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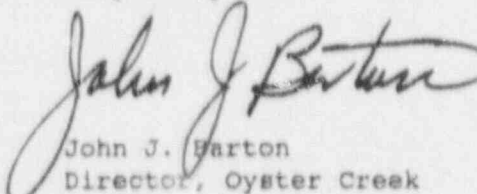
Dear Sir:

Subject: Oyster Creek Nuclear Generating Station (OCNGS)
Docket No. 50-219
Important Environmental Event

In accordance with the reporting requirements of Section 3.5.2 of Appendix B, Environmental Technical Specifications, enclosed is a report of Fishkill Monitoring at OCNGS.

If you have any questions or require any additional information, please contact Mr. Barry W. Durham of our Environmental Licensing Department at (609)971-4630.

Very Truly Yours,


John J. Barton
Director, Oyster Creek

JJB/BWD:jc
Enclosure

cc: Director
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WINTER OUTAGE FISH SAMPLING PROGRAM
REPORT FOR THE PERIOD FEBRUARY 1991

GPU Nuclear Corporation
Oyster Creek Environmental Controls
March 1991

Executive Summary

In order to document the effects of the February 15, 1991 shutdown of the Oyster Creek Nuclear Generating Station on the fishes in Oyster Creek, an intensive sampling program was conducted by GPU Nuclear Corporation. The results of that monitoring effort indicated that an estimated 1,151 fish died due to temperature stress resulting from the station shutdown. Bluefish accounted for 97 percent of the mortalities. A purposefully slow rate of power reduction and concomitant gradual temperature decay appears to have limited cold shock stress and mortality to the species least tolerant of cold shock. It is likely that the majority of the bluefish died within the discharge canal and did not move into Barnegat Bay before dying. Four other fish species that had been involved in previous fishkills, including the Atlantic menhaden, were collected in Oyster Creek during re-shutdown sampling but were unaffected by the February 15 shutdown.

Introduction

This report documents the effects of the February 15-16, 1991 shutdown of the Oyster Creek Nuclear Generating Station on the fishes in Oyster Creek, based upon sampling conducted by GPU Nuclear Corporation. The major objectives of the sampling program were:

- 1) To determine the species composition, relative abundance and distribution of fishes in Oyster Creek prior to Station shutdown.
- 2) To quantify the extent of any shutdown-induced mortalities.

Data collection began on February 2 and continued through February 17, 1991. Oyster Creek Nuclear Generating Station (OCNGS), which had operated continuously since July 4, 1990, began the shutdown process at noon on February 15, 1991. By approximately 0845 hours on February 16, the discharge canal temperature had been reduced from a pre-shutdown temperature of 62°F to ambient temperature of 39°F.

Materials and Methods

Pre-Shutdown Surveys

Gill net and bottom trawl samples were collected, at the stations indicated in Figure 1, on February 2-3, 5-6, 9-10, and 13-14, 1991. All sampling was conducted after dark.

Bottom trawl samples were collected at five locations in the discharge canal east of the Route 9 bridge, including the length of two of the residential lagoons. Trawling was done with a 4.8 m semiballoon trawl with a 3.9 cm stretch mesh body, a 3.2 cm stretch mesh cod end and a 1.3 cm stretch mesh liner. One five minute trawl sample was taken at stations T1, T4 and T5 during each sampling period. At stations T2 and T3, the trawl was dragged the length of the residential lagoons (Fig. 1).

At gill net stations G1, G2, G3 and G4 (Fig. 1), samples were collected with a 60 x 2.4 m monofilament net consisting of two 30 m panels of 3.9 and 8.5 cm stretch mesh.

All fish captured were identified and enumerated; the length range of specimens of each fish species was determined.

Surface and bottom temperature and salinity measurements were measured with a Beckman salinometer concurrent with each trawl and gill net sample.

Hook and line sampling was the most successful method of capturing the most abundant species, the bluefish, as well as certain other species resident near the condenser discharge prior to shutdown. Hook and line sampling was also used to identify the species of fish observed schooling near the 30" discharge pipe prior to the shutdown.

During and Post-Shutdown Surveys

Post-Shutdown Trawling -

One five-minute bottom trawl was conducted with the trawl described above at trawl stations T1, T2, T3, T4 and T5 between 1050 and 1230 hours on February 16 and again on February 17 from 1100 to 1230 hours. Additionally, ten-minute bottom trawl samples were conducted between 0925 and 1015 hours on February 17 at trawl stations T6, T7 and T8, which were located in Barnegat Bay immediately east, south and north of the mouth of Oyster Creek, respectively. All fish captured were identified and enumerated; length ranges were obtained.

Dipnetting -

Dead and stressed fish were collected with dipnets along the banks of the discharge canal, from the condenser discharge to the mouth of Oyster Creek. All fish were identified to species and enumerated; length ranges were obtained.

Post-Shutdown Diver Survey

A "hardhat" diver survey was conducted following station shutdown to determine the species composition and abundance of fish which sank to the bottom of the discharge canal after death. A total of 19 transects were conducted between the OCNCS discharges and the mouth of Oyster Creek, including two transects within residential lagoons (Figs. 2 and 3). Transects D7 through D19 were sampled between 0830 and 1600 hours on February 16. Transects D1 through D6 were sampled between 0800 and 1205 hours on February 17. All fish within an arm's length of the diver were identified and enumerated. For the only species found in abundance, bluefish, the number of individuals per square foot along each transect was determined. These densities were used to estimate the number of bluefish on the entire canal bottom from the OCNCS discharges to the mouth of Oyster Creek.

Results and Discussion

Pre-Shutdown Trawling and Gill Netting

The initial survey of the fish fauna of Oyster Creek on February 2-3 yielded a total of 1,537 fish comprising 20 species. The species of interest with respect to a possible fishkill based upon previous cold-shock experience included bluefish, Atlantic menhaden, white perch, black sea bass and Atlantic herring. Their abundance and size range as well as that of other species captured at the various stations are indicated in Tables 1 and 2.

Water temperature in the discharge canal during the February 2-3 sampling event ranged from 44.9 to 50.2°F (7.2-10.1°C), while salinities within the canal ranged from 21.0 to 21.9 ppt. (Table 3).

The second survey of the fish fauna of Oyster Creek was conducted on February 5-6, 1991. The sampling effort yielded 296 fish comprising 18 species (Tables 2 and 4). The species of interest with respect to a possible fish kill included bluefish, menhaden and striped bass.

Water temperature in the discharge canal during the sampling period ranged from 50.4 to 51.7°F (10.2-11.5°C), while salinities ranged from 22.1 to 23.7 ppt.

Bluefish appeared to be concentrating in the warmest water, in the eastern-most portion of the condenser discharge. Twelve large bluefish were captured at gill net station G3 during the February 6 sampling effort (Table 2) and an additional 23 bluefish were taken by hook and line at the condenser discharge (Table 5). Bluefish were swimming deeply in the eastern-most condenser discharge, and were not observed near the surface.

The third pre-outage fish survey was conducted on February 9-10, 1991. The sampling effort yielded 1,063 fish comprising 22 species (Tables 6 and 7). The species of interest with respect to a possible fishkill included bluefish, menhaden, speckled seatrout, striped bass and northern kingfish.

Water temperature in the discharge canal during the third sampling period ranged from 50.7 to 52.3°F (10.4-11.3°C), while salinities ranged from 22.1 to 22.7 ppt.

The fourth and final fish survey before the plant shutdown was conducted on February 13-14, 1991. The sampling effort yielded 374 fish comprising 20 species. The species of interest with respect to a fishkill included bluefish, menhaden, speckled seatrout and striped bass (Tables 7 and 8). Water temperatures in the discharge canal during the February

13-14 sampling period ranged from 47 to 49°F (8.1-9.2°C), while salinities ranged from 21.5 to 22.1 ppt.

Based upon the results of these pre-shutdown sampling efforts, our observations of fish in the discharge canal, and our historical data base on fishkills, it was concluded that there were three fish species at risk of cold-shock that were present in relatively large numbers: 1) several hundred bluefish, 2) several hundred to a few thousand striped bass, and 3) a few thousand Atlantic menhaden.

During and Post-Shutdown Surveys

Station shutdown commenced at approximately 1200 hours on February 15, 1991 when ambient water temperature (condenser intake) was approximately 41°F. Condenser discharge temperature at that time was approximately 62°F and the Route 9 bridge temperature, 52°F. In order to minimize the impact of station shutdown on the fishes in the discharge canal, GPUN developed a power reduction plan which controlled the effluent temperature reduction at the main condenser discharge at a rate of approximately 1°F per hour. This rate of temperature change is approximately one fifth the rate which is typically utilized to acclimate fish to laboratory conditions and represents a power reduction scenario lasting approximately twice as long as normal station shutdown. The plan also called for shutting the dilution pumps off early in the shutdown process in order to further minimize the rate of temperature decay in the discharge canal. The relatively slow and uniform reduction in power brought OCNGS condenser discharge temperature down to ambient levels over a period of approximately 20 hours. As a result of the two operating dilution pumps being taken out of service sequentially at 1149 and 1417 hours, the canal temperature, as measured at the Route 9 bridge, increased stepwise twice

between 1200 and 1700 hours and then slowly decreased (Fig. 4). Water temperature in the condenser discharge area, unaffected by dilution pump activity, continued to decline during that period. At approximately 0900 hours on February 16, the entire discharge canal had reached ambient temperature of about 39°F.

During the early hours of the shutdown process on the afternoon of February 15, hook and line sampling indicated that bluefish were still tightly concentrated in the eastern condenser discharge bay, swimming close to the bottom. As the shutdown process progressed through the late afternoon and evening hours of February 15, there was no visible evidence of stressed fish in the condenser discharge or anywhere else in the discharge canal.

Large numbers of bluefish were observed swimming closer to the surface of the eastern-most condenser discharge bay during the early morning hours of February 16. A total of 93 bluefish were collected from this area between 2200 to 0500 hours by dipnet or hook and line. By 0500 hours, the condenser discharge temperature had decreased to 43°F and the apparently stressed bluefish began to disperse and move away from the eastern portion of the condenser discharge. The bluefish continued moving further westward and downstream, with many being observed at 0530 hours near the eastern side of the peninsula between the condenser and dilution discharge structures.

Between 0630 and 0800 hours, water temperatures were observed to be approximately 1.5°F higher near the dilution discharge structure than at the condenser discharge and the bluefish appeared to have been attracted by this pocket of warmer water. These fish were severely stressed and 300 were dipnetted from this area during this 1.5 hour period.

Further downstream, several local fishermen dipnetted a total of 47 bluefish from the discharge canal at the Route 9 bridge between 0630 and 1000

hours. GPUN workers in a small boat dipnetted 52 bluefish between 0630 and 0800 hours, plus an additional 91 bluefish between 0800 and 1000 hours, from the discharge canal west of Route 9. An additional 22 dead bluefish were collected from the discharge canal banks and areas east of Route 9 between 0800 and 1700 hours.

Stressed and dead fish were also collected by GPUN personnel walking along the banks of Oyster Creek, out to Barnegat Bay, between 0800 and 1700 hours on February 16. Three bluefish were collected from the 30" discharge pipe area and the south bank of the discharge canal, and 10 were taken along the north canal bank. An additional 5 bluefish were collected at the mouth of Oyster Creek along the north shore beach. Four bluefish were also dipnetted by the consultant conducting the trawl surveys between Route 9 and the mouth of Oyster Creek. Thus, it was apparent that the vast majority of the stressed and dead fish were collected near the plant with gradually decreasing numbers observed in areas further downstream. In addition to the bluefish, small numbers of dead or stressed spot (20 individuals), speckled seatrout (11), smooth dogfish (3), weakfish (1), northern kingfish (1), and Atlantic herring (1) were found along the banks, primarily west of the Route 9 bridge.

The dead and stressed bluefish collected ranged from 250 to 875 mm (9.75 to 34.5 inches) in length.

Post-Shutdown Trawl Surveys

Post-shutdown trawl surveys were conducted on February 16 and 17 at the same five stations along the discharge canal at which pre-shutdown trawls had been conducted. Three additional post-shutdown trawls were also collected February 17 in Barnegat Bay immediately outside the mouth of Oyster Creek (Figure 1). Only one additional stressed bluefish was

collected (at station T2) during the post-shutdown trawling, confirming that few stressed or dead fish had moved east of Route 9. The Atlantic menhaden, a species which has been susceptible to cold shock during previous winter shutdown events, did not appear to be affected by the February 15 shutdown and were collected alive in small numbers during the post-shutdown trawling. Likewise, the 14 other species collected during post-shutdown trawling showed no apparent signs of cold shock (Tables 9, 10 and 11).

Post-Shutdown Diver Surveys

A total of 19 diver transects were conducted between the discharge structures and the mouth of Oyster Creek. The diver survey began at 0830 hours February 16 and the last transect was completed at 1220 hours on February 17. All but five of the 34 total fish observed by the diver were bluefish, corroborating that bluefish was the predominant species involved in this fishkill (Table 12). Only one of the dead bluefish observed during the diver transects was located east of Route 9, with the majority of cold shock deaths occurring between the discharge structures and the trestle bridge.

In addition to the bluefish observed by the diver, one speckled seatrout (Cynoscion nebulosus) was collected slightly upstream of the trestle bridge. The other four dead fish observed were single specimens of winter flounder, American eel, silverside and menhaden. Because the latter four specimens were all collected immediately downstream of the screenwash discharge pipe near the dilution discharge, they are thought to have been discharged from the screenwash pipe following impingement on the traveling screens rather than being victims of cold shock following OCNCS shutdown.

For the only species found in abundance, bluefish, the number of individuals per square foot along each transect was determined. These densities were used to estimate the number of bluefish on the entire discharge canal bottom from the OCNGS discharge structures to the mouth of Oyster Creek. A total of 509 dead bluefish were calculated to have fallen to the bottom of the discharge canal (Table 13).

During their diving activity on February 16, the divers observed fish including striped bass swimming in the vicinity of the 30 inch discharge pipe, just downstream of the condenser discharge. These fish scattered as the diver approached indicating that they were not adversely affected by the station shutdown.

Conclusions

Pre-shutdown surveys of Oyster Creek indicated the presence of a wide variety of fish species including six species that have been involved in past shutdown-related fishkills (i.e., bluefish, blueback herring, Atlantic menhaden, northern kingfish, white perch and bay anchovy). These surveys, conducted over the two week period immediately prior to the station shutdown, revealed that the number of species and abundance of most species in the discharge canal remained relatively uniform. Large numbers of bluefish, and lesser numbers of speckled seatrout and striped bass were noted during this period near the station discharges. Further downstream in the discharge canal, blueback herring was the species found in the greatest abundance during pre-shutdown surveys.

The station shutdown sequence resulted in a gradual reduction of condenser discharge temperature at a rate of about 1°F per hour. This relatively slow and uniform decrease in the temperature of the OCNGS heated effluent to which

the fish were exposed was apparently beneficial in limiting the extent of the fishkill to those species most susceptible to cold shock.

Most bluefish did not appear to be severely stressed until several hours after initiation of station shutdown when the condenser discharge temperature had been reduced from 62°F to about 45°F. They then began to die rapidly, especially near the dilution discharge, after a pocket of relatively warm and calm water to which they were attracted had cooled significantly. Based upon the diver survey, an estimated 509 bluefish died and sank to the bottom of the discharge canal. An additional 605 individuals of this species were dipnetted, resulting in a total of 1,114 bluefish. A total of 37 dead or stressed individuals of 6 additional species were found following the shutdown.

Striped bass, Atlantic menhaden, blueback herring, white perch and bay anchovy were not adversely affected by the February 15-16 station shutdown even though all but the striped bass have been involved in previous cold-shock related fishkills.

In summary, the number of fish involved in the fishkill of February 15-16, by species, was as follows:

bluefish	1,114 (actual count & estimate from diver surveys)
spot	20 (actual count)
speckled seatrout	11 (actual count)
smooth dogfish	3 (actual count)
weakfish	1 (actual count)
northern kingfish	1 (actual count)
Atlantic herring	1 (actual count)

TOTAL	1,151
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Table 1. Numbers of fish caught in pre-outage trawl samples in Oyster Creek on February 2, 1991; range of lengths in millimeters in parentheses.

SPECIES	STATION				
	T1	T2	T3	T4	T5
<u>Pseudopleuronectes americanus</u>	9 (79-228)	1 (102)	1 (160)	7 (98-242)	56 (95-200)
<u>Tautoga onitis</u>	1 (85)	0	0	1 (115)	0
<u>Alosa aestivalis</u>	47 (75-91)	1,147 (77-143)	133 (78-96)	2 (80-90)	0
<u>Alosa pseudoharengus</u>	0	3 (105-115)	2 (104-120)	0	0
<u>Apeltes quadracus</u>	4 (46-54)	5 (41-50)	6 (37-50)	0	0
<u>Anchoa mitchilli</u>	1 (46)	0	0	0	0
<u>Etropus microstomus</u>	3 (47-110)	0	0	0	9 (43-102)
<u>Paralichthys dentatus</u>	1 (145)	1 (214)	0	0	3 (200-220)
<u>Conger oceanicus</u>	2 (260-370)	0	0	0	0
<u>Prionotus carolinus</u>	0	0	0	0	1 (103)
<u>Morone americana</u>	0	3 (112-134)	12 (121-132)	0	0
<u>Brevoortia tyrannus</u>	0	3 (60-121)	33 (108-146)	0	0
<u>Menidia menidia</u>	0	1 (98)	7 (52-94)	0	0
<u>Ophidion marginata</u>	0	0	0	0	6 (164-220)
<u>Fundulus heteroclitus</u>	0	0	1 (121)	0	0
<u>Anguilla rostrata</u>	0	0	1 (200)	0	0
<u>Urophycis regia</u>	0	0	0	0	2 (93-102)
<u>Syngnathus fuscus</u>	0	0	1 (110)	0	0
<u>Sphoeroides maculatus</u>	0	0	0	1 (152)	0

Table 2. Numbers of fish caught in pre-outage gill net samples in Oyster Creek on February 2 and February 6, 1991; range of lengths in millimeters in parentheses.

February 2, 1991

<u>SPECIES</u>	<u>STATION</u>			
	<u>G1</u>	<u>G2</u>	<u>G3</u>	<u>G4</u>
<u>Brevoortia tyrannus</u>	229 (125-138)	24 (122-290)	NET LOST	0
<u>Pseudopleuronectes americanus</u>	1 (95)	0	AFTER	0
<u>Alosa pseudoharengus</u>	0	1 (146)	LINE PARTED	0
<u>Clupea harengus</u>	0	0		1 (NOT MEASURED)

February 6, 1991

<u>SPECIES</u>	<u>STATION</u>			
	<u>G1</u>	<u>G2</u>	<u>G3</u>	<u>G4</u>
<u>Brevoortia tyrannus</u>	23 (110-170)	16 (123-292)	0	1 (156)
<u>Alosa aestivalis</u>	1 (105)	0	0	0
<u>Morone americana</u>	4 (128-142)	0	0	0
<u>Pomatomus saltatrix</u>	0	0	12 (369-443)	1 (480)

Table 3. Oyster Creek discharge canal surface and bottom temperature (°F) and salinity (parts per thousand) during pre-shutdown and post-shutdown surveys, February 1991.

STATION	DATE											
	FEB. 2-3		FEB. 5-6		FEB. 9-10		FEB. 13-14		FEB. 16		FEB. 17	
	TEMP. (°f)	SALINITY (ppt)	TEMP. (°f)	SALINITY (ppt)	TEMP. (°f)	SALINITY (ppt)	TEMP. (°f)	SALINITY (ppt)	TEMP. (°f)	SALINITY (ppt)	TEMP. (°f)	SALINITY (ppt)
T1 SURFACE	48.8	21.4	49.6	22.7	51.8	22.2	48.2	21.3	38.8	22.1	34.3	20.5
T1 BOTTOM	49.1	21.3	50.5	23.7	51.8	22.5	48.4	21.7	38.8	22.9	35.4	22.9
T2 SURFACE	47.1	21.1	50.4	22.2	50.7	22.1	46.6	21.7	41.9	23.6	35.1	20.9
T2 BOTTOM	44.9	21.0	50.4	22.6	51.6	22.6	46.6	21.7	41.9	23.6	38.3	22.7
T3 SURFACE	48.2	21.0	51.6	22.2	51.1	22.4	47.8	21.6	41.9	23.5	34.9	20.5
T3 BOTTOM	48.4	21.0	51.4	22.4	51.4	22.7	47.8	22.0	41.9	23.3	37.8	22.0
T4 SURFACE	50.0	21.0	52.0	22.1	52.0	22.4	48.4	21.9	37.0	23.5	35.1	21.1
T4 BOTTOM	49.6	21.0	52.7	22.3	52.2	22.2	48.6	22.0	36.5	23.1	34.9	21.8
T5 SURFACE	50.0	21.8	52.0	22.4	51.8	22.3	48.0	22.0	35.1	22.0	33.4	20.3
T5 BOTTOM	50.2	21.9	52.0	22.5	52.0	22.2	48.0	21.9	34.7	24.1	33.3	22.2
T6 SURFACE	-	-	-	-	-	-	-	-	-	-	32.4	22.9
T6 BOTTOM	-	-	-	-	-	-	-	-	-	-	32.2	24.1
T7 SURFACE	-	-	-	-	-	-	-	-	-	-	33.4	23.5
T7 BOTTOM	-	-	-	-	-	-	-	-	-	-	33.4	23.7
T8 SURFACE	-	-	-	-	-	-	-	-	-	-	32.7	23.1
T8 BOTTOM	-	-	-	-	-	-	-	-	-	-	32.7	23.8
G1 SURFACE	49.3	21.0	51.4	22.2	51.6	22.3	48.4	21.7	-	-	-	-
G1 BOTTOM	48.9	20.9	51.4	22.3	51.6	22.2	48.4	22.2	-	-	-	-
G2 SURFACE	49.6	21.3	51.8	22.2	51.8	22.1	48.4	22.0	-	-	-	-
G2 BOTTOM	49.8	21.2	51.4	22.2	52.2	22.2	48.4	22.1	-	-	-	-
G3 SURFACE	59.2	-	63.9	23.1	63.7	22.6	60.4	21.7	-	-	-	-
G3 BOTTOM	-	-	63.9	23.1	63.7	22.6	60.4	21.7	-	-	-	-
G4 SURFACE	59.2	-	63.9	23.1	63.7	22.6	60.4	21.7	-	-	-	-
G4 BOTTOM	-	-	63.9	23.1	63.7	22.6	60.4	21.7	-	-	-	-

Table 4. Numbers of fish caught in pre-outage trawl samples in Oyster Creek on February 5, 1991; range of lengths in millimeters in parentheses.

SPECIES	STATION				
	T1	T2	T3	T4	T5
<u>Pseudopleuronectes americanus</u>	7 (96-115)	0	0	6 (112-121)	47 (101-200)
<u>Alosaestivalis</u>	0	94 (72-103)	16 (76-86)	0	0
<u>Alosa pseudoharengus</u>	0	1 (116)	0	0	0
<u>Apeltes quadracus</u>	0	0	2 (41-44)	2 (52-67)	0
<u>Etropus microstomus</u>	1 (92)	0	0	0	6 (46-100)
<u>Paralichthys dentatus</u>	0	0	0	0	3 (125-215)
<u>Morone americana</u>	2 (140-158)	2 (115-119)	0	6 (122-180)	0
<u>Brevoortia tyrannus</u>	0	3 (105-118)	0	0	0
<u>Ophidion marginata</u>	0	0	0	0	4 (185-210)
<u>Urophycis regia</u>	1 (95)	0	0	0	1 (152)
<u>Syngnathus fuscus</u>	1 (275)	0	0	0	0
<u>Scophthalmus aquosus</u>	1 (280)	0	0	0	0
<u>Gobiosoma boscii</u>	0	0	1 (42)	0	0
<u>Trinectes maculatus</u>	0	0	0	1 (136)	0
<u>Opsanus tau</u>	0	0	0	1 (120)	0
<u>Symphurus plagiata</u>	0	0	0	0	1 (100)

Table 5. Number of fish caught by hook and line in the condenser discharge of the Oyster Creek Nuclear Generating Station on February 3, 5, 7, 9 and 13, 1991; range of lengths in millimeters in parentheses.

<u>SPECIES</u>	<u>February 3</u>	<u>February 5</u>	<u>February 7</u>	<u>February 9</u>	<u>February 13</u>
<u>Pomatomus saltatrix</u>	20 (350-910)	23 (374-748)	18 (220-370)	5 (445-920)	15 (270-635)
<u>Morone saxatilis</u>	0	3 (482-518)	28 (350-450)	39 (355-558)	5 (405-560)
<u>Morone americanus</u>	0	0	2 (268-279)	0	0
<u>Paralichthys dentatus</u>	0	0	9 (278-282)	0	0
<u>Menticirrhus saxatilis</u>	0	0	1 (300)	0	0
<u>Cynoscion nebulosus</u>	0	0	0	5 (480-525)	2 (525-530)

Table 6. Numbers of fish caught in pre-outage trawl samples in Oyster Creek on February 9, 1991; range of lengths in millimeters in parentheses.

SPECIES	STATION				
	T1	T2	T3	T4	T5
<u>Pseudopleuronectes americanus</u>	7 (95-125)	2 (116-125)	0	35 (97-178)	34 (97-135)
<u>Tautoga onitis</u>	0	0	0	1 (125)	0
<u>Alosa aestivalis</u>	0	437 (76-90)	156 (75-102)	0	0
<u>Alosa pseudoharengus</u>	2 (92-102)	0	0	0	0
<u>Apeltes quadracus</u>	1 (43)	10 (40-52)	13 (36-55)	3 (42-58)	1 (48)
<u>Etropus microstomus</u>	0	0	0	0	3 (97-110)
<u>Paralichthys dentatus</u>	0	0	0	1 (190)	0
<u>Prionotus carolinus</u>	1 (70)	0	0	0	0
<u>Morone americana</u>	3 (105-115)	0	0	2 (135-161)	0
<u>Brevoortia tyrannus</u>	2 (42-305)	0	3 (83-122)	0	0
<u>Menidia menidia</u>	1 (112)	4 (72-97)	7 (70-130)	0	0
<u>Ophidion marginata</u>	1 (150)	0	0	0	1 (160)
<u>Urophycis regia</u>	2 (82-135)	0	0	2 (140-170)	3 (92-128)
<u>Syngnathus fuscus</u>	0	0	0	3 (138-169)	0
<u>Gobiosoma boscii</u>	1 (56)	0	1 (45)	0	0
<u>Fundulus majalis</u>	0	0	1 (140)	0	0
<u>Urophycis chuss</u>	0	0	0	1 (161)	0
<u>Scophthalmus aquosus</u>	0	0	0	0	1 (220)

Table 7. Numbers of fish caught in pre-outage gill net samples in Oyster Creek on February 9-10 and February 13-14, 1991; range of lengths in millimeters in parentheses.

February 9-10, 1991

SPECIES	STATION			
	G1	G2	G3	G4
<u>Brevoortia tyrannus</u>	9 (123-140)	255 (123-144)	0	0
<u>Pseudopleuronectes americanus</u>	0	1 (96)	0	0
<u>Morone americana</u>	2 (161-181)	1 (161)	0	0
<u>Menticirrhus saxatilis</u>	0	1 (?)	0	0

February 13-14, 1991

SPECIES	STATION			
	G1	G2	G3	G4
<u>Brevoortia tyrannus</u>	3 (118-136)	95 (121-316)	0	1 (155)
<u>Alosa sapidissima</u>	0	0	0	1 (170)
<u>Morone americana</u>	0	0	3 (261-280)	0
<u>Pomatomus saltatrix</u>	0	0	2 (340-505)	2 (405-430)
<u>Fundulus majalis</u>	1 (143)	0	0	0
<u>Ictaloga onitis</u>	0	0	1 (340)	0

Table 8. Numbers of fish caught in pre-outage trawl samples in Oyster Creek on February 13, 1991; range of lengths in millimeters in parentheses.

SPECIES	STATION				
	T1	T2	T3	T4	T5
<u>Pseudopleuronectes americanus</u>	7 (63-283)	1 (100)	0	3 (108-174)	23 (82-299)
<u>Astroscopus guttatus</u>	0	0	0	0	1 (123)
<u>Alosa sapidissima</u>	1 (195)	0	0	0	0
<u>Alosa aestivalis</u>	0	73 (71-96)	84 (82-97)	4 (74-85)	0
<u>Apeltes quadracus</u>	0	2 (44-60)	1 (57)	0	0
<u>Etropus microstomus</u>	3 (76-102)	0	0	0	5 (42-100)
<u>Paralichthys dentatus</u>	0	0	0	0	2 (195-230)
<u>Morone americana</u>	0	0	0	1 (163)	0
<u>Brevoortia tyrannus</u>	0	0	2 (44-93)	0	0
<u>Menidia menidia</u>	0	2 (72-100)	10 (81-112)	1 (92)	0
<u>Ophidion marginata</u>	0	0	0	0	2 (155-230)
<u>Urophycis chuss</u>	1 (190)	0	0	0	0
<u>Urophycis regia</u>	0	0	0	0	3 (129-138)
<u>Syngnathus fuscus</u>	0	0	0	0	1 (175)
<u>Menidia beryllina</u>	0	0	10 (52-63)	0	0

Table 9. Numbers of fish caught in post-outage trawl samples in Oyster Creek on February 16, 1991; range of lengths in millimeters in parentheses.

SPECIES	STATION				
	T1	T2	T3	T4	T5
<u>Pomatomus saltatrix</u>	0	1 (485)	0	0	0
<u>Pseudopleuronectes americanus</u>	0	1 (93)	1 (138)	1 (344)	0
<u>Alosa aestivalis</u>	0	81 (77-88)	5 (80-88)	1 (79)	0
<u>Alosa pseudoharengus</u>	0	0	7 (99-124)	0	0
<u>Apeltes quadracus</u>	0	0	2 (42-52)	2 (45-51)	1 (52)
<u>Anchoa mitchilli</u>	0	1 (85)	0	0	0
<u>Brevoortia tyrannus</u>	0	1 (54)	0	0	0
<u>Menidia menidia</u>	0	99 (70-143)	2 (90-92)	0	0
<u>Menidia beryllina</u>	0	0	7 (48-61)	0	0
<u>Gasterosteus aculeatus</u>	1 (66)	0	0	0	0
<u>Cyprinodon variegatus</u>	0	2 (33-45)	0	0	0

Table 10. Numbers of fish caught in post-outage trawl samples in Oyster Creek on February 17, 1991; range of lengths in millimeters in parentheses.

SPECIES	STATION				
	T1	T2	T3	T4	T5
<u>Pseudopleuronectes americanus</u>	1 (106)	0	1 (162)	1 (320)	0
<u>Tautoga onitis</u>	1 (93)	0	0	0	0
<u>Alosa aestivalis</u>	573 (80-190)	365 (87-93)	89 (88-100)	9 (70-202)	0
<u>Alosa pseudoharengus</u>	10 (98-123)	5 (104-120)	0	2 (94-112)	0
<u>Apolltes quadracus</u>	1 (41)	0	0	0	0
<u>Dorosoma cepedianum</u>	0	0	0	1 (151)	0
<u>Brevoortia tyrannus</u>	53 (88-175)	53 (112-143)	26 (79-130)	5 (90-117)	0
<u>Menidia menidia</u>	37 (67-117)	37 (64-147)	532 (66-99)	62 (76-138)	0
<u>Scopthalmus aquosus</u>	1 (274)	0	0	0	0
<u>Alosa sapidissima</u>	29 (92-163)	1 (96)	0	17 (98-153)	0
<u>Ammodytes americanus</u>	1 (121)	0	0	0	0

Table 11. Numbers of fish caught in post-outage trawl samples in Barnegat Bay near the mouth of Oyster Creek on February 17, 1991; range of lengths in millimeters in parentheses.

<u>SPECIES</u>	<u>STATION</u>		
	<u>T6</u>	<u>T7</u>	<u>T8</u>
<u>Alosa sapidissima</u>	0	0	1 (126)
<u>Alosa aestivalis</u>	0	1 (91)	0
<u>Apeltes quadracus</u>	0	1 (48)	0
<u>Menidia menidia</u>	1 (64)	1 (93)	0

Table 12. Numbers of dead fish observed in post-outage diver transects across OCHGS discharge canal, February 16-17, 1991.

DIVER TRANSECT	SPECIES					
	Bluefish (<u>Pomatomus saltatrix</u>)	Speckled seatrout (<u>Cynoscion nebulosus</u>)	Winter flounder (<u>Pseudopleuronectes americanus</u>)	American eel (<u>Anguilla rostrata</u>)	silverside (<u>Menidia menidia</u>)	Atlantic seabird (<u>Brevortia tyrannus</u>)
D1	0	0	0	0	0	0
D2	0	0	0	0	0	0
D3	0	0	0	0	0	0
D4	1	0	0	0	0	0
D5	0	0	0	0	0	0
D6	0	0	0	0	0	0
D7	0	0	0	0	0	0
D8	0	0	0	0	0	0
D9	1	0	0	0	0	0
D10	2	0	0	0	0	0
D11	3	0	0	0	0	0
D12	2	0	0	0	0	0
D13	5	1	0	0	0	0
D14	4	0	0	0	0	0
D15	1	0	0	0	0	0
D16	4	0	0	0	0	0
D17	4	0	0	0	0	0
D18	2	0	0	0	0	0
D19	1	0	1	1	1	1
	30	1	1	1	1	1

Table 13. Estimated number of dead bluefish in OCNGS discharge canal following February 15, 1991 shutdown based on diver transects.

<u>CANAL SECTION</u>	<u>BLUEFISH MORTALITY ESTIMATE</u>
1 (condenser discharge area)	3
2 (dilution discharge area)	7
3 (0 to 150 feet downstream of discharge structure)	29
4 (between 30 inch discharge pipe and trestle bridge)	49
5 (between trestle bridge and Rt. 9)	135
6 (East of Rt. 9)	286
	—
TOTAL =	509

TEMPERATURE PROFILE AT OCNGS

FEBRUARY 15-16, 1991

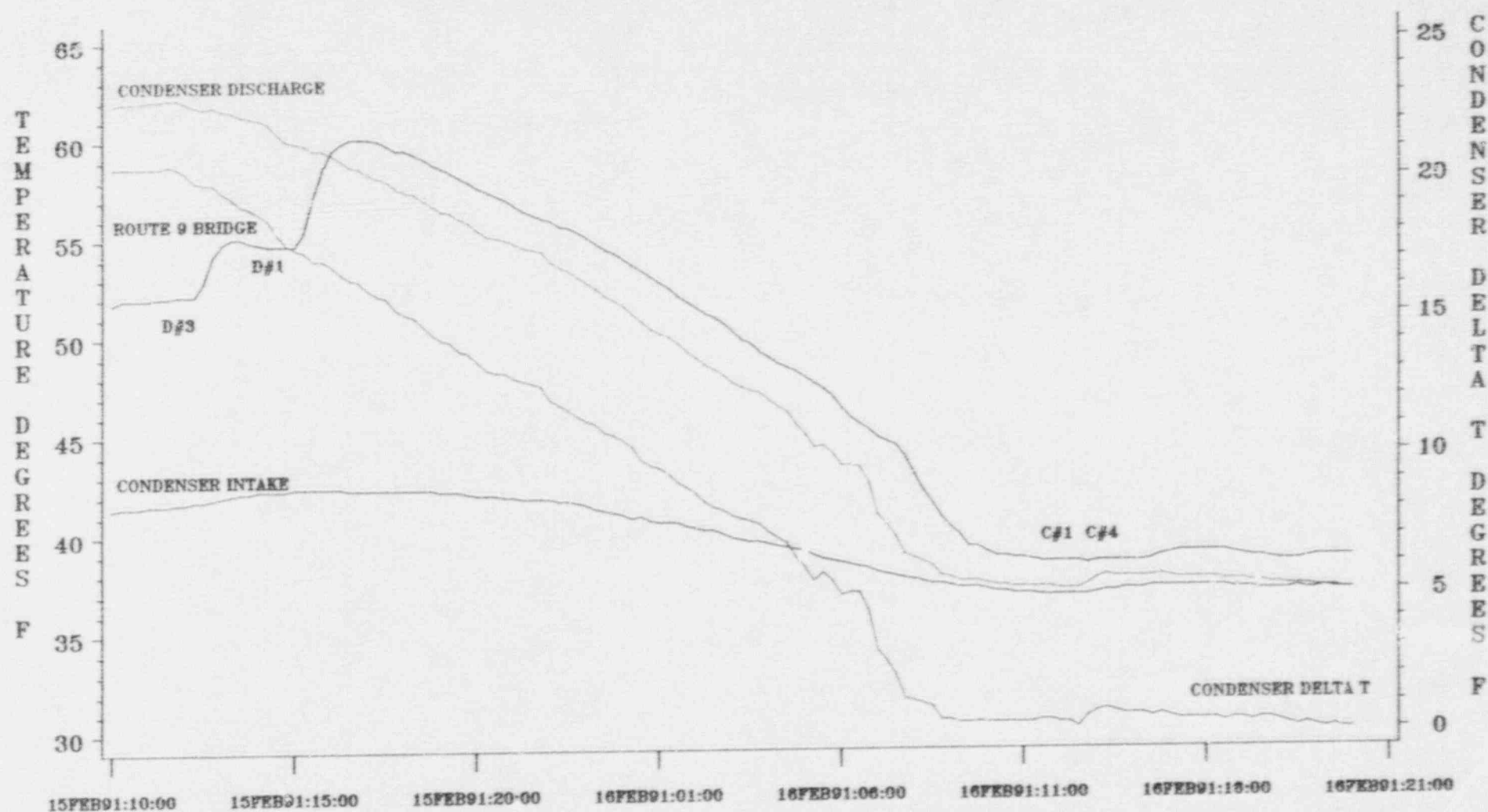


FIGURE 4. TEMPERATURE DECAY IN OCNGS DISCHARGE CANAL, FEBRUARY 15-16, 1991.

NOTE: DILUTION PUMPS #3 & #1 WERE TAKEN OUT OF SERVICE ON 2/15/91 AT 1149 & 1417, RESPECTIVELY. CIRCULATING WATER PUMPS #1 & #4 WERE TURNED OFF ON 2/16/91 AT 1232 & 1242, RESPECTIVELY, WITH #2 & #3 OFF-LINE ON 2/17/91 AT 1116.

Figure 1

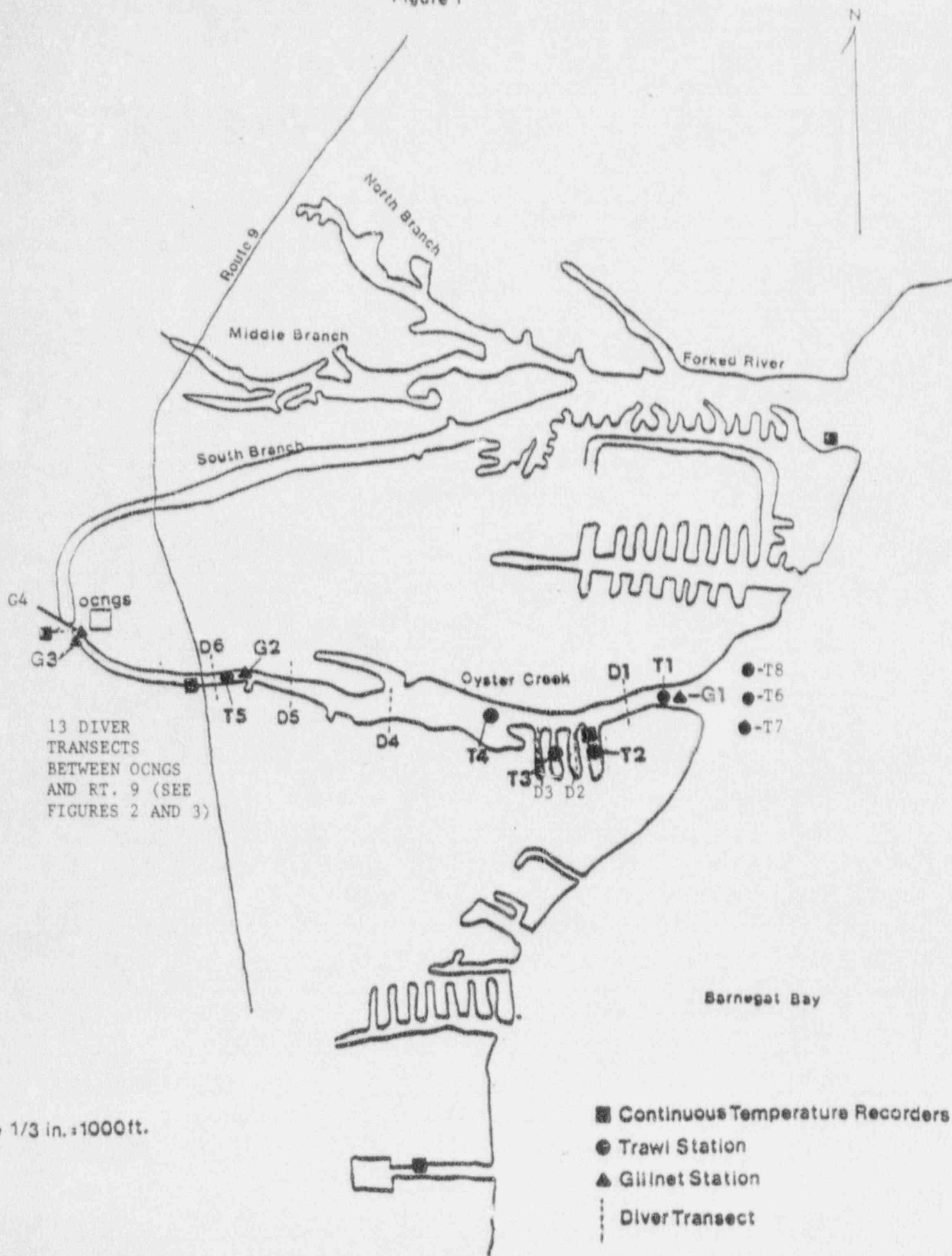
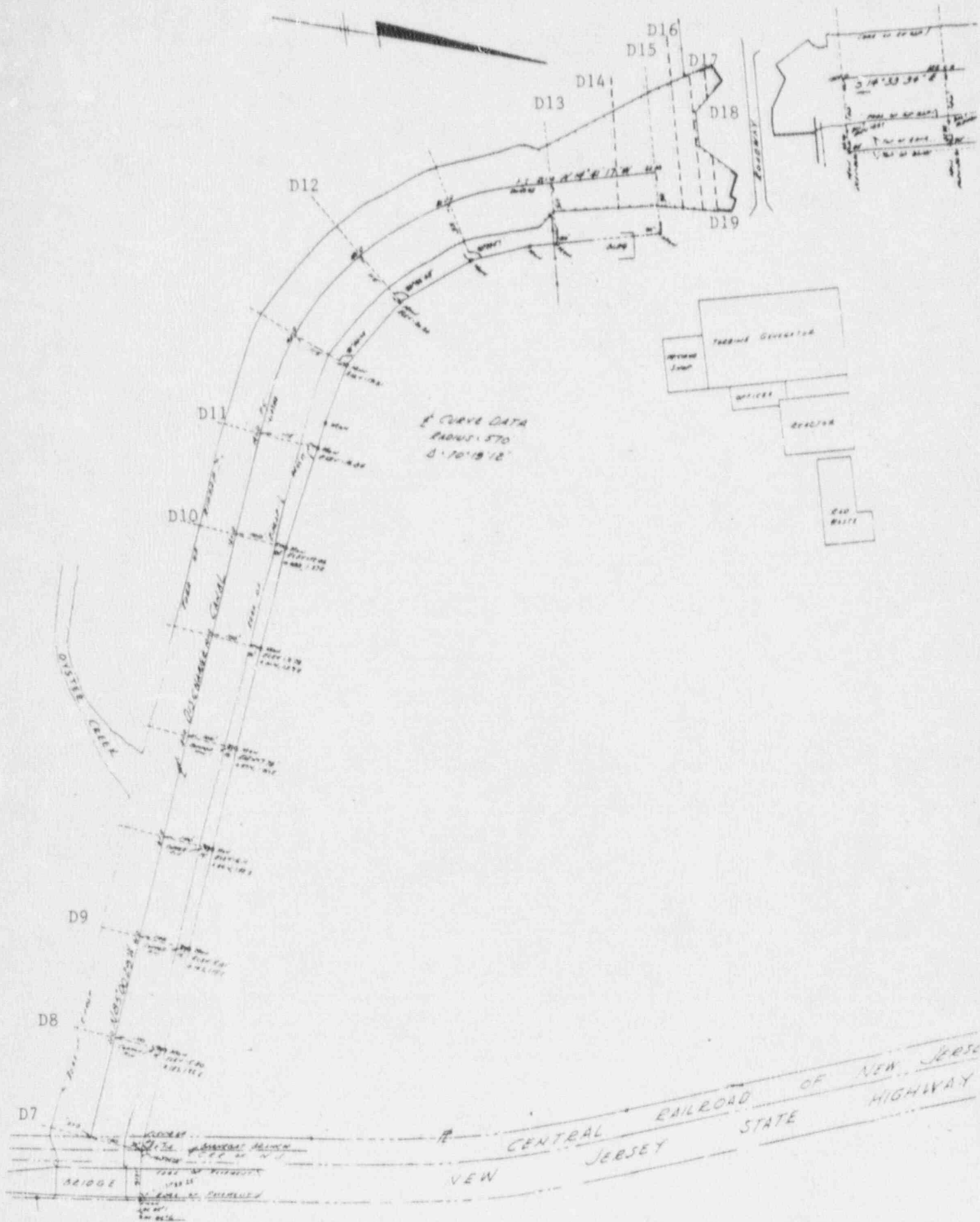


FIGURE 2



RADW5: 570

$\Delta = 70^{\circ} 19' 12''$