | | | |
| 75 | | | | | 0.00 | | | | | |

Number of larvae per 1000 ft³
Day: 7/7-7/13/68

| Depth (ft) | West 15 | West 30 | West 45 | West 60 | Center 75 | East 60 | East 45 | East 30 | East 15 | East 5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.14 | — | — | — | — | — | — | 0.89 | 0.56 | 0.44 |
| 15 | — | 0.24 | 0.34 | 0.36 | 0.00 | 0.89 | 0.29 | 0.98 | 2.40 | |
| 30 | | — | — | — | — | — | — | — | | |
| 45 | | | — | — | — | — | — | | | |
| 60 | | | | — | — | — | | | | |
| 75 | | | | | — | | | | | |

Night: 7/7-7/13/68

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.35 | — | — | — | — | — | 0.00 | 0.08 | 0.68 | 0.22 |
| 15 | — | 0.35 | 0.82 | 0.82 | 2.19 | 0.00 | 1.27 | 0.44 | 1.43 | |
| 30 | | — | — | — | — | — | 0.35 | — | | |
| 45 | | | — | — | — | — | — | | | |
| 60 | | | | — | — | — | | | | |
| 75 | | | | | — | | | | | |

Number of larvae per 1000 ft³
Day: 7/14-7/20/68

| Depth (ft) | West 15 | West 30 | West 45 | West 60 | Center 75 | East 60 | East 45 | East 30 | East 15 | East 5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.19 | 0.00 | 0.15 | 0.00 |
| 15 | 0.30 | 0.14 | 0.72 | 0.00 | 0.00 | 0.26 | 0.00 | 0.00 | 0.53 | |
| 30 | | 3.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.32 | | |
| 45 | | | 1.02 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| 60 | | | | 0.00 | 0.00 | 2.33 | 0.00 | | | |
| 75 | | | | | 0.00 | | | | | |

Night: 7/14-7/20/68

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | — | — | 0.00 | — | 0.00 | 0.00 | 0.87 | 0.22 | 0.22 | 2.83 |
| 15 | — | 0.67 | 0.00 | 0.65 | 0.39 | 4.37 | 0.00 | 0.59 | 0.75 | |
| 30 | | — | 0.00 | — | 0.00 | 0.00 | 0.53 | 0.79 | | |
| 45 | | | 0.00 | — | 0.30 | 0.91 | 0.00 | | | |
| 60 | | | | — | 0.00 | 0.00 | | | | |
| 75 | | | | | 0.37 | | | | | |