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Regulatory Docket File

RECEIVED 10-2-76 U.S. NUCLEAR REGULATORY COMMISSION Mail Section

September 23, 1976

RECEIVED OCT 2 1976 U.S. NUCLEAR REGULATORY COMMISSION Mail Section

Director of Nuclear Reactor Regulation
Attn: Mr. George W. Knighton, Chief
Environmental Projects Branch No. 1
Division of Reactor Licensing
United States Nuclear Regulatory Commission
Washington, D. C. 20555

RE: Docket No. 50-247

Dear Mr. Knighton:

In response to your letter dated March 26, 1976, received on March 31, 1976 and the accompanying list of questions to which you requested answers, we have attached hereto responses to questions A: 12, 14, 20, 21, 22, 23a, e, f, 25d and B: 3, 4, 5, 6.

With this set of responses, all requested additional information on "First Annual Report for the Multiplant Impact Study of the Hudson River Estuary," and other references related to the application for extension of operation with once-through cooling for Indian Point Unit No. 2, have been provided.

Sincerely yours,

William J. Cahill, Jr.

William J. Cahill, Jr.

jbw/klg

cc: Paul Shemin
Stephen Lewis
Michael Curley
Sarah Chasis

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Question A 12: The first line on page VI-57 refers to "NYU, unpublished data, 1973." Please supply these data.

Response: This data appears in an addendum to the "1973 Report - Hudson River Ecosystem Studies; Effects on Entrainment by the Indian Point Power Plant on Biota in the Hudson River Estuary," which was submitted to the Nuclear Regulatory Commission on September 7, 1976.

A copy of Table 21 from this report, Larval Striped Bass Length Frequency, is included.

Table 21

LARVAL STRIPED BASS LENGTH FREQUENCY

	RIVER				INTAKES				DISCHARGE			
Date	Mean (mm)	Mode* (mm)	Range (mm)	N**	Mean (mm)	Mode* (mm)	Range (mm)	N**	Mean (mm)	Mode* (mm)	Range (mm)	N**
5/15	-	-	-	-	4	4	2,7	456	4	4	2,6	165
5/22	-	-	-	-	5	6	3,7	31	6	5	2,18	74
5/29	7	7	2,10	177	4	3	3,10	33	5	6	2,8	17
6/5	5	5	2,8	403	4	4	2,8	731	4	4	2,10	1302
6/12	6	6	2,10	6277	6	7	2,8	855	7	7	2,13	1246
6/10	7	6	3,13	4802	8	8	3,20	2380	9	8,9	3,18	12741
6/26	8	8	4,17	2152	11	10	3,21	3622	11	10	3,25	22735
7/3	9	7	5,22	219	14	10	6,25	323	13	11,12	5,29	2499
7/10	15	10	8,30	45	21	25	7,34	145	17	10,11	5,37	862
7/17	11	10	6,28	18	17	11	7,41	69	14	12	7,38	332
7/24	28	34	10,43	11	25	33	10,43	38	15	12	7,40	46

* Mode of distribution based on percent of total catch for each date.

** The sample sizes given for each sample region should not be interpreted as a reflection of abundance because of variations in effort between regions.

Question A 14:

Provide figures illustrating the movement of tagged striped bass comparable to Figures VI-16, VI-17, and VI-18 (pp. VI-73, and VI-74) for tagged white perch.

Response:

Figure 1 presents recapture information for Hudson River striped bass tagged with Floy fingerling tags and recaptured between 1 June and 15 September 1974. Data from which this figure was prepared are presented in Table 1. No fish tagged with fingerling tags (i.e., fish $<$ 250 mm TL) were both tagged and recaptured within the Hudson River during this interval in 1973 or during the intervals 1 January - 31 May (1973 and 1974) and 16 September - 31 December (1973). Figure 2 presents recapture information for striped bass tagged with internal anchor tags (fish $>$ 250 mm TL). Fish in this group ranged from 492 to 980 mm TL. All were tagged and recaptured during the interval 1 January - 31 May (1973 and 1974). No fish tagged with internal anchor tags were both tagged and recaptured within the Hudson River during any other interval.

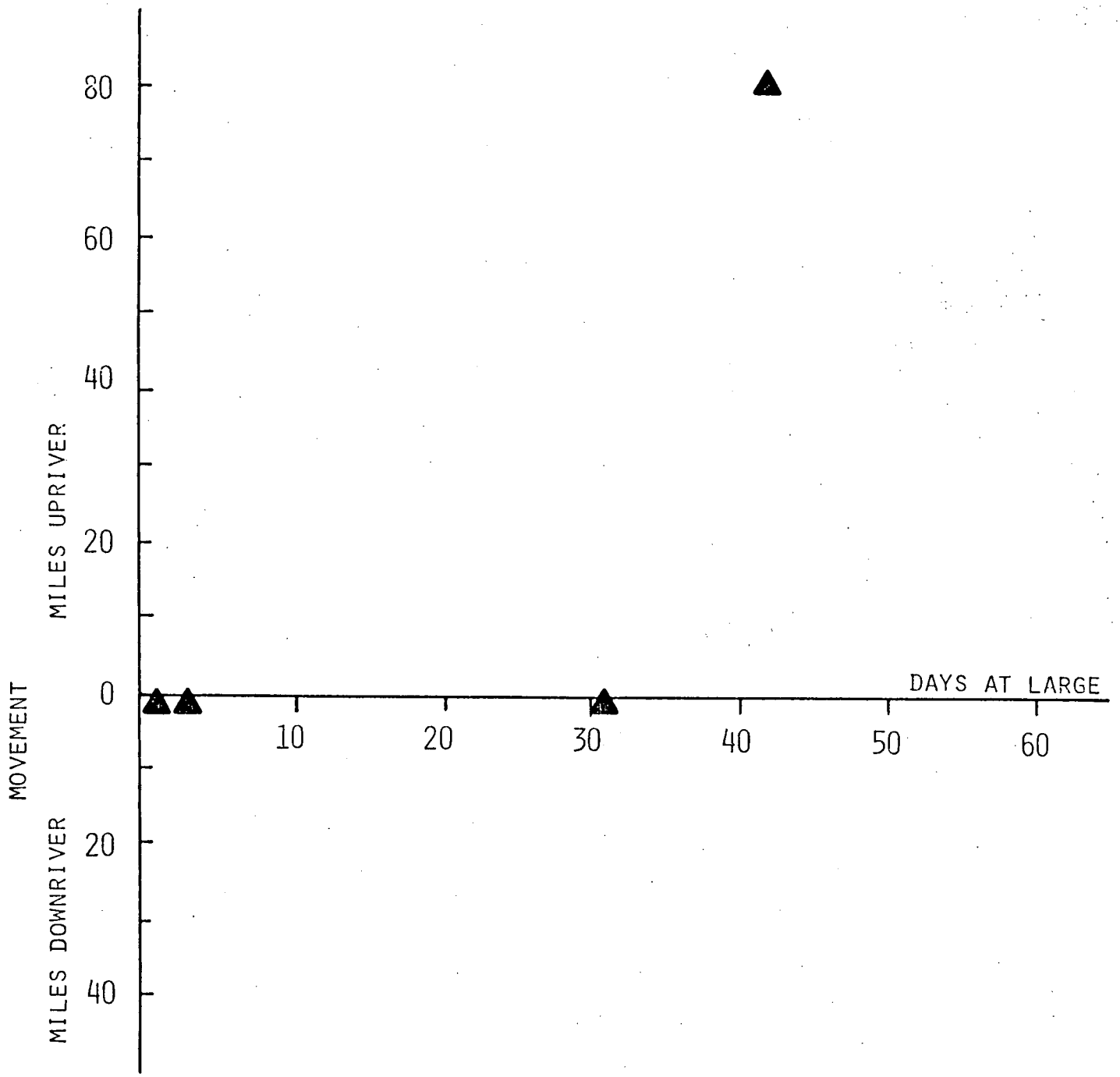

Figure 1

Movement of Tagged Striped Bass (<250 mm Total Length) in the Hudson River during Period 1 June - 15 September 1974. All fish were marked and released in Area 2 (RM 39-46).

Table 1

Release and Recapture Data for Striped Bass (<250 mm Total Length) Tagged with Floy Fingerling Tags and Released in the Hudson River 1 June - 15 September 1974

Tag #	Release		Recapture		Days at Large	Miles Traveled[1]
	RM	Date	RM	Date		
7495	43	7-12-74	42	7-13-74	1	1-D
7498	43	7-12-74	42	7-15-74	3	1-D
6753	43	7-11-74	42	8-11-74	31	1-D
6793	43	7-11-74	124	8-22-74	42	81-U

[1]D designates recapture downstream from release site.

U designates recapture upstream from release site.

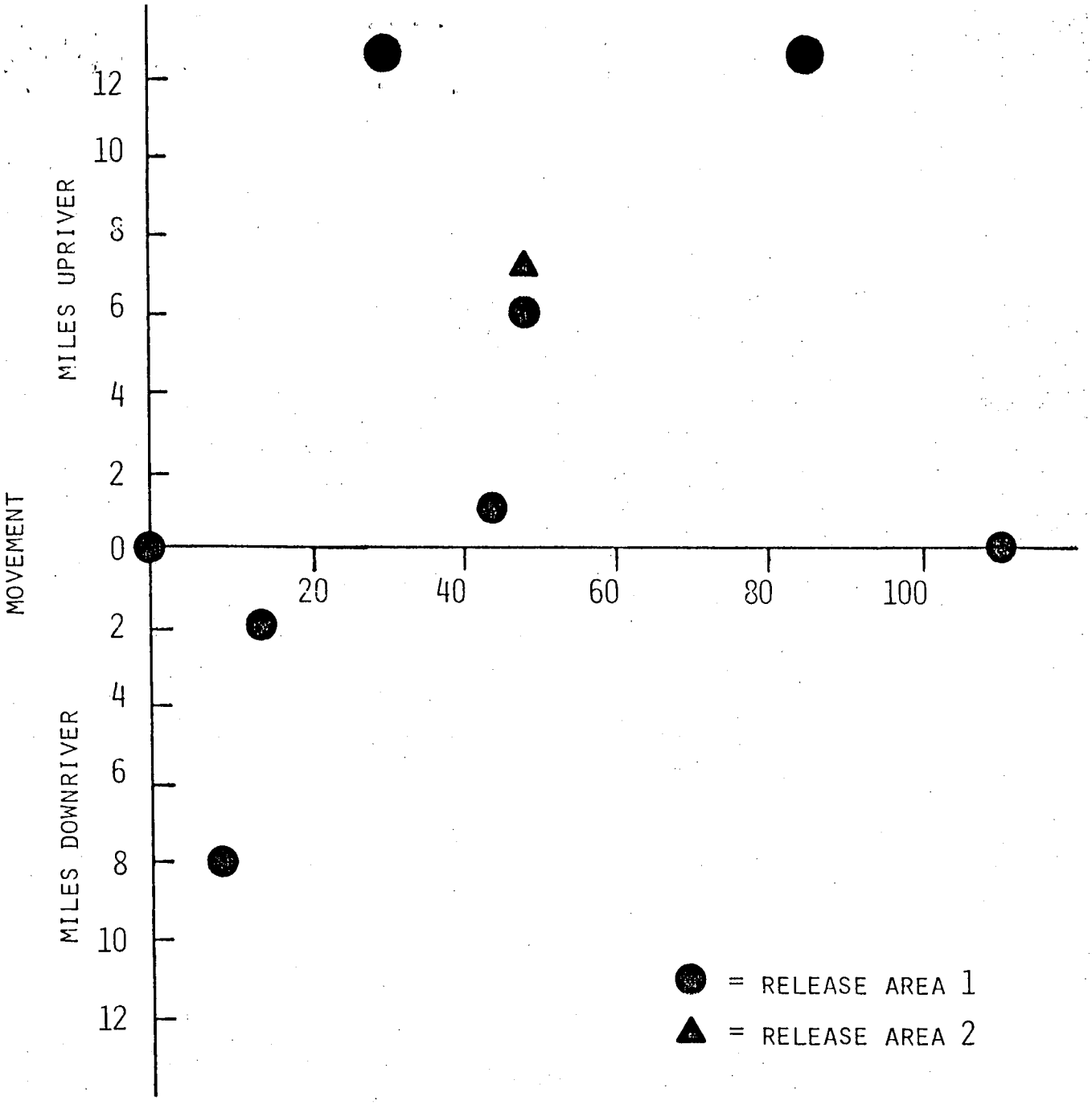

Figure 2

Movement of Striped Bass >250 mm Total Length Tagged with Internal Anchor Tags and Released in Hudson River 1 January - 31 May (1973 and 1974).

Table 2

Release and Recapture Data for Striped Bass (>250 mm Total Length) Tagged with Internal Anchor Tags and Released in the Hudson River 1 January - 31 May (1973 and 1974)

Tag #	Release		Recapture		Days at Large	Miles Traveled [1]
	RM	Date	RM	Date		
3014	34	3-14-73	34	3-14-73	0	0
3018	34	1-3-73	34	4-23-73	111	0
3058	33	3-9-73	39	4-27-73	49	6-U
3059	33	3-9-73	34	4-23-73	45	1-U
3196	33	4-3-73	31	4-17-73	14	2-D
3502	32	3-13-73	39	5-1-73	49	7-U
1276	42	4-23-74	34	5-2-74	9	8-D

[1] D designates recapture downstream from release site.

U designates recapture upstream from release site.

Question A 20:

Provide additional detailed discussion of the rationale for choosing among the various population estimates for striped bass and white perch for purposes of estimation of impingement impact (pp. VII-32 - VII-34).

Response:

Of the assumptions which must be met for a valid mark and recapture estimate of population size (Ricker, 1975), the assumption of random mixing of marked and unmarked individuals is most frequently violated in a water system such as the Hudson River. A violation of this assumption is particularly critical when rate of recapture is as low as it is in the Hudson River (usually 1%). Random mixing is assumed to be complete when the ratio of marked:unmarked fish in the catch remains essentially constant. A declining ratio through time for a given mark after terminating application of that mark indicates that random mixing is not yet complete; such a decline has been observed to occur for a period of up to two months. Adjustments for differential short-term mortality of marked fish (Table F-2, p. F-18) have been made and there is no reason to believe that additional mortality of marked fish is responsible for the observed change in ratio. An additional complication to the use of recapture data shortly after the application of mark is that recapture rate may be inflated by behavioral phenomena: lethargy of marked fish or homing of marked fish to the site of capture. The dispersal of marked fish into the unmarked population could be delayed by a lethargy induced by the physiological stress of capture and marking. Homing of marked fish may also be responsible for an initially inflated recapture rate; although marked fish are released away from the site of their capture, a few marked individuals homing to the site of capture and recaptured immediately would be sufficient to bias the marked:unmarked ratio when the total number of recaptures is small.

One solution to the problem of random mixing is to distribute recapture effort proportionally to the number of fish present in the various areas of water sampled. This is at least partially accomplished by the beach seine sampling regime in which samples are distributed roughly proportionally to abundance of fish in the shore zone (particularly striped bass young-of-the-year). However, an unknown proportion of the population is found in deeper water where such sampling is not as effective. As an additional solution to non-random mixing, the recapture period was delayed for up to six months after marking to allow greater mixing in the population. This alternative is feasible as long as mortality of marked and

unmarked fish is equal and marks are not lost.

The Petersen method allows such a delay in recapture effort, and therefore the results of the Peterson estimates were considered more reliable than those from the multiple census method (Schumacher-Eschmeyer method). The delay in recapture effort for striped bass probably need not be as long as for white perch. Young-of-the-year striped bass appear to be more errant than white perch and appear to disperse downriver to the area of salt intrusion near Croton and Haverstraw Bays and below during their first year. The estimates for striped bass from fall and spring recapture periods are similar when one considers their variances. Movement of young-of-the-year white perch differs from that of striped bass; many remain in the upper reaches of the river where sampling is not as intense as in the lower Hudson River (RM 12-62). Therefore, mixing is expected to be more rapid for striped bass than for white perch.

The estimate of 7,824,000 young-of-the-year white perch, based on spring recaptures, is probably more reliable that that of 1,992,000, based on fall recaptures for the reasons stated above. Thus the former estimate was chosen for use in impact estimation. The same conclusions are also applicable to estimates of yearling and older white perch population sizes. (Table VII-9, p. VII-33).

Literature Cited

Ricker, W.E. 1975. Computation and Interpretation of Biological Statistics of Fish Populations. Fisheries Research Board of Canada, Bulletin 191. 382 pp.

Question A 21:

For each estimate in Tables VII-9 and VII-10 (pp. VII-33 and VII-34), provide a table, similar to Table F-2 (p. F-20), but including as additional entries (a) number marked, not adjusted for 14-day handling mortality; (b) total number of marks recaptured, both with and without impingement; and (c) total number (marked and unmarked combined) captured during recovery period, both with and without impingement. Include any other information needed to reconstruct the estimates. For young-of-the-year white perch, provide data including fin-clipped individuals.

Response:

Information requested concerning Peterson estimates was submitted to the NRC Staff on August 6, 1976. Tables 1, 2 and 3 provide mark-recapture data used to generate Schumacher-Eschmeyer estimates of young-of-the-year white perch, young-of-the-year striped bass and yearling and older white perch populations, respectively, as presented in tables VII-9 and VII-10 of the First Annual Report for the Multiplant Impact Study. All three estimates were made using impingement collection data. However, no recaptures occurred by means of impingement during the period within which these estimates were made. Both white perch estimates were made using all fin clip types.

The original estimate of 1,549,000 young-of-the-year white perch, presented in Table VII-9 of the Multiplant Report, is in error as a consequence of errors in the adjustment applied to the numbers of marked fish for mortality. The revised estimate made using corrected figures is 1,544,000. Both the numbers used in generating the original estimate and the corrected numbers are presented in Table 1.

The original estimate of 1,367,000 yearling and older white perch presented in Table VII-9 of the Multiplant Report is in error. During one time interval, the adjustment for mortality applied to the number of marked fish was incorrect (Table 3). Furthermore, the recapture of a single marked fish during one interval was overlooked at the time the original estimate was made. The revised estimate made using corrected figures is 1,308,000. Both the numbers used in generating the original estimate and the corrected numbers are presented in Table 3.

Although re-examination of mark-recapture data has resulted in the revision of two of the Schumacher-Eschmeyer population estimates, both revised values fall within the 95% confidence intervals presented for the original estimates. Since Schumacher-Eschmeyer estimates were considered less reliable than Petersen estimates, none of these values were used for impact estimation in the Multiplant Report.

Table 1

Data used to generate a Schumacher-Eschmeyer estimate of 1,549,000 young-of-the-year white perch in the Hudson River estuary[a] for fall of 1973, as presented in Table VII-9 of the First Annual Report for the Multiplant.

Weekly Interval[b]	Number Examined(C)		Number Recaptured(R)		Cumulative Number Marked(M)[c] (Adjusted)	Cumulative Number Marked[d] (Unadjusted)
	Total	Impingement	Total	Impingement		
8/12	1279	540	0	0	3	3
8/19	1355	356	0	0	238	255
8/26	1610	158	0	0	556	596
9/2	952	1	1	0	994	1045
9/9	2105	21	3	0	1689	1752
9/16	2305	65	9	0	2853	2937
9/23	1853	11	6	0	4063	4169
9/30	2373	2	3	0	5185(5178)	5290
10/7	2235	3	6	0	6422(6401)	6514
10/14	1323	6	0	0	7057(7031)	7143
10/21	1144	8	1	0	7281(7248)	7361
10/28	2132	21	33	0	8376(8336)	8450
11/4	1544	320	1	0	9378(9339)	9453

[a] River miles 12-62 (km 19-99) only

[b] Mid-August-Mid-November 1973

[c] Adjusted for 14-day mortality; cumulative total at mid-point in interval; figure in parentheses represents a correction of the original value which was in error.

[d] Unadjusted cumulative total at mid-point in interval

Table 2

Data used to generate Schumacher-Eschmeyer estimate of 1,641,000 young-of-the-year striped bass in the Hudson River estuary[a] for fall of 1973, as presented in Table VII-10 of the First Annual Report for the Multiplant.

Weekly Interval[b]	Number Examined(C)		Number Recaptured(R)		Cumulative Number Marked(M)[c] (Adjusted)	Cumulative Number Marked[d] (Unadjusted)
	Total	Impingement	Total	Impingement		
8/19	1604	15	0	0	191	254
8/26	1857	16	2	0	620	825
9/2	637	4	2	0	1070	1331
9/9	2769	1	2	0	1609	1870
9/16	2461	2	13	0	2970	3231
9/23	1782	7	6	0	4592	4853
9/30	1858	0	3	0	5741	6002
10/7	908	1	8	0	6527	6788
10/14	1227	5	7	0	6820	7081
10/21	872	4	0	0	6959	7220
10/28	2870	5	18	0	8191	8452
11/4	1422	35	2	0	9357	9618

[a] River miles 12-62 (km 19-99) only

[b] Mid-August-Mid November 1973

[c] Adjusted for 14-day mortality; cumulative total at mid-point in interval

[d] Unadjusted cumulative total at mid-point in interval

Table 3

Data used to generate Schumacher-Eschmeyer estimate of 1,367,000 yearling and older white perch in the Hudson River estuary[d] for fall of 1973, as presented in Table VII-9 of the First Annual Report for the Multiplant.

Weekly Interval[b]	Number Examined(C)		Number Recaptured(R)		Cumulative Number Marked(M)[c] (Adjusted)	Cumulative Number Marked[d] (Unadjusted)
	Total	Impingement	Total	Impingement		
9/2	142	0	0	0	0	0
9/9	1216	2	0	0	14	16
9/16	232	6	0	0	18	20
9/23	760	1	1	0	100(114)	135
9/30	447	2	0	0	315	354
10/7	625	2	0	0	598	646
10/14	345	4	0	0	921	981
10/21	1083	6	0	0	1359	1433
10/28	1820	15	0	0	2398	2514
11/4	726	22	1	0	3287	3435
11/11	1575	34	13(14)	0	3883	4030
11/18	565	20	6	0	4640	4788
11/25	503	3	0	0	5121	5268
12/2	1733	3	1	0	5316	5464

[a] River miles 12-46 (km 19-74) only; listed incorrectly as RM 12-62 (km 19-99) in Multiplant Report.

[b] September-November 1973

[c] Adjusted for 14-day mortality; cumulative total at mid-point in interval; figure in parentheses represents a correction of the original value which was in error.

[d] Unadjusted cumulative total at mid-point in interval

[e] Figure in parentheses represents a correction of the original value which was in error.

Question A 22:

In the estimation of impingement impact on white perch, juvenile and older white perch were combined (pages VII-35 - VII-36). Nonetheless, independent population estimates are available for young-of-the-year and yearling white perch, and suppositions can be made concerning the age of impinged white perch. Assume (a) all impinged fish are young-of-the-year, (b) all impinged fish are yearlings or older, (c) the ratio of young-of-the-year, white perch to yearling or older white perch in the impinged population is identical to the ratio of population size estimates of the two groups. For each of these three assumptions, (a) recalculate the impingement impact estimates separately for the 1972 and the 1973 year classes of white perch, (b) derive a formula similar to the one on page VII-43, and (c) assuming that impacts on yearling and older white perch in the 1973 year class would be the same as those on yearling and older white perch in the 1972 year class, provide estimates of the overall multiplant impact on the 1973 year class as a result of impingement over the two year period.

Response:

None of the three assumptions listed above indicate the actual situation that exists with respect to age composition of impinged white perch. However, since the vast majority of impinged fish are young-of-the-year, it is felt that comparison to the young-of-the-year standing crop represents the "best estimate" of impingement impact for these fish. Table VII-9 has the necessary information to recalculate this impact as described.

Question A 23:

With respect to the analysis of stock-recruitment relationships beginning on p. VIII-2:

a. Provide an analysis and discussion of results of the striped bass stock-recruitment relationships with recruitment measured 4, 5, and 6 years after stock.

e. Provide an explanation for the availability of gear data and American shad landings data for 1949, 1950, 1951 and 1954 but the unavailability of striped bass and white perch landings data for these four years (see Table V-1, p. V-6).

f. Discuss the method of collection and reliability of the landings data and effort data used in these stock-recruitment analyses.

Response:

a. Table 1 provides catch-per-unit effort (CPUE) data for Hudson River striped bass from 1931-1972. These have been taken from Table V-1 of the "First Annual Report for the Multiplant Impact Study." Data are tabulated to allow comparisons between landings from any year (t) and landings from 4 (t + 4), 5 (t + 5) and 6 (t + 6) years later. Examination of these data reveals a sharp increase in CPUE in 1955 which continued through 1972. Since it is likely that at least a portion of the increase was due to a change in fishing efficiency associated with a transition from linen to nylon netting in the mid 1950's, it appears best to examine post-1954 data separately from pre-1954 data in attempting to identify stock-recruitment relationships.

Simple linear regression and correlation analyses were used to examine the relationship between striped bass CPUE in each year since 1955 and CPUE 4, 5 and 6 years later. In each case, the relationship was inverse; i.e., low CPUE at time t was associated with a higher CPUE at t + 4, t + 5 and t + 6 (Table 2). The correlations between CPUE at t and t + 4 ($r = -0.710$) and CPUE at t and t + 5 ($r = -0.811$) were significant at the $a = 0.01$ level; that between CPUE at t and t + 6 ($r = -0.24$) was not significant at the $a = .05$ level. The inverse relationship between CPUE at times t and t + 4, t + 5 and t + 6 years suggests the activity of density dependent mechanisms within the Hudson River striped bass stock. Thus, relatively low spawning stocks, as indexed by CPUE, may produce relatively high stocks after a several year lag. The strong correlation

between CPUE at time t and t + 5 is in accord with the preliminary findings that most Hudson River female striped bass mature and spawn for the first time at 5 years of age. However, more detailed examination of stock-recruitment will require information on the age composition of the commercial catch. It is likely that 3 and 4 year old fish contribute significantly to the commercial catch from which the CPUE index is generated, and this contribution may be responsible for the relatively strong correlation between CPUE at time t and t + 4.

Response:

e. Commercial catch data and information on fishing effort within New York State has historically been compiled by the National Marine Fisheries Service (NMFS) and its predecessor agency, the Bureau of Commercial Fisheries. The catch of species from the Hudson River, (other than American shad) represents a small proportion of total New York State landings; the greatest proportion come from Long Island Sound and coastal Atlantic waters which constitute the New York Marine District. Total New York catch statistics are published annually (with a 2-3 year lag time) in "Fisheries Statistics of the U. S." Landings from the New York Marine District have been published separately since 1954 in the series called "New York Landings" which is published monthly. While shad landings from the Hudson River are sizable, and therefore published separately in the Fisheries Statistics of the U. S., landings of species other than shad are not published for the Hudson River, but added to those from the New York Marine District to produce the New York State total. Records of Hudson River landings are subsequently maintained only informally in the records of the compiling agency and sometimes in the records of the New York State Department of Environmental Conservation (NYDEC). Mr. Fred Blossum, New York NMFS officer, was able to glean from those files catch and fishing effort data for all years from 1931 through the present time, with the exception of 1942, 1949, 1950, 1951 and 1954. Further efforts by Mr. Blossum, as well as by other NMFS personnel in Maryland and Washington, D. C., have been unsuccessful in locating data from 1942, 1949, 1950 and 1951. Data from 1954 have tentatively been located. Personnel from the NYDEC are presently reviewing their files in an attempt to locate records from earlier years which were used to generate published New York totals.

Response:

f. The accuracy of catch and effort data for the Hudson River commercial fishery is limited by procedures used in their acquisition. Data are compiled presently by personnel of the National Marine Fisheries Service from information supplied by the fishermen. Information on catch-by-species during the preceding year is requested at the time of application for annual commercial licenses in the state of New York. However, no supporting evidence is required and in past years, fishermen who failed to provide any catch information nevertheless received new licenses. In addition to failures to report catch at all the possibility exists that landings reported are in error, either because the fisherman failed to keep accurate records, or because of intentional misrepresentation to reduce taxation. As a consequence of the above biases, catch tallies taken from these records are likely to underestimate actual catch. Methods used to adjust catch records for these biases have varied among compiling agents and are undocumented.

The effort index used is a function of square yardage of gill net licensed for the Hudson River and maximum weekly hours of fishing allowed. Square yardage of nets licensed for the Hudson River is estimated by the National Marine Fisheries Service from information provided on license applications. Regular commercial licenses in New York are issued on the basis of lineal feet of net; special shad licenses are issued on a per net basis with only maximum length established. In neither case is net depth reported. For nets licensed on a lineal-foot basis, total square yardage is estimated by multiplying lineal feet by depth of typical nets employed by fishermen. For nets licensed on an individual basis, no dimensions are reported on license applications and total square yardage is estimated as the product of number of nets licensed and square yardage of typical nets found to be in use. Therefore, square yardage of gill net reported is only an approximation.

The effort index employed assumes that all licensed nets are fished for the maximum allowable time all season. This undoubtedly provides an overestimation of fishing effort. Actual effort varies from year to year with weather conditions, economic factors and fishing success. Furthermore, all units are not used with equal efficiency.

Ability varies among fishermen. There is also a likelihood that gill net efficiency was affected by the transition from linen to nylon netting which occurred during the mid-1950's but the magnitude of the effect is uncertain and probably varied among species of fish. No information is presently available by means of which these factors affecting the fishing effort index may be quantified.

In addition to the inherent errors indicated above, the possibility exists that transcriptional errors may have appeared in the available records. Medeiros (1974) examined American shad catch and effort data reported for the Hudson River and reported discrepancies which he felt represented recording or copying errors incorporated as records were prepared for publication.

Table 1

Catch-Per-Unit-Effort (CPUE) for Hudson River Striped Bass from 1931-1972 as Taken from Table V-1 of the "First Annual Report for the Multiplant Impact Study" (Volume I)

Time (X)		Time (X+4)		Time (X+5)		Time (X+6)	
Year	CPUE	Year	CPUE	Year	CPUE	Year	CPUE
1931	147	1935	489	1936	395	1937	363
32	106	36	395	37	363	38	258
33	290	37	363	38	258	39	389
34	190	38	258	39	389	1940	484
35	489	39	389	1940	484	41	307
36	395	1940	484	41	307	42	-
37	363	41	307	42	-	43	346
38	258	42	-	43	346	44	477
39	389	43	346	44	477	45	674
1940	484	44	477	45	674	46	348
41	307	45	674	46	348	47	277
42	-	46	348	47	277	48	262
43	346	47	277	48	262	49	-
44	477	48	262	49	-	1950	-
45	674	49	-	1950	-	51	-
46	348	1950	-	51	-	52	591
47	277	51	-	52	591	53	485
48	262	52	591	53	485	54	-
49	-	53	485	54	-	55	1897

Table 1 (Cont'd)

Time (X)		Time (X+4)		Time (X+5)		Time (X+6)	
Year	CPUE	Year	CPUE	Year	CPUE	Year	CPUE
1950	-	1954	-	1955	1897	1956	2550
51	-	55	1897	56	2550	57	2456
52	591	56	2550	57	2456	58	2479
53	485	57	2456	58	2479	59	3985
54	-	58	2479	59	3985	1960	4089
55	1897	59	3985	1960	4089	61	2372
56	2550	1960	4089	61	2372	62	1670
57	2456	61	2372	62	1670	63	2039
58	2479	62	1670	63	2039	64	1378
59	3985	63	2039	64	1378	65	1952
1960	4089	64	1378	65	1952	66	2842
61	2372	65	1952	66	2842	67	3595
62	1670	66	2842	67	3595	68	3397
63	2039	67	3595	68	3397	69	4852
64	1378	68	3397	69	4852	1970	2608
65	1952	69	4852	1970	2608	71	1743
66	2842	1970	2608	71	1743	72	1213
67	3595	71	1743	72	1213		
68	3397	72	1213				
69	4852						
1970	2608						
71	1743						
72	1213						

Table 2

Results of Simple Linear Regression and Correlation Procedures Applied to Catch-Per-Unit-Effort Data for Hudson River Striped Bass from 1955-1972 Comparisons

CPUE

Comparison	Slope	Intercept	r	df	P(2 tailed t)
t vs t + 4	-0.90	5058	-0.710	12	0.996
t vs t + 5	-1.05	5281	-0.811	11	0.999
t vs t + 6	-0.30	3217	-0.237	10	0.548

Literature Cited

Medeiros, W.H. 1974. The Hudson River shad fishery: background, management problems and recommendations. New York Sea Grant Institute. NYSSGP-RS-75-011. State University of New York, Albany, New York.

Question 25 d:

Explain the logic of using June temperatures as opposed to July and/or August temperatures in the partial correlation analysis relating July to August growth with density of young-of-the-year.

Response:

The month whose mean temperature produced the largest simple correlation coefficient (See Table 1, row $r_{a,c}$) was chosen for the analysis discussed in pages VIII-8 through VIII-12. When the variation due to June temperature is removed by partial correlation, the partial correlation coefficient is by far the largest for the months tested (See table 1 row $r_{a,b \cdot c}$).

The partial correlation coefficient of a and b, holding c constant, is calculated by:

$$r_{a,b \cdot c} = \frac{r_{a,b} - (r_{a,c} \cdot r_{b,c})}{\sqrt{(1 - r_{a,b}^2)\ (1 - r_{b,c}^2)}}$$

where

a is mean catch per unit area in July and August (c/f or CPUA)

b is July to August growth

c is monthly mean minimum temperatures

Table 1

Simple and Partial Correlation Coefficients for Striped Bass

	May	June	July	August
$r_{a,b}$	-0.719	-0.719	-0.719	-0.719
$r_{a,c}$	-0.336	-0.387	-0.230	0.218
$r_{b,c}$	0.221	-0.174	-0.072	-0.489
$r_{a,b \cdot c}$	-0.702	-0.866	-0.758	-0.719
r^2	0.49	0.75	0.57	0.52

Question B3:

Provide titles and date of availability for all reports relevant to aquatic biota of the Hudson River expected during 1976.

Response:

A listing of all reports, including those that have already been submitted to the NRC, appears on the following pages.

Report Title	Expected Availability Date
I. Texas Instruments Incorporated:	
1. Bluefish Predation In The Lower Hudson River February 1976	2/76 *
2. Fisheries Survey of the Hudson River Vol. IV (March - December 1973) (Revised edition dated June 1976)	6/76 *
3. Hudson River Ecological Study - in the area of Indian Point - Thermal Effects Report	9/76
4. 1974 Year-Class Report for the Hudson River Estuary	11/76
5. A Review Of Pumped-Storage Hydro-electric Projects And Associated Environmental Studies	11/76
6. A Synthesis of Available Data Pertaining to Major Physicochemical Variables Within The Hudson River Estuary - Emphasizing The period from 1972 through 1975	11/76
7. 1974 and 1975 Gear Evaluation Studies	12/76
8. Indian Point Impingement Study Report for the period 1 January 1975 through 31 December 1975	11/76
9. Report On Relative Contribution Of Hudson River Striped Bass To The Atlantic Coastal Fishery	12/76
10. 1975 Cornwall Transect Data Display	8/76
11. Hudson River Ecological Study - in the area of Indian Point - 1975 Annual Report	12/76
12. Feasibility of Culturing and Stocking Hudson River Striped Bass 1975 Annual Report	12/76

Report Title	Expected Availability Date
13. Final Artificial Propagation Overview Report (1973-1975)	3/77
II. New York University:	
1. An Addendum to the 1973 Hudson River Ecosystem Studies	
A. Larval Striped Bass (*Morone saxatilis*) Length Frequency Analysis - (Oct. 1974 - Draft)	8/76 *
B. A Preliminary Analysis of the Abundance of Four Life History Stages of Striped Bass (*Morone saxatilis*) collected in the Intakes of Indian Point Unit 1 and in the Hudson River in Front of Indian Point (December 1974 - Draft)	
Revised Addendum dated March 1975 Final Report dated August 1976	
2. Effects of Entrainment by the Indian Point Power Plant on Biota in the Hudson River Estuary - Progress Report for 1974 (February 1976)	2/76 *
3. Mortality of Striped Bass Eggs and Larvae in Nets (A Special Report) (July 1976)	7/76 *
4. The Effects of Temperature and Chlorine on Entrained Hudson River Organisms (June 1976)	7/76 *
5. The Effects of Changes in Hydrostatic Pressure on Some Hudson River Biota - Progress Report for 1975 (July 1976)	7/76*
6. Cytogenetic Study Of The Striped Bass (*Morone saxatilis*) From The Hudson River	9/76

Report Title	Expected Availability Date
7. Effects of Entrainment by the Indian Point Power Plant on Biota in the Hudson River Estuary - Progress Report for 1975	–
III. Lawler, Matusky & Skelly Engineers	
Report on 1974 Data Analysis and Application of Real-Time Model of The Hudson River Striped Bass Population	–
IV. Edenton National Fish Hatchery	
The Rearing Of Hudson River Striped Bass At The Edenton National Fish Hatchery 1975	–
V. LaSalle Hydraulic Laboratory	
Cornwall Pumped Storage Scheme Hydraulic Model Study of Hudson River Flows Around Screen Structure (July 1976)	7/76 **
VI. Stone & Webster Engineering Corporation	
Final Report Indian Point Flume Study Consolidated Edison Company of New York, Inc. (July 1976)	7/76 *
VII. UMA Engineering Pacific, Inc.	
Striped Bass Rearing Experiments 1975	10/76
VIII. University of Rhode Island	
1. Life Stage Duration Studies on Hudson River Striped Bass, *Morone saxatilis* (Walbaum)	9/76

Report Title	Expected Availability Date
2. Racial Investigation of the Striped Bass (*Morone saxatilis*) Using Critical Scale Analysis, Phase II	11/76

* Report already submitted to the Nuclear Regulatory Commission

** Report submitted to Federal Power Commission

\- Availability date to be determined

Question B4:

Provide the following comparisons of observed and simulated distributions for each striped bass young-of-the-year life stage considered in the particular model using the 1973 data, the 1974 data, and the 1975 data.

a. Completely mixed model (version sent to ORNL in January 1976). Provide comparisons of temporal distributions, i.e., graphs of total standing crop in the estuary versus week.

b. Tidal-averaged, one dimensional transport model (version sent to ORNL in January 1976). Provide comparisons of temporal distributions, as in Item a above. Provide comparisons of longitudinal distributions, i.e., graphs of density versus river mile, at biweekly intervals (1973 data) or weekly intervals (1974 and 1975 data) from May 1 through August 31.

c. Real-time, two-dimensional model. Provide comparisons comparable to those requested in Item b above.

For each of the models provide a clear documentation of all of input parameter values used in the model runs generating the simulations presented.

Response:

At the present time, all simulations of the young-of-the-year growth and distributional patterns are performed using the real-time model. The completely mixed and transport models are no longer used for these purposes. Therefore, comparisons involving these models would not represent current project efforts.

The comparison of field data and real-time model output for 1973, 1974 and 1975 data will be presented in the environmental report accompanying the request for the deletion of the closed cycle cooling requirement at Indian Point Unit No. 2 (January 1977). Comparisons are not yet available, and meaningful results cannot be presented until further evaluation of parameters and model results are completed. Submission of incomplete results to the NRC Staff may cause significant misinterpretation regarding the accuracy of the real-time model.

Question B.5:

Tables A-2.1 through A-2.10 (pp. A-8 through A-13) in "Indian Point Impingement Study Report for the Period 15 June 1972 through 31 December 1973," Texas Instruments, December 1974, provide data on average weights and lengths by week and by power plant unit at Indian Point for each of the major species of fish impinged. Provide data on the range and standard deviation of the lengths of striped bass and white perch for each value of average length given in these tables.

Response:

The attached tables include weekly, monthly, seasonal and yearly average lengths (in mm) for white perch and striped bass impinged at Indian Point and recorded by Texas Instruments in 1972-1973 and the standard deviations and ranges associated with each. The number of fish used to determine the averages is not usually the same as the number impinged during the period because not all fish were measured (See page II-3 of Impingement Study Report for 15 September 1972 through 31 December 1973). Weeks are as identified in Table A-1.0, i.e., the first week being 1-7 January. Seasons are defined on page II-6 and are used here as:

Winter	1 January	-	19 March
Spring	20 March	-	17 June
Summer	18 June	-	17 September
Fall	18 September	-	31 December

Some mean lenghts reported here are slightly different from those published in the report. These deviations result from continuing efforts to identify and correct errors in data transcription.

Texas Instruments began impingement monitoring in May 1972. Therefore, data for the Spring of 1972 are incomplete. For this reason no seasonal (Spring) information was included in Table A-2.9. However, in this response, we are including the limited data that were collected as an indication of Spring values.

UNIT 1 YEAR 1972

WEEKLY LENGTH AVERAGES, STANDARD DEVIATIONS AND RANGES

	WHITE PERCH					STRIPED BASS				
WEEK	NUMBER	AVERAGE	STD. DEV.	MIN -	MAX	NUMBER	AVERAGE	STD. DEV.	MIN -	MAX
21	28	77.6	4.6	67.	84.	0	0.0	0.0	00	0.
22	251	74.5	17.3	47.	200.	0	0.0	0.0	0.	0.
23	409	72.4	18.7	44.	197.	0	0.0	0.0	0.	0.
24	229	78.1	24.2	39.	191.	5	96.4	26.0	79.	148.
25	64	130.1	53.8	48.	221.	1	45.0	0.0	45.	45.
26	71	110.0	47.6	66.	200.	2	141.0	31.0	110.	172.
27	44	131.3	45.1	48.	200.	3	129.7	23.0	98.	152.
28	58	170.8	37.0	67.	222.	0	0.0	0.0	0.	0.
29	149	177.4	23.0	63.	209.	5	198.4	20.3	162.	225.
30	48	165.0	38.1	59.	205.	36	178.0	44.6	65.	263.
31	103	157.8	43.7	54.	263.	80	165.2	42.7	90.	280.
32	418	130.1	51.9	22.	215.	165	159.2	57.4	47.	411.
33	588	124.1	47.1	39.	216.	181	157.4	60.0	54.	327.
34	225	137.6	53.6	39.	246.	56	180.3	68.5	54.	312.
35	323	140.6	55.5	43.	235.	72	180.0	81.3	47.	370.
36	366	138.6	56.6	38.	312.	128	177.2	77.5	34.	305.
37	346	107.6	62.7	40.	260.	80	170.3	80.4	51.	296.
38	381	102.4	58.4	41.	210.	80	144.9	91.3	40.	319.
39	399	80.5	47.0	41.	238.	49	136.8	88.6	48.	299.
40	710	84.8	50.5	40.	254.	100	128.8	89.0	50.	387.
41	1074	78.5	42.1	40.	236.	137	89.3	54.4	46.	340.
42	1013	69.6	33.0	32.	218.	82	117.3	71.7	50.	304.
43	1322	61.3	20.2	35.	223.	87	95.0	46.7	49.	260.
44	532	63.2	27.7	40.	263.	14	97.6	53.7	50.	255.
45	519	63.2	23.7	43.	215.	23	102.3	39.8	60.	229.
46	1012	64.3	26.0	40.	220.	48	105.0	27.7	58.	175.
47	1290	59.8	16.4	40.	201.	29	111.6	37.4	56.	196.
48	889	60.5	19.2	34.	209.	33	104.2	34.7	63.	203.
49	555	67.9	23.8	40.	230.	29	128.9	45.3	72.	226.
50	698	69.3	22.5	45.	210.	16	118.7	33.1	80.	193.
51	466	79.9	29.9	48.	206.	26	145.8	49.1	82.	267.
52	426	75.7	33.3	45.	209.	13	123.3	42.3	72.	204.

UNIT 1 YEAR 1972

MONTHLY LENGTH AVERAGES, STANDARD DEVIATIONS AND RANGES

	WHITE PERCH					STRIPED BASS				
MONTH	NUMBER	AVERAGE	STD. DEV.	MIN -	MAX	NUMBER	AVERAGE	STD. DEV.	MIN -	MAX
5	169	75.6	19.6	47.	200.	0	0.0	0.0	0.	0.
6	883	81.2	31.7	39.	221.	8	101.1	38.3	45.	172.
7	319	166.5	36.6	48.	222.	59	179.4	44.0	65.	269.
8	1593	132.6	51.6	22.	263.	481	164.4	62.4	47.	411.
9	1577	106.2	59.7	38.	312.	355	160.8	85.1	34.	319.
10	4509	70.8	36.1	32.	254.	405	105.8	67.8	46.	387.
11	3672	62.0	22.2	40.	263.	132	104.8	34.9	50.	229.
12	2328	71.8	27.1	34.	230.	96	126.2	44.8	71.	267.

UNIT 1 YEAR 1972

SEASONAL LENGTH AVERAGES, STANDARD DEVIATIONS AND RANGES

	WHITE PERCH					STRIPED BASS				
SEASON	NUMBER	AVERAGE	STD. DEV.	MIN -	MAX	NUMBER	AVERAGE	STD. DEV.	MIN -	MAX
SPRING	920	74.6	20.2	39.	200.	5	96.4	26.0	79.	148.
SUMMER	2877	133.3	54.6	22.	312.	785	168.1	67.1	34.	411.
FALL	11253	69.2	32.3	32.	263.	746	112.5	66.0	40.	387.

UNIT 1 YEAR 1972

YEARLY LENGTH AVERAGES, STANDARD DEVIATIONS AND RANGES

WHITE PERCH					STRIPED BASS				
NUMBER	AVERAGE	STD. DEV.	MIN -	MAX	NUMBER	AVERAGE	STD. DEV.	MIN -	MAX
15050	81.8	44.8	22.	312.	1536	140.8	72.1	34.	411.

UNIT 2 YEAR 1972

WEEKLY LENGTH AVERAGES, STANDARD DEVIATIONS AND RANGES

	WHITE PERCH				STRIPED BASS			
WEEK	NUMBER	AVERAGE	STD. DEV.	MIN - MAX	NUMBER	AVERAGE	STD. DEV.	MIN - MAX
25	66	97.8	44.2	56. 194.	3	208.0	34.3	161. 242.
26	61	82.5	21.6	62. 178.	1	131.0	0.0	131. 131.
35	6	68.0	43.5	44. 165.	1	185.0	0.0	185. 185.
36	8	52.5	5.3	43. 60.	6	217.2	72.9	63. 284.
37	14	64.3	38.3	42. 196.	3	117.7	89.5	48. 244.
38	30	68.7	36.6	46. 190.	17	88.8	82.2	35. 283.
39	121	63.4	31.2	42. 212.	13	147.0	91.0	50. 268.
40	130	69.9	40.6	48. 218.	17	187.4	95.6	48. 312.
41	93	60.1	19.3	48. 185.	7	65.1	6.5	53. 74.

UNIT 2 YEAR 1972

MONTHLY LENGTH AVERAGES, STANDARD DEVIATIONS AND RANGES

	WHITE PERCH				STRIPED BASS			
MONTH	NUMBER	AVERAGE	STD. DEV.	MIN - MAX	NUMBER	AVERAGE	STD. DEV.	MIN - MAX
6	127	90.4	36.0	56. 194.	4	188.7	44.7	131. 242.
9	198	67.2	37.5	42. 212.	44	133.5	93.1	35. 284.
10	204	62.8	28.5	48. 218.	20	151.3	102.6	48. 312.

UNIT 2 YEAR 1972

SEASONAL LENGTH AVERAGES, STANDARD DEVIATIONS AND RANGES

	WHITE PERCH				STRIPED BASS			
SEASON	NUMBER	AVERAGE	STD. DEV.	MIN - MAX	NUMBER	AVERAGE	STD. DEV.	MIN - MAX
SUMMER	156	85.4	37.3	42. 196.	14	185.4	77.3	48. 284.
FALL	373	65.1	33.2	42. 218.	54	130.8	95.8	35. 312.

UNIT 2 YEAR 1972

YEARLY LENGTH AVERAGES, STANDARD DEVIATIONS AND RANGES

	WHITE PERCH				STRIPED BASS			
	NUMBER	AVERAGE	STD. DEV.	MIN - MAX	NUMBER	AVERAGE	STD. DEV.	MIN - MAX
	529	71.1	35.7	42. 218.	68	142.0	94.9	35. 312.

UNIT 1 YEAR 1973

WEEKLY LENGTH AVERAGES, STANDARD DEVIATIONS AND RANGES

	WHITE PERCH					STRIPED BASS				
WEEK	NUMBER	AVERAGE	STD. DEV.	MIN -	MAX	NUMBER	AVERAGE	STD. DEV.	MIN -	MAX
1	18	85.4	34.7	54.	175.	0	0.0	0.0	0.	0.
19	436	66.2	17.4	36.	183.	6	103.0	38.4	72.	186.
20	242	75.6	37.2	45.	210.	0	0.0	0.0	0.	0.
21	137	135.4	50.7	58.	241.	3	113.0	37.3	76.	164.
22	131	124.7	53.2	50.	246.	6	96.3	14.9	80.	125.
23	70	141.9	46.5	56.	209.	2	111.5	3.5	108.	115.
24	5	160.0	35.0	110.	200.	0	0.0	0.0	0.	0.
31	1	166.0	0.0	166.	166.	0	0.0	0.0	0.	0.
33	2	117.0	65.0	52.	182.	0	0.0	0.0	0.	0.
46	21	72.9	19.3	53.	140.	3	69.3	3.9	64.	73.
47	64	81.5	23.5	58.	187.	5	109.2	28.5	72.	154.
48	10	79.2	22.7	55.	140.	2	85.0	5.0	80.	90.
49	26	76.7	8.7	63.	95.	2	79.0	1.0	78.	80.
50	54	76.4	21.6	58.	204.	7	74.6	8.6	66.	90.
51	17	82.4	30.4	55.	198.	1	65.0	0.0	65.	65.
52	30	77.4	6.2	61.	86.	2	102.5	12.5	90.	115.

UNIT 1 YEAR 1973

MONTHLY LENGTH AVERAGES, STANDARD DEVIATIONS AND RANGES

	WHITE PERCH					STRIPED BASS				
MONTH	NUMBER	AVERAGE	STD. DEV.	MIN -	MAX	NUMBER	AVERAGE	STD. DEV.	MIN -	MAX
1	18	85.4	34.7	54.	175.	0	0.0	0.0	0.	0.
5	870	83.5	42.5	36.	246.	9	106.3	38.3	72.	186.
6	151	133.5	51.8	55.	235.	8	100.1	14.6	80.	125.
8	3	133.3	57.9	52.	182.	0	0.0	0.0	0.	0.
11	85	79.4	22.8	53.	187.	8	94.3	29.7	64.	154.
12	137	77.6	19.0	55.	204.	14	80.0	13.0	65.	115.

UNIT 1 YEAR 1973

SEASONAL LENGTH AVERAGES, STANDARD DEVIATIONS AND RANGES

	WHITE PERCH					STRIPED BASS				
SEASON	NUMBER	AVERAGE	STD. DEV.	MIN -	MAX	NUMBER	AVERAGE	STD. DEV.	MIN -	MAX
WINTER	18	85.4	34.7	54.	175.	0	0.0	0.0	0.	0.
SPRING	1021	90.9	47.4	36.	246.	17	103.4	29.8	72.	186.
SUMMER	3	133.3	57.9	52.	182.	0	0.0	0.0	0.	0.
FALL	222	78.3	20.6	53.	204.	22	85.2	21.8	64.	154.

UNIT 1 YEAR 1973

YEARLY LENGTH AVERAGES, STANDARD DEVIATIONS AND RANGES

	WHITE PERCH					STRIPED BASS				
	NUMBER	AVERAGE	STD. DEV.	MIN -	MAX	NUMBER	AVERAGE	STD. DEV.	MIN -	MAX
	1264	88.7	44.1	36.	246.	39	93.1	27.2	64.	186.

UNIT 2 YEAR 1973

MONTHLY LENGTH AVERAGES, STANDARD DEVIATIONS AND RANGES

	WHITE PERCH				STRIPED BASS			
MONTH	NUMBER	AVERAGE	STD. DEV.	MIN - MAX	NUMBER	AVERAGE	STD. DEV.	MIN - MAX
1	198	64.8	16.7	50. 186.	49	80.8	10.7	55. 121.
2	1622	71.2	23.6	31. 205.	136	84.6	16.2	50. 184.
3	4044	75.5	29.5	34. 239.	486	85.5	13.9	55. 259.
4	2432	89.1	31.3	36. 216.	341	91.5	12.3	62. 146.
5	650	86.3	35.5	45. 247.	9	94.4	29.3	31. 132.
6	666	124.6	50.7	53. 234.	25	135.6	45.6	70. 230.
7	381	143.6	55.8	36. 230.	28	120.4	84.0	41. 324.
8	1410	58.8	34.5	32. 215.	223	58.0	22.9	34. 265.
9	216	66.7	30.3	40. 210.	21	104.6	69.6	45. 304.
10	43	116.1	58.0	55. 220.	14	107.2	32.9	65. 185.
11	401	76.2	24.7	42. 207.	113	91.3	25.8	54. 194.
12	368	78.5	19.3	54. 194.	34	94.8	20.8	68. 176.

UNIT 2 YEAR 1973

SEASONAL LENGTH AVERAGES, STANDARD DEVIATIONS AND RANGES

	WHITE PERCH				STRIPED BASS			
SEASON	NUMBER	AVERAGE	STD. DEV.	MIN - MAX	NUMBER	AVERAGE	STD. DEV.	MIN - MAX
WINTER	4697	68.3	20.5	31. 215.	577	84.2	14.4	50. 259.
SPRING	4743	93.2	37.0	36. 247.	456	91.7	14.5	31. 195.
SUMMER	2088	82.2	55.6	32. 234.	276	70.8	46.8	34. 324.
FALL	903	78.8	26.9	42. 220.	170	94.2	30.3	54. 304.

UNIT 2 YEAR 1973

YEARLY LENGTH AVERAGES, STANDARD DEVIATIONS AND RANGES

WHITE PERCH				STRIPED BASS			
NUMBER	AVERAGE	STD. DEV.	MIN - MAX	NUMBER	AVERAGE	STD. DEV.	MIN - MAX
12431	80.9	37.0	31. 247.	1479	85.2	26.9	31. 324.

UNIT 2 YEAR 1973

WEEKLY LENGTH AVERAGES, STANDARD DEVIATIONS AND RANGES

	WHITE PERCH					STRIPED BASS				
WEEK	NUMBER	AVERAGE	STD. DEV.	MIN -	MAX	NUMBER	AVERAGE	STD. DEV.	MIN -	MAX
5	198	64.8	16.7	50.	186.	49	80.8	10.7	55.	121.
6	13	57.5	5.5	43.	65.	2	72.5	4.5	68.	77.
7	784	68.2	19.4	31.	197.	66	81.6	10.1	50.	106.
8	397	82.9	32.1	45.	205.	45	91.3	22.4	68.	184.
9	1149	65.8	17.6	33.	209.	92	82.7	11.9	62.	121.
10	995	69.9	21.1	36.	197.	298	84.7	14.7	61.	259.
11	1046	64.7	15.9	38.	215.	23	86.0	12.6	71.	120.
12	764	86.3	34.2	37.	239.	11	83.3	14.0	55.	112.
13	638	110.0	42.6	50.	235.	110	90.4	13.1	61.	146.
14	654	98.9	32.3	49.	215.	202	91.4	10.4	62.	121.
15	913	81.9	25.2	50.	199.	21	93.3	13.0	67.	123.
16	348	77.1	22.9	47.	160.	0	0.0	0.0	0.	0.
17	366	88.7	31.5	36.	207.	92	91.2	14.0	71.	137.
18	301	84.9	30.9	50.	235.	3	94.3	7.4	84.	101.
19	153	71.4	28.5	47.	247.	2	82.0	2.0	80.	84.
20	107	87.2	35.5	51.	205.	4	117.5	16.5	90.	132.
21	70	110.1	35.7	52.	209.	0	0.0	0.0	0.	0.
22	112	98.7	43.3	45.	215.	2	55.5	24.5	31.	80.
23	314	105.5	48.7	53.	220.	9	107.2	35.0	70.	195.
24	118	147.9	39.4	54.	223.	2	164.0	2.0	162.	166.
25	101	161.6	36.2	65.	234.	3	146.7	30.1	105.	175.
26	91	148.2	48.2	57.	226.	11	153.4	45.8	100.	230.
27	92	167.3	32.5	71.	230.	3	112.7	13.2	98.	130.
28	32	174.9	17.3	142.	225.	2	151.0	41.0	110.	192.
29	59	158.7	40.0	41.	201.	3	174.7	40.5	118.	210.
30	122	137.1	57.6	38.	213.	7	208.3	99.7	63.	324.
31	452	65.4	47.1	32.	214.	124	55.2	22.7	34.	206.
32	234	67.1	44.7	38.	215.	40	59.3	11.3	43.	120.
33	389	51.1	19.0	32.	195.	43	57.4	6.2	46.	69.
34	282	53.3	17.1	35.	193.	16	73.7	50.5	46.	265.
35	176	61.6	29.4	42.	206.	18	61.6	13.6	42.	96.
36	57	64.2	37.4	40.	210.	5	143.8	86.9	67.	274.
37	1	173.0	0.0	173.	173.	1	95.0	0.0	95.	95.
38	23	63.4	5.6	49.	76.	2	182.5	121.5	61.	304.
39	68	77.0	28.7	50.	196.	7	87.4	17.4	61.	117.
40	12	98.9	55.2	57.	200.	0	0.0	0.0	0.	0.
41	4	66.3	8.5	55.	75.	1	129.0	0.0	129.	129.
42	5	120.2	63.0	64.	205.	5	98.8	32.6	65.	158.
43	10	116.8	53.4	66.	192.	5	97.6	16.8	76.	126.
44	14	136.4	56.6	65.	220.	6	120.2	53.2	55.	194.
45	36	74.2	19.3	60.	180.	37	92.5	21.3	68.	159.
46	166	76.4	22.1	42.	188.	40	90.3	26.5	54.	182.
47	66	77.4	31.2	43.	205.	16	101.4	27.7	65.	152.
48	151	75.8	24.1	53.	207.	20	84.2	23.0	65.	176.
49	84	77.0	17.6	59.	190.	8	82.6	9.3	68.	98.
50	178	78.2	17.8	54.	194.	17	95.1	15.9	70.	126.
51	53	72.5	14.6	58.	156.	4	98.3	19.7	69.	124.
52	28	93.8	28.2	65.	169.	1	110.0	0.0	110.	110.
53	5	109.4	32.0	86.	172.	1	93.0	0.0	93.	93.

Question B 6:

Tables 2 and 3, pp. 22-25 in Appendix C of the Environmental Report for the extension of once-through cooling present model results on the annual percent change in the Hudson River adult striped bass population assuming cooling tower construction in May 1979 or May 1981. The staff has the following questions and requests:

a. What baseline was used to calculate the annual percent change values?

b. What accounts for the cycles of negative and positive numbers in each time series?

c. Provide a deck of input data cards and a listing of these cards for Cases 5-8.

Response:

a. The annual percent change values were calculated as follows:

   1. The model was run with a total egg production and temporal and spatial distributions calculated from Texas Instruments 1973 field data to establish a baseline population with no plants operating.

   2. The model was run with the projected plant operating conditions for each year from 1975 through 2021, assuming cooling tower construction in May 1979 (Table 2) and in May 1981 (Table 3).

   3. The values in Tables 2 and 3 represent the incremental annual percent change in the adult striped bass population relative to the baseline population discussed in step 1 above.

Response:

b. The values presented in Tables 2 and 3 are the <u>incremental</u> annual percent changes in the total adult striped bass population. Thus, the value -1.52 for 1975 in Table 2, Case 7 means that the model predicts a decrease of 1.52% in the population relative to the baseline. The value,

-.447 for 1976 indicates that the population will decrease an additional .447% during 1976. Thus, the total percent reduction in 1976, relative to the baseline is 1.52 + .447 = 1.967%. The same accumulative procedure can be applied for all subsequent years in the time series.

The cycle of negative and positive numbers reflect the fact that the model does not predict a steady decline in the striped bass population after cooling towers go online. The positive numbers do not suggest that the population will increase above the baseline but rather that the predicted total percent reduction for a given year is not as large as that for the preceding year.

Response:

c. The requested data cards and listing are enclosed.