TRANS Ltr 12-24-73

50-286

APPENDIX

TO

COMMENTS OF CON EDISON

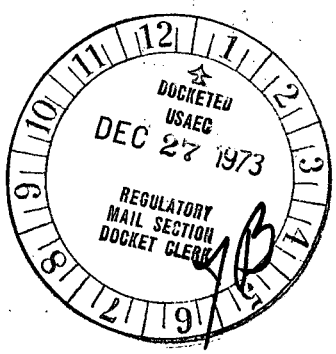
ON

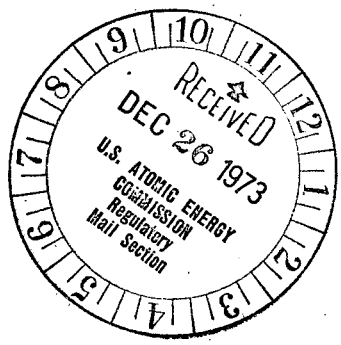
DRAFT ENVIRONMENTAL STATEMENT

RELATED TO THE OPERATION OF

INDIAN POINT NUCLEAR GENERATING PLANT

UNIT NO. 3





9131

1. Page i, Item (2), par. 2

License request for Unit 3 is for 965 MWe and 3025 MWt. All calculations should be based on these values, and not on the 1033 MWe employed by the Staff.

2. Page iii, Item (3). f

In stating its conclusion that the thermal discharges from Indian Point Units 1,2, and 3 may exceed the state thermal criteria, the staff gives no indication of the qualifications on this conclusion. On page V-11 of the DES the staff states "In assessing the results of the thermal discharge studies, it should be emphasized that the estimates are strong functions of the values of the input parameters, which are largely based on judgement and need verification by more field data than are now available." So as not to be misleading, a similar qualifying statement should be made here.

3. Page iii, Item (3). f

On page V-17 of the DES the staff acknowledges the conclusion and position of the applicant that:

A) "The scarcity of field data available makes the modelling difficult," (as demonstrated by the disagreement between the Applicant's physical and mathematical model predictions.)

B) "The applicant will carry out a thermal plume program" which will "enable the applicant and staff to predict more accurately the thermal plume characteristics."

C) The applicant "intends to operate the Indian Point facility so that the addition of Indian Point thermal discharges to the existing Lovett and Bowline discharges will not create a violation of the State thermal criteria

However, on Page iii, Item f, the staff describes the applicants' conclusion as being simply "that the thermal discharges from Unit Nos. 1,2, and 3 will meet the New York State thermal criteria." This oversimplification is misleading, and the true position of the applicant, as indicated above, should be given here also.

4. Page iii, Item (3) g

In the initial decision for Indian Point Unit 2* the ASLB ruled that "The applicant must monitor the dissolved oxygen in the vicinity of the plant. If the concentration falls to dangerous levels, which is hardly to be expected, the discharge must be aerated or other suitable action taken to satisfy the requirements of the New York State Department of Environmental Conservation." In the light of this decision, it is assured that dissolved oxygen will not be permitted to fall, due to plant operation, to levels dangerous to aquatic life. This should be noted in the staff's conclusion on dissolved oxygen, which as now worded gives the incorrect impression that no action is presently planned to insure that dissolved oxygen will be maintained at safe levels.

5. Page iv, Item (3) i

No reference is made here (Summary and Conclusions) to the program imposed by the Unit #2 Environmental Technical Specification Requirements of determining the lowest residual chlorine that is possible consistent with plant operations. Also we have not chlorinated at the frequencies listed here for several years. The description of the circulating water system (page V-25) contains reference to these current programs and similar statements should be incorporated in "Summary and Conclusions."

6. Page iv, Item (3) j (1)

In addition to studies on the effectiveness of the air bubbler and reduced flow to reduce impingement, the applicant is also undertaking a flume study to investigate fish guidance and avoidance devices which if installed at the Indian Point intakes could reduce fish impingement. This flume study should also be mentioned here.

7. Page v, Item (3) j (2)

There is no sound basis for assuming that all larvae entrained will be killed.

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* Docket No. 50-247 (September 25, 1973)

8. Page vi, Item 4b

The staff's assertion that the few additional years required for completion of the proposed ecological study carry significant risk of irreparable environmental damage is unsupported by general theory or by fact.

The Staff also fails to acknowledge methods to mitigate damage while studies are being performed. If operation of the Indian Point power plant caused damage to fish populations which was irreversible through natural processes, then mitigation by stocking, or temporary reduction of fishing with financial compensation to economically damaged parties, could be employed to restore the loss value of the natural resources to the public.

9. Page vii, Item 4c

Staff does not acknowledge data presented in the IP2 hearings. Stresses should not be termed severe if they do not cause mortality. See the following:

Rebuttal Testimony of Gerald J. Lauer, Ph.D., on Effects of Entrainment on Morone sp. (striped bass and white perch) eggs and larvae at Indian Point, dated February 5, 1973

Testimony of Gerald J. Lauer on Effects of Operations of Indian Point Units 1 and 2 on Hudson River Biota; October 30, 1972

Rebuttal Testimony of Gerald J. Lauer, Ph.D., on Studies of the Effects of Rapid Pressure Changes on Striped Bass Eggs and Larvae by New York University, dated February 5, 1973

Testimony of Gerald J. Lauer on Effects of Elevated Temperature and Entrainment on Hudson River Biota, April 5, 1972

Rebuttal Testimony of Gerald J. Lauer, Ph.D., on The Temperature Tolerance of Striped Bass Eggs and Larvae Relative to Their Seasonal Occurrence and

Expected Indian Point Plant Discharge Temperatures, dated February 5, 1973

Testimony of Gerald J. Lauer on Effects of Chemical Discharges from Indian Point Units 1 and 2 on Biota and on River Chemistry, April 5, 1972

10. Page vii, Item 4d

Statement is not supported by the analysis.

11. Page vii, Item 4e

There is no sound basis for this statement.

12. Page vii, Item 4f

Reduction of mean probability of entrainment of phytoplankton has inherent value only if it were to be damaged, which NYU studies show will be true only during chlorination. Furthermore, a reduction of phytoplankton is only significant if total populations in the river are reduced. Staff erroneously implies that any reduction is a significant adverse environmental impact. In any event, Staff should state the expected impact of this mortality on total populations in the river.

See the following:

Rebuttal Testimony of Gerald J. Lauer, Ph.D., on Effects of Entrainment on Morone sp. (striped bass and white perch) eggs and larvae at Indian Point, dated February 5, 1973

Testimony of Gerald J. Lauer on Effects of Operations of Indian Point Units 1 and 2 on Hudson River Biota; October 30, 1972

Testimony of Gerald J. Lauer on Effects of Chemical Discharges from Indian Point Units 1 and 2 on Biota and on River Chemistry, April 5, 1972

13. Page ix, Item 8c

Requirement for plan to reduce impact during time prior to installation of cooling towers is inconsistent with Item 4b (see comment above)

		which states irreparable damage may take place during studies.
14.	Page x, Item 8d	The need for detailed studies is inconsistent with conclusions that studies cannot determine the impact of plant operations.
15.	Page xi, Item 8d (5)	The plant does not discharge copper in its operations, although, as a theoretical matter, immeasurable copper discharges may result from corrosion of condenser tubes.
16.	Page xi, Item 8d (10)	This requirement is too general to be meaningful, and there is another inconsistency in the following paragraph. It implies that the massive impact predicted might not be detected.
17.	Page I-2, Table I-1	(A) The maximum ambient temperature in the vicinity of Indian Point, is 79°, not 81°F as postulated by the Staff. A detailed discussion of the maximum ambient temperature in the vicinity of Indian Point, including comments on the Staff's utilization of applicants data is presented in Appendix B-1, Con Edison's comments to the Draft Environment Statement for I.P. 2 (see FES, I.P. 2, Vol II, p. 203). (B) Freshwater flows in excess of the maximum value stated by the Staff (50,000 cfs) have been regularly reported. See, for example Geise and Barr,"The Hudson River Estuary," State of New York Conservation Department, Water Resources Commission, Bulletin 61, 1967* (Table 2 in the aforementioned document gives mean monthly net fresh water flows at Poughkeepsie (which is upstream of Indian Point) of, for example, almost 68,000 cfs for April 1960.

* Reference 5 in Ch. II of DES.

18. Page I-3, par. 1, I-9, line 4

Ten supplements, not nine, have been submitted to the Unit No. 3 Environmental Report. Supplement 11 will also be submitted prior to issuance of the Final Environmental Statement.

19. Page I-8

The discussion on future environmental approvals does not take into account recent changes in New York State law. Effective September 1, 1973, the New York Environmental Conservation Law was amended to eliminate the requirement for an operating permit and to substitute a requirement for an "SPDES" permit. This amendment was intended to make New York law compatible with the federal system adopted under the 1972 Amendments of the Federal Water Pollution Control Act. Until December 31, 1974, an application for a permit is deemed a permit. Accordingly, SPDES permits for Units No. 1 and No. 2 are not required until December 31, 1974.

Furthermore, a certification pursuant to Section 401 of the Federal Water Pollution Control Act was issued by the New York Department of Environmental Conservation for Unit No. 2 on September 24, 1973. An application for similar certification for Unit No. 3 has been filed.

20. Page I-8, Item 3

The New York State order of April 28, 1972 states that if it were determined at public hearings that the air bubbler system now in use is "not satisfactorily protecting the fish population of the Hudson River, or that the screened lagoon will provide a level of fish protection significantly higher than the air bubbler system", then Con Edison must build the screened lagoon.

21. Page I-9

Staff should discuss the additional approvals required in connection with its recommendation for the installation of cooling towers.

22. Page II-1, Section A

This discussion should describe the visually affected area around the site, i.e., the region within which the plant structures and emissions can be seen. The size of this region

and the visual impact of the plant varies with light and meteorological conditions and the distance from the plant.

This zone of influence extends from Bear Mountain Bridge south to the Tappan Zee Bridge and to the high topography which creates the Hudson River Valley rim. Natural scenic geologic features include the estuary itself, Prickly Pear Hill, Anthony's Nose, Bear Mountain, Dunderberg Mountain, South Mountain (High Tor) and Hook Mountain, the latter two forming the northern extremity of the Palisade Diabase.

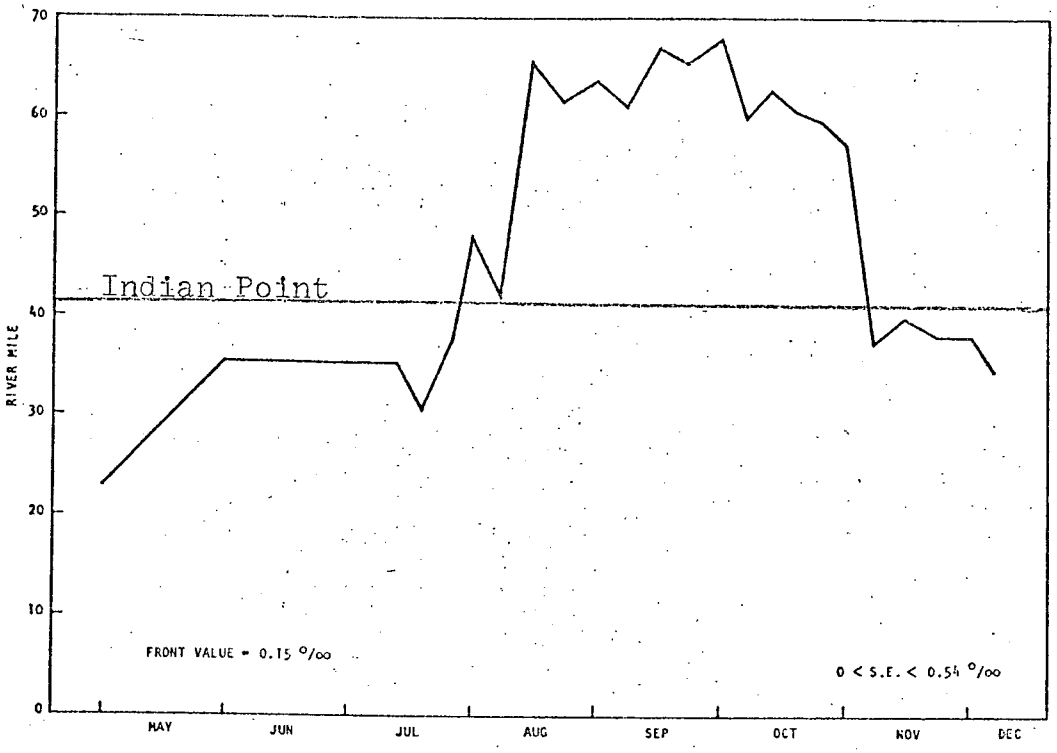
The dominant man-made features include several communities; Buchanan Montrose, Verplanck, West Haverstraw, Stony Point, Tomkins Cove, and Peekskill.

It should be pointed out that the Penn Central Railroad at Croton-on-Hudson has large switching yards and is an important terminus.

The important geographical features in Figure II-1 should be included in the text.

22. Page II-1, par. 3

The salt front is not neccessarily upstream of Indian Point" much of the year" as indicated here or all but three months of the year (March, April, May) as indicated on page B-5. The figure below from Texas Instruments' 1972 Annual Report on Indian Point shows that the salt front is above Indian Point only 3 months of 1972. The remainder of the year it was below Indian Point.



Saltwater Intrusion Length, Indian Point Region, Hudson River, 1972

23. Page II-1, par. 4

This paragraph is grossly misleading. The entire river south of Albany serves as a spawning and nursery area. The sentence would be more accurate if the words "near Indian Point" were deleted.

24. Page II-6, par. 3

This paragraph should be rewritten as suggested below:

"The State Archeologist of the New York State Museum and Science Service, State Education Department has noted archeological sites at Montrose Point (shell middens), Georges Island, Oscawana Island, Croton Neck and Kettle Rock Point. None of these sites are impacted by the facility." The reference to relic collectors is sheer speculation.

25. Page II-7, par. 2

The Staff's statement on the maximum value of the freshwater flow at I.P. (50,000 cfs) is incorrect (see comment 17B above).

26. Page II-13, par. 3

See comment 17A above for Applicant's analysis of the maximum ambient temperature in the vicinity

of Indian Point. The data presented by the Staff do not acknowledge the effect of plant operation on the measurements and the precision of the instruments used, which were geared for biological activity rather than temperature distribution. See Appendix EE (2), "Supplemental Study of Effect of Submerged Discharge of Indian Point Cooling Water on Hudson River Temperature Distribution, "Qirk, Lawler and Matusky Engineers, May 1972, pages I-3 to I-5, for a detailed discussion (I.P. 3 ER).

27. Page II-17

It should be pointed out that both the 100 foot and 400 foot meteorological towers are located at sites over 100 feet above sea level.

28. Page II-18, par. 3, line 15

The Staff rejected Applicant's models on the grounds that instruments were not sufficiently accurate. Wind instruments used on the 100 foot meteorological tower were installed at the 100 foot level and operational from 1 January 1970 to present. Specific sensor criteria for the instrumentation are: threshold of 0.6 MPH and accuracy ±0.15 MPH for the wind speed; wind direction threshold less than 1 MPH and accuracy +3°. The aforementioned criteria are within the instrument accuracy presented in Regulatory Guide 1.23 (Safety Guide 23). Furthermore, although "more conservative meteorological models" are appropriate for nuclear safety matters, they are not appropriate for a realistic assessment of environmental impact.

29. Page II-26, Section b, par. 1

Role of phytoplankton as food for zooplankton varies in different bodies of water. In the Hudson River, organic detritus appears to be a more important food source. See Howells, G.P., and Weaver, S. "Study on Phytoplankton at Indian Point", Proceedings of the Second Symposium on Hudson River Ecology. 1969

30. Page II-28, par. 4

The Staff's statement that macroinvertibrates ability to recover from kills is restricted because they reproduce only once per year, is incorrect. Although some do reproduce only once per year, various individuals may be reproducing at different times throughout the year. Also, Congeria, Balanus, Amnicola, although they naturally incur high seasonal mortalities at Indian Point, nevertheless regenerate and maintain large and healthy populations. For further data the Staff should consult TI's First Annual Report on Indian Point (April 1973)

31. Page II-27

Delete "and euphasiids" from last paragraph. There are no euphasiids in the Hudson.

32. Page II-29, par. d, line 8

The reference to Long Island Sound is misleading. The parties are in agreement that Hudson River striped bass predominate in the western portion of Long Island Sound, but the Staff is well aware that there is a dispute as to their presence in the eastern portion of Long Island Sound. The omission of a reference to this controversy makes this statement misleading.

33. Page III-1, line 18

Insert the word "approximately" before the words "10 feet per second".

34. Page III-1

The Applicant will furnish a more recent photograph of the site.

35. Page III-5, fig III-2

(A) Unit No. 1 has one condenser with two halves, not two condensers as indicated

(B) The de-icing flow for Unit No. 1 is not achieved via a pumped return flow from the discharge canal, as indicated by the Staff, but via a direct flow from the condenser outlet.

(C) The values for Unit No. 3 should be based on the license request power level, not the maximum calculated power. The proper values are:
- MWt: 3025, not 3216
- MWe (net): 965, not 1033

- Condenser Rise: 16.3°F, not 17.5°F
- Canal Rise: 14.8°F, not 15.3°F.

All subsequent calculations and evaluations by the Staff should employ the license request power levels.

36. Page III-6, par. 2

In connection with the parenthetical expression at the end of this paragraph it should be noted that the design of Unit No. 3 has been altered from that of Unit No. 2 for environmental reasons. The fixed screens at Unit No. 2 have been replaced at Unit No. 3 by placing the traveling screens at the river face of the intake structure so that fish cannot be trapped in the forebays as was the case with the Unit No. 2 design before installation of the fixed screens. The air curtains are being tested for possible use with the Unit No. 3 intake.

37. Page III-7, Table III-2.

The columns under "Unit No. 3" and "Total" should be changed to reflect the comments on Figure III-2 above.

38. Page III-10 & Table III-3

The residence time for IP3 at full flow and simultaneous operation of I.P. 1 & 2 is 5.91 minutes. If Unit 3 operates alone at full flow, the transit time is 8.71 minutes.

39. Page IV-3

The discussion of Applicant's upgrading of its transmission facilities is not relevant to the environmental impact of Unit No. 3. The Atomic Energy Commission resolved this matter in Regulatory Guide 4.2 (S. 3.9).

40. Page IV-3 Ninth line from bottom

Change "1952" to"1932"

41. Page IV-4, Item c,. par. 1

Water is recirculated from the discharge side of main pumps to the forebays in front of the pumps. The water is not recirculated from the condenser outlet.

42. Page V-4

Discussion of transmission lines beyond the Buchanan substation is improper under Reg. Guide 4.2 (see comment on IV-3).

43. Page V-5, Section B.2, line 3

The phrase "service nuclear boilers" should be "service boilers".

Section 2 Air Quality section - the sulfur content of the fuel oil used in the package boilers is 0.3%, subject to recent problems of availability. Reference should be made to the Indian Point Unit No. 1 Environmental Report and Benefit Cost Analysis June 1973 (Supplement 1, 8/73, Dckt. 50-3) for an updated document on the superheater stack and associated package boiler installation. There are a total of seven stationary combustion installations including the superheater.

44. Page V-6

We do not object to a comparison of emissions to standards for new stationary sources but we strongly object to omission of the fact that these standards are not applicable to the Indian Point plants. Also, the .055 lbs/10^6 BTU and 28% figures for particulates are inconsistent.

45. Page V-7, Item c.1

All thermal calculations should be revised to reflect the license request values, i.e., three unit heat load of 15.22 x 10^9 BTU/hr, and temperature rise of 14.8°F.

46. Page V-8, par. 2

The statement given on page V-8, which follows,

> "In addition, the limit of 1.5°F during July through September is waived for the estuarine portion of the Hudson River, because of the thermal monitoring studies being carried out in the estuary."

is misleading as written. The actual statement taken from the recommended thermal criteria as determined by the Federal Thermal Task Force in their report of November 1971, is as follows,

> "Because of the studies that have been made on the estuarial portion of the Hudson River the need for limiting the temperature rise here during July through September to 1.5°F is waived and the conditions specified for October through June will be permitted year-round."

47. Page V-9 to V-18

The combination of values of the dispersion coefficient (E) heat transfer coefficient (K) and fresh water flow (Q_f) selected by the Staff are in many cases unrealistic. For example, the Staff selected a K of 90 BTU/sq ft^{o}F with a Q_f of 4000 cfs. Applicant's remarks on this combination of a winter K with a typical summer Q_f are presented in (a) "Additional Testimony of John P. Lawler, Ph.D., Quirk, Lawler and Matusky Engineers on the Cumulative Effects of Bowline, Roseton and Indian Point Generating Station on the Hudson River," March 30, 1972 and (b) "A response by John P. Lawler, Ph.D., Quirk, Lawler and Matusky Engineers on Additional Information Requested by the Staff on the Temperature Distribution Section in our March 30, 1973 Testimony....., "April 20, 1973. Staff apparently refuses to recognize current progress and state of the art in evaluating K, (see Table 2 in (b) above), where values in excess of 200 are presented for summertime conditions. The Staff selection of values less than 10 for a dispersion coefficient is also quite unrealistic for the freshwater flows selected.

48. Page V-9 par. 2

The Staff's remarks "...applicant's difficulties to maintain 10 fps discharge velocity at all times due to leakage around the discharge ports" and inferences from these remarks are incorrect because (a)the leaks have been fixed and (b) the leaks were of such a nature that difficulty in attaining 10 fps was a problem only at low flows (i.e., I.P. 1 alone). One should note that because of the small thermal load of Unit 1, a minimal velocity would provide the required dilution.

49. Page V-12, and V-13, Table V-1

Commenting only on the computational technique employed by the Staff, and not on the validity of the parameters selected, the Staff's employment of

the recirculation factor is incorrect. The area average temperatures is not dependent on recirculation, but only on the dispersion coefficient (E), thermal stratification factor (TSF), heat exchange (or transfer) coefficient (K), fresh water flow (Q_r), plant heat rejection rate (H), and river geometry. Employing the nomenclature used by the Staff (FES I.P. 2 p. III-27), the average temperature, T_A is:

$$\bar{T}_A = \frac{H}{\rho C_p Q_r \sqrt{1 + \frac{4KD}{\rho C_p A}(TSF)E/U^2}}$$

Recirculation affects the spatial temperature distributions across the river, but not the area average value.

50. Page V-19 par. 2

The 100,000 gpm necessary for dilution of chemical wastes during outages is not necessarily service water, but water for any use, including condenser cooling water.

51. Page V-19, Section 2.a(1)

First sentence should read:"The standard chemicals utilized in the primary system are lithium hydroxide and boric acid." Hydrazine is used not in the primary, but in the secondary system.

Add "lithium" after"2.2 ppm."

Add "lithium hydroxide" after "lb/day."

52. Page V-20, Table V -2

See Table attached as Exhibit A.

53. Page V-21

Table V-3 serves no purpose and should be deleted.

54. Page V-22

Paragraph on potassium chromate in "Primary System" should be removed and added to section on "Auxiliary Systems" since potassium chromate is not used in the primary system.

55. Page V-22, Section 2

1st par., second sentence should read: In Unit No. 3 the maximum phosphate concentraton will not exceed 80 ppm. At a maximum expected discharge rate of 40 gpm, the expected maximum sustained release is 38 lbs/day from Unit No.2 or 3, and 15 lbs/day for Unit No. 1.

The reference to the blowdown intertie should be deleted. This intertie will not be used for "chemical treatment."

2nd paragraph, second sentence should read: The expected maximum flow rate is 40 gpm, and the expected sustained release is 1 (2) lb/day during normal operation.

3rd paragraph, 1st line: "neither and or morpholine" should be deleted.

2nd line: add "not" before "exceed"

56. Page V-23 1st line:

"maximum" should be "expected" and "200 gpm" should be "40 gpm."

4th line: "12 (24) lb/day" should be "2.4 (4.8) lb/day."

6th line: "either amine" should be deleted

2nd paragraph 3rd line: "excess" should be "spent"

14th line: "clean" should be "treat"

3rd paragraph - line ten: "discharge" should be "use"

The last sentence should be deleted. The blowdown from the flash evaporator containing the spent sulfuric acid (pH 7.0 to 8.5) is discharged directly to the circulating water.

The following sentence should be added. "No bulk amounts of acids or basis shall be instantaneously discharged without prior neutralization."

4th paragraph - The sentence beginning "The sulfuric acid..." should be deleted.

57. Page V-24

This page should note that the neutralization facility presently under construction will neutralize all acids and bases from the site demineralization facility.

58. Page V-24, 1st paragraph

The sentence beginning, "Thus a total of 1410..." should be deleted. 960 lbs/day of sulfuric acid of this total is not released as sulfuric acid but as a neutralized salt solution.

2nd paragraph

The last sentence should be deleted and the following substituted: "The spent soda-ash solution is neutralized prior to discharge.

3rd paragraph

The following sentence should be added: "Sears biodegradable detergent will also be used."

59. Page V-25, Section 2.a(3)

In lines 6 and 13, "as Cl_2" should be "as available chlorine."

In the last line, change "40°F" to "45°F."

60. Page V-26, section C.2.b

Applicant does not intent to chlorinate effluents from the sewage treatment facility.

61. Page V-26, section C.3

The sentence "thus about 23% of the tidal water is used by the once through cooling system" is incorrect for it suggests the plant uses 0.23 x 178,000 cfs or 40,000 cfs. Actual plant usage is 4585 cfs.

62.	Page V-27, par. 2, line 6	change "450,000 gpm" to "450,000 gpd."
63.	Page V-28	The DES should note that the thermal discharges will benefit navigation in the winter by reducing ice conditions and will extend the growing season for aquatic biota. If the DES is to represent analysis of all environmental impacts, favorable ones should be noted as well as unfavorable ones.
64.	Page V-28, Section C.4	No one swims in the area of the discharge structure. The reference to this activity should be deleted.
65.	Page V-29 to V-37	The definitions and values for approach and intake velocities are not consistent throughout this discussion and should be made consistent.
66.	Page V-29, Item a. impingement, par. 2	Alterations of the physical structures surrounding the intakes were effective at reducing impingement. Removal of sheet piling and fixed screens eliminated the trapping effect and enlarging the intake openings reduced the intake velocity.
67.	Page V-30, par. 1	Statement concerning fixed screens contradicts statement on V-29 that changes in physical structures surrounding the intakes did not reduce impingement. Statement that fish count data from 1967 to 1969 were "not included" implies it is available but not supplied. Count data for this time does not exist.
68.	Page V-30, par. 2	The statement that the impingement was simply shifted from the travelling screens to the fixed screens is not justified. Observations and data make it clear that the installation of fixed screens at the mouths of the intake forebays has reduced the impingement problem.

69.	Page V-30, par. 3	The meaning of the last sentence is not clear. An example of Staffs' bias is that, after discussing in detail the periods for which accurate impingement data are unavailable, the Staff fails to mention the period subsequent to December 1970 during which time detailed records have been kept of numbers, size and species of all fish collected on the intake screens.
70.	Page V-31	Throughout this discussion of fish impingement, the Staff assumes that any plant-induced mortality is an environmental cost. This constitutes an application of the "as low as practicable" philosophy, which has not been made applicable to environmental matters by any law. This mortality does not properly constitute an environmental cost unless there is an impact on total populations in the river, which has not yet been established and cannot be properly assumed.
71.	Page V-31	Impingement data since December 1970 should be included.
72.	Page V-31, par. 3	Winter water temperatures are commonly at 32°F.
73.	Page V-31, par. 4	Statement that reduced intake velocity is only effective method disagrees with statement on p. V-30 that fixed fine screens are effective.
74.	Page V-33, par. 2	During reduced flow operation 40% is recirculated and 60% is passed through plant.
75.	Page V-31, par. 2	Statement that fish are exposed to velocities up to 2 fps is inconsistent with velocities given on p. V-33.
76.	Page V-32, Fig V-4	Change "Intake Current Velocity" to "Average Velocity*." Also, add the following footnote: "*Velocity measurements were made at several locations throughout the intake bays of Unit No. 1 prior to fixed-screen installation and represent average water velocity in the intake bays, not velocity through the screens."

77. Page V-33 to V-34

In addition to the air bubbler and reduced flow, the flume study should also be mentioned. See comment above on p. iv, Item (j).

78. Page V-34, par. 1

Number of species reported (66) is too high. The number should be 44.

79. Page V-35, par. 3

Daily counting actually started in December 1970.

80. Page V-36

It should also be noted in this section on impingement that the plant may be acting as a scavenger in impinging only the less fit members of fish populations. Evidence clearly indicates that fish impinged on the screens have a significantly lower weight per unit length (up to 30%) than fish in the river. See the I.P. 3 Environmental Report, Appendix BB, page 46.

81. Page V-36, par. 3

The last sentence provides further evidence of the one-sided approach taken by the Staff. Applicant's biologists believe that the design improvements in the Unit No. 3 intake should result in less impingement than at Unit No. 2 but here, unlike the Staff's discussion of entrainment, the Staff seeks operating data before making a prediction.

82. Page V-36, par. 4

The Staff appears to have overlooked the fact that the fixed screens at Unit No. 2 have been replaced by traveling screens at Unit No. 3 which will be washed automatically when the head differential exceeds one foot.

83. Page V-36, par. 5

Cause and effect are known. Cause: intake velocity pulls fish back against screen. Effect: fish dies. Subtleties of the process are unknown.

84. Page V-37, section b, par. 1

In order to be accurate after the word "organisms" on line 4 insert "compensatory mechanisms" and at the end of the paragraph add "as related to the river populations of the species."

85. Page V-37, par. 2

"Consumption" of passive organisms is related not only to rate of water used, but to the mortality of organisms withdrawn.

86. Page V-37, par. 3

Plant does not act like large predator even in case of those organisms killed because it does not consume them. Rather it returns them to the river where they are eaten or decomposed, thus recycled through the food chain. This paragraph implies that all entrained organisms are killed. This is a gross exaggeration.

Statement on relation of combined plant flow being equal to volume of river flow in 2.1 days is very misleading.

This discussion of plant predation should be put into perspective by reference to other forms of predation, such as commercial and sport fishing. Biological comparison between plant predation and removal of sport fish by fishermen should be described.

87. Page V-38

In the discussion of Applicant's position, reference should be made to the contention that the post yolk sac larvae gradually develop swimming ability and at 13-16 mm. (approximately 4 weeks old) move to the shoals thus terminating their planktonic downstream movement.

88. Page V-39

The conclusion of the statements of Applicant's position should refer to the fact that Applicant places little confidence in the ability of these early developmental mathematical models to predict biological effects. Applicant contends that the traditional scientific empirical approach of quantifying aquatic data before and after plant startup, while maintaining detailed data on plant operations and all other river variables, is the only scientifically responsible approach. This view of mathematical models is supported by

the Department of the Interior, which in a letter to the AEC Staff dated May 10, 1973, stated as follows:

> "The combination of fresh water and tidal flows in the vicinity of the plant site is a complex phenomenon which makes modeling and computation of expected thermal effects extremely difficult and open to doubt and manipulation. Only actual measurement of operational temperatures will determine if a different outfall design will be needed; . . .".

89. Pages V-39 to V-46

These pages contain the discussion of the biological model in a way which is contrary to scientific analysis. There is no evidence to support the concept that the predicted percentages of reduction of striped bass are accurate and the most that can be said is that these reductions may occur depending entirely on the validity of the assumptions that went into the Staff model and the ability of the model to reproduce cause and effect over time. The DES does not indicate whether the Staff has applied its model to predict the difference between the base line and the plants in operation at the present time. Applicant's attempt to use the Staff model in this manner showed that the model completely misrepresented the present status of bass populations in the river. Furthermore, at the bottom of page V-42 there is a discussion of the reasons the predicted reductions could be larger. Where is the corresponding discussion of the factors that could make the predicted reductions smaller?

90. Pages V-39 to V-40

The assumptions used in developing equation (1) are incorrect. The assumption of uniform concentration of organisms through the plant river segment and the failure to allow for intake avoidance by entrainable organisms result in unrealistically high probabilities of entrainment (P_t). Also, the method used by the Staff in equation (2) to calculate the effective

downstream transport flow (Q_{TR}) is incorrect and yields values of this variable which are unrealistically low. When substituted into equation (1) to calculate the probability of entrainment these values of Q_{TR} yield even higher and more unrealistic values of P_T than indicated in the above comment. The reason equation (2) yields unrealistic values of Q_{TR} is that it fails to account for vertical mixing caused by density differences and tidal turbulence. A detailed criticism of the use of this equation by the Staff can be found in Con Edisons' comments on the Staff's Indian Point Unit 2 DES. (See I.P. 2 FES, Volume II, pages 239-263)

91. Page V-40, par. 1

The relationship of the assumption to reality and the sensitivity of the results to the assumption should at least be set forth in a footnote, together with a range of results reflecting other assumptions.

92. Page V-40 end of par. 3

Very doubtful if any population is maintained solely by local reproduction as implied.

93. Page V-41, fig. V-5

The probability of entrainment (P_T) presented in this figure is unrealistically high for the reasons indicated in the above comment.

94. Page V-42, par. 2

American eel is not likely to be affected because it is relatively unavailable to entrainment and hardy enough to survive entrainment in any case.

American shad not likely to be much affected because shad spawn far up river.

The Indian Point plants do not entrain or impinge a significant number of American shad.

95. Page V-42, par. 3

The data provided in our October 1973 Report "1973 Hudson River Program, Fisheries Summary Data, May-July", supplemented by our December 1973 Report to be released shortly "1973

Hudson River Program, Fisheries Summary Data, August-November", provides far more accurate and reliable data and should be used in any analysis of river populations of young of the year striped bass.

96. Page V-43

Are these plots based on 50% or 100% assumption mortality of entrained organisms? How would it appear if 50% were assumed? Do these also assume no compensation? The presentation of a chart like this, without a clear identification of assumptions, is misleading.

97. Page V-44, par. 2-3 and Figures V-7 and V-8

The predicted reductions in juveniles presented here by the Staff are the result of a math model which, because of several serious flaws, gives unrealistically high estimates of plant entrainment impact. A detailed description of these flaws is presented in the comments below on Appendix B of the DES.

98. Page V-47, Table V-4 and Page V-51

Most of acclimation temperatures quoted are far below summer ambient temperatures at Indian Point; therefore, upper critical temperatures are also low and not relevant to conditon described in top paragraph on Page V-51.

As for tomcod, the small sizes of those occur during winter and late spring, in which case upper critical temperature is far higher than plume temperature that would occur at Indian Point.

There is a "curious" absence of any of the abundant New York University data on summertime temperature tolerance for Hudson River species in this table.

99. Page V-49

Statement that "larval development also requires narrow ranges of temperature" is taken out of context. In stating this, de Sylva was referring to marine species which are much more stenothermal than estuarine species .

100. Page V-51 par 1

Thermal range of metabolic insensitivity undefined. Here Staff says effects are difficult to detect. In section on primary producers Staff says effects would be readily detectable.

Fish and larger invertebrates could prefer or avoid plume to cause changes in composition, but not microcrustaceans or algae. In any case no algae data are referenced in Table V-4.

101. Page V-51, par. 3

No mention of NYU Temperature Tolerance data on earlier life stages submitted for Indian Point Unit 2. See the following:

Rebuttal Testimony of Gerald J. Lauer, Ph.D., on The Temperature Tolerance of Striped Bass Eggs and Larvae Relative to Their Seasonal Occurrence and Expected Indian Point Plant Discharge Temperature dated February 5, 1973.

Duration of exposure of several hours is speculative as indicated.

102. Page V-51, par 1.

Assumption that detrimental effect would be positively correlated with extent and volume of 4° and 6° isotherms indicates that those temperatures increases are detrimental.

This is an unfounded assumption. There is more foundation for concluding that growth, reproduction and species diversity would be increased in those areas.

103. Page V-51, par. 3

The temperature history of the Hudson River indicates 90° will be reached in the Indian Point discharge the second week in July (see Figure 13 of Feb. 5, 1973, testimony of John Lawler "Expected Water Temperature at Indian Point During Entrainment Period").

104. Page V-52, par. 2

The statement "the probability of being exposed to a ΔT of $4^{\circ}F$ or greater in moving past Indian Point is 0.37" and its accompanying calculation is incorrect.

105. Page V-52, par. 4

No basis exists for saying this. Spawning location may have and probably does have little to do with temperature.

106. Page 52, par. 4

Raney testified (TR. 5843 and 5983 ff) that behavior of spawners would not be altered by a thermal plume. Merriman reports similar experience.

107. Page V-52, par. 5

Thermal attraction will lead fish to the discharge not the intake. If recirculation causes an increase in temperature at the intake of $1 - 2^{\circ}F$ and the discharge produces an increase in temperature of $15^{\circ}F$, there is no question but that the fish will be attracted to the discharge rather than the intake.

108. Page V-53, par. 1

In its discussion of fish in the discharge canal, the Staff has ignored the fact that the 10 ft/sec velocities will normally preclude fish from entering the discharge canal.

109. Page V-53, par. 1

If indeed the plant induces spawning near the plant (and the evidence at other plants is to the contrary) the entrainment losses would thereby be reduced based on the AEC model for they would move downstream sooner where they then become free of plant entrainment.

110. Page V-53, par. 3

The growth rates would be enhanced rather than decreased. At no time will a significant portion of the Hudson River exceed the preferred temperature.

111. Page V-54

Rejection of Dr. Lauer's studies is unwarranted and further evidence of the bias in the DES. The criticism that the pressure studies did not include turbulence and shear is erroneous. Dr. Lauer's pressure tests were conducted in a static pressure chamber.

But he also performed a comparison of intake and discharge mortalities on passage through the plant, which necessarily included the synergistic effects of pressure and the other relevant variables. But, most importantly, what does the Staff substitute for Dr. Lauer's studies? Sheer speculation. The Staff has absolutely no data to support its discussion on this page, which is no more than a theoretical possibility.

112. Page V-54, par. 5

No data supports statement that more organisms will be withdrawn with bubbler screen.

113. Page V-55, Item 3 & V-56

The statement on D.O. levels ranging "from low summer values of 3 ppm to high winter values of 11 ppm" appears to be based on a few data points in a report of Raytheon Company.

Since the Staff has previously agreed that the Raytheon data are probably erroneous (see FES I.P. 2 Volume I, page V-13), Applicant fails to understand why the Staff continues to refer to these data, particularly without reference to the evidence of inaccuracies in the data.

The first T.I. Annual Report, p. II-19 (April 1973) shows mean D.O. levels varying from 5 to 13 ppm. with the variation from station to station showing little relation to plant location, and in many instances being less than the mean variation from surface to bottom.

114. Page V-55

Summary not consistent with preceeding. In any case, NYU's no ΔT operation intake-discharge studies relate directly to this speculation and indicated mortality somewhere between 7 and 39%. Similar range found at ΔT up to 11°F.

1973 data from no ΔT operation show latent effects for larvae collected from discharge no greater than for those collected from intake.

115. Page V-56, par. 1 & 3

Increased metabolism e.g. photosynthesis also, tends to increase D.O. during the day. Net effect could be slight elevation of D.O. in day, slight reduction in D.O. at night in plume.

116. Page V-55, par. 3

An objective report should reflect that the applicant and other power companies on the river are continuing to collect data on the synergistic effects of passage through condensers and better information will be available by 1976.

117. Page V-58, par. 3

Analyses are spurious. D.O. is so variable from place to place that one can pick out data from any two points and have one be lower than the other. There were also many occasions when D.O. in plume was same or higher than outside plume.

118. Page V-54, par. 2

There are no data to support statement of certain damage to gas bladder due to pressure change.

119. Page V-58, par. 2

The first sentence of this paragraph illustrates how the Staff consistently rejects field data collected by the Applicant when it does not support the Staff's speculations. In the Indian Point 2 proceeding, Applicant submitted ample data to show that the impact of plant operations on D.O. is very small. The Staff also ignores the fact that the D.O. of the river at Indian Point has undoubtedly been affected by the BOD of the Standard Brands Company and Peekskill sewer discharges upstream of the plant/

120. Page V-60, par. 1

The evidence is all to the contrary with respect to growth rates and D.O.

121. Page V-61

The absence of any discussion of the chlorination frequency studies by the Applicant and the % of time chlorination will be used biases the report.

122. Page V-62, par. 2

Organisms were held for 4 days(96 hours)

123. Page V-62, par. 4

Clarify the first sentence in item (a). As presently worded, it is unclear.

124. Page V-63, par. 1

Inhibition in plume was at about the level expected based on a dilution of discharged water at sampling point. This doesn't indicate damage was taking place in plume.

125. Page V-63, par. 4

Although the sensitivity of the amperometric technique is superior to that of the ortho-tolidine or Black-Whittle method of analysis, for the concentrations which were found to result in mortality to test organisms, the sensitivity of the latter technique was sufficient.

126. Page V-64, par. 1

Last sentence is sheer speculation.

127. Page V-65, par. 1

The evidence to date at Indian Point supports a contrary conclusion of no deleterious effect of chlorine in the plume.

128. Page V-70, line 6

Should read "1983".

129. Page V-71, line 4

Insert after "years" "by commercial fishing".

130. Page V-72, par. 2

The Staff ignored the potential for extended growing periods of certain organisms caused by the thermal plume and the beneficial consequences it offers. It is further evidence of bias to talk about inhibition of growth during certain portions of the year without also mentioning the stimulation of growth during greater portions of the year.

131. Page V-63, par. 6

Whether or not two of species were not among most common is irrelevant.

132. Page V-65, line 9

On page V-65 the Regulatory Staff asserts "....most of the toxic chlorine components will be in the thermal plume, which will be spread out on the surface.", that is, the thermal discharge from Indian Point (or any other power plant) induces thermal stratification in the Hudson, with the warm water (i.e., the thermal plume) on the surface. Therefore, the thermal stratification factor (TSF), defined as the surface average excess temperature divided by

the area average excess temperature is greater (in fact much greater) than one. The foregoing is inconsistent with the Staff's handling of the degree of stratification of the thermal plume in its analysis of the thermal discharge from Indian Point. The Staff asserts (page V-9) that their parametric studies involved "...varying the values of input parameters over a reasonable range." Yet in the Staff's assignment of TSF's, the value of unity was selected most often (Table A-4, page A-12, -13, out of 47 cases, 29 (61%) has a TSF of unity; and in Table A-6, page A-21, out of 8 cases, 6 (75%) had a value of unity.) A TSF of unity is indicative of a well mixed effluent, without a surface plume. The Applicant has presented field data indicating the existence of TSF's greater than unity - in fact TSF values of about 20 were observed approximately one half mile downstream of the Damskammer power plant (Re-direct-Rebuttal Testimony of John P. Lawler, Ph.D., Quirk, Lawler and Matusky Engineers, on the Thermal Effects of Indian Point Cooling Water on the Hudson River, February 5, 1973).

133. Page V-65, line 3

With regards to the statement "the probability....would also be lessened by chlorination schedules that coincide with peak tidal flows . . .," the Staff implies that the chlorine will be diluted, not only with the freshwater flow, but also the tidal flow. This is in direct contradiction to Table V-2, p. V-20, where the Staff calculated the chlorine concentration in the Hudson River by assuming the chlorine diluted was only with the freshwater flow.

134. Page V-65

The Staff indicates that the Applicant is conducting a series of bioassays on the exposure of biota to metals. This should be deleted since no such study is being conducted. It has been adequately demonstrated by past investigations that there is no threat to biota from metal discharges at Indian Point. (See IP 3 Environmental Report, Appendix Z).

135. Page V-71, par. 4

Phytoplankton productivity in the Hudson is so low that they probably are much less important than detritus as food.. See Howells & Weaver, "Study on Phytoplankton at Indian Point", Proceedings of 2nd Symposium on Hudson River Ecology (1969)

136. Page V-71, par. 5

First sentence fails to acknowledge Lauer data which shows a net increase in assimilative capacity. See:

Testimony of Gerald J. Lauer on Effects of Elevated Temperature and Entrainment on Hudson River Biota, April 5, 1972

137. Page V-71, last par.

Why does the Staff refer to other power plants when Lauer has presented extensive data from Indian Point? Unless the data is obtained at Indian Point, it is essentially irrelevant. The Staff appears to accept Con Edison data only when it shows environmental damage.

138. Page V-72, par. 2

Estimation of complete "reproductive kill" is unwarranted because data show complete kill does not occur.

139. Page V-72, par. 3

Dominance by blue-greens in discharge canals occur at temperature near 90°F and above.

140. Page V-73, par. 1

Much data directly from Indian Point shows that inhibition will not occur at maximum plume temperatures.

141. Page V-73, par. 2

Speculative. Data from site indicate that neither of these types of damage will occur, so neither will secondary effects listed.

142. Page V-73, par.3

Data which Lauer presented supports neither the position in the prior paragraph or in this paragraph.

143. Page V-74, par. 1

The York River results are different with respect to the temperature associated with change than reported by Lauer but not in conflict. Conflict would exist only if someone else's data from Indian Point was different than Lauer's. Data from

Hudson is certainly more relevant to Hudson than data from York. Also, quite a number of other references report data more in agreement with Hudson River data than with York River data.

142. Page V-74, par. 2

Would it not be more fair to say that these "changes can be easily detected by the sampling program the Applicant proposes"? As written the implication is that the sampling program is not "proper".

143. Page V-75, par. 2

Bottom temperatures are not expected to exceed 90°F. So why include the implication that they will?

144. Page V-76 to V-77

Recent Texas Instruments' studies indicate that Neomysis is probably not very important in aquatic community dynamics near Indian Point. This should be noted here.

145. Page V-76, par. 1

Statement on Neomysis is true but Neomysis is not a microzooplankton form.

146. Page V-76, par. 2

Each Neomysis female can reproduce only once but the population probably produces three generations per year, only one of which occurs when Neomysis is present as far north as Indian Point. Gammarus produces two or more generations/year/female, and there are almost always gravid females present during spring, summer and fall.

There is no basis for saying they move to get to Indian Point from downstream, and then stay there. Rather the Neomysis are probably being continually sloshed back and forth and intermixed longitudinally along the river and adjacent coastal waters by the tidal currents and mixing, at and below the salt front.

147. Page V-77, par. 1

Conclusion completely overlooks the abundant data that Gammarus, not Neomysis, are the principal food item and thus the effect on neomysis (none of which are removed from the food chain in any case) will probably have no identifiable deleterious effect on the recruitment from the nursery.

148. Page V-77, par. 2

Maintenance in zone of preferred salinity is speculative. Neomysis may just avoid fresh water zone or die and settle out if carried into it. The species occurs at least to Montauk Point to the east and to Sandy Hook to the south, so it lives in much higher salinity in most of its regional range than is present at Indian Point.

149. Page V-77, par. 1 and 4

"Unpublished 1972 NYU data indicate that juvenile Neomysis are distributed throughout the salt water portion of the estuary, thus disproving the Staff's suggestion that the Indian Point region may be a nursery area for juvenile Neomysis.

150. Page V-78, par. 3

It is only fair to add at least that "the Applicant maintains that reductions in annual recruitment greater than 25% caused by the plant operation will be detected in the course of the Applicant's study and in time to take corrective action before the change becomes irreversible".

151. Page V-78

In fairness there should be added the conclusion that "in no case will the effect on neomysis be irreversible".

152. Page V-79, par. 1

There is insufficient evidence to support the supposition that longitudinal distribution is controlled by temperature. Other influences such as salinity and hydrology are probably more important. Also there is no basis to suppose that the presence of the thermal plume from Indian Point will cause a greater proportion of spawning in the vicinity of Indian Point.

153. Page V-79

Evidence clearly indicates that the progression from planktonic movement to independent swimming starts at the post yoke sac stage and by 13 to 16 mm (about 4 weeks of age) the larvae are more independent than planktonic and have also acquired an avoidance capability, and exhibit a shoreward and to a lesser extent downstream migration.

154. page V-17, par. 2.

The statement than 70 to 90% of the surviving juveniles had migrated past Indian Point is not correct. The data presented in Table B-11 only indicates that 70 to 90% were distributed below Indian Point. This does not mean that all of these 70 to 90% migrated past the plant. Some and possibly many of them were spawned below the plant and therefore never passed it.

155. Page V-79, par. 2, last sentence

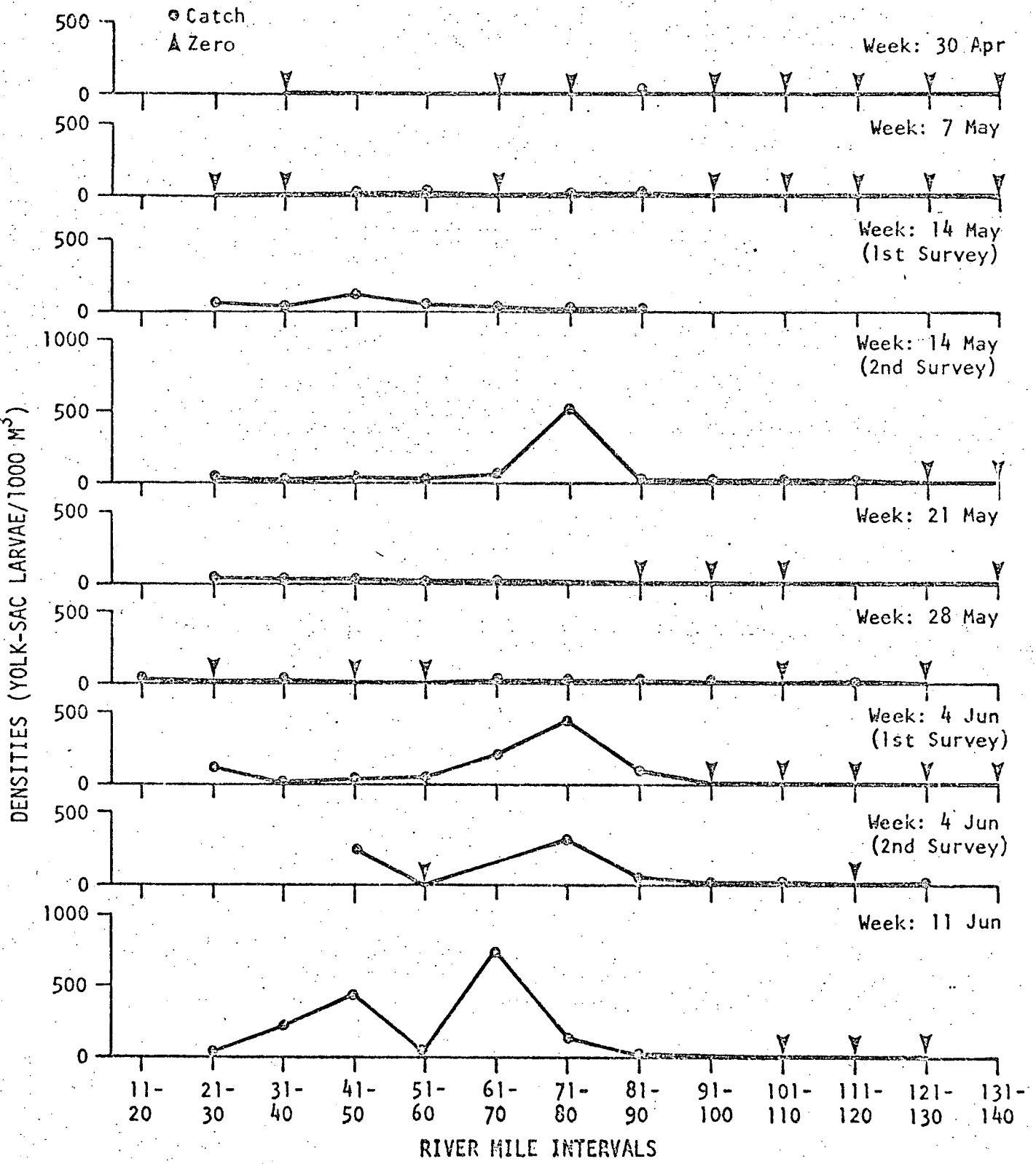
Our analysis of 1973 data shows that all spawning does not take place above Indian Point.

156. Page V-79 to V-82

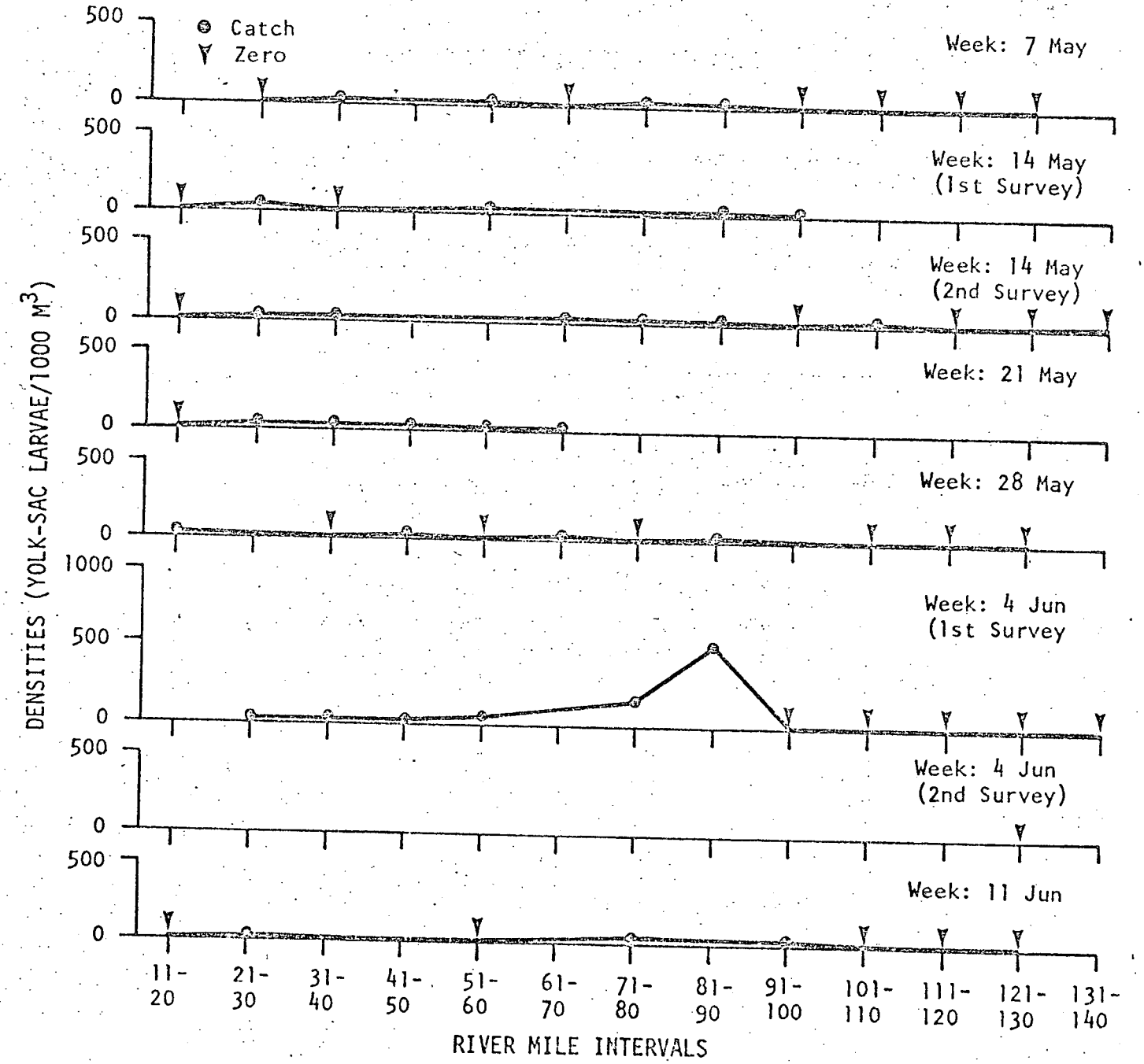
Staff's position on downstream migration of young striped bass in relation to entrainment by Indian Point power plant as developed in V-79 to V-82 is based upon data of very poor scientific quality compared to data now available from Applicant's ecological study. These newly available data will be further supplemented by additional studies to be carried out during 1974. Analyses of 1973 studies are not yet complete but preliminary indications are that previously held notions about striped bass abundance, spawning areas, movement of young, and distribution of nursery areas are seriously in error, and that the more accurate view which will be available through 1973 and 1974 studies will not support Staff's predictions of extremely high losses due to entrainment. Furthermore, Applicant's research program is expected to yield empirical estimates of fraction of young striped bass population entrained, which can be presented free of the assumptions included in the models used in Indian Point #2 hearings.

157. Page V-80

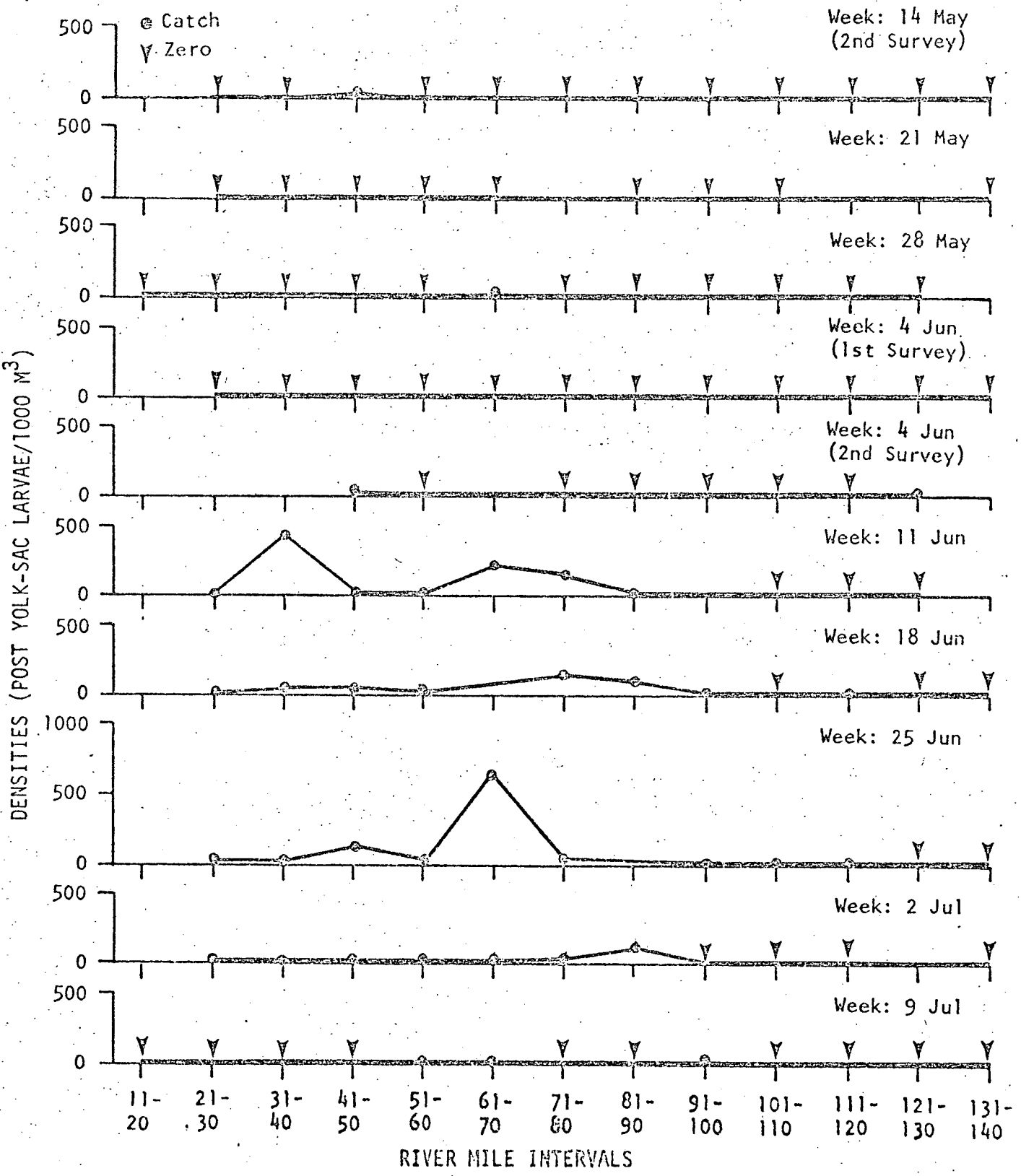
Attached are updated charts showing spatial and temporal distribution of striped bass eggs and larvae in 1973. These should be substituted for the charts on page V-80.



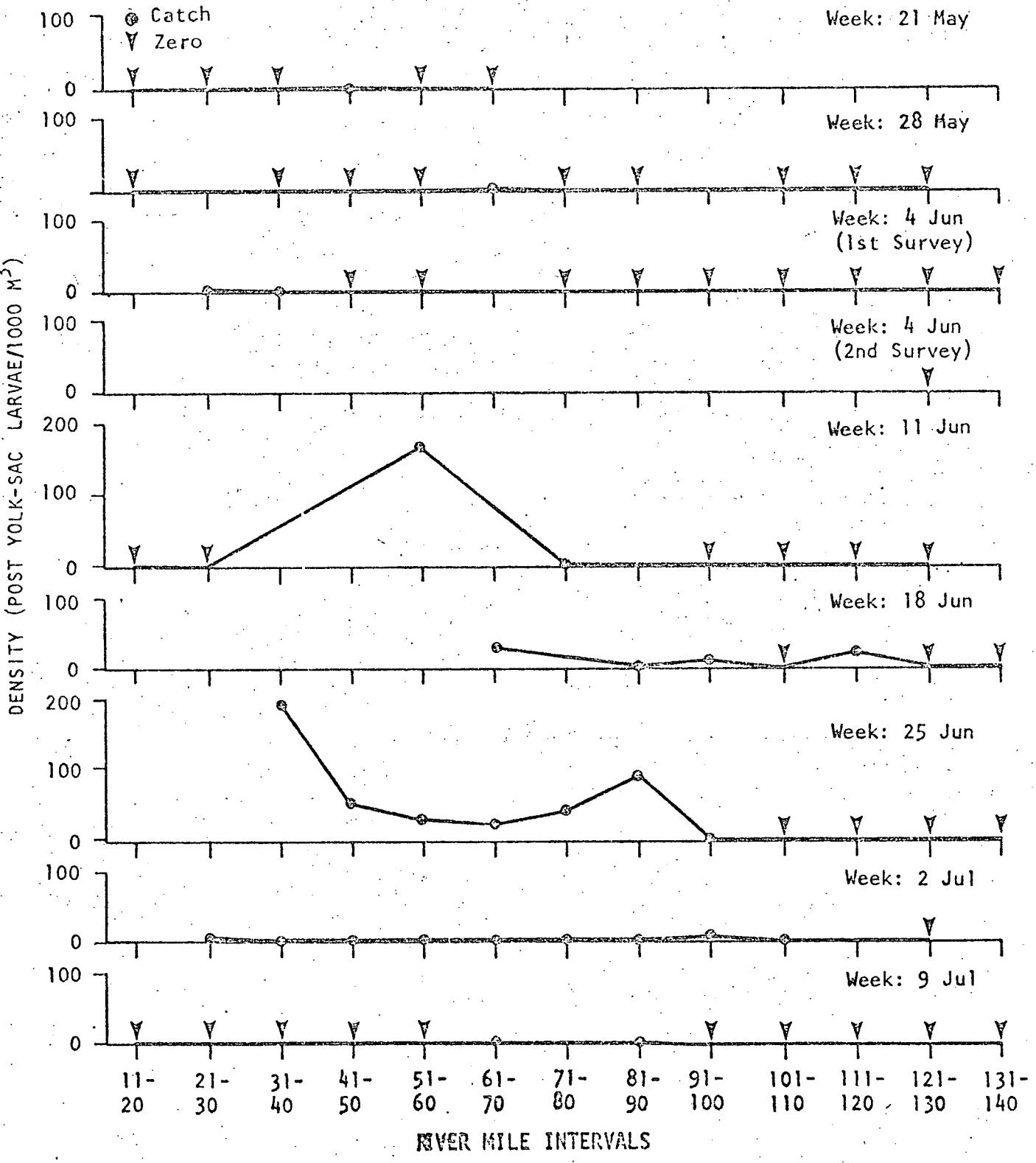
Densities for Striped-Bass Yolk-Sac Larvae (No./1000 M^3) Collected by Epibenthic Sled in 10-Mi Intervals, Hudson River Estuary, RM 11-140, April-June 1973



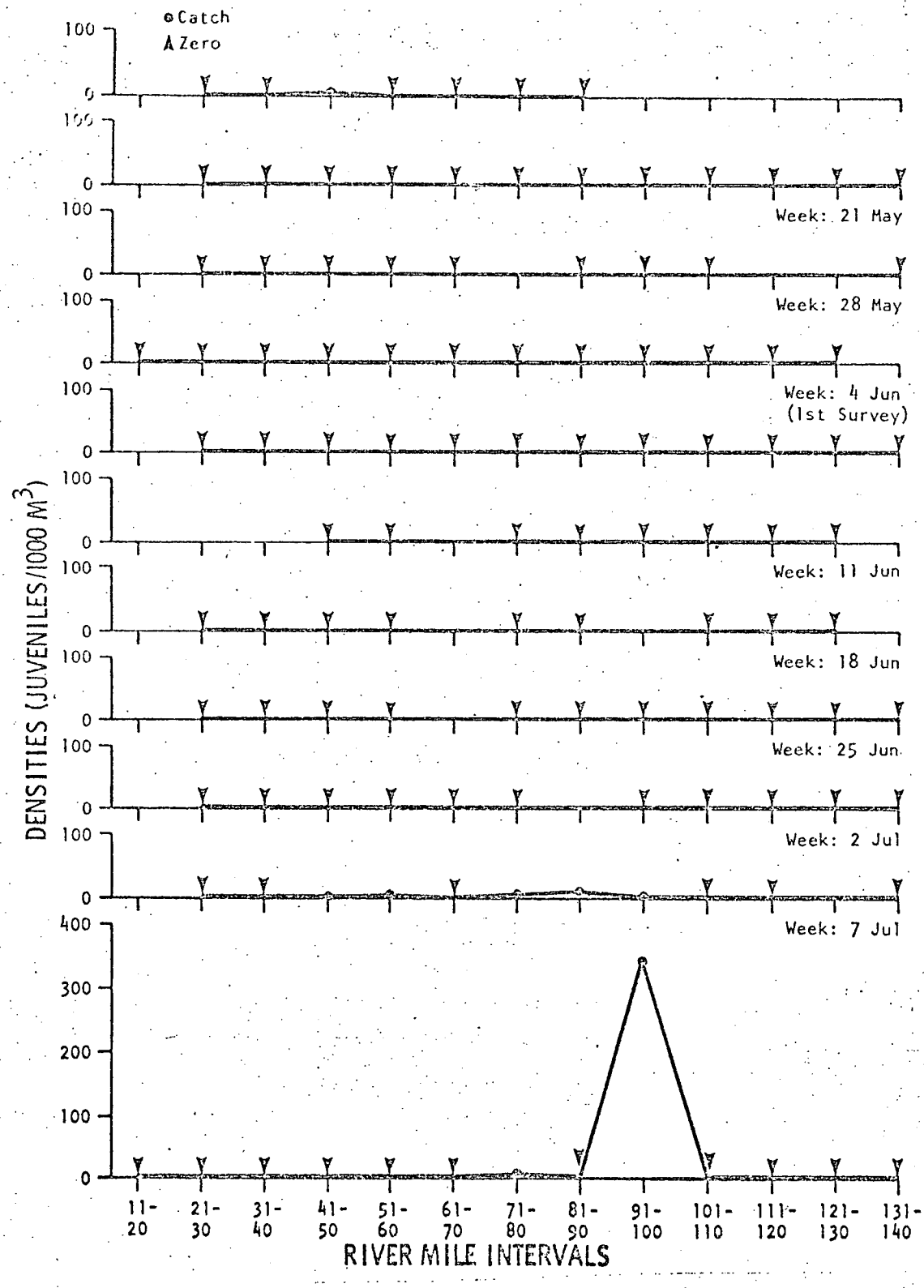
Densities for Striped-Bass Yolk-Sac Larvae (No./1000 M^3) Collected by Tucker Trawl in 10-Mi Intervals, Hudson River Estuary, RM 11-140, May-June 1973



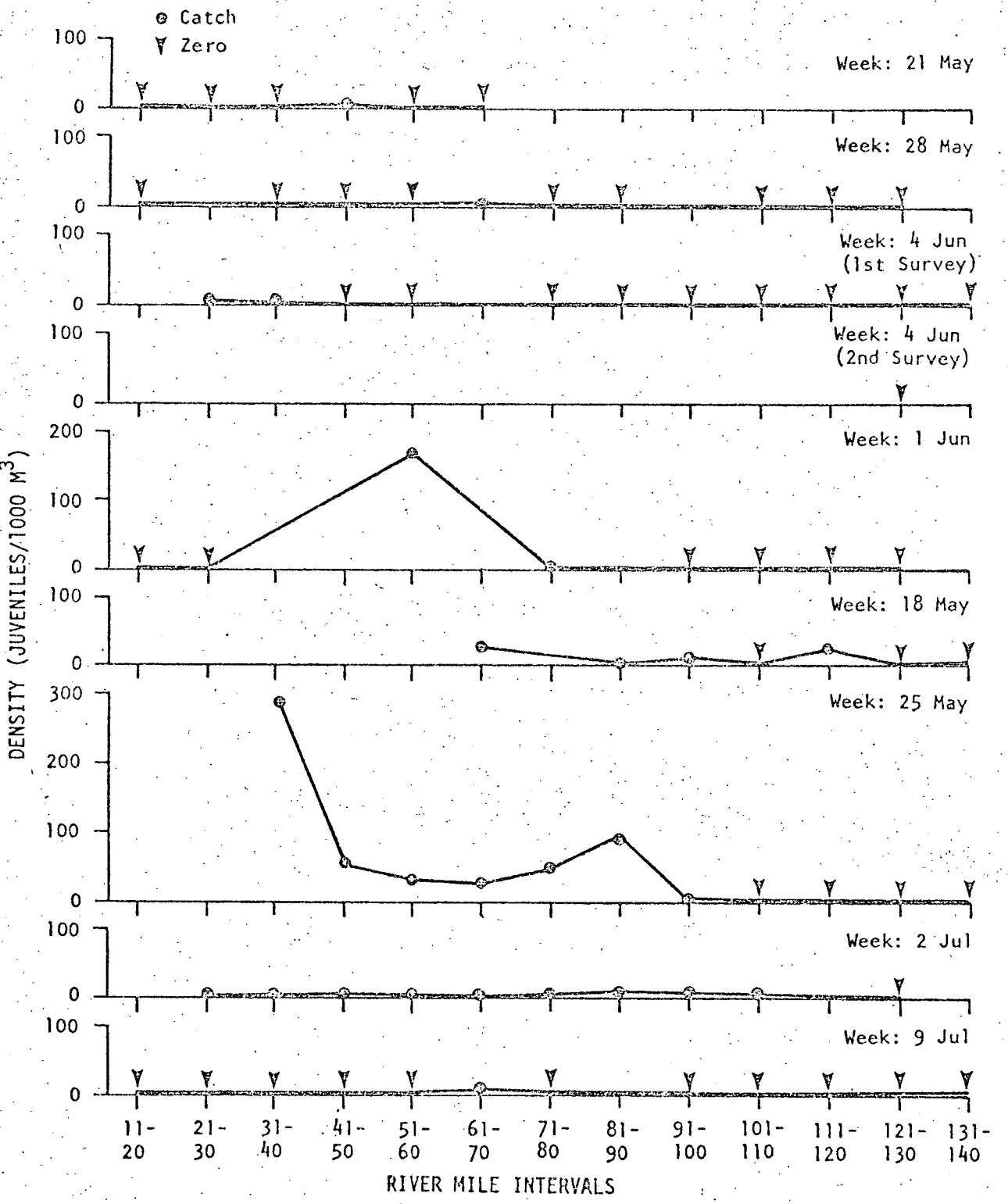
Densities for Striped-Bass Post Yolk-Sac Larvae (No./1000 M^3) Collected by Epibenthic Sled in 10-Mi Intervals, Hudson River Estuary, RM 11-140, May-July 1973



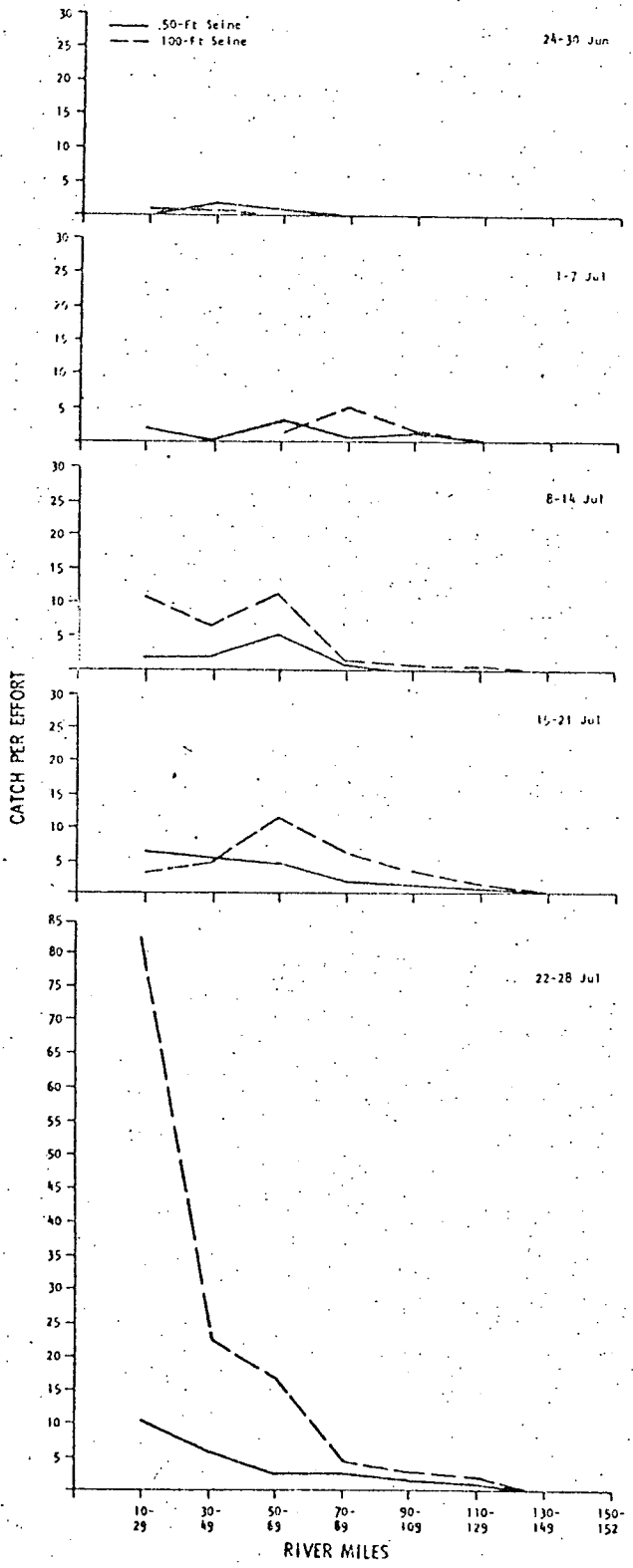
Densities for Striped-Bass Post Yolk-Sac Larvae (No./1000 M^3) Collected by Tucker Trawl in 10-Mi Intervals, Hudson River Estuary, RM 11-140, May-July 1973



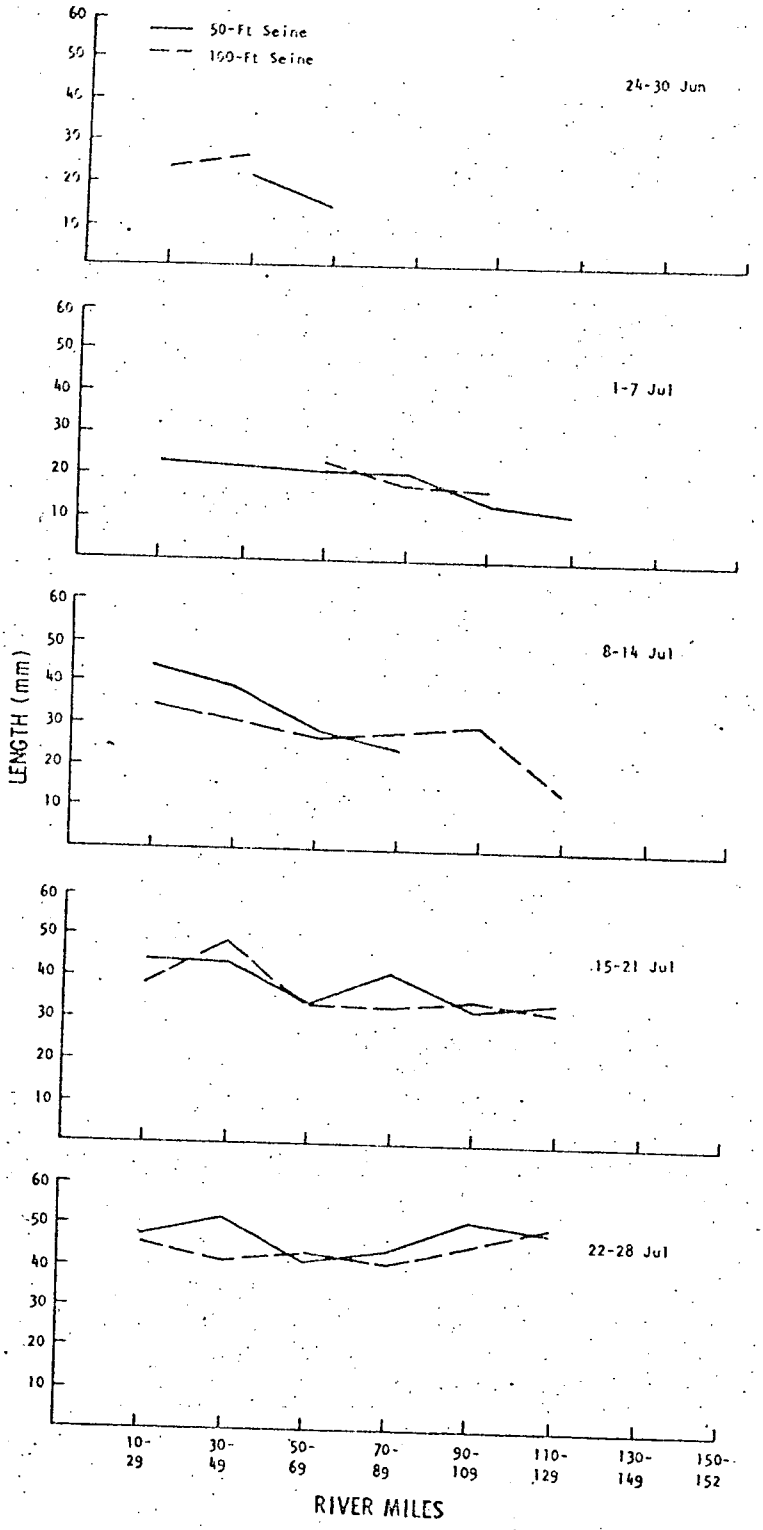
Densities for Striped-Bass Juveniles (No./1000 M^3) Collected by Epibenthic Sled in 10-Mi Intervals, Hudson River Estuary, RM 11-140, July 1973



Densities for Striped-Bass Juveniles (No. /1000 M^3) Collected by Tucker Trawl in 10-Mi Intervals, Hudson River Estuary, RM 11-140, May-July 1973



Catch per Effort for Young-of-the-Year Striped Bass Captured by 50-Ft and 100-Ft Beach Seines in 20-Mi Intervals, Hudson River, Weekly, 24 June-28 July 1973



Average Total Lengths (mm) of Young-of-the-Year Striped Bass Captured by 50-Ft and 100-Ft Beach Seines, RM 10-152, Hudson River, Weekly, 24 June-28 July 1973

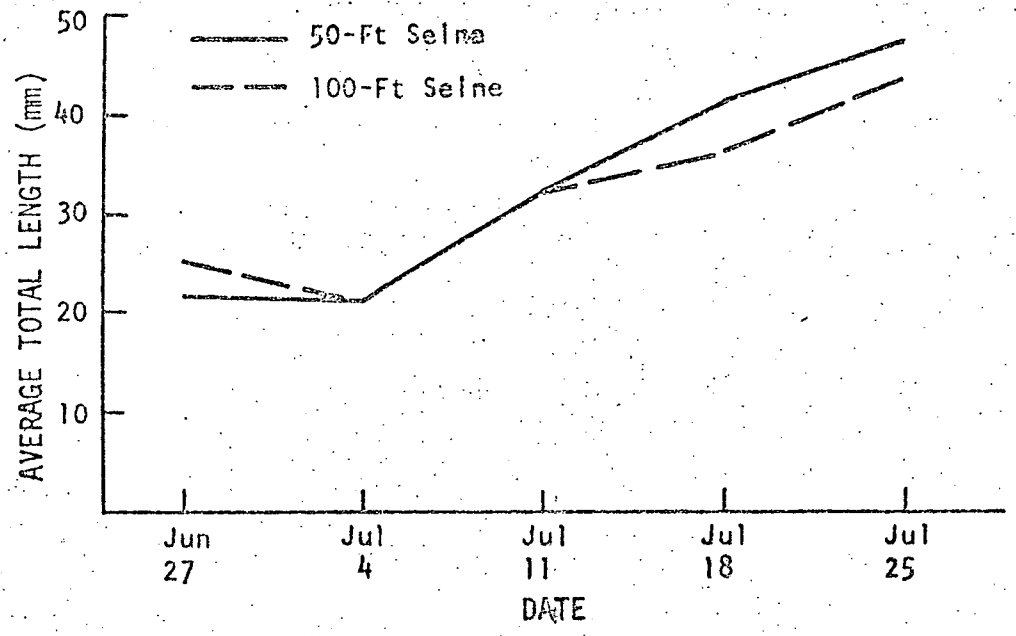
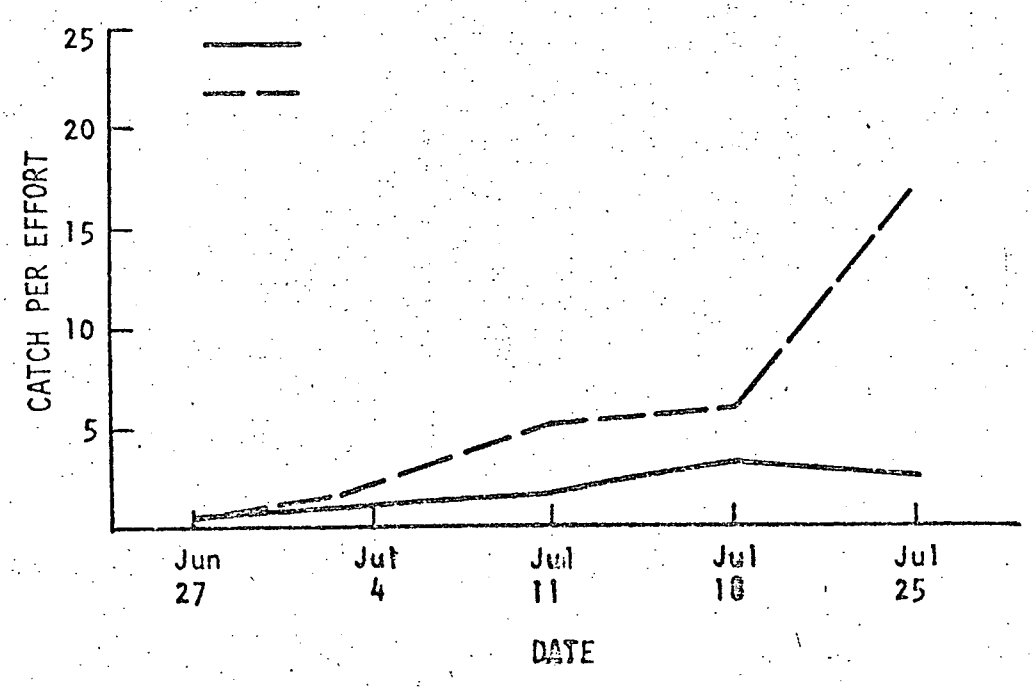
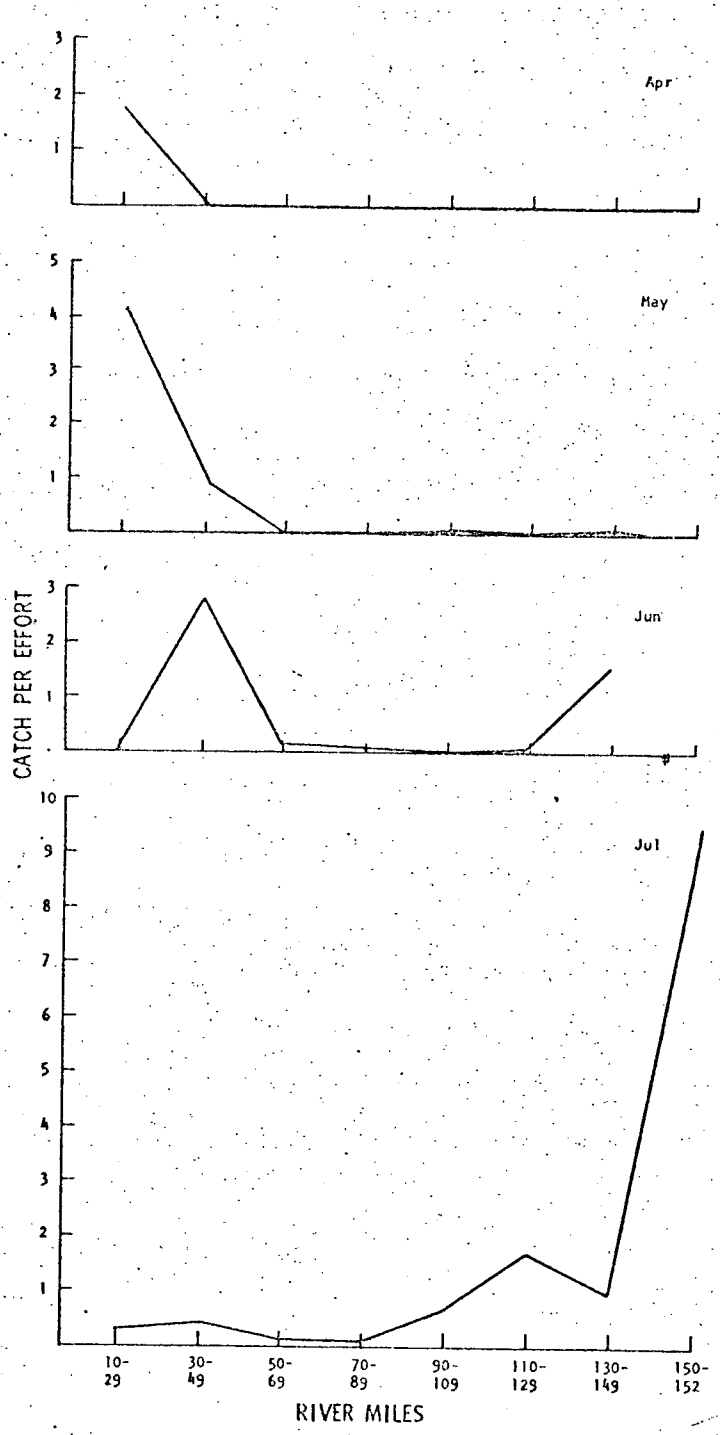


Figure IV-13. Average Total Lengths (mm) of Young-of-the-Year Striped Bass Captured by 50-Ft and 100-Ft Beach Seines in 20-Mi Intervals, Hudson River, Weekly, 24 June-28 July 1973



Catch per Effort for Young-of-the-Year Striped Bass Captured by 50-Ft and 100-Ft Beach Seines in 20-Mi Intervals, Hudson River, Weekly, 24 June-28 July 1973



Catch per Effort for Yearling Striped Bass Captured by 100-Ft Beach Seine, RM 10-152, Hudson River, April-July 1973

158. Page V-81, par. 1

Add "but in no case is the change expected to be irreversible by 1983".

159. Page V-81, par. 2

Although the Applicant has little confidence in the ability of a math model to replicate biologic cycles in the river, it is preparing a third generation model which will reflect variations in abundance and life stage on a real time basis.

160. Page V-82, par. 2

Striped bass are known to be cannibalistic, a form of predation which is generally density dependent.

161. Page V-82, par. 2

The Staff's statement that the major predator on striped bass is man ignores the fact that during its early life stages the striped bass is exposed to many predatory fish whose impact on the striped bass population size can far exceed the impact of man's fishing.

162. Page V-83, par. 3

There are many influences besides food that effect population density, some density dependent such as cannibalism and interspecific predation and predation and competition for food, and some density independent such as storms, run-off, and pollution and fishing intensity which can be either. The widely observed year class fluctuation of striped bass, which has been apparent for 40 years, has yet to be related to a specific cause.

163. Page V-83, par. 3, last line

The fecundity is known to increase naturally as populations decrease. Thus speculating to the contrary without a full discussion of the alternative would indicate bias in the analysis.

164. Page V-83 & V-84

A definition of a "stable population size" would help particularly in view of the known year class fluctuations of 400% in the Hudson and 300% in the Mid Atlantic.

165. Page V-83

All of the discussion on reproduction strategy leads inescapably to a conclusion that short term effects (less than 10 years) would not be expected to be irreversible.

166. Page V-85, par. 2

The Applicant did supply an estimate of 5% to 10% contribution of the Hudson to the Mid Atlantic (Raney Tr. 5965 - 5973 and 5985 - 5988) Presently planned meristic and electro pheresis studies are expected to provide definitive data that will confirm this hypothesis.

167. Page V-86

The Staff's conclusion that the Hudson is the major contributor to the Mid-Atlantic striped bass fishery because 93% of the variability in recruitment can be attributed to the presence of mature fish in the Hudson is improper. This only demonstrates that a correlation exists and not that the Hudson is the major contributor. An analysis was presented by the Applicant in the Indian Point Unit 2 hearings which demonstrated a similar correlation with the Chesapeake.

A third analysis between Mid-Atlantic and combined Hudson/Chesapeake landings showed an even higher correlation than the above two. Also, under cross examination in this hearing the Staff admitted 1) That this method of analysis could not be used to prove a hypothesis but only to show that one cannot be rejected; and 2) That the variations in Mid-Atlantic and Hudson landings could very well both be the results of a third factor such as climate or fishing effort, rather than cause and effect themselves. This should be noted here in the DES.

168. Page V-83, par. 2

The first sentence of par. 2, page V-83 is misleading on two counts. First, regulation of a prey population by factors such as predation or competition with another species does not, indeed cannot by definition, take place independent of the density of the prey population. Regardless of whether the process is intra specific or inter specific, regulation of a population involves feedback from its own density. Second, a population which is regulated by inter specific factors can compensate for changes in survivorship of other

individuals in the population (taken to mean individuals other than those upon which the interspecific factor referred to impinges). Unless the population has been driven to such a low level of abundance that every potential compensatory process was operative, additional mortality imposed on, say, the juveniles, might reduce population density to a level where one of the following occurrs: (a) lower juvenile density triggers compensatory response in juvenile stage, (b) lower juvenile density results in lower adult density and population stability at the new, lower, average density due to compensatory response of the fishery; (c) lower juvenile density results in lower adult density and population stabilized at the new, lower, average density due to compensatory response other than the fishery-possibly an increase in survival when some natural predator switched from less abundant striped bass to other food resources.

169. Page V-83 to V-84

The last par. of V-83 and first par. of V-84 repeat the misleading dissociation of prey population density from regulation by predation cited in the first part of the preceeding comment here. If predation is regulating a population (i.e. if it is a compensatory process) then it involves feedback from prey population density and it produces effects similar (possibly identical) to those of intraspecific regulation. Applicant agrees that predation need not be a regulatory process - that it can be density independent, or even inversely density dependent (depensatory; creates positive feedback).

170. Page V-86 to V-92

Staff analyses on pages V-86 through V-92 are seriously wrong methodologicall and logically and the conclusions reached are utterly without substance.

171. Page V-86

The Staff's failure to even mention here the many studies that reach a contrary conclusion which are discussed in Appendix F is reflection of bias.

172. Page V-91, par. 3

The Staff's bias is again illustrated by their continued reference to an alleged decline in populations of white perch. Populations fluctuate naturally and, by selecting a temporary downward fluctuation, the Staff projects a continuing decline. Furthermore, the theory that impingement at Unit No. 1 could have caused the decline in 1965-69 is obviously false because impingement problems recurred in late 1969 and 1970. It would appear obvious to an unbiased writer that the reduced impingement in the intervening years was caused by improvements in the intake structure design.

173. Page V-91, par. 3

Not true that NYU data indicated decline in white perch between 1965-1969. The data were too variable to indicate anything by professional interpretation, as already debated in Unit 2 hearings.

174. Page V-95

Contrary to Staff position in paragraphs 1 and 2, page V-95, that impacts on fish populations of the drastic proportions predicted by Staff and intervenors can be readily detected through changes in fish population parameters measured in the ongoing ecological study. Had lower impacts been predicted by Staff, the Applicant's field studies might not have been sensitive enough to detect them. However, the position taken by Staff has been that impacts on fish populations will be serious because they will be massive. This position is inconsistent with the view that the ecological studies underway cannot detect the postulated serious change.

175. Page V-92, figure V-15

No consideration is given to the method of haul, the season, the net size, or mesh size, which must be included in order to avoid possible bias. For example, if beach seines in 1969 were taken in areas or times of low concentrations as compared to 1967, they would necessarily have a lower catch-per-unit-effort. The white perch must be considered a migratory species in its first year.

176. Page V-94

The Applicant holds that the fish species in the Hudson having significant social value are limited to striped bass and shad. Other aquatic species are significant to the extent they are a vital link in the food chain of one of these two species. The evidence that shad are not impinged and that young of the year are spawned and reared past the first life stage of passively floating planktonic larvae is clear evidence of the validity of the Applicant's conclusion.

177. Page V-94, par. 2

More than 1700 megawatts of once through cooling have been added to the lower Hudson since 1949. If that is minor, then by definition the addition of Indian Point 2 and 3 must be minor.

178. Page V-95, par. 1

We are not trying to determine any irreversible damage in two years. We do intend to determine if the operation of the plant will reduce annual recruitment by the amounts speculated by the Staff.
We are committed to take the appropriate mitigating measure (including the alternative of the construction of cooling towers) should such losses be identified. Thus the last sentence is irrelevant and misleading.

179. Page V-97

The "general concurrence" in paragraph (3) is not clear. The preceeding paragraph on the position of HRFA contains several points, some substantive and some unsupported attacks on the honesty and integrity of Con Edison and its consultants. The Final Environmental Statement should clarify the concurrence, and the Staff should disassociate itself from this attack.

180. Page V-97

The staff again states that the Applicant must "conclusively demonstrate no unacceptable adverse impact on the fisheries. This standard is not only contrary to law, but contrary to scientific method which depends on statistical significance of results rather than conclusive demonstration. Thus, by adopting this standard, the staff has placed upon applicant a burden which is not only

illegal but which cannot be achieved through scientific procedures. The Staff certainly cannot "conclusively demonstrate" its prediction of environmental damage.

181. Page V-98

Objectives 2, 3, 4 in part, and 5 in part, are being pursued by NYU, not T.I. as indicated.

182. Page V-100, par. 3

The Applicant does not intend to use the striped bass transport model as the basis for the conclusions to be drawn from the study. The conclusions will be based on the data, not on the mathematical model.

183. Page V-102

It is simply not true that no baseline of prior environmental measurements exists to be used as a control for new measurements made concurrent with start up of Indian Point Units 2 and 3. Significant studies have been carried out since the mid 1960's. These are well known to Staff who have used them to formulate their present position Applicant has outlined in detail the continuity for comparative purposes which exists between these earlier studies and the present ecological studies.

184. Page V-103, par. 3

Staff's allegation that "the applicant has formulated his hypothesis in a way that allows the applicant to derive benefit from poor experimental design or careless execution of the required sampling" is untrue and completely contradictory to statistical theory and scientific method. The choice used in the form of statement of null hypothesis:

a) is consistent with universally accepted scientific procedures;
b) does not preclude Applicant, Staff or intervenors from establishing and testing different hypotheses with data from past and ongoing ecological studies.

c) has not led to experimental or sampling designs in the research program which are importantly different from those which would have been employed had the hypotheses been stated in a different way;

d) confers absolutely no benefit on the applicant from deliberate or accidental carelessness in conducting the research programs;

e) does not in any way preclude use of the "interval estimation" approach to statistical analysis of research data, which approach applicant intends to use along with the "hypothesis testing" approach in order to provide the most complete and understandable analysis of research findings attainable.

Poor experimental design or careless execution of sampling would work to great disadvantage of the Applicant. Greater sample size would be required to reach satisfactory levels of precision in the data, thereby increasing the cost of research. More important, anything which increases the sampling variability of research data widens the confidence interval around estimates and thereby admits of a larger probability of severe environmental impact even if the point estimates indicate moderate or no impact.

185. Page V-104, par. 1

The first sentence is grossly erroneous and is another indication of bias. The Applicant has never proposed "research as an alternative to closed cycle cooling systems".

186. Page V-105, par. 1

The estimate of impingement was conditioned heavily. Experience at Indian Point 2 since making a projection on Indian Point 1 statistics indicates impingement rates at 1/10th of the Indian Point 1 extrapolations.

187. Page V-105, last par.

Probability of entrainment should not be equated to mortality.

188. Page V-106

There are considerable data from studies at the site on many of these points and experience says the Staff is wrong or over-exaggerates. Valid cost-benefit analysis would require evaluation of the most probable level of environmental effects, rather than the maximum possible approach that the Staff has taken.

189. Page V-108

The last sentence makes a factual prediction which is not supported by the preceeding analysis, since it was largely in terms of potential adverse impacts. Also, the Staff fails to state how long it would take to create "irreparable damage".

190. Page V-111, fig. V-17

The figure is not totally correct. The corrected version is attached as Exhibit B.

191. Page V-113

The Staff estimates steam generator blowdown to be 10 gpm. Blowdown rates are, however, expected to be about 5 gpm per steam generator for a total continuous blowdown rate of 20 gpm.

192. Page V-117 to V-122

There appears to be an inconsistency concerning monitoring of gaseous releases. At the bottom of p. V-117 the Staff says that all paths except turbine hall ventilation air will be monitored. On p. V-122 they indicate that the Indian Point Unit No. 1 Blowdown Flash Tank vent releases will not be monitored. This path will be monitored indirectly for I-131 by sampling and analyzing the liquid blowdown upstream and downstream of the flash tank.

In addition, the releases from the Indian Point Unit No. 3 Blowdown-Flash Tank vent will not be monitored. The maximum releases from this path will be so low (less than 0.04 Ci/yr) that monitoring is not considered necessary.

193. Page V-122, item 6 — Delete "through the plant vent".

194. Page V-122, item 7 — The sentence starting with "after treatment..." should be changed to read "prior to treatment..."

195. Page VI-6 — The Staff states that accidental criticality for new fuel shipments is "impossible for all meaningful purposes." It is, therefore, illogical to discuss the hypothetical results of the impossible accident.

196. Page VII-1 to VII-5 — This discussion of adverse environmental effects which cannot be avoided is limited to the plant as presently designed. Since the AEC Staff is recommending the construction of natural draft cooling towers, the adverse effects of these towers should be discussed in at least equivalent detail.

197. Page VII-2, par. 2 — The present version should be deleted and the following substituted: "The visual impact from some historical landmarks on the west bank of the Hudson will be different viewing the nuclear facilities than the amusement park previously located at Indian Point. The architectural style, building massing, organized site development, as well as the appearance of building materials are esthetically superior to most other industrial or commercial facilities situated along the estuary."

198. Page VII-4, item b — The concept of relating the water withdrawal rate of the plant to the freshwater flow is misleading. It implies that the plant withdraws only fresh water, and makes no allowance for the tidal flows past the plant.

199. Page VII-5, par. 2, line 3 — To be consistent with the analysis, this should read "effects which might occur would be to the aquatic environment **".

200. Page VII-5, par. 2 — More recent data suggest the 3 million will be substantially reduced.

201. Page VII-5, par. 3 — Chlorination will also be limited to selected river temperatures and in frequency.

202. Page VII-7, par. 2

Long term should be defined. Nothing has been presented to indicate that operation of once through cooling through 1983 can have these effects.

203. Page VII-6

The sentence starting with "The staff will require ..." should be changed to read: "The staff will require that, subject to feasibility studies, the total residual chlorine concentration at the point of discharge into the Hudson River shall not exceed 0.1 ppm."

204. Page VII-7

In the first paragraph, the Staff includes American shad among the species most likely to be affected by the plant. Extensive studies have shown that American shad is not significantly affected by either impingement or entrainment by the Indian Point plants.

205. Page VII-7, par. 2

The fact that phytoplankton in Hudson are light-limited, combined with relatively short exposure time to elevated temperature above 3 to 4 ^{o}F and experience from other plants, indicates that effects on phytoplankton will be slight.

206. Page VII-7, par. 3

Entire paragraph is speculation not based on facts.

207. Page VII-7, par. 4

A similar relationship exists by this kind of analysis between Atlantic and Chesapeake landings.

208. Page VII-8, par. 1

At issue in this case is the definition of a few years. The Staff has provided no analysis to support the view that from 1975 to 1983 is more than a few years.

209. Page VII-8

Among the additional adverse impacts due to the operation of wet natural - draft cooling towers, land use effects, noise and economic impact should be added.

210. Page VII-8, Par. 2

If mortality of entrained striped bass i 50% instead of 100%, then by staff's own analyses the present once through system starts to approach the 15% loss the staff projects for the closed cycle system. See p. XI-34.

Adverse effects on other biota are only assumed by Staff and are not supported by data.

211. Page VIII-1, Item A, Par. 2

"national park area" should be "natural park area."

212. Page VIII-3, Par. 1

The statement "Further quantification of long-term effects seems irrelevant to the basic objective of preventing significant damage to the fishery resources of the Hudson River" is inconsistent with the requirement that decisions be made by a balancing of costs and benefits, which have been quantified whenever possible.

213. IX - General Comments

Since the Staff is proposing the construction of cooling towers at Indian Point, this chapter should include a discussion of irreversible and irretrievable commitments of resources resulting from that recommendation. Such a discussion should properly include not only the land and materials required for the towers but also the irretrievable scenic losses and the possible losses caused by the emission of air pollutants from the towers.

214. Page XI-1, par. B2

Classifying as irreversible, biospecies destroyed indicates a lack of understanding of the definition of aquatic biosystems.

215. Page X-1, par. B2

Add "initially" before "40% of the Roseton Station Capacity".

216. Page X-19

Table X-7, the schedule of capacity additions and retirements, including dates of initial service or shutdown, is properly listed. However, the projected capacity, load and reserve as a result of these changes improperly shows capacity which is to be installed or retired after a given summer capability period but before the end of the year as being either added or removed before that summer capability period rather than by the next summer period. The effect of this error is to increase the capacity apparently available in most of the summer capability periods.

In addition, the following items in the table should be changed, as winter rather than summer ratings were given:

Gas Turbines (location undecided) Spring 1976 550 MW

Gas Turbines (location undecided) Spring 1977 220 MW

217. Page X-26

The Draft states that Con Edison has recently announced plans to build five 1100 MW baseload units in the 1980's. At the present time Con Edison has not announced specific plans for these plants, but rather, has included provision in its 20 year generation expansion program for such units to maintain reserve levels consistent with our long range load forecast. If and when firm plans are made for any of these units, they will be specified in future changes to our 20 year generation expansion program.

218. XI-1 General Comments

The Benefit/Cost Analysis performed by the AEC Staff does not consider carrying charges in the determination of generating costs and incremental generating costs with cooling towers installed. Accordingly, their analysis does not reflect the true revenue requirements which will be incurred by Con Edison if a cooling tower were installed. Moreover, the AEC Staff analysis does not consider the cost of replacement capacity and energy during plant downtime to allow cut-in of the cooling tower. The effect of these omissions is to understate the cost of the cooling tower for Indian Point No. 3.

219. Page XI-14, line 12 & line 21

Change "periodically" to "continuously" and "400" to "500" feet high.

220. Page XI-14

The adverse salt drift effects are expected to attack the leaves by percolation and root absorption.

221. Page XI-4

Energy conservation suggests shutting these old plants down as soon as possible because of their high heat rate and high atmospheric discharge rate per kw of power generated.

222 Page XI-6

Since the Staff concludes that it is not appropriate to consider alternative types of plants, it is not appropriate to include the discussion of alternative plants which follows that statement.

223 Page XI-7 to XI-9

Costs estimates for coal and oil fired units are not representative of Con Edison's costs in New York City. For example, Astoria 6, an 800 MWe, oil-fired unit may cost Con Edison $340/Kwe.

224. Page XI-14 to XI-15

AEC Staff fails to describe and assess environmental effects of alternate cooling systems to the same degree that the AEC Staff assesses the damage caused by once-through cooling systems, see comments which follow.

225. Page XI-15

On page XI-15, the Staff referred to a recent article (Reference 16 of Section XI) on the construction and design time requirement for a natural-draft cooling tower. The Staff misinterpreted the content of this report, and erroneously implies that construction of the system is complete. According to Ecodyne Cooling Products division, the designer and builder of the 350-foot Ecokel natural draft tower, the erection of the hyperbolic shell structure was indeed completed just over a year after the start of foundation work on May 16, 1972. (Site preparation including any excavation, land fill, etc. must be completed prior to foundation construction.) However, in order to complete the installation of all other components, such as water distribution systems, cooling fill and supporting columns, drift eliminator, etc., the total time requirement would be about two and a half years. As of November 16, 1973, the

construction work was still going on and will not be completed by the end of 1974.

This tower was originally designed for Miami Fort Station No. 7, a 500 MWe fossil plant. But the design was modified to handle the additional heat load from Unit No. 8, the other 500 MWe fossil plant. The dimensions of the hyperbolic shell itself remains intact, but the size of the internal cooling "fill" section has been doubled to accommodate the higher heat load. From the thermodynamic point of view, since the cooling air flow rate could not possibly be doubled without increasing the tower diameter, the tower "approach" must be increased for closed-cycle operation. This would increase the turbine back pressure, which in turn would increase the turbine derating.

Therefore, comparing the present single tower design to a hypothetical two-tower system for the two 500 MWe units, the former system will cause higher turbine derating during the entire service life of the cooling tower. The additional incremental generating cost due to higher derating might not be compensated by the lower initial construction cost.

226. Page XI-16

The statement that wet towers have minimal impact cannot be supported by data and should be deleted.

The discussion of dry cooling towers fails to mention that such towers cannot operate under all conditions with the existing turbine generator.

227. Page XI-18

The AEC Staff does not lack land or location requirements. They toured the site and have access to detailed plot plans.

228. Page XI-19

The Staff states that a natural draft tower would extend more than 350 feet above surrounding vegetation. It would be more accurate to state "more than 500 feet".

The statement "...noise levels outside the immediate perimeter of the towers usually do not exceed background levels" is unfounded. The estimate of 50 dB (A) at 2500 feet can be interpolated to 80 dB (A) at 80 feet. This estimate is in substantial agreement with actual field data, taken by Ostergaard Associates, for Con Edison. These preliminary data range from 83-99 dB (A) at the tower rim to 75-80 dB (A) at 80 feet, to an average of 54 dB (A) at 1000 feet. It is certainly reasonable to suggest that natural draft cooling tower noise emissions will exceed background (sound) levels.

Concerning the statement "...the applicant's information suggests that sound levels attributable to the towers will be exceeded by those generated by vehicular traffic along Broadway, which exceed 60 dB (A) more than 50% of the time...," the applicant agrees that the noise primarily generated by traffic along Broadway exceeds 60 dB (A) more than 50% of the time.

However, this statement is valid for only the increment of time during which community (traffic) sound levels were measured. These measurements along Broadway were taken during daytime and were, at best one hour in duration. It is more appropriate to compare cooling tower noise emissions to the (background) sound levels that exist more than 90% (L_{90}) of this time, especially during the quieter nighttime hours. Data taken near Broadway during nighttime (ER, IP-3 Section 22, page 4.2-2, 4.2-5: Point 6) indicate background sound levels (L_{90}) below 40 dB (A). Additionally, this nighttime data indicates that community noise exceeded a level of only 40 dB (A) more than 50% of the time.

The additive effect of the operation of natural-draft cooling towers was not estimated. It can be reasonably anticipated that approximately 53 dB (A) (average) at 2500 feet will result from the operation of two natural-draft

towers of similar size, for both Units 2 and 3

The directional aspects of noise from large complexes of mechanical draft towers must not be overestimated, as cell units are placed mostly in series and the cased surface area is relatively small. The louvered faces of such complexes, both for Unit No. 2 and 3, would substantially face the nearby community. The approximate sound level, at 5000 feet, from the operation of two complexes would be 63 dB (A).

As stated in the DES "...mechanical-draft towers for Unit No. 3 will produce a sound level of 50 dB (A) at a distance of 5000 feet...". Estimated sound levels of 50 dB (A) at 5000 feet can be interpolated to 66 dB (A) at the Broadway property line. This suggests that some of the 745 residents will be exposed to sound levels as high as 66 dB (A), which according to the proposed HUD criteria are "clearly unacceptable".

The applicant recognizes the potential detrimental sound impact due to the operation and construction of either natural-draft or mechanical-draft cooling towers. A study undertaken by an independent acoustical consultant will examine the existing day and nighttime community sound levels and estimate the intrusion and subsequent environmental costs caused by the operation and construction of these alternate cooling systems.

229. Page XI-21

The results of salt deposition studies mentioned for the Forked River plant are not applicable to Indian Point because of the different types of flora existing in and near the Indian Point site.

230. Page XI-21 Line 3-7

Reference is made to the fact that water containing 640 to 1280 ppm of total salts is suitable for supplemental irrigation of plants having low salt tolerance. The conclusion drawn from this point, that drift deposition from cooling towers is unlikely to cause vegetative damage, is faulty. The amount of vegetative damage due to salt to a particular plant is different depending upon whether the salt is taken in through the roots or impact on the leaf directly. The reference in question deals only with vegetative damage by means of root uptake and not with direct leaf impaction.

231. Page XI-21 Lines 9-14

Reference is made to the Forked River Nuclear Station Unit 1 Natural Draft Salt Water Cooling Tower study entitled Assessment of Environmental Effects, which "suggests that average nearground concentrations of drift salts are a factor of 40 to 100 below levels known to affect the general vigor and distribution of plants (i.e., 0.23 to 0.1 ug/m^3)." The species of plants used to make this assumption are species indigenous to the Forked River area which is in an area in close proximity to a large salt aerosol source (i.e., the Atlantic Ocean). Those indigenous species in order to survive must be salt resistant. The Indian Point area is not as close to such a salt aerosol source and the vegetative species indigenous to the natural ecosystem have not had to be as salt resistant to survive. Therefore, conclusions drawn from the Forked River Study concerning plant susceptibility may not hold ture for the Indian Point site.

It should also be noted that on page 39 of the Forked River Study the statement is made, " Experiments indicated there was also variable response of individual plants within the same species." This particular

statement shows that plant response is not clearly defined, and preliminary results of our Boyce Thompson study are showing that the relative susceptibilities of plants to salt aerosols are more complex than previously assumed.

Existing data on plant susceptibility very often does not account for changes in temperature, relative humidity, degree of light and size of the salt particle. All of these factors are being shown to be important parameters in the determination of plant susceptibility.

The effects of salt spray on vegetation indigenous to the Indian Point area can only be known by empirical methods given the poor reproducibility of existing and past data. Empirical results in this area are now being performed by the Boyce Thompson Institute for Con Edison and it would be premature to make conclusions without this specific empirical data.

232. Page XI-22 Lines 32-34

It is stated that, "In practice, it becomes quite difficult to separate vegetation damage related to foliar deposition from that caused by uptake of salts from soil solution." This is an erroneous statement as a controlled experiment has been designed and is being carried out by Boyce Thompson for Con Edison to estimate the risk of vegetative injury related to only foliar deposition of a salt aerosol of cooling tower origin.

233. Page XI-29

The figure "319,000 gpm" should be "318,000 gpm".

234. Page XI-32, par. 1

Probability of entrainment cannot be assumed equivalent to loss. All phytoplankton and zooplankton entrained into closed cycle cooling systems will be killed compared to essentially no phytoplankton and variable percentages of zooplankton in once-through, except during chlorination when high mortality is expected.

235. Page XI-26, par. 1

If the effects of other water users are to be combined in determining a need to mitigate damage, then alternate mitigating measures by all users including fishermen should be considered in any NEPA balancing of alternatives and in the selection of the alternative that maximizes public benefit at minimum public cost.

236. Page XI-31, Table XI-6

This table erroneously equates plant mortality with environmental costs when the effect on the populations of socially significant species should be a measure of the costs, or to be more precise, of the reduction in income from commercial fishing and the loss of recreation days.

237. Page XI-31

It is erroneous in a cost-benefit analysis to indicate impingement losses as an environmental cost without any relationship to total fish populations of the river. If impingement at the plant has no impact on the total fish populations of the river, as may well be the case, then the environmental cost of impingement is zero.

238. Page XI-32, par. 2

Projection for all other fish species is unfounded since many species are not subject to entrainment.

239. Page XI-34 to XI-37

It is not clear that the portions of these tables and figures designated "50% mortality" only assume 50% mortality for the plants with open-cycle cooling. The plants with closed-cycle cooling should of course compute 100% mortality in all cases.

240. Pages XI-34 to XI-37

Although these charts and tables indicate results of the base design at 60% flow, alternative A is analyzed only at full flow. If alternative A were adopted, Con Edison would operate Units Nos. 1 and 3 with reduced flow during the cold portions of the year. Accordingly, alternative A should be reanalyzed with reduced

flow or a reduced flow analysis should be added to alternative A in these charts and tables.

241. Page XI-35, Table XI-8

Table should be revised to reflect 50% mortality for once-through cooling and 100% for closed-cycle in all cases. The comparable figures should similarly be modified.

242. Page XI-38

The assumption by the Staff that biological damage is proportional to the volume of water within a specified isotherm (i.e. 4°F and 6°F isotherms) is improper because it fails to consider:

1) that the critical isotherm will probably vary for different species at different life stages and seasons of the year
2) that the time of exposure to increased temperature greatly affects the occurrence of biological damage.
3) that the distribution of organisms in the river is non-uniform
4) that some organisms can use their motive ability to avoid entering the plume.

The Staff's assumption that there will be a reduction in D.O. in the plume is probably not valid since the aeration effect of water turbulence along with oxygen production from phytoplankton should offset any oxygen consumed by increased metabolism of oxygen consumers.

243. Page XI-39 and XI-40 Table XI-10 and XI-11

Table XI-10 gives, for the base design at 100%, a volume of 66,000 ft^3 of water inside the 4°F excess temperature isotherm. If this excess isotherm was concentrated at the plane of discharge (where the cross sectional area is approximately 160,000 ft^2, the width of this isotherm is approximately (66,000/160,000) 0.41 ft. Or, if one uses the width of the discharge structure* (250 ft)

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* This is apparently how the staff determined its number of 66,600 ft^3 (see page A-10, Table A-3)

and assumes all the heat is concentrated in this region, the corresponding cross-sectional area is (66,600/250) 270 ft^2, which is (270/160,000) = 0.16% of the River cross sectional area. This does not even approach the values presented by the staff in table A-4.

Table XI-11 presents, for the distance along the river where the excess temperature exceeds 4^oF, a value of 15 miles (base case, 100% flow). If one combines this value with the volume presented in Table XI-10, 66,600 ft^3 (see above), one gets an average width of the 4^oF isotherm of (66,600/15x5, 280) 0.85 ft. This suggests an extremely thin ribbon for the 4^oF excess isotherm which would not contravene the state criteria.

244. Page XI-41

The Staff suggested that the blowdown could be held up to allow sunlight to decompose excess residual chlorine prior to discharge to the river (page XI-41). This is not a practical method for Indian Point.

245. Page XI-45

The Staff's figure of 15,000,000 juveniles which would have to be replaced by a hatchery is not consistent with table XI-8 which presents the results of the Staff's entrainment model for Indian Point Units 1, 2, and 3. This table shows a maximum reduction in juveniles caused by Indian Point of 7,500,000 (13,500,000 baseline population minus 6,000,000 if plants are operated). Average population reductions shown in this table are 5,500,000 fish (assuming 100% entrainment mortality) and 3,700,000 fish (assuming 50% entrainment mortality). Not only does the 15,000,000 figure cited by the Staff far exceed these figures, it even exceeds the 13,900,000 maximum baseline population predicted by the Staff's model if there were no plants operating.

Also, unpublished verbal communication from the 21 state and federal rearing facilities using striped bass furnished by Monck's Corner indicates that in 1973 a composite survival of 9% from egg to fingerling size was

obtained. In light of this the 1.4% survival estimated by the Staff is too low.

246. Page XI-46, par. 1

We commend the Staff for this conclusion and urge it be a basis for permitting the Applicant to complete and report upon its study before imposing the irreversible burden of closed-cycle cooling on our customers.

247. Page XI-46, par. (VI) 2, last sentence

Here the Staff again mistakenly deals in the priceless value of one food source and recreational experience contrary to NEPA and Federal Policy as set forth in Senate Document 97.

248. Page XI-46

The Staff states that the hatchery program would be a means to mitigate damage done to the striped bass fishery during interim plant operation. If this is acceptable as a mitigation measure, it would seem that operation with the once-through cooling system could be allowed until sufficient dats is obtained to reach better environmental decisions.

249. Page XI-47, last par.

We agree with the Department of Interior (see comment on p. V-39) concerning the doubtful results of mathematical models relating to thermal plumes and suggest that the doubts increase geometrically as uncertainties of life systems are added. One must thus conclude that the probability of the results of a biomodel at this stage of development can be accepted with confidence only suggests that confidence is misplaced.

250. Page XI-49

The Staff has taken information on costs for a single tower at Unit No. 2 from the Environmental Report for Unit No. 2 instead of the more recent analysis presented in the testimony of Carl L. Newman dated April 9, 1973, in the Unit No. 2 licensing proceeding.

251. Page XI-50, lines 3-7

The Staff should indicate what steps would be appropriate to minimize drift losses and subsequent salt deposition.

252. Page XI-50

The 400-foot meteorological tower is fully operational at this time.

253. Page XI-51

The flume study should also be mentioned here.

254. Page XI-51, Item E., Par. 1

The channel walls at Unit 3 do not have openings at the bottom to allow lateral movement of fish. The channel walls do not extend beyond the travelling screens. Lateral freedom is provided by placing the travelling screens at the river's edge and by placing the bar racks on pillars which do not obstruct the flow.

255. Page XI-51, Par. 2

The 0.5 ft/sec. approach velocity is for the area directly in front of the travelling screens, not the trash bar racks.

Present plans call for reduction of flow rate by construction of a recirculation loop as was done at Indian Point 2, rather than by two-speed pumps.

256. Page XI-51, Par. 4

The velocities for the common intake structure are designed as 0.5 ft/sec. in summer and 0.3 ft/sec. in winter and would be "less" only if one of the units were down.

257. Page XI-52, Par. 2

Staff states that no method of fish protection was effective except for the air bubble curtain. This is in disagreement with a previous statement that reduced flow was reducing fish impingement.

258. Page XI-52

Con Edison now estimates the cost of installing the common intake structure at $18 million.

259. Page XI-56

Computation of "regional product" substantially underestimates the product. The calculation is based on the number of households in Applicant's service area. This ignores the fact that Con Edison's service area is probably responsible for a large part

of the regional income of surrounding communities. If environmental costs are considered to include impacts on the striped bass population of the New England Coast and the Mid-Atlantic, certainly the calculation of benefits from the plant should include consideration of impact on the surrounding communities. Also, no valid reason appears for omitting the income multiplier referred to in the last sentence of this section. And finally, the prorating of the regional product to Unit No. 3 was based on percent of future generating capacity (MW) instead of future generation(MWHRS). The result of correcting all these errors would be a number considerably higher than $2.1 billion.

260. Page XI-57

The employment is incorrect for the same reasons the regional product is wrong (see above comment on Page XI-56).

Kerosene should be noted as being 0.05% sulfur, not 0.5% sulfur.

As stated, a reduction in atmospheric emissions will improve air quality. However, with the latest cooling tower design, the 83 MW(e) derating would have to be made up using fossil-fueled plants.

261. Page XI-58

Since the AEC Staff is recommending installation of wet natural draft cooling towers, this table should include a statement of the environmental damage from salt drift.

262. Page XI-59

The calculations for generating costs are grossly underestimated. The major omission is that of cost of capital. The Staff apparently assumes that money to construct cooling towers will be made available to Con Edison without charge. This is highly erroneous. In Con Edison's testimony in the Indian Point 2 proceeding, a composite cost of capital of 8-3/4 percent was used in order to comply with AEC guidelines then in existence, but Con Edison's actual costs are higher, recently estimated at 9.375 percent. This figure is undergoing upward revision to reflect recent increases in the cost of capital.

In addition, the calculation is erroneous for the following reasons:

a. The Staff omitted the cost of replacement power for plant downtime during final "cut-in" of the cooling tower. The Staff assumes the cut-in could be accomplished without downtime. This assumption has no foundation in fact.

b. The Staff amortized the cost of the cooling tower system over the 30-year life of the plant. This does not take into account the fact that the plant will probably operate for approximately five years without a cooling tower system. Accordingly, the cooling tower system should be depreciated over 25 years.

c. The Staff admittedly failed to include taxes for no apparent reason. Taxes are real expenses and recognized as such by all accounting authorities.

263. Page XI-67

The present value and annualized generating costs are wrong for the above reasons.

264. Page XI-67, Item (1)

Staff should provide method for estimating numbers and weight of fish impinged with various alternatives.

265. Page XI-69

The AEC Staff does not evaluate the damaging devaluation which will result to neighboring property from alternative cooling system requirements.

266. Page XI-70

The Staff should state why 1981 or 1983 would not be suitable as alternatives to 1978 as target dates for operation of cooling towers at Indian Point, especially since during interim operation the applicant would take all practicable steps to minimize any adverse impact of the plant.

267. Page XI-73, item d (2)

Delete "and trash racks." No fish are impinged on trash racks.

APPENDIX A

(1) Appendix A

Staff's analyses of thermal impact for the facility should be based on the license requested for Unit 3, not the plant's maximum calculated capacity.

(2) Page A-11, Item (3)

See comment concerning pages V-9 to V-18 for remarks on the Staff's selection of parameters for model.

(3) Page A-18, 19

Comments on the Staff's analyses have been previously presented by Applicant. ("Additional Testimony of John P. Lawler, Ph. D., on the cummulative Effects of Bowline, Roseton and Indian Point Generating Stations on the Hudson River," March 30, 1973, and "A response by John P. Lawler, Ph. D., on Additional Information Requested by the staff on the Temperature Section in our March 30, 1973, Testimony...," April 20, 1973,). Reiterating the salient points:

a. The instantaneous water velocity profile presented by the staff

$$U(t) = U_f + U_{max} \sin\left(\frac{t}{t_d}\right)$$

where:

U_f = freshwater velocity
$U(t)$ = instantaneous water velocity
U_{max} = maximum tidal velocity
T_d = tidal period
t = time

is incorrect, for it ignores the phase lag along the river, i.e., the time of maximum velocity is different at, for example, Bowline and Roseton* plants.

b. The Staff's analyses ignores the presence of thermal stratification (i.e., plume buoyancy) in its model, by employing a thermal stratification factor of unity.

*In its simplest case, the time of ebb and flood varies along the river

APPENDIX B

(1) Pages B-11 to B-40

Results of the 1973 Texas Instruments' riverwide ichthyoplankton and beach seining programs should be included in this section. See comment concerning pages V-79 to V-81.

(2) Pages B-41 to B-55

The model presented in this section by the AEC Staff is similar to that presented by the staff in the Indian Point Unit 2 hearings. Prominent flaws in this model which result in an unrealistic overestimate of plant entrainment effect on striped bass include:

1) the improper use of daily average tidal flows and larval vertical distributions without including terms to represent deviations from these averages within the 24 hour period. This generates a continuous circulation belt of larval organisms passing Indian Point.

2) the use of segment averaged concentration of larvae in the Indian Point river segment for withdrawal concentrations rather than the upper layer concentrations.

3) the absence of a compensatory mechanism to control population growth and decline.

4) the inability of the model to predict the impact of plant operation on adult populations of striped bass.

These flaws are described in detail in the testimony of Dr. John P. Lawler in the Indian Point Unit 2 Hearings.*

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*February 5, 1973 testimony of John P. Lawler, Ph. D. on the Mathematical Model used by the Staff to Estimate the Effect of Indian Point Units 1 and 2 Entrainment on Hudson River Striped Bass. (Docket No. 50-247)

February 20, 1973 testimony of John P. Lawler, Ph. D. on the Mathematical Model used by the Staff to Estimate the Effect of Indian Point Units 1 and 2 Entrainment on Hudson River Striped Bass. (Docket No. 50-247)

(3) Page B-49

The egg release function with temperature (Fig. B-14) appears to be a hypothesis which is not substantiated with calculations or comparison with 1966 or 1967 MRFA spawn distributions.

(4) Page B-51

The additional mortality encountered when early stages transfer from one age group to the next (Fig. B-15) also appears to be an unsubstantiated hypothesis.

APPENDIX E

(1) The tables should be relabelled with the standard meteorological notation as supplied in the ER. The listed tables will tend to confuse analysis and interpretation.

Calms should be stated. The extremely low frequencies reported are significant to the meteorology of the site.

APPENDIX F

(1) Page F-1

The Staff commences this discussion with the statement that the contribution from the Hudson to the Mid-Atlantic fishery is 80%. The following pages do not support such a specific figure. The first five pages discuss studies entirely consistent with Applicant's position. Commencing in the middle of page F-6, there is a theoretical attack on these analyses which, at most, establishes that the source of Mid-Atlantic striped bass is presently unknown. The figure of 80% is not substantiated.

(2) Pages F-3 to F-9

A substantial portion of the discussion involves the interpretation of tagged recoveries. This entire discussion assumes that the percentage of tag returns are equal to percentage contribution. This is only true if the exploitation rate (not discussed) is the same for all populations.

(3) Page F-4

In the 7th line from the bottom, the word "lighter" should read "higher".

(4) Page F-6

The 2nd line should read "...South Beach between 1961 and 1963, may have been of Hudson origin. As indicated earlier, however, most striped..."

(5) Page F-6

The assumption that a bass captured in the winter would spawn in that area is not only unsupported by any data but is contradicted by several observations. In the Indian Point 2 hearings, Dr. Raney described the wintering of striped bass in the Connecticut River where it is well known they do not spawn. See also Vladykov & Wallace, 1952. Accordingly, the discussion following this assumption is erroneous.

(6) Page F-6

The logic of the last paragraph which makes four recaptures in the Hudson greater than seven recaptures in the Chesapeake is

spurious, particularly when one considers the above comment on intensity of fishing rates. Furthermore, it is unlikely that the four fish recaptured in the Hudson were potential spawners since only eleven of the 103 tagged fish were large enough to be mature.

(7) Pages F-7 to F-8

The refutation of the well-accepted Merriman position on the origin of striped bass is still unconvincing. First, it is highly likely that two-year-old fish, although generally non-migratory, will migrate in years of large year classes because of overcrowding. Furthermore, the statement on page F-8, "It is apparent from tagging data in the Chesapeake area that two-year-old fish are not migrating out of the bay to any significant extent" is simply not true. The study referred to shows that a small percentage of Chesapeake Bay stock could be a very large number of fish in view of the substantially greater spawning areas in the tributaries to Chesapeake Bay compared to the spawning areas in the Hudson River. The Staff also fails to mention the basis for Merriman's conclusions, which the Staff acknowledges are generally accepted.

APPENDIX G

(1) Page G-3, last par. 1.3

"The following weather conditions..." This statement is misleading in as much at it implies the weather conditions are representative or typical of what one may expect at the site. The purpose of the weather conditions is for general illustrative representation and should be stated as such in the assumptive manner.

(2) Page G-5, par. 2

In reference to "plume rise", specific mention of plume definition is required. Plume rise is generally considered the centerline value; however, vertical and lateral dimensions must also be specified.

(3) Page G-5, par. 5, last sentence

Comments on the plume penetration local inversions should either be clarified or described in a manner so the possibility of plume trapping by an elevated inversion is also qualitatively described.

(4) Page G-5, par. 1, 1.5

"...suspended in the form of fog", Any suspended moisture that condenses aloft is meteorologically classified as a cloud. Fog is a cloud, based at the ground.

(5) Page G-7, par. 2, line 6

The obvious qualifications on using wet-bulb temperature from Poughkeepsie and applying it to the Peekskill area should be explained along with the assumptions made in utilizing the data. The proximity of Peekskill to the Hudson River compared to the inland Poughkeepsie station should be stated. Also, low level meteorological wind sensors and vertical temperature measurements were used to predict plume dispersion at elevations of several thousand feet. Therefore, the accuracy of this procedure must be stated, especially when considering that the wind sensors were in the valley micrometeorological regime.

6) Page G-8

Only the drift and salt deposition were considered in the analyses, not the effect of airborne salt concentrations causing an increase in ambient salt. This effect can subject

the vegetation to a higher salt concentration and is a different process than deposition.

(7) Page G-14

Reference should be made to the company onsite research effort to obtain data required for a realistic assessment of cooling tower plume behavior. A 400 foot AGL meteorological tower was erected to collect wind, temperature and humidity data characteristic of the area. Extensive ambient salt concentration and deposition measurements are also collected. Additionally, the company is funding research on a cooling tower plume dispersion model and a cooling tower field observation program.

Table V-2. Maximum sustained discharges of chemicals to the Hudson River from the Indian Point Plant (Units Nos. 1,2, and 3)

	Sustained release (lb/day)			Total Concentration in discharge canal (ppm)[a]	Increase in concentration in Hudson River (ppm)[b]	Applicant's proposed limits for discharge canal (ppm)[o]
	Unit No. 1	Unit No. 2	Unit No. 3			
Sodium phosphate (as PO_4)	15	38	38	0.084	0.0047	1.5
Hydrazine	24[m]	1	1	0.0017	0.00009	0.1
Cyclohexylamine	2.5	2.4	2.4	0.004	0.0002	0.1
Lithium hydroxide (as Li)[d]	0.66	0.66	0.66	0.006	0.00037	0.01
Boric acid (as B)[d]	600	600	600	1.5[d]	0.083	9.0
Potassium chromate (as Cr)		30	30	0.05[k]	0.003[k]	0.05
Sodium hydroxide	156[o]	12[e]	12[e]	0.24[d]	0.013	
Sulfuric acid	450[n]			9.0	0.5	
Soda ash (as Na_2CO_3)	1,000[g]					5
Detergent[h]	3[i]			0.03	0.002	1
Copper (See Text)						
Zinc (See Text)						
Residual chlorine	73[j]	215[j]	215[j]	0.5[p]	0.026[q]	0.5
Chlorine reaction products	73[j]	215[j]	215[j]	0.5[p]	0.026[q]	

EXHIBIT A

Notes to Table V-2

[a]Based on 100,000 gpm flow in discharge canal.

[b]Based on 4,000 cfs (1.8×10^6 gpm) freshwater flow in Hudson River.

[c]ER, IP-3, p.10-8.

[d]Released only in case of evaporator breakdown of Unit #2 and Unit #3.

[e]Release at this rate for 2 hr/day once every four to seven days.

[f]A maximum of 20 lb/hr of concentrated sulfuric acid is used in the flash evaporation of river water for makeup water. The resultant blowdown has a pH of 7.0 to 8.5. No acid is discharged.

[g]Release at this rate for 12 hr two to four times a year. Reaction products neutralized prior to discharge.

[h]Colgate Low Foam detergent consisting of 26.5% sodium phosphate, 28% sodium sulfate, 10% sodium carbonate, 6% silicates, 15.5% benzene sulfate, 10% unspecified nonionics, and ~4% water, or Sears Biodegradable detergent.

[i]Release at this rate for 2 hr/day.

[j]See Text.

[k]Based on continuous system leakage and discharge of 25 gpm and an evaporator breakdown. All planned releases will be collected and processed prior to release.

[m]Released once/year.

[n]Released at this rate for 1 hr, once/day. A system is to be installed to neutralize this waste.

[o]120 lbs released once/day for hr. 36 lbs/day sustained release.

[p]Effluent chlorine conc. given as 0.5 mg/l, considers only dilution by other side of Unit 3.

[q]River concentration of 0.026 mg/l considers only river dilution, no river chlorine demand. Demand reactions are considered in Section 2.a(3).

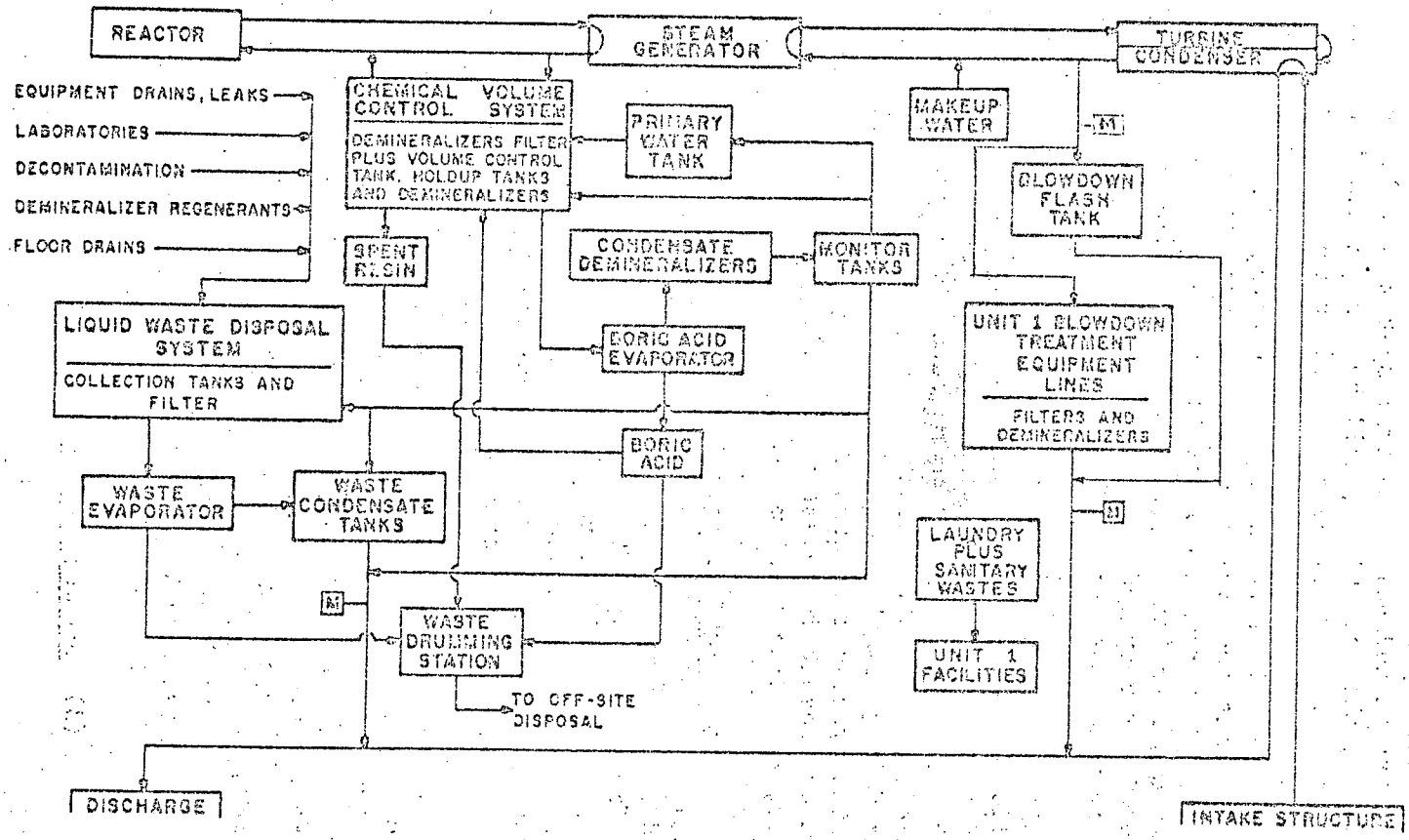

Fig. V-17 Liquid radioactive waste treatment systems for Indian Point Unit No. 3.