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ENVIRONMENTAL IMPACT APPRAISAL
BY
THE OFFICE OF NUCLEAR REACTOR REGULATION
SUPPORTING
AMENDMENT NO.67 TO DPR-44
AND
AMENDMENT NO.66 TO DPR-56

PHILADELPHIA ELECTRIC COMPANY
PUBLIC SERVICE ELECTRIC AND GAS COMPANY
DELMARVA POWER AND LIGHT COMPANY
ATLANTIC CITY ELECTRIC COMPANY

PEACH BOTTOM ATOMIC POWER STATION
UNITS NOS. 2 AND 3

DOCKET NOS. 50-277 AND 50-278

Introduction

By letter dated August 20, 1979, the Philadelphia Electric Company (the licensee) requested an amendment to the Appendix B Environmental Technical Specifications (ETS) for the Peach Bottom Atomic Power Station Units 2 and 3 (Peach Bottom). The licensee proposes to delete, from the Environmental Surveillance and Special Study Programs, those programs covering fisheries, limnology and thermal plume mapping. The ETS allow for termination of these studies upon agreement by the licensee and the NRC that the intended purposes of the studies have been satisfied.

In our review, as described below, we have determined that we can delete the three programs from Section 6 of the ETS. However, with regard to the thermal plume mapping, we have found it necessary to revise ETS 3.1 to make it independent of ETS 6.3.a, thus allowing deletion of the latter without creating an inconsistency in the resultant ETS. Additionally, we have found that the impingement monitoring and reporting requirements in ETS 4.1 and ETS 5.1 are no longer necessary and recommend deletion of these requirements from the ETS. The basis for this action has been presented in the staff's Environmental Impact Appraisal supporting Amendment Nos. 44 and 44 to DPR-44 and DPR-56 issued on July 26, 1978.

Summary of Approach and Findings

In the FES (AEC, 1973), the predicted impacts of plant operation on biota of Conowingo Pond were: (1) reduction in production and changes in species composition of phytoplankton; (2) reduction in abundance of some species of zooplankton during late summer; (3) localized reduction in the benthic community near the discharge; and (4) reduction in standing crop of fishes due to entrainment and impingement.

Also, indirect effects on the fish community were suggested to potentially result from the predicted alterations in primary (phytoplankton) and secondary (zooplankton) productivity.

A comparison of the FES predicted impacts and the observed impacts during initial plant operation (1974-75) has been made by Oak Ridge National Laboratory (Adams et al., 1977). As shown by ORNL's summary comparison (Table 1),

Table 1 Peach Bottom – Comparison of FES predicted impacts with observed impacts *

Predicted impacts	Observations from monitoring data
Phytoplankton	
A possible reduction in phytoplankton production may occur.	There are no significant differences in chlorophyll *a* concentrations among stations and between preoperational and operational years.
An alteration in species composition from diatoms and greens to an increase in the more heat-tolerant blue-greens would be expected.	Shifts in species composition cannot be validated since no quantitative cell counts were made.
Zooplankton	
Significant reduction in microcrustaceans during late summer is expected.	No significant differences in zooplankton densities among stations and among years were observed.
Benthos	
Detrimental effects on resident benthos over a small portion of Conowingo Pond exposed to thermal discharges, outfall scouring, and chlorine releases are expected. This will not be of sufficient magnitude to be important to the pond as a whole.	No significant differences were observed in the biomass of benthos collected at all stations during preoperational and operational periods. Variations in standing crops were probably due to natural variations.
Fish	
In winter, fish will be attracted to discharge plume.	CPE was observed to be higher in the plume in summer than in winter. No differences were observed in CPE during winter in control and in discharge.
Entrainment – High entrainment mortality of zooplankton expected, with selection for heat tolerant forms.	Methods used to estimate entrainment do not give the fraction of living organisms entering the plant that are killed by passage through the condensers.
Standing crops may be lowered partially from entrainment losses.	No significant differences in standing crops of zooplankton were observed between preoperational and operational years.
Impingement – Standing crops of adult fishes may be reduced due to impingement.	No evidence of reduction of standing crops was observed (low numbers impinged). Impingement is a function of temperature, length (age class), and river flow.

* Source: Adams, et al., 1977, p. 3-164, Table 3.25.

no significant impacts on the aquatic biota were identifiable during the initial period of plant operation. It was recommended by ORNL that "...consideration could be given to reducing monitoring effort after data have been collected for a period when both units are operating at full capacity."

The first step in our review was to examine the operational history to determine whether data had been collected which would be representative of full two-unit operation. The monthly and annual average operational levels are presented in Table 2 in terms of percent of design thermal load for one unit; i.e., full operation of two units would be represented by a capacity factor of 200%. The licensee has estimated that the annual average capacity factor would be 80% for these units (or, 160% using the method of data presentation in Table 2). First, note that the 1974-75 period of operation examined by ORNL was well below the expected average for two-unit operation. In 1975, the average capacity was equivalent to one-unit operation. In 1976, the level increased to an average of 130% for the year, followed in 1977 by a reduction to the one-unit equivalent during the first eight months of that year. Thereafter, from September 1977 through August 1979, the capacity factor averaged 153%, thus approaching the expected annual average of 160% over a continuous period of 24 months. The median value (of ungrouped data) for the 24-month period was 162.5%. Thus, the data collected during this recent period of plant operation were judged sufficient for identifying major changes and evaluating the impacts, if any, on aquatic biota and water quality of Conowingo Pond due to plant operation.

TABLE 2

OPERATIONAL HISTORY FOR PEACH BOTTOM UNITS 2 AND 3*
[Average Monthly Power Level in Percent (200% Max.)]

	1974	1975	1976	1977	1978	1979
Jan	-	86	87	90	161	163
Feb	11	110	145	80	148	177
Mar	13	191	141	78	172	165
Apr	43	177	88	85	97	195
May	55	137	51	91	103	152
Jun	65	max=100	102	82	163	145
Jul	88	max=110	142	73	132	181
Aug	96	max=110	155	89	182	188
Sep	91	max=110	177	106	122	-
Oct	105	max=110	171	176	126	97
Nov	120	max=110	141	153	182	-
Dec	135	max=110	158	118	162	-
Annual Mean	48	80	130	102	146	-

- Data unavailable

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* Note: Values represent power levels in percent of rated total thermal output for one unit; i.e., a value of 200 percent represents full two-unit operation.

The second step in our review was to examine data from the fisheries and limnological studies to ascertain whether any major changes had occurred between the pre-operational and operational periods. Specific attention was given to examining those data reported for the recent operational period, September 1977 through June 1979. The changes which we judged worthy of additional examination are:

1. Generally lower abundance of white crappie during operational years 1974-1979 compared to pre-operational years, 1967-1973.

2. An increase in abundance of gizzard shad following the accidental introduction of this species to Conowingo Pond in 1972.

3. Shift in food habits of young white crappie from non-piscivorous in the pre-operational period to piscivorous in the operational period.

4. Shift in prey selection by adult white crappie, channel catfish, smallmouth bass, largemouth bass, and walleye to young gizzard shad during the operational period.

5. Increase in fecundity of white crappie during operational period.

6. Appearance of gizzard shad in observations of fish mortalities, associated with operation of Muddy Run Station (pumped storage) and Holtwood Hydroelectric Station.

7. In comparison to pre-operational value, the adjusted mean densities of zooplankton were significantly lower in 1975 and 1977 and significantly higher in 1978.

8. Localized changes in benthos at the discharge sampling station.

9. Minor differences in food habits for some specimens of fish collected from the thermal plume area.

10. Change in character of the gonosomatic index for white crappie between pre-operational and operational periods.

11. Some differences in the sport fishery of Conowingo Pond.

12. In general, monthly mean values for water temperature were higher in most months during the operational period than during the pre-operational period.

In the third step, we examined the licensee's conclusions and supportive analyses regarding the probable cause/effect relationships involved in the identified changes. In general, we agreed with the licensee's conclusions, and where we differed, the differences involved speculative opinion about possible causes for some changes which were unrelated to plant operation. Of the twelve changes listed above, we judged that the first seven are unrelated to plant operation, the eighth and ninth are plant-induced and the last three likely involve some combination of plant and environmental (non-plant related) factors. As the final step, we considered the impacts of the changes which were judged to be plant-related.

The reduced abundance of white crappie appears to be associated with some combination of the effects due to Tropical Storm Agnes and to the accidental introduction of gizzard shad, both of which occurred in 1972 prior to plant operation. The shift in food habits of young white crappie during the operational period is likely due to competitive interactions with gizzard shad. Shifts in prey selection by other sport species to young of gizzard shad reflect the general availability of the latter species in the forage base. The apparent increase in white crappie fecundity during the operational period suggests compensatory response to the reduced abundance of the white crappie population. With regard to the lower densities of zooplankton observed in 1975 and 1977 (item 7 in the list of changes), the licensee's consultant has suggested one reason for this to be excessive predation by young gizzard shad. We believe the river flow condition to be a major contributing factor in the observed differences in zooplankton abundance.

The plant-induced effects are due to discharge velocity and temperature. The reduction and alteration in benthos at the discharge sampling station are due to a combination of substrate scouring and increased temperature. This is a localized impact which was predicted and judged insignificant by the staff in the FES. Results of the operational studies confirm the FES assessment. The benthic community of Conowingo Pond has undergone and recovered from large natural perturbations affecting the entire Pond during both pre-operational and operational periods (i.e., due to Tropical Storm Agnes and Hurricane Eloise).

The minor differences in food items for some fish species collected in the thermal plume area are likely plant-related. The localized effects on the benthic community, noted above, are reflected in the food items present in the stomachs of fish which feed on benthic organisms. For specimens of top predators, e.g., smallmouth bass and walleye, collected in the plume, there appears to be a greater reliance on fish species such as channel catfish and gizzard shad which may be differentially attracted to the thermal discharge area. These minor differences in food habits are not judged to be a significant impact on the fish community.

The change in the gonosomatic index for white crappie (item 10) appears to be related to both plant operation and non-plant factors. Interruption in spawning has been indicated as a possible response to substantial drops in water temperature following Tropical Storm Agnes in 1972 and unseasonably cold weather in 1975. Similarly, a sporadic spawning activity might be attributable to ingress and egress of fish to and from the thermal plume area. Such an interpretation is further complicated by the licensee's study results which indicate that in 1976 most white crappie of age V and greater completed spawning earlier than those of age II. This latter finding suggests that the sporadic character of the gonosomatic index is dependent on the age composition of the spawning stock and unrelated to plant operation. Based on the distribution of major spawning areas for white crappie as identified by the licensee, i.e., in the lower pond and outside of the plant influence, we conclude that plant related effects, if any, are not impacting the spawning success of white crappie.

The only plant-related change in the sport fishery of Conowingo Pond is a generally higher harvest rate, especially for walleye, reported by anglers who fish the thermal plume area. A major winter fishery has not developed in the plume area. Other identified changes in sport fishing effort and harvest are unrelated to plant operation. Examples of these changes are increase in ice fishing in the lower pond and a seven-fold increase in smallmouth bass harvest since a 1960 survey. No detrimental impacts of plant operation on the sport fishery were identified.

With regard to increased water temperature during the operational period, this change is due to thermal additions from Peach Bottom but also is a function of the natural variation in hydrological and meteorological conditions. The thermal effluents are regulated by the NPDES permit which presently contains a set of interim operating limits on plant operation to assure compliance with water quality standards. These interim limits are to apply until a final determination is reached in the pending proceeding under Section 316(a) of the Clean Water Act. In its Decision issued on March 23, 1979 (ALAB-532), the Atomic Safety and Licensing Board approved a stipulated agreement and accompanying technical specifications as fulfilling the NRC's responsibilities concerning thermal discharges from Peach Bottom. Based on our review of current data, we identified no significant plant-related impacts on the aquatic biota of Conowingo Pond. Therefore, we conclude that the existing operating limits are providing protection of aquatic biota from thermal impacts.

Evaluation of Study Results

Fisheries (ETS 6.1.a.1) - The purpose of this ETS study was to monitor the fish community of Conowingo Pond to determine whether any detrimental effects were resulting from the normal operation of the Peach Bottom Station. The parameters studied were species composition, distribution, relative abundance, annual and seasonal variations in numbers and biomass, growth rates, mortality rates, food habits, spawning relative to the Peach Bottom site, reproductive potential, and movement patterns.

In addressing the first four parameters, sampling has been conducted twice monthly throughout the year with seines, trawls, and trap nets and weekly with plankton nets during the spawning season. Sampling locations were selected to provide representative data from throughout Conowingo Pond and more detailed data from the immediate vicinity of the Peach Bottom site. Some sampling locations have been added or deleted over the extensive study period, but many were instituted and have been maintained since 1967 or 1968.

Detailed results have been reported to the NRC in the licensee's semiannual operating reports. Twelve reports have been submitted: No. 1 covers the period July - December 1973 and No. 12 covers the period January - June 1979. With submission of the 13th report (expected in early 1980), operational data will extend over 6 years for Unit 2 (initial criticality - September 1973) and 5 years for Unit 3 (initial criticality - August 1974). Results of the fisheries study have also been presented by the licensee in demonstration reports to the USEPA pursuant to Sections 361(a) and 316(b) of the Clean Water Act.

Trap net catches have been dominated, numerically, by white crappie. Other commonly occurring species are channel catfish, bluegill, brown bullhead, pumpkinseed, carp and gizzard shad. Variation in catch-per-unit effort (CPUE) is due chiefly to variation in catch of white crappie, as demonstrated in Tables 3 and 4. Only at station 10 in the thermal plume has channel catfish CPUE generally exceeded that for white crappie. The licensee's consultant has attributed the lower catch of white crappie at this station to the species avoidance of the high water velocity at the plant discharge.

For the period of normal two-unit operation (i.e., at expected thermal load level) from the latter half of 1977 through the first half of 1979, trap net CPUE for white crappie remained low in comparison to the CPUE recorded in the preoperational period from the late 1966 through the first half of 1972. The mean annual trap net CPUE for white crappie in 1978 was the lowest recorded for any year of study. In contrast, the monthly mean CPUE of 133 recorded in October 1977 is nearly twice any other monthly mean CPUE recorded for white crappie within the operational period. Also, the 6-month mean CPUE for white crappie in the second half of 1977 is greater than corresponding means for operational years, 1974-1976, and for two of the seven preoperational years. The 6-month mean CPUE in the first half of 1979 was greater than four of the five corresponding means recorded in all previous operational years, 1974-1978.

TABLE 3. SUMMARY OF FISH CATCH PER EFFORT FOR TRAP NET SAMPLES (ALL SPECIES)

	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Jan	-	102.5	-	-	-	6.4	74.2	-	45.6	46.3	-	-	-	-
Feb	-	-	-	-	-	5.2	334.5	55.4	-	50.2	22.9	-	-	-
Mar	-	54.1	-	32.2	248.8	-	105.0	34.1	17.5	48.6	19.8	32.4	1.2	53.6
Apr	-	92.1	55.8	100.4	270.9	152.3	129.2	44.5	24.1	40.8	17.2	24.4	30.7	28.7
May	-	92.3	72.8	57.2	275.2	157.0	94.4	38.1	26.7	73.4	23.6	33.6	16.4	31.1
Jun	-	54.8	81.5	52.4	137.9	173.2	77.5	52.6	25.0	62.0	33.7	19.1	21.3	35.6
Jul	-	117.8	34.3	117.8	122.3	42.8	110.8	29.5	14.8	124.4	21.7	33.0	17.8	
Aug	-	92.7	22.8	35.5	101.6	36.7	20.4	25.6	19.7	63.7	30.7	25.0	29.8	
Sep	-	33.5	30.2	59.4	87.6	67.0	19.0	25.5	40.2	94.1	24.3	33.2	22.3	- Unavailable -
Oct	80.4	36.6	14.2	143.1	99.5	85.9	25.0	53.9	39.9	64.0	40.6	172.3	27.8	
Nov	145.6	41.0	63.8	418.8	112.0	180.2	45.6	27.2	32.6	40.6	19.7	49.3	42.4	
Dec	170.2	48.4	-	559.0	160.1	314.9	58.4	3.2	89.0	20.3	11.9	55.6	27.8	
Average	130.5	69.1	42.5	108.2	141.1	121.0	77.1	38.1	31.9	60.6	25.4	42.6	26.2	34.2

Note: All values represent number of fish per 24-hours of trap net sets.
Yearly average is weighted by amount of monthly effort.

TABLE 4. SUMMARY OF CATCH PER EFFORT FOR TRAP NET SAMPLES (WHITE CRAPPIE)

	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Jan	-	98.1	-	-	-	2.9	38.7	-	31.2	42.3	-	-	-	-
Feb	-	-	-	-	-	2.1	329.5	39.5	-	45.8	13.2	-	-	-
Mar	-	41.7	-	23.7	221.6	-	79.1	25.8	14.5	32.5	12.2	9.2	0.0	22.6
Apr	-	76.0	49.0	78.0	261.0	134.9	93.6	35.3	15.5	28.8	7.5	11.2	8.3	13.3
May	-	78.0	66.9	41.1	243.3	143.4	77.8	28.2	15.5	50.0	14.2	18.2	7.9	10.0
June	-	29.8	74.8	30.3	101.3	144.4	61.2	39.0	12.8	44.9	15.6	8.0	4.4	22.8
Jul	-	60.8	25.6	26.8	87.1	28.5	83.0	17.1	5.8	21.9	8.6	3.9	3.5	- Unavailable -
Aug	-	75.1	11.3	15.6	70.9	21.5	13.1	9.4	4.1	29.3	7.9	4.8	5.2	
Sep	-	23.8	16.9	34.8	63.5	43.5	10.8	10.7	19.2	29.0	5.3	10.3	6.6	
Oct	56.0	22.0	7.2	114.2	70.4	47.9	15.2	24.7	21.8	32.8	5.4	133.0	12.2	
Nov	132.3	30.6	49.2	393.0	91.4	155.3	34.2	18.6	15.0	21.9	8.2	35.0	23.5	
Dec	148.8	36.2	-	539.3	129.0	282.8	51.9	20.5	72.9	15.6	5.4	47.2	16.9	
Average	112.8	50.4	33.4	73.5	111.1	97.6	59.9	24.7	18.5	32.0	9.7	22.6	9.9	16.0

Note: All values represent number of white crappie per 24-hours of trap net sets.
Yearly average is weighted by amount of monthly effort.

Trawl transect catches have been dominated by channel catfish. Other species commonly taken with this gear are white crappie, spottail shiner, carp, comely shiner, and gizzard shad. Comparisons of yearly CPUE for selected species are presented in Table 5. Note that 1979 data (last column) cover only the first half of that year. The white crappie CPUE from trawl transect collections show a generally lower abundance during the operational years, 1974-1979, compared to the preoperational years, 1967-1973. (This same trend was indicated by trap net data). In contrast, the CPUE in 1978 ($\sim$ 3 white crappie per 10 minute trawl haul) was the highest recorded in any of the operational years and was $\sim$ 2x the CPUE in 1973, the last year of the preoperational study period.

The generally lower abundances of white crappie and, to a lesser extent, channel catfish over the period 1972 through 1978 are demonstrated by the trawl zone catches (Figure 1). In contrast, during the first half of 1979, CPUE ($\tilde{\sim}$ 49) for channel catfish in trawl zone 405 (adjacent to plant site) was well above those recorded for the years 1966, 1967, and 1972 through 1978. Also, the CPUE ($\tilde{\sim}$ 8) for white crappie, during the first half of 1979, as recorded in trawl zone 408 (downstream and opposite side of pond from plant site) was greater than the CPUE for white crappie in that zone from any of the previous operational years (RMC, 1979b, Table 3.4-6).

TABLE 5

Comparison of the yearly (January-December) catch per effort (number per 10-min haul) of fishes collected by a 16 ft semi-balloon trawl at transect stations during the preoperational (1967-1973) and postoperational (1974-1978) periods in Conowingo Pond. Gizzard shad not in Pond until 1972.

Year	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	Jan-Jun 1979
Species													
*White crappie	16.26	13.90	113.90	33.93	41.30	6.43	1.15	2.04	0.70	0.12	0.82	3.01	0.89
*Channel catfish	21.32	31.30	127.33	112.43	63.82	28.53	11.26	22.26	20.62	8.54	10.41	27.33	45.22
*Bluegill	1.75	17.33	5.36	0.99	6.74	0.15	0.74	1.41	0.32	0.26	0.09	0.48	0.00
Pumpkinseed	0.71	1.76	1.82	1.02	3.51	0.19	0.34	0.88	0.20	0.08	0.08	0.41	0.13
Tessellated darter	2.53	0.94	1.71	0.82	1.53	0.20	0.69	4.64	0.37	0.36	0.45	0.40	0.69
Spottail shiner	1.08	0.87	5.97	3.67	1.82	0.23	0.44	1.29	0.55	0.05	0.20	2.86	3.25
*Gizzard shad						0.00	0.15	0.02	0.61	0.16	1.47	1.49	0.32
*Smallmouth bass	0.03	0.01	0.16	0.04	0.00	**	0.00	0.06	0.02	0.00	0.01	0.14	0.02
*Largemouth bass	0.02	0.01	0.05	0.04	0.01	**	0.00	0.01	0.01	**	**	0.03	0.00
*Walleye	0.03	0.02	0.05	0.04	0.03	**	0.00	0.02	0.01	0.02	0.00	0.04	0.02

* Designated by U.S. Environmental Protection Agency (1975) as "representative, important species"

** Less than 0.01

Sources: RMC, 1979a, Table 3.3-3, p. 3-33
RMC, 1979b, Table 3.3.2, p. 3-35

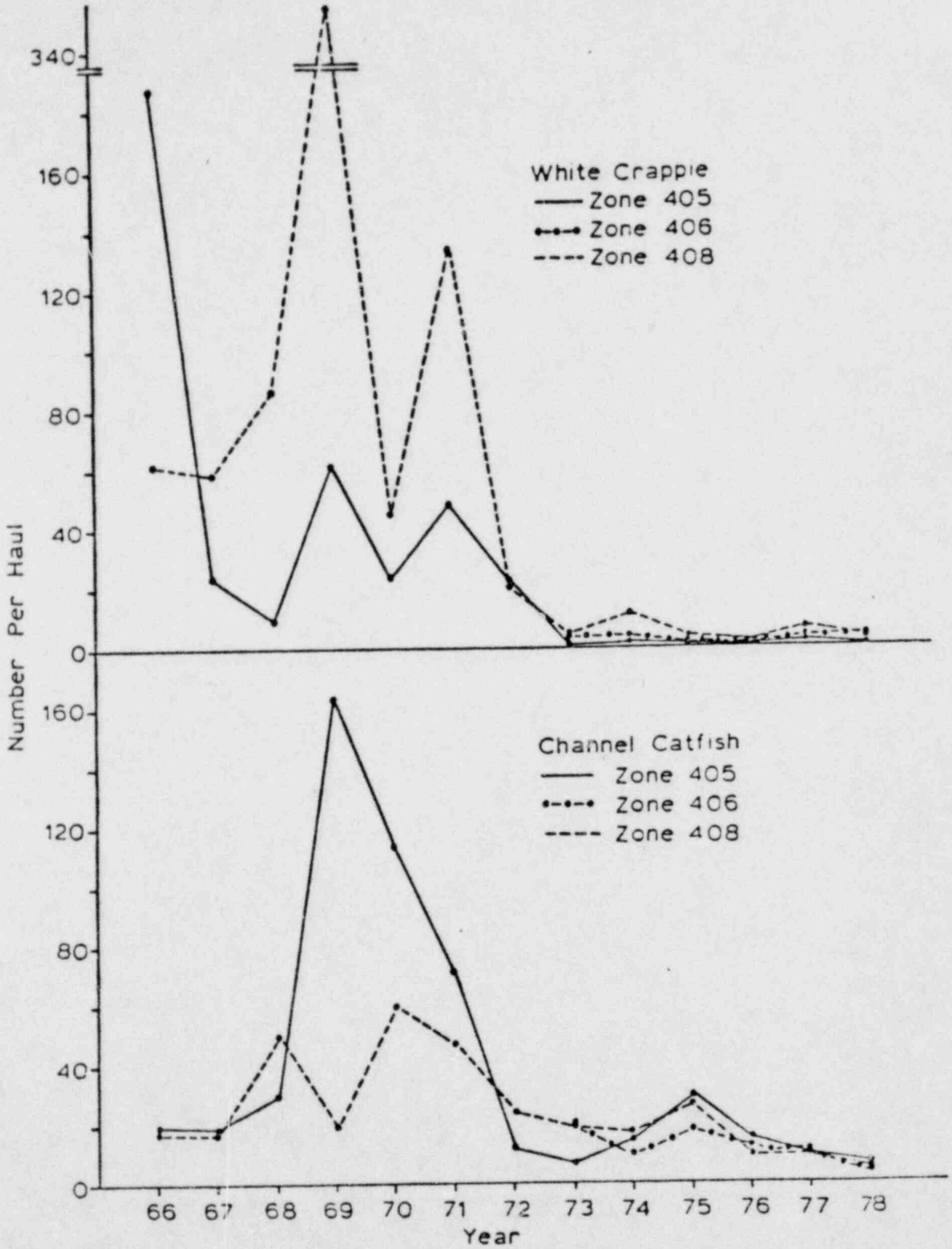

FIGURE 1

Catch per effort (number per 10-min haul) of the white crappie and channel catfish collected by a 16 ft semi-balloon trawl from January-December during the preoperational (1966-1973) and postoperational (1974-1978) periods in trawl Zones 405, 406 and 408 in Conowingo Pond. Zone 406 was established in 1973.

Source: RMC, 1979a, Fig. 3.4-1, p. 3-60.

Comparison of annual CPUE for seine collections (Table 6) show this gear type to be selective for minnows, with spotfin shiner dominating in each of the years, 1966 through 1978 and the first half of 1979. Other species of minnows common to seines are the bluntnose minnow, and spottail shiner. In some years the tessellated darter and centrarchids (bluegill, pumpkinseed, white crappie and largemouth bass) have also contributed significantly to the CPUE for seines. In the seine collections during the first half of 1979, the largemouth bass CPUE (of 5.8) was one to two orders of magnitude greater than the recorded CPUE for the first half of any prior operational year and twice the CPUE of 2.2 recorded for 1969 (1st six months), the highest 6-month mean CPUE for largemouth bass during the preoperational period 1966-1973.

Tables 7 and 8 provide summary comparisons of ichthyoplankton densities for the study years 1969-78 from collections at transect stations and at inshore stations, respectively. The species dominating in the transect station collections have been carp, quillback, channel catfish, tessellated darter, and gizzard shad. The abundance of gizzard shad has been recorded in recent years, 1975-78, following accidental introduction of this species to Conowingo Pond in 1972. The species (or species groups) which have dominated catches at the inshore stations are quillback, sunfishes, white crappies, comely shiner, gizzard shad and unidentifiable ichthyoplankters. Most notable of the variations at the inshore stations over the study period is (1) the "bloom" of gizzard shad in 1975 followed by a decline over the three subsequent years, (2) the high mean density of comely shiner in 1978, and (3) the lower mean density of white crappie in the more recent years, 1975-78. CPUE from ichthyoplankton collections in 1979 are unavailable for use in comparison with previous years.

TABLE 6

Comparison of the annual catch per effort (number per collection) of species collected by 10- and 15 x 4 ft seine at stations during the preoperational (1966-1973) and postoperational (1974-1978) periods in Conowingo Pond.

Year	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Species													
*Gizzard shad							0.00	0.00	0.00	0.38	0.12	1.33	0.86
*Spotfin shiner	109.90	-53.21	41.68	32.82	64.37	51.12	31.87	68.96	72.85	63.88	79.81	29.44	22.57
*Bluntnose minnow	18.52	1.32	1.23	2.98	1.94	1.52	0.83	1.22	3.20	2.86	1.68	0.99	2.70
Pumpkinseed	12.64	0.76	6.61	2.79	0.73	1.75	0.44	0.55	0.77	0.55	0.44	0.76	0.34
*Bluegill	55.45	7.18	30.05	8.53	1.24	8.19	1.89	1.44	0.52	1.48	1.10	3.05	0.75
Spottail shiner	3.18	0.56	1.84	2.93	1.29	2.45	1.30	0.18	1.12	1.09	0.35	0.65	2.93
Tessellated darter	0.67	1.34	0.83	3.59	0.91	2.02	0.58	0.56	5.05	0.51	0.46	1.17	0.55
*Channel catfish	0.46	0.41	0.03	0.02	0.01	0.09	0.07	0.01	0.01	0.04	0.04	0.04	0.07
*Smallmouth bass	0.15	0.33	0.13	1.81	0.16	0.08	0.03	0.06	0.42	0.04	0.13	0.24	0.50
*Largemouth bass	0.31	0.58	0.54	3.00	0.28	1.25	0.12	0.55	1.32	0.22	0.23	0.50	0.52
*White crappie	5.40	0.28	0.39	0.98	0.12	1.22	0.69	0.04	0.08	0.34	0.03	0.50	0.04

* Designated by U.S. Environmental Protection Agency (1975) as "representative, important species"

Source: RMC, 1979a, Table 3.5-4, p. 3-69.

TABLE 7

Yearly comparison of the mean densities (no. per 1000 m^3) of ichthyoplankters (< 25 mm) at transect stations, 1969-1978.

Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
No. Samples	393	449	471	327	628	695	691	686	512	558
No. Species	27	24	18	15	28	27	26	28	19	32
Species										
Herring	-	-	-	-	-	-	-	0.02	-	0.01
Gizzard shad	-	-	-	0.01	1.16	0.23	162.41	243.30	105.85	23.75
Minnows	[illegible]	1.12	0.22	0.60	0.40	0.72	1.70	1.10	0.51	2.38
Stoneroller	-	-	-	-	-	-	-	-	-	0.01
Carp	14.22	9.90	8.60	21.77	17.88	8.69	13.57	53.32	31.51	63.07
Golden shiner	0.04	0.04	0.15	-	0.01	*	0.01	0.02	0.07	0.52
Comely shiner	-	0.04	0.01	0.07	0.01	0.01	0.05	0.03	0.24	0.19
Common shiner	-	-	-	-	-	-	-	-	0.08	0.02
Spottail shiner	0.15	0.22	-	-	0.04	0.01	0.03	0.02	-	0.42
Swallowtail shiner	0.04	0.04	-	-	-	-	-	-	-	-
Rosyface shiner	0.04	-	-	-	0.01	-	0.02	-	-	-
Spotfin shiner	0.41	0.30	0.34	0.11	0.07	1.10	0.43	0.48	0.06	0.35
Bluntnose minnow	0.04	-	-	-	0.01	0.04	0.06	*	0.02	0.10
Fallfish	-	-	-	0.01	-	-	-	-	-	-
Blacknose dace	-	-	-	-	-	-	-	*	-	0.14
Longnose dace	-	-	-	-	-	-	-	*	-	0.03
Creek chub	-	-	-	-	-	-	-	-	0.04	0.01
Suckers	0.03	0.04	-	0.01	0.02	-	0.01	0.04	-	0.07
Quillback	9.42	17.98	4.10	59.83	26.54	13.84	19.12	41.51	3.39	89.09
White sucker	0.07	0.07	0.04	0.43	1.49	0.24	0.21	0.15	-	0.64
Hog sucker	-	-	-	-	-	-	-	0.01	-	0.02
Shorthead redhorse	-	-	-	-	-	-	-	-	-	0.02
White catfish	0.19	0.01	-	-	0.04	0.03	-	0.04	-	0.01
Yellow bullhead	0.15	0.04	-	-	0.04	0.07	0.11	0.10	0.01	0.19
Brown bullhead	0.07	-	-	-	0.01	0.01	0.01	-	-	0.01
Channel catfish	24.16	9.72	2.35	0.01	6.98	6.25	18.21	10.08	3.66	9.89
Rock bass	0.11	0.07	-	0.04	0.01	0.02	0.02	0.29	0.01	0.11
Sunfishes	4.73	1.71	12.62	-	1.83	1.08	1.96	2.08	2.15	1.20
Redbreast sunfish	0.19	0.01	0.04	-	0.01	0.02	0.06	0.50	0.01	0.04
Green sunfish	0.01	0.01	-	-	-	0.01	*	0.01	-	-
Pumpkinseed	0.74	0.15	1.97	0.62	0.04	0.08	0.03	0.01	0.03	0.06
Bluegill	11.32	1.45	7.71	0.11	0.11	0.33	0.12	0.01	-	0.18
Smallmouth bass	0.45	0.07	0.04	-	0.01	0.02	0.01	0.23	-	0.21
Largemouth bass	0.01	0.04	0.04	-	0.01	*	-	*	-	0.01
White crappie	7.33	0.89	5.29	0.33	0.45	0.83	0.18	0.51	0.71	0.93
Black crappie	0.04	0.01	-	-	0.04	1.00	-	-	-	[illegible]
Perches	0.05	0.11	0.01	0.23	0.07	0.07	0.19	0.01	-	0.05
Tessellated darter	66.08	26.51	[illegible]	7.64	2.05	51.85	11.48	5.72	4.89	[illegible]
Banded darter	-	-	-	-	-	-	-	-	-	0.14
Yellow perch	-	0.01	-	-	0.01	0.05	0.05	0.02	-	0.07
Log perch	0.01	-	0.01	-	0.01	0.06	0.64	0.08	0.02	0.95
Shield darter	0.41	0.52	0.19	0.29	0.49	0.84	2.80	3.91	0.04	5.00
Walleye	0.01	-	0.30	0.14	0.11	0.03	0.27	0.04	-	0.03
Banded/shield darter	-	-	-	-	-	-	-	-	-	0.16
Unidentifiable	2.71	2.46	0.75	4.83	1.88	0.22	3.15	4.57	0.84	4.29
Total	144.63	73.12	64.57	97.04	50.38	86.75	236.92	368.26	154.11	215.26

Source: RMC, 1979b, Table 3.6-1, p. 3-72.

TABLE 8

Yearly comparison of the mean densities (no. per 1000 m^3) of ichthyoplankters (< 25 mm) at inshore stations, 1969-1978.

Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
No. Samples	103	74	175	316	192	192	288	[illegible]68	320	306
No. Species	17	12	15	15	14	14	12	16	14	14
Species										
Gizzard shad	-	-	-	:2.62	5.00	9.99	3092.15	1725.15	297.19	70.95
Northern pike	-	-	0.17	-	-	-	-	-	-	-
Minnows	2.55	2.76	0.24	0.73	0.19	0.56	1.12	0.36	0.07	2.52
Carp	3.44	3.83	1.31	1.50	2.96	9.40	2.91	10.59	1.52	3.23
Golden shiner	0.35	0.96	0.39	0.50	0.19	0.90	0.12	0.17	0.26	0.99
Comely shiner	0.26	1.13	-	-	0.74	9.09	9.28	4.60	3.92	223.61
Common shiner	-	-	-	-	-	-	-	-	0.46	0.08
Spottail shiner	-	-	-	0.04	-	-	-	0.35	-	-
Rosyface shiner	0.09	0.13	-	0.04	0.19	-	-	0.09	-	-
Spotfin shiner	1.66	0.65	0.09	-	0.74	4.22	0.32	0.87	-	0.13
Suckers	-	0.06	0.02	0.05	-	-	0.14	0.21	-	-
Quillback	94.76	17.79	8.90	10.80	5.37	2.85	2.60	28.26	1.23	19.47
White sucker	0.04	-	0.13	0.33	0.74	1.03	0.40	1.47	1.95	10.53
White catfish	-	-	-	0.17	-	-	-	-	-	-
Sunfishes	50.58	322.39	22.11	22.92	32.57	26.96	24.19	44.73	7.71	27.29
Redbreast sunfish	-	-	-	-	-	0.11	-	0.30	-	-
Pumpkinseed	0.26	-	11.08	-	-	-	-	-	-	-
Bluegill	1.66	0.17	31.92	-	-	-	-	-	-	-
Smallmouth bass	0.09	-	-	-	-	-	-	0.31	-	-
White crappie	15.79	53.11	41.38	44.19	7.77	25.86	2.66	0.59	3.63	0.12
Perches	-	0.06	-	0.16	0.29	-	0.20	-	0.06	0.07
Tessellated darter	0.04	0.09	0.04	0.17	0.37	-	-	-	-	-
Banded darter	-	-	-	-	-	-	-	-	-	0.14
Yellow perch	0.31	-	1.18	0.17	-	0.41	-	0.12	0.05	2.55
Log perch	0.13	0.17	0.61	0.17	0.19	3.18	1.16	0.73	0.25	16.29
Shield darter	0.31	0.21	0.04	0.33	0.37	0.77	2.69	0.80	0.25	0.24
Walleye	0.04	-	0.39	0.33	1.30	0.09	0.99	-	0.06	1.66
Banded/shield darter	-	-	-	-	-	-	-	-	-	0.26
Unidentifiable	5.87	18.56	1.20	1.93	0.10	0.34	5.84	6.66	1.00	5.44
Total	178.23	422.10	121.11	97.51	59.06	95.76	3146.77	1826.36	319.43	385.08

(Source: RMC, 1979b, Table 3.6-2, p. 3-73.)

In summary, the licensee's CPUE data from trap net, trawl, seine, and meter net (ichthyoplankton) collections provide information on species composition, relative abundance, spatial distribution and temporal variations for the fish community of Conowingo Pond over a period of almost 13 years (late 1966 through early 1979). This period consists of approximately 7 years of preoperational study and 6 years of operational study. The last 2 years of available data, i.e., from the latter half of 1977 through the first half of 1979, have been collected during a period of plant operation, typical of the expected long-term two-unit operational level. The CPUE for most of the commonly occuring species have been within the range of variation observed in both the preoperational period and initial operational period. Where temporal differences in CPUE are notable (e.g., the lower CPUE for white crappie since 1972), such differences are also reflected, spatially, throughout Conowingo Pond. The licensee's consultant has pointed out that, in the case of white crappie, the greatest reduction in catch has occurred in areas of the Pond which are unaffected by plant operation. These areas located in the southern section of the Pond have been identified as the principal spawning grounds for both the white crappie and gizzard shad (RMC, 1979b, p. 3-70).

The success of gizzard shad after its accidental introduction to Conowingo Pond in 1972, and the concurrent decline in white crappie CPUE, would suggest a competitive interaction of these species, with gizzard shad having the competi edge. Such an interpretation is confounded, however, with the effects on the fish community of tropical storm Agnes which also occurred in 1972. Effects on community dynamics of the planned introductions of several species and two hybrids are also unknown. The two hybrids, striped bass X whitebass and the tiger muskie, were introduced by the Pennsylvania Fish Commission during 1977-78 in response to, and in hope of controlling, the expanding population of gizzard shad. Although the mean density of gizzard shad young declined in 1977-78 (see Tables 7 and 8), it is too early to give unqualified credit to the hybrid introduction program in bringing about this reduction. It would be of academic interest (and of practical interest to managers of reservoir fisheries) to follow this program through several more years; however, the staff finds no justification, with regard to potential plant effects, for imposing monitoring requirements on the licensee to accomplish this purpose. The staff concludes that termination of studies on the community dynamics of fishes in Conowingo Pond is justified since operational monitoring has identified no detrimental effects attributable to plant operation.

Other studies required by ETS 6.1.a.1 address effects of plant operation on population parameters for selected important fish species. In addition to the EPA-designated "representative important species" of fish,* the licensee has presented information on pumpkinseed, yellow perch and spotfin shiner for some of the parameters studied. The results of these studies were examined and no detrimental effects of plant operation could be identified. Our summary review, below, addresses those parameters and species for which differences between preoperational and operational periods have been observed.

*In 1975, the following fishes were designated by EPA as "representative important species" for purposes of the Peach Bottom Section 316(a) demonstration: white crappie, channel catfish, bluegill, gizzard shad, largemouth bass and walleye.

Results of food habit studies have been summarized in Report No. 11 (RMC, 1979a, Section 4.1) for white crappie, channel catfish, bluegill, pumpkinseed, smallmouth bass, largemouth bass, walleye, yellow perch, spotfin shiner, and gizzard shad. No significant differences in food habits between preoperational and operational periods or between plume and ambient areas were noted for bluegill, pumpkinseed, and yellow perch. The food habits of spotfin shiner were not studied in the operational period whereas the food habits of gizzard shad were only studied in the operational period. The purpose of the latter investigation was to examine the possible extent of competition for the same food items between gizzard shad and resident species. Results (IA, 1977) suggest that most competition would likely occur between small gizzard shad (< 25 mm) and the young of species (e.g., white crappie, channel catfish, and bluegill) which, in their early life stages, depend almost exclusively on zooplankton. Differences between preoperational and operational periods were noted in the food habits of white crappie, channel catfish, basses, and walleye. Young of white crappie did not eat fish in the preoperational period but were piscivorous in the operational period. Young of gizzard shad became a major prey fish of the adult white crappie in the operational period whereas young bluegill and the tessellated darter had been the most important fishes consumed by adult white crappie during the preoperational period. Likewise, young gizzard shad became a major forage species for channel catfish, smallmouth and largemouth basses, and walleye during the operational period. Minor differences in food items for specimens collected from the thermal plume area were noted in white crappie (greater reliance on chironomids and "other aquatic insects"), channel catfish (consumption of chironomids began earlier in spring), smallmouth bass (young channel catfish were more prominent in the forage), and walleye (gizzard shad particularly dominated the forage).

The study of white crappie reproduction included determinations of gonosomatic ratios and egg production for the years 1971-1977 and 1971-1976, respectively. As shown by Figure 2, the gonosomatic index [(weight of ovaries ÷ total weight of fish) x 100] traces a generalized reproductive cycle with rapidly increasing values in early to mid-May, peak values from mid-May to late June, and decreasing values to the completion of spawning activity in late July to early-August.

Although variations within this generalized cycle have occurred, statistical analyses performed by the licensee's consultant did not reveal any consistent trends between preoperational and operational status nor between thermal plume and ambient areas for monthly (March through July) values of the gonosomatic index. The most notable difference between preoperational (1971-73) and operational (1974-77) periods is the bimodal or multimodal character of the gonosomatic index plot in the operational years as compared with the smoother, nearly unimodal, plots in the preoperational years. Interruption in spawning has been indicated as a possible response to substantial drops in water temperature (RMC, 1979a, p. 4-12) following Tropical Storm Agnes (17°F in 1972) and unseasonably cold weather (9°F in 1975).*

*Note that the plots of water temperature in Figure 2 represent data collected at the time of fish collection (typically biweekly but in some years approaching a weekly frequency) and may not fully describe the range and rate of temperature change between collections.

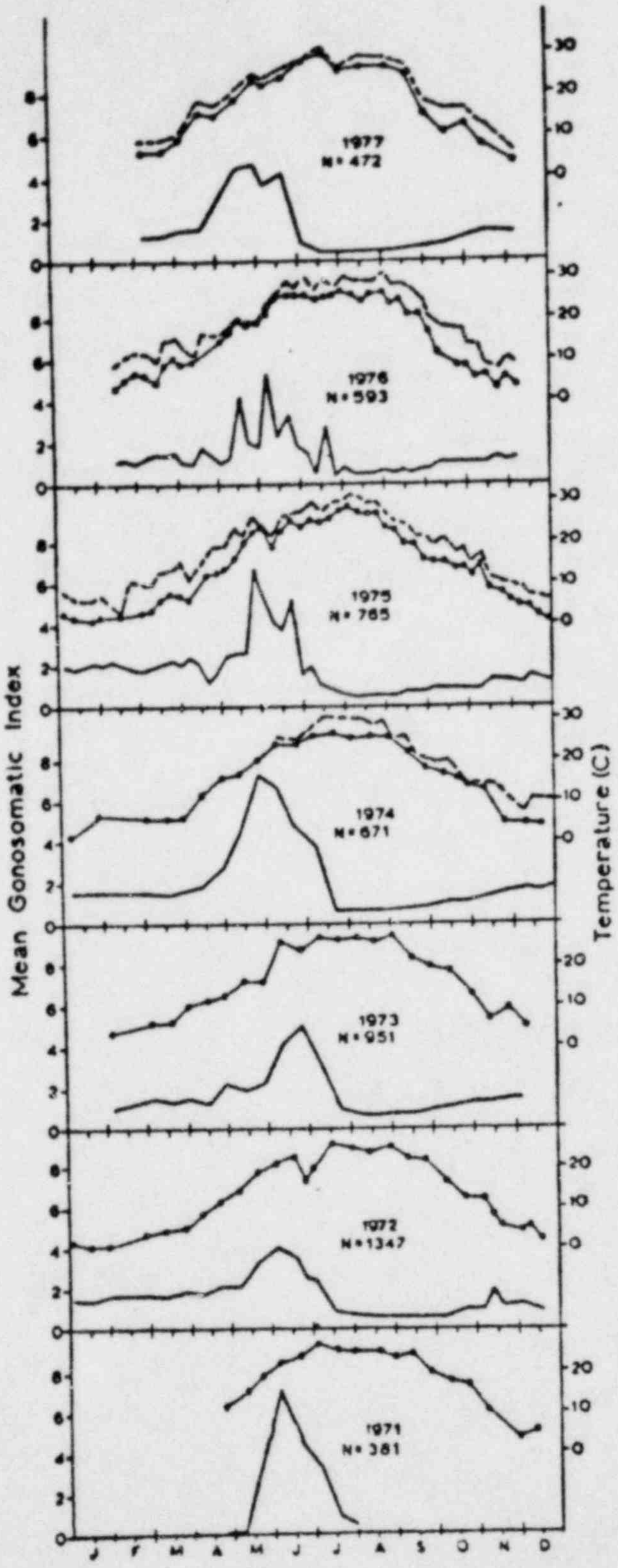

FIGURE 2

Plot of gonosomatic indices of white crappie and water temperature (•—• ambient, ----- plume) during the preoperational (1971-1973) and postoperational (1974-1977) periods in Conowingo Pond.

Source: RMC, 1979a, Figure 4.3-1, p. 4-24.

The multimodel character of the gonosomatic index for 1975 and 1976 is examined further by comparison of values recorded for white crappie collected at ambient Pond stations versus those for collections in the thermal plume (see Figure 3). Note that a dominant feature in each of the six plots given in Figure 3 is the bimodal shape during the period May-July. The bimodality is more pronounced and peak values of the gonosomatic index are greater in "Ambient" collections (bottom three plots) than in "Plume" collections (top three plots). Timing of primary and secondary peaks for "Plume" and "Ambient" were nearly the same in 1975 and in 1977, thereby enhancing the bimodal character for the mean of "Ambient" and "Plume" data combined. (Refer again to Figure 2 for this aspect of the data analysis, noting also the contrast between the plot for 1976 and those for 1975 and 1977.) The multiple peaks in the 1976 plot resulted from the different timing in peaks of the gonosomatic index for "Ambient" and "Plume" collections. (This aspect can be seen by referring back to the middle two plots in Figure 3.) In the 1976 year, the primary and secondary peaks occurred slightly earlier in the "Plume" than in the "Ambient" collections. The licensee's consultant investigated whether the observed differences for 1976 were related to different spawning by the two different age groups which dominated the 1976 collections of white crappie. Results of this investigation indicated that most of the older fish ($\geq$ Age V) completed spawning earlier than II year olds and that the secondary peak in the gonosomatic index appeared to be due largely to the later spawning of the II-year old fish (IA, 1977, p. 4-34). This finding would suggest that the timing of the spawning peaks is dependent on age composition of the spawning stock. An additional aspect of the plot for

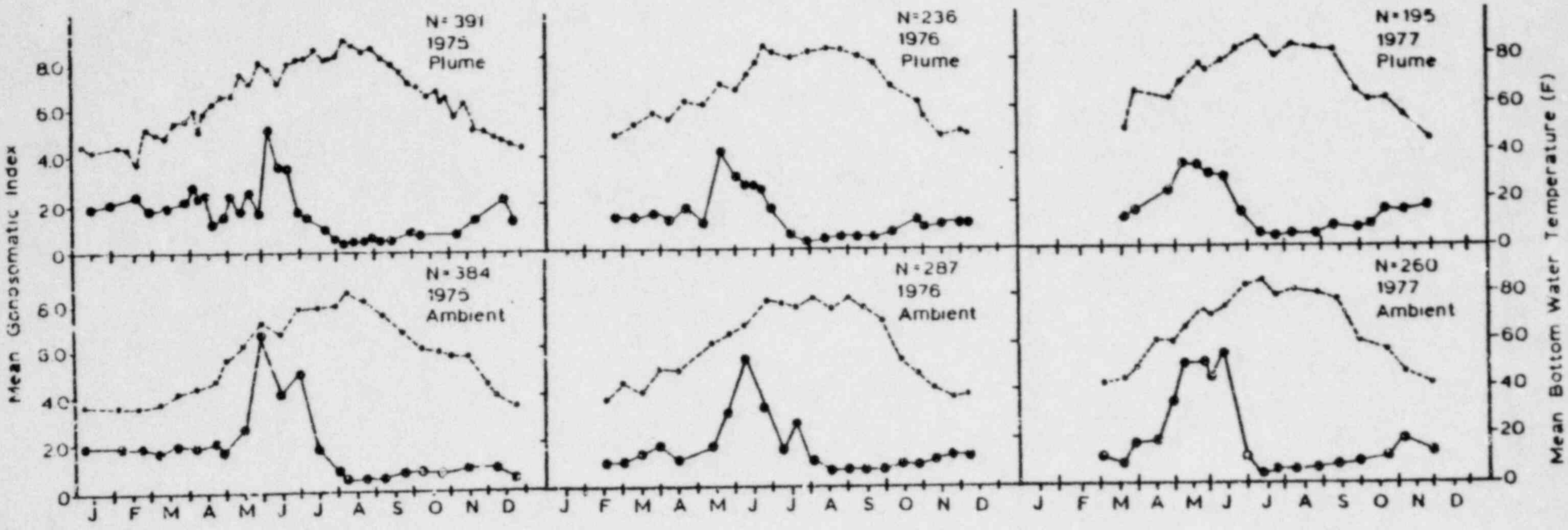

FIGURE 3

Seasonal variation in mean bottom water temperature (dashed line) and mean gonosomatic index (solid line) of white crappie collected in ambient water and in the thermal plume in Conowingo Pond, 1975-1977.

Source: RMC, 1978, Figure 4.3-1, p. 4-18.

1975 "Plume" collections is the more sporadic character during April and May (see upper left plot in Figure 3) as compared with the 1975 "Ambient" and with both "Plume" and "Ambient" for the years 1976 and 1977. This difference may be attributable to ingress and egress of fish to and from the thermal plume area in response to rapidly fluctuating plume temperature or may reflect differences in sampling frequency and sample size.

In addition to the determination of the gonosomatic index, the reproduction studies included estimation of fecundity for selected species. Results for white crappie are of particular interest due to the observed difference between preoperational and operational periods. In preoperational years, 1971 through 1973, the average number of eggs per female white crappie was 25,840 with egg production of individuals ranging from 9,000 to 145,400. In the operational years, 1974 through 1976, the average increased to 44,500 eggs per female with a range of 7,000 to 147,800. Relative fecundity (i.e., number of eggs per gram of fish weight) also differed between the two periods as shown in Table 9. These observed differences have been attributed, in part, to differences in weight, length and age composition of the samples (RMC, 1979a, p. 4-14). Variation in age composition reflects year class fluctuations and dominance of a strong year class over several years. The licensee's consultants have also indicated some potential evidence of density-dependent compensation in the form of increased fecundity and increased growth rate following the thinning of white crappie in 1972 (due to flooding associated with Tropical Storm Agnes). An additional line of potential evidence for compensation is in the inverse relationship between fecundity and population size. Presently, these relationships are considered only possibilities by the investigators because no statistical correlations could be established (Mathur et al., 1979). If

TABLE 9

Yearly variations in mean length, weight, age and fecundity of white crappie collected from Conowingo Pond, 1971-1976.

Year	N	Length	Weight	Age	Absolute Fecundity	Relative* Fecundity
1971	37	190.4	137.7	2.37	27,800	236
1972	41	202.4	122.8	3.24	24,400	201
1973	9	213.6	139.8	3.78	24,300	177
1974	32	209.7	147.4	3.44	41,300	300
1975	79	223.5	172.9	3.28	53,500	304
1976	75	209.2	152.2	2.97	37,000	261

* Relative fecundity - number of eggs per gram of fish weight

Source: RMC, 1979a, Table 4.3-2, p. 4-21.

compensatory fecundity is operable in the white crappie population, the magnitude has not been sufficient to offset other factors which have effected a reduced population level of white crappie since 1972. The lower population levels have been discussed previously in the review of CPUE data. The introduction of gizzard shad, which competes for the same food resource, is one factor which complicates the interpretation of the dynamics of the white crappie population as a functon of the possible compensatory mechanisms. As was previously noted, the CPUE of white crappie in late 1977 and early 1979 showed an increase in population abundance compared with some earlier years in both the preoperational period and the operational period. Studies of white crappie reproduction were not performed during 1978-79, a period of operation at the typically expected two-unit level. However, the results of reproduction studies, reviewed above, and the most recent CPUE data support a finding that fluctuations in abundance of white crappie in Conowingo Pond have not been causally related to operation of Peach Bottom.

Attempts to estimate mortality rates for young-of-the-year white crappie and channel catfish have been only partially successful. For the 12-year period of study, 1966-1977, estimates could only be made for three of the years for each species, i.e., for white crappie in 1969, 1971 and 1974 and for channel catfish in 1971, 1974 and 1975. Operation of the plant in 1974 and 1975 was not typical of the expected two-unit load factor; however, circulating water pumps were operated at normal levels during the latter half of 1974 and first half of 1975. Thus, the estimate of total mortality would include typically expected impingement mortality for young-of-the-year fishes in July-October 1974. This 4-month period corresponds to that segment of the catch curve used in estimating total mortality rates. Results indicate that the populations of young white crappie and channel catfish in Conowingo Pond were being lost at average daily rates of 4.8% and 7.2%, respectively. Impingement rates during the same period averaged less than one white crappie per day and 24 channel catfish per day. From these results, it appears that impingement (the major causal link between plant operation and losses of fishes in the size groups being studied) made a negligible contribution to the estimated total mortality.

Impingement of white crappie and channel catfish has been greater during winter months than during the July-October period of study considered in the estimation of total mortality. To place this in perspective, the licensee's consultant has described winter impingement of white crappie and bluegill to be equivalent to the sport harvest of a few anglers over the same period of comparison (Mathur et al., 1977). Winter impingement of channel catfish could not be put into a similar perspective since few anglers fished for channel catfish.

Some notable differences have occurred in the sport fishery of Conowingo Pond in recent years. However, a significant winter fishery had not developed in the thermal plume area based on a survey conducted through the winter of 1977. This has been attributed to a lack of suitable access for both boat and shore fisherman. Anglers who did fish the thermal plume area reported generally higher harvest rates, especially for walleye.

A winter fishery for crappie has developed primarily in the lower pond, with icefishing there accounting for 10% of the total fishing effort throughout the pond. Fishing in the upper pond was primarily by boat, and catch there was dominated by smallmouth bass and channel catfish. The seven-fold increase in smallmouth bass harvest since a 1960 survey was the most dramatic difference observed between preoperational and operational periods. This has resulted from an increase in fishing pressure but also from a five-fold increase in catch per effort since the 1960 survey.

In the FES, it was noted that some localized fish mortalities had occurred in the vicinity of the Muddy Run Station intake but that the exact causes for those fish mortalities were unknown (AEC, 1973, pg. II-42). Although the ETS did not require an operational study on the occurrences of fish kills (other than impingement at Peach Bottom), the licensee's consultant has continued these observations incidental to the ETS-required field sampling program. A summary of the observations for the years 1966-1978 is given in Table 10.

The notable difference in the operational period is the appearance of gizzard shad in observations of fish mortalities, beginning in 1975. Kills of gizzard shad in 1975-1976 were attributed to operation of Muddy Run Station, while the majority of dead channel catfish in 1975 appeared to have died from bacterial infections. The latter had been a suspected source of mortality based on preoperational observations. The larger kill of gizzard shad, channel catfish, and carp observed in 1977 was, at first, thought to have been caused by the Muddy Run Station; however, the source of mortality was indicated by a subsequent investigation to have been associated with an oxygen depletion in the tailrace of the Holtwood Hydroelectric Station. There have been no fish kills causally related to the discharges from Peach Bottom.

TABLE 10

Species composition of dead fishes observed in July-December during the preoperational (1966-1973) and postoperational (1974-1978) periods in Conowingo Pond.

Species	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Gizzard shad	-	-	-	-	-	-	-	-	-	300	3000+	30,000+	-
Northern pike	-	-	-	-	-	-	-	-	-	-	-	1	-
Muskellunge	-	-	-	-	-	-	-	-	-	-	-	-	1
Tiger muskie	-	-	-	-	-	-	-	-	-	-	-	2	-
Carp	-	-	-	-	-	1	4	-	43	13	-	100+	4
Golden shiner	-	-	-	-	-	1	-	-	-	-	-	-	-
Spottail shiner	-	-	-	1	-	-	-	-	-	-	-	-	-
Spotfin shiner	-	-	-	-	-	-	1	-	-	-	-	-	-
Creek chub	-	-	-	-	-	-	1	-	-	-	-	-	-
Quillback	-	-	-	-	-	1	-	-	-	-	-	-	-
White sucker	-	-	-	-	1	2	-	-	5	1	-	-	-
Catfish species	-	50	3	-	-	-	-	-	-	-	-	-	-
Yellow bullhead	-	-	-	-	-	-	-	-	-	1	-	-	-
Brown bullhead	-	-	-	-	-	-	-	-	1	1	-	-	-
Channel catfish	-	11	2	13	4	273	45	1	137	546	28	600+	17
Redbreast sunfish	-	-	-	-	-	-	-	-	1	-	-	-	-
Green sunfish	-	-	-	-	-	-	-	-	-	-	-	1	-
Pumpkinseed	-	-	-	-	1	5	-	2	-	-	3	1	2
Bluegill	-	-	-	1	-	4	-	2	1	1	2	2	-
Smallmouth bass	-	1	-	-	-	-	-	-	-	1	1	-	-
Largemouth bass	-	-	-	-	-	1	-	-	3	-	-	-	-
White crappie	-	-	1	96	35	440	12	19	6	17	28	33	16
Yellow perch	-	1	-	-	-	1	-	-	-	-	-	-	-
Walleye	-	1	-	-	150	1	-	-	-	1	-	-	-
Unidentifiable	-	-	-	-	-	161	-	-	-	-	-	-	-
Total		64	6	111	191	891	63	24	197	882	3062+	30,740+	40

Source: RMC, 1979a, Table 4.7-1, p. 4-63.

Limnology (ETS 6.1.7.2) - The purpose of this ETS study was to obtain sufficient data, on benthic and planktonic organisms and on water quality, to enable the determination of effects on the "pond ecology" as a result of the operation of Peach Bottom. The specific objectives of the study were as follows:

A. For benthic and planktonic organisms--to determine species composition, distribution, relative abundance and annual and seasonal variations in relative numbers and biomass.

B. For water quality--to monitor physical and chemical parameters of Conowingo Pond; to document and evaluate the ecological effects (if any) of Peach Bottom operation and the effects of natural phenomena on the water quality parameters; to draw correlations between the water quality parameters and the aquatic communities of Conowingo Pond.

Collection gear to be used in these studies was not specified by the ETS but have been described in the licensee's reports to the NRC and previously reviewed for the NRC by Oak Ridge National Laboratory (Adams, et al., 1977). Sampling frequency has been twice monthly throughout the year except for missed samples during some winters due to ice cover. Sampling locations were selected to provide representative data from throughout Conowingo Pond and more detailed data from the immediate vicinity of the Peach Bottom site. In general, sampling locations were established and have been consistent since 1967.

Results of the benthos and plankton studies conducted during initial plant operation, 1974-1975, were considered in the review performed by Oak Ridge National Laboratory (Ibid). In their comparison of predicted verses observed impacts (see Table 1), ORNL identified no significant impacts on the benthic and planktonic communities during initial plant operation. In our present review, we have examined the more recent results of the limnological studies, particularly those results from the 1977-1979 period. Note that this recent period has been characterized previously in this review as typical of expected "normal" two-unit operation with regard to power level.

The licensee's consultants have described the variation in the benthic community via number and biomass densities, species diversity and percent similarity indices and phylogenetic lists. Comparisons have been made between stations and between operational status. We have selected the biomass density data to characterize the observed changes in benthos.

As demonstrated by Table 11, the mean monthly density (recorded in mg dry weight per 81 in^2) has varied between ∼ 2.8 in August 1972 and ∼ 43.0 in December 1969. During the operational years, 1974-1979, the range has been from ∼ 3.0 in October 1975 to ∼ 40.0 in December 1974. For the recent period of "normal" two-unit operation, the range has been from ∼ 6.1 in September 1977 to ∼ 32.8 in June 1979.

In general, the years with low mean biomass densities can be traced to high river flow conditions (see Table 12). The lower annual mean densities, recorded in 1972-1973 are attributable to flooding from Tropical Storm Agnes;

TABLE 11

Comparison of the monthly mean biomass of benthos (mg dry weight per 81 in.^{2}) at stations in preoperational (1967-1973) and postoperational (1974-1979) periods in Conowingo Pond. Dashes indicate sampling not conducted.*

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1967	-	-	-	-	-	11.901	12.509	12.693	12.994	9.002	10.753	16.164	12.388
1968	-	-	-	10.579	8.687	6.782	14.609	6.828	14.814	15.060	-	-	9.963
1969	-	-	-	-	-	27.488	23.055	14.099	32.256	15.606	34.752	43.016	23.292
1970	-	-	39.472	9.239	-	16.672	23.172	10.811	9.118	15.097	10.828	-	14.997
1971	-	-	-	-	32.110	-	18.285	14.989	12.627	8.483	10.145	8.352	13.911
1972	10.590	-	-	10.155	11.080	11.254	8.645	2.831	5.689	7.333	12.922	9.105	8.448
1973	14.732	13.000	12.733	9.049	5.478	3.192	5.211	3.841	6.614	12.871	13.687	15.111	9.022
1974	15.895	-	15.614	19.110	16.809	21.154	19.976	14.647	17.389	22.450	32.209	40.026	21.392
1975	36.865	37.109	19.681	23.278	18.920	26.407	15.270	8.981	9.980	3.029	4.180	3.298	16.392
1976	-	5.096	4.500	5.271	6.502	14.058	17.178	14.962	12.027	22.235	20.479	-	13.014
1977	-	-	18.577	19.728	11.043	14.270	7.931	6.721	6.134	7.606	12.531	13.824	12.018
1978	-	-	-	12.497	12.884	13.498	20.127	11.525	9.575	20.198	24.804	28.648	16.404

* Source: RMC, 1979a, Table 2.5-10, p. 2-88.
** Source: RMC, 1979b, Table 2.5-10, p. 2-70.

TABLE 12

Comparison of the monthly and annual mean river flow (x 1000 cfs) at Holtwood Dam, January 1967–June 1979. Data supplied by Pennsylvania Power and Light Company.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
1967	20.5	30.8	82.6	64.4	66.0	19.2	15.4	21.3	10.6	27.2	44.2	48.4	37.6
1968	18.3	40.2	56.9	34.7	49.6	54.1	18.9	6.5	14.0	7.0	43.9	34.3	31.5
1969	23.0	28.6	28.7	39.6	34.5	20.4	15.8	18.9	6.7	5.2	27.3	32.3	25.1
1970	19.1	59.5	52.4	136.9	42.5	21.2	21.1	10.9	8.7	18.1	58.5	42.6	41.8
1971	27.7	74.5	103.8	62.7	45.4	15.3	7.6	14.5	11.1	11.1	18.5	59.7	37.7
1972	46.9	31.8	113.1	91.1	72.3	178.0	58.2	12.8	7.5	7.5	55.5	105.5	65.0
1973	51.3	62.8	64.9	80.8	60.5	37.3	21.9	14.6	16.1	13.8	27.0	89.8	45.1
Min.	18.3	28.6	28.7	34.7	34.5	15.3	7.6	6.5	6.7	5.2	18.5	32.3	25.1
Mean	29.5	48.3	71.8	75.7	53.0	49.4	22.7	14.2	10.7	12.8	39.3	58.9	40.5
Max.	51.3	64.5	113.1	136.9	72.3	178.0	58.2	21.3	16.1	27.2	58.5	105.5	65.0
1974	72.7	47.6	61.4	92.4	39.7	19.4	21.4	10.6	21.2	11.8	23.0	53.5	39.6
1975	54.4	84.9	81.9	49.9	58.2	43.5	20.2	10.0	83.4	66.7	42.0	37.2	52.7
1976	49.2	100.8	63.8	43.2	34.2	38.0	24.6	20.4	12.5	80.9	36.5	25.1	43.9
1977	11.5	24.7	125.9	85.7	28.8	11.7	18.4	12.9	34.0	73.1	71.4	87.7	49.0
1978	85.2	37.9	118.0	93.8	81.5	27.1							
1979	100.5	45.8	143.9	65.1	43.4	26.1							

Source: RMC, 1979b, Table 2.2-4, p. 2-12.

low monthly means from September 1975 through May 1976 are associated with high flow from Hurricane Eloise; low values during the latter half of 1977 may be associated with high flows during Spring 1977 and during October-December of that year. The low value, recorded for 1968, is likely due to missing data for the winter months and not to river flow conditions in that year. Large changes in abundance of the commonly occurring species were noted following Tropical Storm Agnes in 1972, e.g., densities of some common species were reduced by 3 to 10 times the pre-storm densities while densities of other common species increased 3 to 30 times the pre-storm densities.

Some differences in benthos density have been recorded at the discharge station (Sta. 605) relative to the upstream control station (Sta. 601). For the recent operational period (1977, 1978, and the first half of 1979) the mean densities at the discharge station were about 60 to 70% less in numbers and 20 to 75% less in dry-weight than the mean densities at the central station. This anticipated plant effect is localized and negligible with regard to the benthic community of Conowingo Pond, which has undergone and recovered from large natural perturbations affecting the entire Pond.

Results of phytoplankton studies have been presented via concentrations of plant pigments, an analysis of covariance for total chlorophyll a between the control and other sampling stations, and a trophic index, the latter being a measure of the degree of eutrophication.

Early in these studies, it was found that fluctuations in concentrations of plant pigments were significantly correlated with variations in river flow, i.e., concentrations decreased due to the dilution associated with increased river flow (IA, 1975, p. 2-26). ORNL noted the similarity of response (i.e., sharp decline) in chlorophyll a concentrations at all stations in Conowingo Pong to the increased flow rates during September-October, 1975 associated with Hurricane Eloise (Adams, et al., 1977, p. 3-99). From these data for the initial operational period, ORNL further noted that chlorophyll a concentrations at the discharge (Station 605) were higher than at most stations, particularly during winter, suggesting a possible beneficial effect of the heated plume on primary production (Ibid, p. 3-105).

In Table 13, we have constructed a summary of the (total) chlorophyll a concentrations from the results presented in the licensee's (post) operational reports No. 9, No. 11, and No. 12. This facilitates a comparision of results from the preoperational period, 1971-73, with the recent operational period, 1977 through mid-1979. The annual means for 1977 and 1978 and the six-month mean for 1979 were similar to or greater than the preoperational means. Monthly means differed but means during the operational period were generally within the range of variation observed in the preoperational period. The lower monthly mean values observed in September-November, 1977, may be attributable to high river flow during that period (see Table 12 for comparison of river flow). Recall also that high flows associated with Tropical Storm Agnes occurred in 1972, one of the years used to establish the range of variation during the preoperational period. Overall, the results for the operational period, 1974-1978, did not differ significantly from those for the preoperational period, 1971-73, a conclusion supported by the covariance analysis performed by the licensee's consultatnts (RMC,1979a).

TABLE 13. COMPARISON OF MONTHLY MINIMUM, MAXIMUM AND MEAN TOTAL CLOROPHYLL a CONCENTRATIONS (MG/M^3) FROM PREOPERATIONAL (1971-1973) AND OPERATIONAL (1977, 1978, JANUARY-JUNE 1979) PERIODS IN CONOWINGO POND.

	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan-Dec
							Clorophyll a (Total) 1971-1973							
Surface	N	36	20	31	44	45	41	54	56	49	29	37	36	478
	Min	0.00	0.00	0.35	0.66	1.04	4.48	1.31	4.53	5.58	3.22	1.70	0.95	0.00
	Max	10.82	1.74	7.06	50.21	117.29	96.84	33.66	92.14	70.06	53.04	40.68	9.51	117.29
	Mean	1.56	0.92	2.18	5.23	17.29	26.14	15.51	21.25	17.64	16.84	13.37	3.60	13.02
Bottom	N	12	5	10	18	21	18	29	28	27	15	19	16	218
	Min	0.00	1.00	0.96	0.00	3.40	8.14	2.31	5.92	4.87	3.20	2.96	1.26	0.00
	Max	1.70	2.35	2.87	11.79	25.55	47.24	42.42	33.41	40.46	30.14	24.38	12.10	47.24
	Mean	0.62	1.75	1.89	3.51	14.36	23.25	15.45	15.51	15.48	13.93	10.67	4.47	11.93
							1977							
Surface	N	4	4	13	14	14	13	14	14	14	14	14	7	139
	Min	2.00	6.09	2.05	2.09	6.05	2.74	7.01	5.96	6.10	1.96	1.61	3.00	1.61
	Max	3.39	9.48	19.54	30.34	41.56	32.69	34.85	29.80	24.91	5.14	12.80	3.66	41.55
	Mean	2.54	7.45	8.51	13.85	22.24	17.37	17.03	17.53	12.42	3.95	5.36	3.29	12.18
Bottom	N	-	-	10	10	10	10	10	10	10	10	10	5	95
	Min	-	-	3.57	2.65	9.05	5.44	5.35	4.40	6.79	3.35	1.96	2.69	1.96
	Max	-	-	22.10	31.38	40.55	30.45	22.17	29.50	23.21	7.36	7.79	3.97	40.55
	Mean	-	-	10.63	14.00	20.83	16.95	15.06	18.67	14.70	4.86	4.67	3.53	12.86

TABLE 13. (Con't)

1978

Month		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan-Dec
Surface	N	2	4	3	7	12	14	14	14	14	13	14	14	125
	Min	0.34	0.00	0.00	4.31	6.00	9.06	9.45	9.50	8.45	8.35	9.66	2.39	0.00
	Max	0.35	2.35	8.22	7.48	21.36	40.85	51.67	28.32	37.02	36.05	49.55	11.04	51.67
	Mean	0.35	1.06	4.65	5.85	11.61	22.37	33.99	20.35	18.64	23.33	27.11	5.37	18.34
Bottom	N	-	-	-	5	10	10	10	10	10	10	10	10	85
	Min	-	-	-	5.13	5.39	15.53	8.49	7.23	9.37	13.72	13.06	2.97	2.97
	Max	-	-	-	6.48	21.01	34.23	39.96	26.69	28.00	33.77	44.38	8.33	44.38
	Mean	-	-	-	5.96	11.97	25.65	29.84	19.92	19.82	23.23	27.65	5.08	19.55

1979

		Jan	Feb	Mar	Apr	May	June	(Jan-June)
Surface	N	2	4	9	13	14	14	56
	Min	2.57	0.00	0.00	0.35	5.92	2.78	0.00
	Max	5.39	2.04	0.70	16.33	41.04	50.21	50.21
	Mean	3.98	0.76	0.23	5.24	27.00	19.68	13.12
Bottom	N	-	-	5	10	10	10	35
	Min	-	-	0.00	0.00	6.26	3.75	0.00
	Max	-	-	0.70	6.74	35.99	41.14	41.14
	Mean	-	-	0.42	3.12	26.82	20.71	14.53

Sources: 1971-73 and 1977 - RMC, 1978, Table 2.3-1, p. 2-27.
1978 - RMC, 1979a, Table 2.3-1, p. 2-36.
Jan-Jun, 1979 - RMC, 1979b, Table 2.3-1, p. 2-31.

Symbol code: Number of samples (N)
No sampling conducted (-)

The densities of zooplankton in Conowingo Pond have been associated with water temperature and river flow; i.e., low densities at low temperature and high flow and high densities at high temperature and low flow. This trend was observed in both preoperational and operational periods (RMC, 1979a, p. 2-43). Variations in total zooplankton density between stations and between years (1967 through 1978) are summarized in Table 14. One point of note is that the density at the upstream control station (601) has generally been lower than that observed at the discharge station (605).

Using analysis of covariance, the licensee's consultant determined that the adjusted means for the whole pond in 1975 and 1977 were significantly lower ($P \leq .01$) than the adjusted mean for the preoperational period. In contrast, it was found that the 1978 adjusted mean density was significantly higher ($P \leq .01$) than the preoperational value (RMC, 1979a, p. 2-44). The licensee's consultant has suggested that one reason for lower zooplankton densities in 1975 and 1977 was excessive predation by young gizzard shad. As shown in Table 12, the annual mean river flows in 1975 and 1977 were higher than the flows for all preoperational years, except 1972 (the year of Tropical Storm Agnes). Therefore, it appears that high flows may have contributed partially to the lower densities observed in 1975 and 1977.

The licensee's consultant has provided more detailed information for the abundant taxa of zooplankton. Where differences in densities have been noted between preoperational and operational periods, these have not been attributable to plant operation but to natural conditions similarly affecting most stations throughout Conowingo Pond.

TABLE 14

MEAN NUMBER OF TOTAL ZOOPLANKTON (NO./LITER) AT STATIONS 601-611 IN CONOWINGO POND. JANUARY-DECEMBER, 1967-1978. (N = Number of Samples)

STATION	601	602	603	604	605	606	607	608	609	610	611	MEAN
1967	49.5	94.9	87.1	101.8	72.8	62.7	194.5	102.0	-	-	-	97.3
N	6	7	7	7	8	8	8	9	-	-	-	60
1968	72.2	80.9	118.6	94.6	-	-	-	-	65.4	101.6	159.4	100.8
N	8	7	8	8	-	-	-	-	9	9	10	59
1969	47.9	69.5	79.7	-	38.5	43.2	77.8	42.6	55.8	82.6	-	61.3
N	8	11	10	-	10	10	14	6	8	8	-	85
1970	28.3	30.9	26.6	60.5	40.1	38.5	89.1	47.1	76.0	132.5	101.3	60.9
N	18	18	18	18	20	20	20	1[illegible]	19	18	18	205
1971	30.7	47.5	45.9	48.1	50.6	48.0	84.8	78.3	105.3	121.6	110.9	70.4
N	13	13	13	13	13	13	13	13	14	13	13	144
1972	19.4	17.9	17.7	31.1	24.7	20.1	35.7	17.3	23.9	39.8	41.8	26.3
N	19	19	19	19	19	19	19	19	19	19	19	209
1973	9.6	10.8	10.5	19.0	10.1	11.6	25.5	14.2	19.5	31.8	35.0	17.9
N	21	21	21	20	21	21	21	21	21	21	21	230
1974	16.0	15.7	29.5	40.2	18.1	20.8	56.0	21.3	26.7	50.2	68.4	33.0
N	21	21	21	21	21	21	21	21	21	21	21	231
1975	8.7	6.7	12.0	12.8	12.1	12.7	19.4	8.3	10.2	13.7	13.2	11.8
N	20	20	20	20	20	20	20	20	20	20	20	220
1976	4.1	5.6	6.7	11.5	7.2	8.6	10.5	8.2	9.2	12.7	37.6	11.1
N	18	18	18	18	18	18	18	18	18	18	18	198
1977	20.7	14.2	19.9	35.1	26.3	32.5	22.6	24.3	44.0	36.6	34.9	28.3
N	19	19	19	19	19	19	19	19	19	19	19	209
1978	20.2	21.6	32.5	53.7	30.2	38.2	55.6	28.3	41.0	43.6	77.9	40.3
N	17	17	17	17	17	17	17	17	17	17	17	187

Source: RMC, 1979a, Table 2.4-6, p. 2-50.

The licensee's water quality studies further document the general homogeneity of Conowingo Pond. Spatial variations in physiochemical parameters are small compared to seasonal variations. Water chemistry and some of the physical parameters have been significantly correlated with river flow as were the benthic and plankton communities. In general, monthly mean values for water temperature were higher in most months during the operational period than during the pre-operational period.

The contribution of thermal addition's from Peach Bottom to the Pond water temperature are summarized in Table 15 (ΔT between intake and discharge). In the recent period (typical of "normal" two-unit operation) from late 1977 through the first half of 1979, the monthly mean ΔT across the plant has ranged from 5.6°C in October 1978 to 12.7°C in February 1979. The maximum ΔT for this period, as well as for the total operational period, was recorded for the month of January 1978 (i.e., 18.7°C). To place the plant thermal inputs into perspective, in 13 of the 22 months over the period September 1977 through June 1979, the mean surface water temperature in Conowingo Pond was higher than the established pre-operational mean value for the corresponding month (see Table 16). For the other 9 months, the monthly means were equal to or less than the pre-operational mean for the same month. Typically, the differences between pre-operational and operational mean values are less during the warmer months of the year when the cooling towers are operating with higher cooling efficiencies. Other than the noted localized effects in the immediate discharge area, we identified no impacts on the biotic communities due to thermal effluents from Peach Bottom.

TABLE 15

Monthly summary of PBAPS operation, 1974-1979. Temperature increase (Delta T) of circulating water to Conowingo Pond as measured by paired hourly thermograph water temperature readings[c]. Discharge structure (S32) minus PBAPS intake (S30) - °C.

	Hourly Delta T - Plant discharge minus plant intake temperature - In °C											
	1974[a]		1975[b]		1976[b]		1977[b]		1978[b]		1979[b]	
Month	Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max
Jan	-	-	5.61	9.6	6.80	9.8	7.27	12.5	11.67	18.7	11.35	18.4
Feb	-	-	5.67	9.9	8.57	12.5	8.90	16.1	12.18	16.0	12.70	15.1
Mar	1.25	5.1	8.84	9.7	7.40	11.3	5.54	10.4	12.50	16.2	11.20	14.7
Apr	2.32	4.1	8.14	10.2	7.24	11.5	4.68	8.8	ND	ND	9.30	12.4
May	2.34	6.3	4.42	6.1	3.76	9.7	6.67	12.7	6.03	9.3	6.53	10.3
[illegible]	2.14	5.9	3.34	6.7	6.37	9.2	5.95	11.4	6.13	9.3	5.85	8.7
Jul	2.38	4.2	4.10	6.6	6.67	10.3	4.35	9.0	5.67	9.4		
Aug	ND	ND	3.98	6.3	6.94	10.0	4.36	7.3	6.03	7.2		
Sep	3.84	5.0	4.30	6.2	8.28	11.0	2.05	4.6	ND	ND		
Oct	4.01	8.4	6.55	8.2	1.43	3.2	7.88	10.3	5.61	9.0		
Nov	5.88	9.9	3.80	5.1	8.33	12.2	6.93	10.7	7.34	9.8		
Dec	ND	ND	6.48	8.0	9.73	14.2	7.27	12.7	11.58	14.0		

FOOTNOTES:

ND - No Data
UA - Unavailable
a - Reported in (Philadelphia Electric Company 1974) monthly reports (Nos. 9-35) to NRC and PA. DER in graphic form
b - Reported in (Philadelphia Electric Company 1974) monthly reports (36-72) to NRC and PA. DER in tabular form
c - Total number of paired hourly readings equal 37445

Source: RMC, 1979b, Table 1-1, p. 1-2.

TABLE 16

CONOWINGO POND: COMPARISON OF MONTHLY MINIMUM, MAXIMUM AND MEAN SURFACE WATER TEMPERATURE (°C) BETWEEN PREOPERATIONAL (1967-1973) AND OPERATIONAL (1977-JUNE 1979) PERIODS.

1967-1973

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan-Dec
N	43	29	32	56	65	164	205	211	149	102	115	56	1227
Min	0.3	1.0	1.1	4.2	13.3	16.1	20.1	23.9	18.6	11.4	5.0	1.7	0.3
Max	6.4	5.0	10.6	18.3	18.4	27.8	30.6	29.7	29.4	22.2	14.0	8.3	30.6
Mean	1.9	2.8	6.5	10.8	15.8	23.3	26.6	26.6	23.8	17.1	9.3	4.8	19.2

Source: RMC, 1978, Table 2.2-1, p. 2-10 (converted from °F).

1977

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan-Dec
N	4	4	25	26	26	25	26	26	37	26	26	15	226
Min	1.1	1.7	3.9	6.4	12.8	21.1	26.7	24.4	16.4	9.4	7.2	1.9	1.1
Max	5.0	5.6	8.0	19.4	26.1	27.8	30.6	30.8	26.1	20.6	19.4	6.4	30.8
Mean	2.9	3.8	5.3	12.8	19.4	23.8	27.9	27.2	21.8	13.0	12.1	4.4	17.1

Source: RMC, 1978, Table 2.2-1, p. 2-10 (converted from °F).

1978

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan-Dec
N	4	4	3	26	24	26	31	42	26	29	33	18	266
Min	1.7	2.8	2.8	8.3	13.0	23.3	23.9	25.6	21.7	13.3	10.0	2.2	1.7
Max	5.3	6.1	4.4	17.2	18.9	28.0	31.4	31.7	29.7	20.3	17.8	10.0	31.7
Mean	2.9	4.6	3.9	10.8	15.6	24.7	27.4	28.1	24.7	16.9	13.0	5.8	18.9

Source: RMC, 1979a, Table 2.2-1, p. 2-11 (converted from °F).

1979

	Jan	Feb	Mar	Apr	May	Jun	Jul–Dec	(Jan-Jun)
N	4	4	21	35	37	26	- Data Unavailable -	127
Min	0.6	1.1	3.9	9.[illegible]	16.7	22.2		0.6
Max	1.1	4.4	14.4	21.1	24.4	28.6		28.6
Mean	0.8	2.6	7.0	13.4	20.3	24.1		15.8

Source: RMC, 1979b, Table 2.2-1, p. 2-9 (converted from °F).

N = number of determinations

<u>Thermal Plume Mapping (ETS 6.3.a)</u> - The purpose of this ETS study was to determine the extent of the thermal plume and to select a representative measurement that would accurately predict pond conditions. Mapping was to be performed with one and two unit operation, under various conditions of load, stream flow, operations of hydroelectric plants, meterological conditions and ambient stream temperature. Details of the thermal monitoring program are essentially described in Supplement No. 2 to the Environmental Report Operating License Stage (PECO, 1972). The program includes a network of continuous recorders and surveys via boat-mounted recorders. The frequency of boat surveys has been twice monthly or greater. In ORNL's review and analysis of the hydrothermal studies, it was concluded that:

> "PECO has conducted a hydrothermal monitoring program that apparently exceeds the requirements of the Technical Specifications. The boat survey data provide a fine resolution for defining the extent of the thermal plume, while the thermograph data provide adequate information to establish significant temporal effects. The only complaints pertaining to these studies is that no boat surveys were made during the early morning or evening and that there was extensive missing thermograph data during the preoperational period, as a result of frequent instrument relocation. The staff's analysis was limited by the absence of good in-plant data, in particular, data related to cooling tower operation." (Adams, et. al., 1977, p. 3-162)

In its Decision issued on March 23, 1979 (ALAB-532), the Board approved both the stipulation and the accompanying technical specifications "...as fulfilling the NRC's responsibilities concerning thermal discharges from Unit 3 of the Peach Bottom facility." The licenses for Peach Bottom 2 and 3* were amended on May 3, 1979, (Amendment Nos. 52 and 52) pursuant to ALAB-532.

Based on the record, summarized above, we conclude that the purpose of the Thermal Plume Mapping program, as described in ETS 6.3.a, has been satisfied with regard to NRC's responsibilities. Any continuing needs for thermal plume mapping during normal operation of Peach Bottom will be those identified by the EPA and the State of Pennsylvania in the pending Section 316(a) determination. In discussions with representatives from both EPA and the State, we have learned that additional thermal plume mapping studies are considered unnecessary at the present time (personal telecommunications with R. Greaves and J. LaBuy, EPA-Region III. and J. Ulanowski, Pennsylvania Department of Environmental Resources, December 17-18, 1979).

With regard to ETS 3.1, as revised by License Amendment Nos. 52 and 52, we find that the record supports the need for retaining this requirement until a final determination is reached in the Section 316(a) proceding. The staff's objective in ETS 3.1 was to assure that thermal regimes, during cooling tower outage linked with extreme environmental conditions, were

*The Board noted that action on the stipulated matters would also effect Unit 2, which shares a condenser cooling system with Unit 3 (ALAB-532, Footnote 1).

not detrimental to aquatic biota. Procedures for documentation of the thermal regimes during such conditions were not duplicated in the revised ETS 3.1 since these procedures were already specified in ETS 6.3.a. To avoid an inconsistency in the ETS upon deletion of the latter, we have found it necessary to incorporate the procedures into ETS 3.1. The objective of ETS 3.1 remains unchanged.

Impingement of Fishes: Report Levels (ETS 4.1) and Monitoring Requirements (ETS 5.1) - These ETS require a determination and reporting of the amount of fishes impinged on the intake screens. Prior to Amendment Nos. 44 and 44, the ETS also required a special study of impingement in ETS 6.1.b. In the EIA supporting Amendment Nos. 44 and 44, the staff concluded that the impingement impact was insignificant, justifying termination and deletion of the special study from the ETS. Based on the staff's previous EIA, we find that ETS 4.1 and ETS 5.1 are unnecessary and should be deleted. Further support for this action has been given by the licensee's successful demonstration to EPA (July 1978) pursuant to Section 316(b) of the Clean Water Act.

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Basis and Conclusion for Negative Declaration

We have reviewed the proposed amendments relative to the requirements set forth in 10 CFR Part 51 ard the Council of Environmental Quality's Guidelines, 40 CFR 1500.6. We have determined that the proposed license amendments do not authorize a change in effluent types or total amounts nor an increase in power levels and will not result in any significant environmental impact. We have also determined that there will be no significant environmental impact attributable to the proposed issuance of these amendments which has not already been predicted and described in the Final Environmental Statement issued by the Commission in April 1973. Therefore, the staff has found that an environmental impact statement need not be prepared, and that a negative declaration to this effect is appropriate.