

CONNECTICUT YANKEE ATOMIC POWER COMPANY

HADDAM NECK PLANT

HADDAM, CONNECTICUT

ANNUAL ENVIRONMENTAL OPERATING REPORT

PART A: NONRADIOLOGICAL REPORT

January 1, 1980 --- December 31, 1980

Operating License No. DPR-61

Docket No. 50-213

March 31, 1981

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1.0 INTRODUCTION

1.1 Connecticut Yankee

This environmental report has been prepared for the Connecticut Yankee Atomic Power Company (CYAPCO) by the Northeast Utilities Service Company (NUSCO). CYAPCO operates the Haddam Neck Plant, hereinafter referred to as Connecticut Yankee (CY). NUSCO is responsible for engineering and administrative support of the CY operation. The plant is located in the Town of Haddam, Connecticut on a site of approximately 525 acres.

CY was one of the first large nuclear base load units to go into operation in the United States. It was constructed in accordance with Construction Permit No. CPPR-14 issued by the AEC on May 14, 1964, and has been in commercial operation since January 1, 1968. The nuclear unit is a pressurized water reactor with a once-through condenser cooling system, initially licensed to produce 1,473 Mwt or about 490 MW of gross electrical power. On March 11, 1969, the plant was licensed to operate at its design rating of 1,825 Mwt or about 600 MW of gross electrical power.

1.2 Purpose of this Report

This report has been prepared in compliance with Section 5.6.1-a. of the Connecticut Yankee Environmental Technical Specifications (ETS), Document Number 50-213. Included in the report are summaries, interpretations, and statistical evaluation of the results of the nonradiological environmental surveillance activities (ETS Section 3.0) and the environmental monitoring programs required by limiting conditions for operation (ETS Section 2.0) for the report period January 1, 1980 through December 31, 1980.

2.0 LIMITING CONDITIONS FOR OPERATIONS

2.1 Thermal

Temperature and pH are continuously monitored by sensing units located in front of the intake structure and in the discharge canal. The continuous output of the sensors is reduced to digital form using a Data General Model 1220 Nova minicomputer located at Connecticut Yankee and average values for each are recorded every 15 minutes. At the end of each hour, a host computer system at Northeast Utilities Service Company telephones the Connecticut Yankee field computer and logs the data on disc storage. The data are examined twice daily for validity and edited as necessary on a monthly basis. A permanent annual record is maintained on magnetic tapes. If the field computer is not called for a period of two hours, it automatically prints out the data on its teletype and punches a paper tape for later incorporation into the data record. An analog record is maintained at the plant and is used to fill in data gaps caused by digital system failure.

Temperatures are also measured by sensors located in the condenser inlet and at the outlet of each of the four condenser waterboxes. They are recorded hourly by the plant computer and used as a back-up or secondary source of data at times when the primary system sensors or processing system are inoperative.

2.1.1 Maximum ΔT Across the Condenser and Maximum Discharge Temperature

Table 2.1 shows ranges of intake and discharge temperature as monitored by the primary system, their differences, and the maximum hourly rate of change of discharge temperature for each day during the period January 1 through December 31, 1980. When the primary monitoring system was inoperative, data from the secondary system were incorporated into the record. During May, June, and July, when the plant was shut down for refueling, temperature data were not taken for an extended period because of sensor malfunction. Since no heat was being produced, no thermal monitoring was required.

Intake temperatures ranged from 30.4°F in January, February, and December to 86.0°F in August. Discharge temperatures ranged from ambient during periods of shutdown to 109.4°F on August 10 and 11.

The specified maximum temperature increase (ΔT) of 26°F was exceeded for several periods less than 24 hours during routine operation. Most of these occurred during the period of deicing when a 10% allowance is made. The maximum ΔT of 33°F was exceeded on February 19 and 20.

As required by Section 2.1.1.7(d) and (e), the intake temperatures measured by the primary monitoring system were correlated with those measured by the secondary system in the condenser intake waterbox. The correlation equation is:

$$T_{PI} = 0.991 T_{SI} + 0.53 \quad (2.1-1)$$

where T_{PI} = primary intake temperature

T_{SI} = secondary intake temperature

with a correlation coefficient of $r = 0.990$

Prior to May 2 and after December 14, the intake water was warmed for purposes of deicing as permitted by section 2.1.3. During those periods,

$$T_{PI} = 1.042 T_{SI} - 0.83 \quad (2.1-2)$$

with a correlation coefficient of $r = 0.9320$.

Similarly, discharge temperatures monitored by the primary system can be correlated with the average of condenser outlet temperature measured by the secondary system by the following:

$$T_{PD} = 1.009 T_{SD} - 0.27 \quad (2.1-3)$$

where T_{PD} = primary discharge temperature ($^{\circ}\text{C}$)

T_{SD} = secondary discharge temperature ($^{\circ}\text{C}$)

with a correlation coefficient of $r = 0.9860$

2.1.2 Rate of Change of Discharge Temperature

The hourly rate of change of discharge temperature exceeded 8°F (specified in Section 2.1.2.1) on February 19 during an emergency load drop caused by high chlorides in the steam generator; on March 27 due to a trip caused by a false signal indicating high containment pressure; on November 18 following a manual trip due to two dropped rods; and on November 20 due to a spurious turbine trip from full load. Since these were for the protection of plant equipment, they were not violations as specified in Section 2.1.2.2.

On March 29, a decrease in discharge temperature of 9.4°F per hour occurred when two circulating water pumps were turned on during startup at 25% load.

2.1.3 Deicing Operations

The periods of deicing operations in 1980 were January 1 through May 2 and December 14 through December 31.

2.2 Chemical

2.2.1 Biocides

Weekly grab samples have been collected in front of the intake structure and in the discharge canal during the chlorination period. These were analyzed for total residual chlorine using the amperometric titrator. No detectable chlorine was found in the intake water from the river or in the plant discharge.

2.2.2 pH

pH was monitored continuously at the intake and in the discharge canal. Values of discharge pH are included in Table 2.1. When the sensor systems were inoperative, weekly grab samples were taken and these pH values have been incorporated into Table 2.1.

The continuous monitor was checked by weekly grab samples which were collected during periods of discharge and analyzed using standard methods.

On several occasions, the pH at the discharge fell below the level of 6.8 specified in Section 2.3.2.1 and on other occasions it exceeded 8.5. In all but one of these instances, the change in pH is less than or equal to 1.0 as permitted by Section 2.3.2. On May 2 the change in pH indicated by the EDAN digital data exceeded 1.0 for a period of less than one hour due to an unexplained sudden rise in intake pH. Prior to that hour, the intake pH reading was 7.0 vs. the indicated discharge pH of 6.4. There was no reason to expect any difference and grab sample checks on the same day indicated 6.66 and 6.76 respectively. The strip chart record of pH logged in the control room did not confirm this change in intake pH. It is probable that the pH change was less than 1.0 and the indication was caused by a summation of calibration errors which are well within operating requirements. This calibration was corrected after the refueling outage which began May 3.

TABLE 2.1
CONNECTICUT YANKEE STATION
MONTHLY WATER QUALITY DATA SUMMARY

DATA PERIOD = 1 JAN 80/0015 - 31 JAN 80/2315

PARAMETER

DAY	PH RANGE	INTAKE TEMPERATURE			DISCHARGE TEMPERATURE				TEMPERATURE RISE		
		MAX.	MIN.	AVE.	MAX.	MIN.	AVE.	MRC	MAX.	MIN.	AVE.
1	6.9- 6.8	39.4	34.0	35.1	64.4	59.9	61.2	4.5	27.7	24.1	26.2
2	6.8- 6.8	36.1	33.4	34.3	61.5	53.6	60.3	2.9	27.0	24.1	25.9
3	****-****	37.4	32.9	34.2	61.7	59.0	59.8	-2.5	26.1	23.9	25.5
4	****-****	35.6	32.2	33.5	59.7	58.5	59.3	0.7	27.0	24.8	26.0
5	****-****	40.1	31.5	33.8	59.7	58.3	59.2	1.4	28.1	21.2	25.8
6	****-****	37.9	30.9	33.2	61.7	57.2	58.4	4.1	27.4	22.7	24.9
7	****-****	41.9	30.6	33.2	64.2	57.7	59.2	5.9	27.4	22.3	25.8
8	****-****	33.8	31.5	32.2	59.0	57.6	58.4	-0.7	27.5	25.2	26.3
9	****-****	33.6	30.6	32.1	59.0	57.6	58.4	-0.5	27.9	25.6	26.6
10	****-****	37.9	31.1	32.6	59.5	57.7	58.6	0.5	28.4	25.9	26.8
11	****-****	41.2	31.5	33.9	59.7	57.7	58.3	-2.0	27.0	25.2	26.2
12	****-****	36.1	33.4	34.4	61.5	59.0	60.1	-0.9	28.1	23.8	25.6
13	****-****	36.1	33.1	34.9	62.4	60.3	61.2	0.7	27.7	25.7	26.6
14	****-****	35.6	32.7	34.1	62.1	59.0	60.0	2.5	27.4	23.6	25.9
15	****-****	36.1	31.3	33.9	61.5	59.0	59.8	-2.5	28.8	24.5	26.1
16	****-****	40.8	34.0	35.7	65.5	59.2	61.2	6.3	27.4	21.1	25.8
17	****-****	43.0	34.7	36.6	65.3	59.5	61.5	3.1	25.7	22.3	24.6
18	****-****	41.9	33.6	35.7	65.5	59.7	61.1	5.8	27.4	21.8	25.0
19	****-****	36.7	34.5	35.8	62.1	59.9	61.0	-0.7	26.3	24.1	25.4
20	****-****	37.4	34.7	36.3	63.5	55.0	61.1	-5.8	28.1	18.7	25.1
21	****-****	37.0	34.7	35.8	63.0	61.0	62.0	-0.9	27.2	24.7	26.2
22	****-****	42.1	34.3	36.3	66.2	61.5	63.1	-2.5	27.5	24.1	25.9
23	****-****	41.0	33.4	35.6	65.3	60.4	61.9	4.1	26.8	24.3	25.7
24	****-****	34.5	31.3	33.2	61.0	58.8	59.7	0.5	28.8	25.2	26.5
25	****-****	36.3	32.0	33.0	61.0	58.8	59.9	1.8	27.9	23.8	26.7
26	****-****	33.6	31.5	32.4	60.4	57.7	59.3	-1.1	27.7	25.2	26.8
27	****-****	37.6	31.3	32.9	63.5	57.9	59.8	5.6	28.4	24.3	27.0
28	6.8- 6.6	39.4	31.5	33.0	61.5	57.7	60.0	-3.4	28.6	24.7	27.2
29	6.8- 6.6	41.2	31.1	33.4	64.9	56.8	58.6	5.4	27.2	23.8	25.2
30	6.9- 6.8	35.4	30.4	32.2	59.9	56.5	57.5	3.1	27.4	23.9	25.4
31	6.9- 6.8	39.2	30.9	32.9	64.2	56.1	57.8	5.9	28.1	19.1	25.0
MONTH	6.9- 6.6	43.0	30.4	34.1	66.2	55.0	59.9	6.3	28.8	18.7	25.9

PH RANGE = HIGHEST AND LOWEST PH AT DISCHARGE CANAL (PH UNITS)

ALL TEMPERATURES ARE IN DEGREES FAHRENHEIT

MRC = MAXIMUM RATE OF CHANGE IN DISCHARGE TEMPERATURE (DEGREES / HR.)

**** MEANS LACK OF DATA FROM CONTINUOUS MONITORING SYSTEM DUE TO SENSOR MALFUNCTION (REQUIRED GRAB SAMPLE DATA HAVE BEEN TAKEN)

TABLE 2.1 (CONT.)
CONNECTICUT YANKEE STATION
MONTHLY WATER QUALITY DATA SUMMARY

DATA PERIOD = 1 FEB 80/0015 - 29 FEB 80/2315

PARAMETER

DAY	PH RANGE	INTAKE TEMPERATURE			DISCHARGE TEMPERATURE				TEMPERATURE RISE		
		MAX.	MIN.	AVE.	MAX.	MIN.	AVE.	MRC	MAX	MIN.	AVE.
1	6.9-6.8	34.7	30.4	32.1	59.0	55.6	57.0	1.6	27.2	21.2	24.9
2	6.9-6.8	32.5	30.9	31.7	57.7	56.1	56.8	0.5	26.8	24.3	25.1
3	6.9-6.8	34.5	30.6	32.2	59.2	56.3	57.5	-1.4	26.1	23.8	25.3
4	6.9-6.8	37.4	31.1	32.8	60.4	56.5	57.9	4.0	26.6	22.5	25.0
5	6.9-6.8	35.0	31.1	32.5	59.7	56.3	57.9	2.9	26.8	23.8	25.3
6	6.9-6.8	39.4	31.8	33.1	63.7	54.3	57.7	-4.7	27.0	20.2	24.5
7	6.9-6.8	40.3	30.4	33.0	64.2	55.0	57.7	-4.1	26.6	19.8	24.7
8	6.9-6.8	35.2	31.1	32.8	60.1	55.9	57.6	-2.5	27.9	21.2	24.8
9	6.9-6.8	36.5	31.5	33.2	59.2	56.3	57.9	2.0	26.8	22.7	24.7
10	6.9-6.8	42.1	31.3	33.8	65.3	56.8	58.7	5.6	26.6	20.3	24.8
11	6.9-6.8	41.0	31.1	34.4	65.3	56.8	59.1	7.9	28.1	20.7	24.7
12	6.9-6.8	42.1	32.0	34.0	64.6	57.2	58.9	6.8	26.1	21.4	24.9
13	6.9-6.8	42.4	32.2	33.8	64.6	57.0	59.0	7.0	30.1	21.6	25.1
14	6.9-6.8	41.0	32.2	34.3	65.1	57.4	59.3	5.9	27.4	20.7	25.0
15	6.9-6.8	40.8	32.7	35.5	65.3	57.4	59.8	5.4	27.0	22.9	24.4
16	6.9-6.8	40.8	32.7	36.1	63.5	57.7	60.9	4.5	28.8	21.1	24.9
17	6.9-6.8	40.3	31.8	34.1	67.3	57.0	62.2	-5.2	30.8	22.3	28.1
18	6.9-6.8	42.6	31.5	34.4	68.2	61.0	63.0	5.4	31.0	20.2	28.6
19	6.9-6.6	42.4	32.0	34.8	71.2	55.6	63.7	-10.1	35.6	18.5	28.8
20	7.0-6.8	42.4	32.7	35.9	72.7	52.9	64.2	-7.0	33.5	17.3	28.3
21	7.0-6.8	40.6	33.6	35.2	62.6	46.9	54.3	-7.6	28.1	11.7	19.0
22	7.0-6.8	40.8	33.8	36.4	63.7	54.5	59.9	5.0	24.1	16.6	23.5
23	7.0-6.8	41.0	32.9	35.5	63.7	57.4	59.7	4.0	25.9	18.7	24.2
24	6.9-6.8	41.9	34.0	37.3	65.3	59.5	61.5	5.6	26.1	20.0	24.1
25	6.9-6.8	43.3	35.4	38.4	66.2	59.5	62.5	6.7	26.3	22.1	24.1
26	7.0-6.8	43.0	34.5	37.0	66.2	58.5	61.2	3.8	26.1	19.4	24.2
27	7.0-6.8	43.5	33.4	37.0	65.1	58.3	60.9	6.3	25.7	19.8	23.9
28	7.0-6.8	42.6	34.0	35.9	64.4	58.8	60.2	3.1	25.4	18.7	24.3
29	7.0-6.9	39.4	31.8	34.5	63.5	57.0	59.4	-2.5	26.1	22.7	25.0
MONTH	7.0-6.6	43.5	30.4	34.6	72.7	46.9	59.5	-10.1	35.6	11.7	25.0

PH RANGE = HIGHEST AND LOWEST PH AT DISCHARGE CANAL (PH UNITS)

ALL TEMPERATURES ARE IN DEGREES FAHRENHEIT

MRC = MAXIMUM RATE OF CHANGE IN DISCHARGE TEMPERATURE (DEGREES / HR.)

**** MEANS LACK OF DATA FROM CONTINUOUS MONITORING SYSTEM DUE TO SENSOR MALFUNCTION (REQUIRED GRAB SAMPLE DATA HAVE BEEN TAKEN)

TABLE 2.1 (CONT.)
CONNECTICUT YANKEE STATION
MONTHLY WATER QUALITY DATA SUMMARY

DATA PERIOD = 1 MAR 80/0015 - 31 MAR 80/2315

PARAMETER

DAY	PH RANGE	INTAKE TEMPERATURE			DISCHARGE TEMPERATURE				TEMPERATURE RISE		
		MAX.	MIN.	AVE.	MAX.	MIN.	AVE.	MRC	MAX.	MIN.	AVE.
1	7.0-6.9	37.0	31.5	33.0	59.7	56.5	58.0	2.3	26.3	21.8	25.0
2	7.0-6.9	38.8	31.1	33.4	64.4	56.5	58.4	4.9	28.1	22.1	25.0
3	7.0-6.9	41.0	31.8	34.6	62.8	56.5	58.8	4.7	25.7	19.6	24.2
4	7.0-6.9	42.1	32.0	35.1	64.6	57.0	59.4	5.6	26.5	20.5	24.3
5	7.0-6.9	40.8	32.9	35.5	64.4	57.9	60.1	5.0	26.3	19.3	24.5
6	7.0-6.9	41.0	33.4	35.3	64.9	58.1	59.7	5.4	25.6	18.9	24.4
7	7.0-6.9	41.5	32.9	36.0	66.0	58.3	60.9	6.1	26.8	22.9	24.9
8	7.0-6.9	42.8	34.7	37.2	65.5	60.1	61.8	4.7	26.6	22.1	24.6
9	6.9-6.8	42.8	35.6	37.6	64.6	60.4	62.2	2.9	26.1	20.7	24.7
10	6.9-6.8	45.7	36.5	39.6	68.2	61.0	64.1	3.4	26.1	22.0	24.5
11	7.0-7.0	40.1	38.3	39.4	64.9	63.7	64.6	-0.7	25.9	24.3	25.2
12	****-****	40.1	37.2	38.5	64.2	64.0	64.1	0.2	26.1	23.9	25.3
13	****-****	40.1	35.2	36.6	63.3	60.6	62.1	0.7	26.6	24.5	25.7
14	6.6-6.6	43.0	34.0	36.4	66.0	58.3	60.9	-1.8	25.2	23.4	24.4
15	6.8-6.6	35.2	34.0	34.7	61.3	58.6	60.1	-0.5	26.5	23.9	25.4
16	6.8-6.6	42.4	34.0	36.0	65.5	59.7	61.6	4.5	26.6	23.0	25.6
17	6.8-6.6	44.4	35.4	39.2	67.8	61.3	64.0	5.6	26.3	22.0	24.8
18	6.8-6.6	43.7	37.9	39.6	68.7	62.8	64.4	-2.9	25.9	23.2	24.8
19	6.8-6.6	41.0	38.8	39.9	66.0	63.3	65.1	0.9	25.9	23.9	25.1
20	6.6-6.5	40.6	38.5	39.1	64.4	63.1	64.0	-0.7	25.9	23.6	24.9
21	6.6-6.5	40.2	38.1	39.0	64.4	62.8	63.8	-0.5	26.1	23.9	24.8
22	6.6-6.5	39.7	37.4	38.9	64.0	61.5	62.7	-0.7	25.2	23.0	23.8
23	6.5-6.3	38.3	36.1	36.8	61.5	60.1	60.9	0.5	25.2	22.7	24.2
24	6.3-6.1	38.5	36.1	37.2	64.0	60.8	61.5	-2.5	26.1	22.9	24.3
25	6.3-6.3	38.8	37.4	38.1	63.1	61.5	62.2	0.5	25.2	23.2	24.2
26	6.4-6.3	39.4	37.4	38.5	64.4	61.7	62.9	-1.4	25.9	23.2	24.5
27	6.4-6.3	39.4	37.9	38.6	63.3	39.7	54.2	-19.8	25.2	0.9	15.6
28	6.5-6.4	40.1	38.1	39.0	57.7	39.4	48.5	6.8	18.5	0.5	9.4
29	6.5-6.3	41.2	39.0	39.9	64.4	47.8	60.5	-9.4	23.9	8.8	20.6
30	6.4-6.4	41.5	39.7	40.6	64.4	63.1	63.8	-0.5	23.9	22.1	23.2
31	6.5-6.4	42.4	38.5	40.3	63.5	62.6	63.2	-0.4	24.3	20.9	22.9
MONTH	7.0-6.1	45.7	31.1	37.5	68.7	39.4	61.2	-19.8	28.1	0.5	23.7

PH RANGE = HIGHEST AND LOWEST PH AT DISCHARGE CANAL (PH UNITS)

ALL TEMPERATURES ARE IN DEGREES FAHRENHEIT

MRC = MAXIMUM RATE OF CHANGE IN DISCHARGE TEMPERATURE (DEGREES / HR.)

**** MEANS LACK OF DATA FROM CONTINUOUS MONITORING SYSTEM DUE TO SENSOR MALFUNCTION (REQUIRED GRAB SAMPLE DATA HAVE BEEN TAKEN)

TABLE 2.1 (CONT.)
CONNECTICUT YANKEE STATION
MONTHLY WATER QUALITY DATA SUMMARY

DATA PERIOD = 1 APR 60/0015 - 30 APR 60/2315

DAY	PH RANGE	INTAKE TEMPERATURE		DISCHARGE TEMPERATURE		TEMPERATURE RISE					
		MAX.	MIN. AVE.	MAX.	MIN. AVE.	MAX.	MIN. AVE.				
1	6.5-6.4	41.0	38.5	39.7	63.7	62.2	63.0	0.4	23.9	22.5	23.3
2	6.5-6.4	41.7	39.4	40.4	64.4	62.4	63.7	-1.6	24.3	22.1	23.3
3	6.5-6.4	41.9	39.2	40.7	62.4	60.8	61.8	-1.4	22.3	19.8	21.1
4	6.6-6.4	43.5	40.3	41.4	62.8	61.0	61.8	0.4	21.2	19.1	20.4
5	6.5-6.4	42.4	41.2	41.7	63.1	61.7	62.4	0.5	21.6	20.2	20.7
6	6.6-6.5	44.6	41.2	42.7	64.6	61.9	63.4	0.5	21.4	19.6	20.6
7	6.6-6.5	45.3	42.1	43.6	65.5	62.6	64.2	0.5	21.6	19.6	20.6
8	6.5-6.5	44.8	43.0	43.9	65.3	63.7	64.6	0.5	21.1	20.2	20.6
9	6.6-6.5	45.0	43.0	45.1	66.7	65.8	66.1	-0.9	23.0	19.8	20.9
10	6.6-6.4	47.3	45.7	46.5	66.4	65.3	66.0	0.4	20.5	18.9	19.4
11	6.4-6.3	46.2	43.7	45.3	66.2	64.2	65.2	-0.4	20.5	19.1	19.9
12	6.3-6.3	45.5	43.2	44.7	65.1	64.0	64.6	0.4	20.5	19.4	19.9
13	6.4-6.3	46.2	43.5	44.8	66.0	64.4	65.2	-0.5	21.8	19.8	20.4
14	6.4-6.4	45.5	43.5	44.7	67.3	65.8	66.7	0.4	20.6	20.7	22.0
15	6.5-6.4	46.9	44.6	45.5	69.4	66.7	68.2	-0.4	23.9	22.0	22.8
16	6.4-6.4	45.0	44.8	45.6	68.7	66.4	67.2	-1.8	23.4	21.3	21.6
17	6.4-6.4	46.0	43.3	45.0	67.8	65.7	66.6	-2.0	22.9	17.8	21.7
18	6.4-6.4	46.2	43.3	45.4	66.9	65.9	65.9	0.5	21.6	19.6	20.5
19	6.4-6.4	48.9	44.4	45.8	67.8	65.5	66.8	0.5	22.3	18.9	21.0
20	6.6-6.4	48.2	44.0	46.8	69.6	66.4	68.2	0.7	22.1	20.2	21.4
21	6.4-6.3	50.2	46.4	48.7	71.4	68.0	70.0	0.7	22.3	20.0	21.3
22	6.4-6.3	50.9	49.6	49.6	72.1	69.4	71.0	0.7	22.1	20.7	21.4
23	6.4-6.3	53.0	48.0	50.1	72.5	70.0	71.4	-0.5	22.9	20.0	21.3
24	6.4-6.4	52.3	49.6	50.8	73.4	70.7	72.2	-0.5	22.5	20.2	21.4
25	6.4-6.3	52.9	50.9	52.0	74.3	72.3	73.5	0.5	22.7	20.3	21.4
26	6.4-6.3	52.7	50.5	51.7	73.9	66.4	71.3	-3.8	22.1	13.9	19.6
27	6.4-6.7	52.7	51.1	52.4	74.3	73.2	73.9	-0.5	22.3	20.7	21.5
28	6.4-6.3	53.2	50.0	51.6	73.9	70.5	71.9	-1.6	22.1	18.9	20.4
29	6.5-6.4	51.1	49.1	50.1	70.5	68.7	69.8	-0.4	20.5	19.3	19.7
30	6.5-6.4	50.9	48.4	49.6	70.3	68.7	69.3	0.5	20.5	19.1	19.7
MONTH	6.8-6.3	53.2	38.5	46.2	74.3	60.8	67.2	-3.8	28.6	13.9	21.0

PH RANGE = HIGHEST AND LOWEST PH AT DISCHARGE CANAL (PH UNITS)

ALL TEMPERATURES ARE IN DEGREES FAHRENHEIT

MRC = MAXIMUM RATE OF CHANGE IN DISCHARGE TEMPERATURE (DEGREES / HR.)

**** MEANS LACK OF DATA FROM CONTINUOUS MONITORING SYSTEM DUE TO SENSOR MALFUNCTION (REQUIRED GRAB SAMPLE DATA HAVE BEEN TAKEN)

TABLE 2.1 (CONT.)

CONNECTICUT YANKEE STATION

MONTHLY WATER QUALITY DATA SUMMARY

DATA PERIOD = 1 MAY 80/0015 - 31 MAY 80/2315

PARAMETER

DAY	PH RANGE	INTAKE TEMPERATURE			DISCHARGE TEMPERATURE				TEMPERATURE RISE		
		MAX.	MIN.	AVE.	MAX.	MIN.	AVE.	MRC	MAX.	MIN.	AVE.
1	6.5- 6.4	51.4	49.3	50.2	70.5	69.4	69.8	-0.4	20.9	18.4	19.6
2	6.5- 6.4	51.8	49.6	50.5	71.2	69.1	70.2	-0.4	20.7	18.9	19.7
3	6.6- 6.4	54.3	50.0	52.1	70.5	52.7	57.5	-5.4	19.6	0.2	5.4
4	6.6- 6.5	55.9	52.9	54.6	56.3	54.1	55.2	-0.4	1.3	0.4	0.6
5	8.5- 6.5	57.4	55.0	56.1	57.9	55.9	56.8	0.9	1.3	0.2	0.7
6	6.5- 6.5	58.6	56.8	57.5	59.0	57.7	58.4	0.4	1.6	0.0	0.9
7	6.5- 6.5	60.1	57.9	58.5	59.9	59.0	59.4	0.4	1.6	0.0	0.9
8	6.5- 6.5	59.5	57.7	58.4	59.5	58.6	59.0	-0.4	0.9	0.0	0.6
9	6.5- 6.5	57.4	56.8	57.2	59.0	57.9	58.2	-0.2	1.8	0.5	0.9
10	6.8- 6.4	57.4	55.9	56.7	57.9	56.5	57.4	-0.5	1.1	0.4	0.7
11	****-****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
12	****-****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
13	6.8- 6.8	58.1	56.8	57.8	58.8	57.4	58.4	-0.4	1.1	0.0	0.7
14	7.0- 6.6	60.1	57.4	58.7	60.4	58.1	59.3	0.5	1.3	0.0	0.7
15	6.8- 6.6	59.5	58.1	58.9	60.4	59.2	59.6	0.5	1.3	0.4	0.7
16	6.8- 6.6	60.1	59.5	59.8	60.6	60.1	60.5	0.4	0.9	0.5	0.6
17	6.9- 6.6	62.8	58.8	60.0	62.6	59.5	60.5	-1.1	2.0	0.0	0.6
18	6.8- 6.6	61.0	59.5	60.3	61.3	59.9	60.8	-0.5	1.3	0.0	0.5
19	6.9- 6.5	62.8	59.2	61.0	63.1	59.7	61.5	0.7	1.1	0.0	0.5
20	6.8- 6.5	62.8	61.0	61.6	63.3	61.5	62.2	0.5	0.9	0.2	0.5
21	****-****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
22	6.9- 6.6	63.5	63.1	63.4	67.8	64.4	66.4	1.6	4.3	0.9	3.0
23	7.4- 6.5	65.1	62.4	63.6	69.6	64.9	66.5	-3.2	4.5	0.2	2.8
24	7.0- 6.6	66.4	64.4	65.8	67.3	64.6	66.2	0.5	1.1	0.0	0.4
25	7.3- 6.6	67.8	64.9	66.7	68.5	65.3	67.1	-0.5	1.3	0.0	0.4
26	7.8- 6.8	67.8	65.3	66.6	67.8	65.8	66.9	-0.5	0.9	0.0	0.3
27	8.3- 7.1	67.1	65.5	66.4	67.8	66.0	66.7	-0.5	1.1	0.0	0.3
28	8.6- 7.3	68.5	65.5	67.1	68.5	65.5	67.2	0.7	0.5	0.0	0.1
29	8.5- 7.4	69.1	66.4	67.6	69.1	67.1	67.8	-0.7	0.9	0.0	0.2
30	8.8- 7.3	70.0	67.1	68.1	70.0	67.1	68.4	0.5	0.9	0.0	0.3
31	8.5- 7.4	69.8	67.6	68.7	70.0	67.8	68.9	0.7	0.7	0.0	0.2
MONTH	8.8- 6.4	70.0	49.3	60.9	71.2	52.7	63.4	-5.4	20.9	0.0	2.5

PH RANGE = HIGHEST AND LOWEST PH AT DISCHARGE CANAL (PH UNITS)

ALL TEMPERATURES ARE IN DEGREES FAHRENHEIT

MRC = MAXIMUM RATE OF CHANGE IN DISCHARGE TEMPERATURE (DEGREES / HR.)

**** MEANS LACK OF DATA FROM CONTINUOUS MONITORING SYSTEM DUE TO SENSOR MALFUNCTION (REQUIRED GRAB SAMPLE DATA HAVE BEEN TAKEN)

TABLE 2.1 (CONT.)

CONNECTICUT YANKEE STATION

MONTHLY WATER QUALITY DATA SUMMARY

DATA PERIOD = 1 JUN 80/0015 - 30 JUN 80/2315

DAY	PH RANGE	INTAKE TEMPERATURE		DISCHARGE TEMPERATURE		TEMPERATURE RISE					
		MAX.	MIN. AVE.	MAX.	MIN. AVE.	MAX.	MIN. AVE.				
1	8.5-7.1	72.3	67.8	69.5	72.1	68.5	69.8	0.7	0.7	0.0	0.3
2	7.4-7.4	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
3	8.1-7.1	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
4	7.6-6.9	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
5	7.9-6.9	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
6	7.9-6.9	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
7	7.1-6.9	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
8	7.1-6.9	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
9	7.3-6.9	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
10	7.0-6.9	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
11	7.3-6.8	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
12	7.8-6.8	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
13	8.4-6.9	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
14	8.3-7.0	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
15	7.3-7.3	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
16	8.5-7.5	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
17	8.5-7.4	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
18	8.8-7.5	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
19	8.8-7.5	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
20	8.3-7.4	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
21	8.6-7.4	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
22	8.6-7.5	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
23	9.0-7.8	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
24	8.9-8.0	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
25	8.6-7.8	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
26	8.3-7.4	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
27	7.4-7.0	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
28	7.3-6.9	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
29	7.0-6.9	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
30	6.9-6.8	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
MONTH	9.0-6.8	72.3	67.8	69.5	72.1	68.5	69.8	0.7	0.7	0.0	0.3

PH RANGE = HIGHEST AND LOWEST PH AT DISCHARGE CANAL (PH UNITS)

ALL TEMPERATURES ARE IN DEGREES FAHRENHEIT

HRC = MAXIMUM RATE OF CHANGE IN DISCHARGE TEMPERATURE (DEGREES / HR.)

***** MEANS LACK OF DATA FROM CONTINUOUS MONITORING SYSTEM DUE TO SENSOR MALFUNCTION (REQUIRED GRAB SAMPLE DATA HAVE BEEN TAKEN)

TABLE 2.1 (CONT.)

CONNECTICUT YANKEE STATION

MONTHLY WATER QUALITY DATA SUMMARY

DATA PERIOD = 1 JUL 80/0015 - 31 JUL 80/2315

PARAMETER

DAY	PH RANGE	INTAKE TEMPERATURE			DISCHARGE TEMPERATURE				TEMPERATURE RISE		
		MAX.	MIN.	AVE.	MAX.	MIN.	AVE.	MRC	MAX.	MIN.	AVE.
1	7.0- 6.6	****	****	****	****	****	****	****	****	****	****
2	7.9- 6.8	****	****	****	****	****	****	****	****	****	****
3	7.0- 6.8	****	****	****	****	****	****	****	****	****	****
4	7.8- 6.6	****	****	****	****	****	****	****	****	****	****
5	8.3- 6.9	****	****	****	****	****	****	****	****	****	****
6	8.3- 7.0	****	****	****	****	****	****	****	****	****	****
7	8.6- 7.1	****	****	****	****	****	****	****	****	****	****
8	8.4- 7.4	****	****	****	****	****	****	****	****	****	****
9	8.0- 7.1	****	****	****	****	****	****	****	****	****	****
10	8.0- 7.0	****	****	****	****	****	****	****	****	****	****
11	7.8- 7.1	****	****	****	****	****	****	****	****	****	****
12	8.0- 7.0	****	****	****	****	****	****	****	****	****	****
13	8.0- 7.1	****	****	****	****	****	****	****	****	****	****
14	7.8- 7.0	****	****	****	****	****	****	****	****	****	****
15	7.4- 7.0	****	****	****	****	****	****	****	****	****	****
16	7.4- 7.0	****	****	****	****	****	****	****	****	****	****
17	7.3- 6.9	****	****	****	****	****	****	****	****	****	****
18	7.1- 6.9	82.4	81.1	81.8	****	****	****	****	****	****	****
19	****-****	82.6	79.9	81.4	****	****	****	****	****	****	****
20	****-****	****	****	****	****	****	****	****	****	****	****
21	****-****	85.3	82.2	83.6	****	****	****	****	****	****	****
22	****-****	****	****	****	****	****	****	****	****	****	****
23	****-****	84.7	83.5	84.0	****	****	****	****	****	****	****
24	****-****	83.8	81.5	82.8	****	****	****	****	****	****	****
25	****-****	83.3	81.7	82.4	****	****	****	****	****	****	****
26	****-****	83.3	81.5	82.5	****	****	****	****	****	****	****
27	****-****	82.9	81.5	82.4	91.4	84.7	90.2	3.2	9.2	2.7	7.6
28	8.6- 8.6	83.1	81.7	82.2	82.4	82.4	82.4	****	0.4	0.4	0.4
29	8.6- 8.6	82.0	82.0	82.0	82.4	82.4	82.4	****	0.4	0.4	0.4
30	7.5- 7.5	82.0	82.0	82.0	82.4	82.4	82.4	****	0.4	0.4	0.4
31	7.9- 7.9	82.0	82.0	82.0	82.4	82.4	82.4	****	0.4	0.4	0.4
MONTH	8.6- 6.6	85.3	79.9	82.3	91.4	82.4	83.6	3.2	9.2	0.4	1.5

PH RANGE = HIGHEST AND LOWEST PH AT DISCHARGE CANAL (PH UNITS)

ALL TEMPERATURES ARE IN DEGREES FAHRENHEIT

MRC = MAXIMUM RATE OF CHANGE IN DISCHARGE TEMPERATURE (DEGREES / HR.)

**** MEANS LACK OF DATA FROM CONTINUOUS MONITORING SYSTEM DUE TO SENSOR MALFUNCTION (REQUIRED GRAB SAMPLE DATA HAVE BEEN TAKEN)

TABLE 2.1 (CONT.)

CONNECTICUT YANKEE STATION

MONTHLY WATER QUALITY DATA SUMMARY

DATA PERIOD = 1 AUG 80/0315 - 31 AUG 80/2315

PARAMETER

DAY	PH RANGE	INTAKE TEMPERATURE			DISCHARGE TEMPERATURE				TEMPERATURE RISE		
		MAX.	MIN.	AVE.	MAX.	MIN.	AVE.	MRC	MAX.	MIN.	AVE.
1	7.9- 7.9	82.0	82.0	82.0	82.4	82.4	82.4	*****	0.4	0.4	0.4
2	7.9- 7.9	82.0	82.0	82.0	82.4	82.4	82.4	*****	0.4	0.4	0.4
3	7.9- 7.9	82.0	82.0	82.0	82.4	82.4	82.4	*****	0.4	0.4	0.4
4	7.6- 7.6	82.0	82.0	82.0	82.4	82.4	82.4	*****	0.4	0.4	0.4
5	7.9- 7.9	82.0	82.0	82.0	82.4	82.4	82.4	*****	0.4	0.4	0.4
6	7.8- 7.8	84.0	64.0	75.9	89.6	82.4	83.7	3.1	5.6	0.0	1.1
7	7.7- 7.7	84.0	64.4	75.7	105.1	91.0	97.5	2.7	21.1	8.1	14.7
8	7.9- 7.9	86.0	65.3	77.3	108.0	106.0	107.1	1.1	24.1	22.0	23.1
9	****-****	86.0	65.3	77.7	108.9	106.3	107.6	0.9	24.1	22.0	23.0
10	****-****	86.0	64.6	77.7	109.4	106.0	108.1	2.0	24.1	22.0	23.4
11	8.0- 8.0	86.0	63.5	77.3	109.4	105.6	107.9	1.4	25.0	22.0	23.2
12	8.3- 8.3	85.5	62.8	76.6	105.0	105.1	107.0	2.0	23.9	21.1	22.9
13	8.4- 8.4	84.9	62.6	75.6	107.6	104.0	105.9	2.0	24.1	22.5	23.4
14	8.1- 8.1	82.9	61.0	74.5	106.0	102.9	104.9	2.7	24.7	22.9	23.2
15	8.3- 8.3	82.0	61.0	73.6	104.4	102.0	102.8	1.4	23.0	22.0	22.4
16	****-****	81.0	58.6	72.2	104.7	100.9	102.4	2.3	23.9	22.3	23.2
17	****-****	79.0	59.2	71.1	102.2	99.0	100.7	3.2	24.1	22.9	23.5
18	8.5- 8.5	79.0	59.9	71.7	102.0	100.0	100.8	-1.1	24.1	22.9	23.2
19	8.1- 8.1	79.0	75.9	77.5	101.8	99.0	100.9	2.5	24.1	22.9	23.4
20	7.6- 7.6	78.1	58.1	70.3	101.3	99.5	100.4	1.4	24.1	22.9	23.6
21	7.7- 7.7	77.0	75.0	76.1	100.0	98.1	99.3	-1.1	24.1	23.0	23.2
22	7.3- 7.3	77.0	56.5	68.7	100.0	97.0	98.4	1.1	24.1	22.7	23.3
23	****-****	75.9	56.3	68.8	100.0	96.6	98.5	2.0	24.1	22.7	23.3
24	****-****	78.1	56.8	69.4	100.9	97.0	99.3	2.0	24.1	22.9	23.3
25	****-****	79.0	57.2	71.4	102.4	97.0	100.2	2.0	25.0	22.9	23.6
26	7.9- 7.9	80.1	74.8	77.7	102.9	97.9	100.8	-1.1	24.1	22.9	23.1
27	8.0- 8.0	81.0	75.9	78.4	104.0	100.0	101.7	-2.0	24.1	22.9	23.3
28	7.7- 7.7	81.0	78.1	79.4	104.0	101.5	102.8	1.1	24.3	22.0	23.4
29	7.8- 7.8	81.0	59.9	73.5	104.0	102.2	103.2	1.8	24.3	22.9	23.7
30	****-****	81.0	78.1	79.2	104.2	101.5	102.8	2.3	24.5	23.2	23.6
31	****-****	80.1	78.1	79.0	104.0	101.3	102.8	2.0	24.5	22.9	23.8
MONTH	8.5- 7.3	86.0	56.3	75.8	109.4	82.4	97.2	3.2	25.0	0.0	17.0

PH RANGE = HIGHEST AND LOWEST PH AT DISCHARGE CANAL (PH UNITS)

ALL TEMPERATURES ARE IN DEGREES FAHRENHEIT

MRC = MAXIMUM RATE OF CHANGE IN DISCHARGE TEMPERATURE (DEGREES / HR.)

**** MEANS LACK OF DATA FROM CONTINUOUS MONITORING SYSTEM DUE TO SENSOR MALFUNCTION (REQUIRED GRAB SAMPLE DATA HAVE BEEN TAKEN)

TABLE 2.1 (CONT.)

CONNECTICUT YANKEE STATION

MONTHLY WATER QUALITY DATA SUMMARY

DATA PERIOD = 1 SEP 80/0015 - 30 SEP 80/2315

PARAMETER

DAY	PH RANGE	INTAKE TEMPERATURE			DISCHARGE TEMPERATURE			MRC	TEMPERATURE RISE		
		MAX.	MIN.	AVE.	MAX.	MIN.	AVE.		MAX.	MIN.	AVE.
1	****-****	84.2	81.5	82.7	105.8	104.9	105.4	-0.9	23.4	21.6	22.7
2	8.5- 8.0	85.8	80.2	81.8	109.0	104.2	105.4	1.1	24.1	22.7	23.6
3	8.6- 7.5	83.1	80.4	81.7	106.2	103.6	105.0	1.6	23.8	22.5	23.0
4	****-****	82.6	79.0	80.5	106.0	103.1	104.0	2.9	24.3	22.5	23.5
5	****-****	82	77.9	79.6	104.4	102.0	103.0	-1.3	24.1	22.0	23.4
6	****-****	80.8	77.5	79.3	103.3	102.0	102.8	1.3	24.5	22.3	23.6
7	****-****	81.1	77.2	78.9	104.0	100.6	102.1	2.2	25.0	21.1	23.1
8	****-****	80.6	75.4	78.1	103.6	100.0	101.9	1.6	25.9	22.5	23.7
9	****-****	79.5	74.3	77.1	103.8	101.3	102.1	1.3	27.0	23.4	25.0
10	8.1- 7.6	77.9	74.8	76.4	101.1	96.6	99.3	2.3	23.8	18.9	22.8
11	7.9- 7.5	77.7	73.2	75.9	101.8	97.3	99.2	1.8	24.3	22.3	23.4
12	7.9- 7.5	78.8	74.1	76.0	101.1	97.7	99.2	1.6	24.5	21.6	23.2
13	7.9- 7.4	79.3	73.2	76.5	102.0	97.5	99.6	2.3	25.0	21.6	23.1
14	7.5- 7.4	79.3	73.9	76.8	102.7	97.3	100.2	2.7	24.8	22.0	23.5
15	7.5- 7.3	79.0	73.2	76.0	101.3	96.8	99.2	2.3	25.0	20.0	23.2
16	7.6- 7.3	77.7	72.1	74.7	100.2	95.9	97.8	1.8	24.5	21.8	23.1
17	7.5- 7.3	76.1	71.2	73.5	98.8	95.2	96.8	2.9	24.7	20.9	23.2
18	7.5- 7.3	75.4	69.4	71.9	98.6	95.2	96.4	3.4	27.0	22.1	23.8
19	7.5- 7.1	73.0	69.4	71.2	95.9	93.7	94.7	1.3	24.5	22.1	23.6
20	7.5- 7.1	73.2	69.1	70.7	96.1	92.8	94.5	1.8	24.7	22.5	23.8
21	7.5- 7.1	74.5	69.6	71.7	97.7	93.4	95.4	1.6	25.2	22.3	23.7
22	7.5- 7.3	76.3	70.5	73.1	99.7	94.8	97.2	2.3	25.6	22.5	24.0
23	7.5- 7.3	76.6	71.2	73.5	100.4	95.9	97.7	1.8	25.6	23.0	24.1
24	7.6- 7.3	73.9	69.4	71.8	97.9	94.3	96.0	1.6	25.7	23.0	24.2
25	7.5- 7.3	73.0	69.6	70.7	96.1	94.8	95.3	-1.3	25.6	22.9	24.6
26	7.5- 7.1	74.8	68.0	70.8	96.8	88.7	94.9	-4.5	25.9	20.7	24.1
27	8.1- 7.4	67.6	64.0	66.2	83.3	66.4	69.7	-5.4	16.0	0.9	3.5
28	8.1- 7.5	66.7	64.2	65.3	67.1	65.5	66.4	-1.3	2.3	0.4	1.1
29	8.5- 7.4	67.3	64.2	65.1	71.6	65.1	66.9	2.5	7.0	0.4	1.8
30	8.4- 7.5	67.1	63.5	65.2	86.5	72.1	77.2	3.2	21.2	7.4	12.0
MONTH	8.6- 7.1	85.8	63.5	73.8	109.0	65.1	94.3	-5.4	27.0	0.4	20.6

PH RANGE = HIGHEST AND LOWEST PH AT DISCHARGE CANAL (PH UNITS)

ALL TEMPERATURES ARE IN DEGREES FAHRENHEIT

MRC = MAXIMUM RATE OF CHANGE IN DISCHARGE TEMPERATURE (DEGREES / HR.)

**** MEANS LACK OF DATA FROM CONTINUOUS MONITORING SYSTEM DUE TO SENSOR MALFUNCTION (REQUIRED GRAB SAMPLE DATA HAVE BEEN TAKEN)

TABLE 2.1 (CONT.)

CONNECTICUT YANKEE STATION

MONTHLY WATER QUALITY DATA SUMMARY

DATA PERIOD = 1 OCT 80/0015 - 31 OCT 80/2315

PARAMETER

DAY	PH RANGE	INTAKE TEMPERATURE			DISCHARGE TEMPERATURE				TEMPERATURE RISE		
		MAX.	MIN.	AVE.	MAX.	MIN.	AVE.	MRC	MAX.	MIN.	AVE.
1	7.9- 7.5	67.6	64.4	65.7	90.3	87.1	88.7	1.6	24.3	21.8	23.0
2	8.1- 7.5	68.7	65.5	67.1	91.4	89.2	90.2	2.2	24.1	22.3	23.1
3	7.5- 7.3	67.6	64.9	66.3	90.3	88.0	89.3	1.4	23.9	22.1	23.1
4	7.4- 7.3	69.1	64.9	66.8	91.6	88.5	89.9	1.8	24.3	21.6	23.1
5	7.4- 7.1	68.0	65.3	66.4	90.7	89.3	89.6	1.6	23.9	21.6	23.2
6	7.4- 7.1	66.9	63.7	65.4	89.6	87.1	88.6	2.3	24.1	21.8	23.2
7	7.4- 7.3	66.9	63.3	64.8	89.2	86.7	87.8	1.8	23.8	22.1	23.1
8	7.5- 7.1	67.1	62.2	63.6	88.5	85.3	86.9	1.8	23.9	21.4	23.3
9	7.5- 7.1	64.6	61.3	62.7	87.4	84.9	85.9	1.8	24.1	21.4	23.1
10	7.8- 7.1	64.4	60.6	62.4	87.1	83.8	85.6	2.5	24.1	21.2	23.2
11	7.3- 7.1	64.9	60.4	62.2	87.6	84.2	85.8	2.3	24.3	22.7	23.5
12	7.1- 7.0	64.2	59.5	61.6	86.7	83.5	85.1	1.4	24.3	22.0	23.5
13	7.1- 7.0	63.1	57.9	59.9	86.0	82.2	83.5	1.8	24.3	21.6	23.6
14	7.3- 7.0	60.1	57.4	58.7	84.0	81.5	82.5	1.4	24.5	22.5	23.8
15	7.3- 7.0	61.7	57.2	59.0	85.1	81.1	82.7	2.7	24.5	22.5	23.8
16	7.4- 7.0	63.1	57.7	59.3	86.0	81.3	83.1	3.6	24.7	22.9	23.8
17	7.4- 7.0	64.4	57.9	60.0	86.9	81.7	83.8	3.6	24.7	21.6	23.7
18	7.3- 7.0	63.3	57.2	59.7	86.0	81.7	83.7	2.5	26.1	23.6	24.0
19	7.1- 7.0	63.3	57.7	59.9	86.0	82.2	83.8	2.7	24.7	22.7	23.9
20	7.3- 7.0	64.0	59.2	60.6	86.5	83.3	84.6	2.5	24.8	22.5	24.0
21	7.1- 7.0	62.6	59.2	60.7	86.5	84.0	84.8	2.7	25.2	22.9	24.1
22	7.0- 6.9	62.4	57.9	59.6	86.0	82.6	84.0	2.1	25.2	22.7	24.4
23	7.0- 6.9	59.7	55.4	57.6	84.2	79.9	82.2	1.8	25.6	23.0	23.5
24	7.0- 6.9	58.8	54.1	56.0	82.9	78.8	80.7	2.1	25.2	22.5	24.6
25	7.0- 6.9	59.0	53.8	55.9	82.6	78.4	80.3	2.0	25.2	22.3	24.4
26	7.0- 6.9	57.7	50.7	52.5	79.5	68.5	74.7	-5.1	24.5	15.1	22.2
27	7.0- 6.9	54.7	50.2	51.3	78.1	74.3	75.5	2.1	24.7	23.4	24.1
28	7.0- 6.9	54.5	49.8	51.2	77.7	74.3	75.3	2.9	24.7	22.7	24.1
29	6.9- 6.9	50.5	49.3	49.8	74.8	73.0	74.1	1.3	24.8	23.2	24.3
30	6.9- 6.8	52.0	48.0	49.2	76.1	73.0	73.9	1.6	25.4	23.6	24.7
31	6.9- 6.8	50.5	47.8	48.5	74.8	71.8	73.1	2.3	25.4	22.9	24.6
MONTH	8.1- 6.8	69.1	47.8	59.3	77.6	68.5	83.0	-5.2	26.1	15.1	23.7

PH RANGE = HIGHEST AND LOWEST PH AT DISCHARGE CANAL (PH UNITS)

ALL TEMPERATURES ARE IN DEGREES FAHRENHEIT

MRC = MAXIMUM RATE OF CHANGE IN DISCHARGE TEMPERATURE (DEGREES / HR.)

**** MEANS LACK OF DATA FROM CONTINUOUS MONITORING SYSTEM DUE TO SENSOR MALFUNCTION (REQUIRED GRAB SAMPLE DATA HAVE BEEN TAKEN)

TABLE 2.1 (CONT.)

CONNECTICUT YANKEE STATION

MONTHLY WATER QUALITY DATA SUMMARY

DATA PERIOD = 1 NOV 80/0015 -- 30 NOV 80/2315

PARAMETER

DAY	PH RANGE	INTAKE TEMPERATURE			DISCHARGE TEMPERATURE				TEMPERATURE RISE		
		MAX.	MIN.	AVE.	MAX.	MIN.	AVE.	MRC	MAX.	MIN.	AVE.
1	6.9- 6.8	47.5	46.6	47.2	72.7	70.9	71.6	-1.1	25.6	23.8	24.4
2	6.9- 6.8	51.6	45.5	47.4	75.0	69.4	71.9	3.2	25.6	22.7	24.5
3	6.9- 6.8	52.5	46.0	48.7	76.3	70.9	73.1	3.6	25.4	22.5	24.4
4	6.9- 6.8	52.3	46.2	49.0	79.3	71.2	73.9	-5.2	27.7	22.7	24.9
5	6.8- 6.8	52.5	46.0	48.2	76.3	70.9	73.3	2.7	26.1	23.0	25.1
6	6.8- 6.8	51.1	45.3	47.5	75.2	70.9	72.8	3.6	26.1	22.5	25.3
7	6.8- 6.6	53.8	46.2	49.1	78.1	72.1	74.3	2.7	26.3	22.0	25.2
8	6.8- 6.6	52.9	46.9	49.0	77.2	73.0	74.7	2.0	26.6	23.6	25.7
9	6.8- 6.6	52.5	45.5	47.8	77.0	71.6	73.7	3.4	27.0	23.8	25.9
10	6.8- 6.6	50.0	45.5	46.8	75.2	71.8	72.9	1.8	27.0	24.1	26.1
11	6.8- 6.6	45.7	42.8	44.4	72.7	67.3	69.5	-1.8	27.0	24.1	25.2
12	6.9- 6.8	46.0	41.9	43.2	68.5	66.4	67.2	0.9	24.8	22.3	24.0
13	6.8- 6.6	45.7	41.0	42.3	69.1	65.1	66.3	1.4	24.5	22.9	24.0
14	6.9- 6.6	45.1	39.9	42.5	69.1	65.3	66.7	-2.5	25.9	22.5	24.2
15	6.9- 6.8	46.9	41.7	43.1	70.7	66.0	67.2	-2.0	24.8	22.7	24.1
16	6.9- 6.6	46.9	41.7	43.5	70.0	66.2	67.7	2.2	25.2	22.3	24.2
17	6.9- 6.6	49.3	41.0	43.8	70.7	65.5	67.8	2.7	25.7	21.1	24.0
18	7.1- 6.6	47.5	41.2	43.2	69.8	42.8	52.5	-21.1	24.5	1.1	9.3
19	7.0- 6.8	44.6	38.8	40.3	65.1	47.3	53.6	2.7	23.6	7.7	13.3
20	7.1- 6.8	40.3	38.1	38.9	63.1	39.2	44.2	-18.0	23.9	0.2	5.3
21	7.0- 6.9	41.7	37.6	38.9	49.6	39.2	42.5	-4.0	6.1	0.7	3.7
22	6.9- 6.6	45.3	38.1	39.1	64.2	48.4	59.4	2.9	23.8	8.6	20.3
23	6.9- 6.5	46.4	38.1	41.5	67.3	61.0	64.0	3.1	23.6	18.5	22.5
24	6.8- 6.6	46.2	38.8	41.9	67.8	62.2	64.7	3.8	24.1	19.4	22.8
25	6.8- 6.6	46.6	39.4	41.7	68.0	63.5	64.9	3.6	24.1	20.5	23.2
26	6.8- 6.6	41.0	39.4	40.0	64.4	63.3	63.6	0.5	24.3	22.3	23.6
27	6.6- 6.5	40.1	38.3	39.3	64.2	62.4	63.1	-0.5	24.3	22.9	23.8
28	6.8- 6.4	45.5	38.1	40.0	68.7	61.5	63.5	5.0	24.8	20.5	23.5
29	6.8- 6.6	33.1	37.2	37.7	61.9	61.0	61.6	0.4	24.7	23.2	23.9
30	6.6- 6.5	37.6	37.2	37.4	64.4	60.6	62.8	2.3	27.0	23.4	25.4
MONTH	7.1- 6.4	53.8	37.2	43.4	79.3	39.2	65.5	-21.1	27.7	0.2	22.0

PH RANGE = HIGHEST AND LOWEST PH AT DISCHARGE CANAL (PH UNITS)

ALL TEMPERATURES ARE IN DEGREES FAHRENHEIT

MRC = MAXIMUM RATE OF CHANGE IN DISCHARGE TEMPERATURE (DEGREES / HR.)

**** MEANS LACK OF DATA FROM CONTINUOUS MONITORING SYSTEM DUE TO SENSOR MALFUNCTION (REQUIRED GRAB SAMPLE DATA HAVE BEEN TAKEN)

TABLE 2.1 (CONT.)
CONNECTICUT YANKEE STATION
MONTHLY WATER QUALITY DATA SUMMARY

DATA PERIOD = 1 DEC 80/0015 - 31 DEC 80/2315

PARAMETER

DAY	PH RANGE	INTAKE TEMPERATURE			DISCHARGE TEMPERATURE				TEMPERATURE RISE		
		MAX.	MIN.	AVE.	MAX.	MIN.	AVE.	MRC	MAX.	MIN.	AVE.
1	6.6- 6.6	37.6	37.0	37.4	64.4	63.5	63.9	-0.7	27.0	26.1	26.5
2	6.6- 6.6	38.5	37.2	37.8	64.0	60.6	61.8	-1.6	26.8	22.7	23.9
3	6.6- 6.6	38.8	37.0	38.0	62.4	60.6	61.6	-0.5	24.1	22.5	23.5
4	6.8- 6.6	37.9	34.9	36.1	61.9	59.5	60.5	-0.4	25.0	22.7	24.3
5	6.8- 6.6	35.2	33.4	34.0	61.7	56.8	57.9	4.0	27.7	23.2	23.9
6	6.8- 6.6	33.6	32.7	33.3	57.4	56.3	57.1	-0.2	24.1	23.2	23.7
7	6.6- 6.6	34.0	32.9	33.5	57.9	56.5	57.2	-0.5	24.5	22.9	23.7
8	6.6- 6.3	41.7	30.4	35.1	64.9	57.2	59.1	5.9	27.4	18.9	24.0
9	6.8- 6.4	39.0	35.2	36.2	62.4	59.0	59.9	-3.4	26.1	20.2	23.6
10	6.8- 6.3	39.9	36.1	37.0	64.0	59.7	60.7	-4.0	25.0	22.7	23.8
11	6.6- 6.5	37.4	35.2	36.1	61.0	59.0	59.8	1.1	24.3	22.9	23.7
12	6.8- 6.5	37.0	34.5	35.4	59.9	53.8	58.8	-4.9	24.1	19.3	23.4
13	7.0- 6.5	35.4	34.0	34.7	57.7	36.3	45.8	-5.8	23.8	1.1	11.1
14	6.6- 6.4	34.5	32.9	33.9	59.5	56.1	57.2	2.5	26.5	22.5	23.4
15	6.6- 6.5	42.6	32.7	34.7	65.3	58.3	60.3	4.1	26.8	20.5	25.6
16	6.6- 6.4	42.6	32.2	35.2	66.7	58.6	60.8	5.9	28.8	19.6	25.6
17	6.6- 6.3	41.7	32.2	33.8	66.2	57.4	59.3	4.7	27.4	21.2	25.5
18	6.6- 6.3	36.1	31.8	32.7	64.9	57.4	58.9	-3.4	28.8	25.2	26.2
19	6.6- 6.4	41.2	32.2	33.4	65.1	58.1	59.3	-4.7	29.9	19.3	25.9
20	6.5- 6.5	37.9	32.0	32.6	61.0	57.9	59.1	2.0	28.1	21.1	26.6
21	6.5- 6.5	35.1	32.0	32.7	62.1	57.9	59.6	2.0	28.1	25.9	26.9
22	6.5- 6.1	41.5	32.2	33.7	65.5	58.6	60.1	-5.0	27.0	22.9	26.3
23	6.6- 6.3	42.8	32.2	34.0	66.7	58.3	60.4	7.9	28.8	23.4	26.4
24	6.5- 6.3	41.0	32.5	33.9	66.0	58.3	60.2	7.0	29.0	24.1	26.3
25	6.5- 6.4	32.2	32.0	32.0	60.1	57.4	58.6	1.4	28.1	25.4	26.5
26	6.5- 6.4	33.4	32.0	32.1	60.1	57.9	58.8	-1.1	28.1	25.9	26.7
27	6.5- 6.4	32.5	32.2	32.3	59.5	57.9	58.6	-0.5	27.0	25.6	26.3
28	6.5- 6.4	33.1	32.0	32.5	59.7	57.9	58.8	-1.1	27.2	25.2	26.2
29	6.5- 6.4	36.3	32.2	33.7	62.2	58.6	60.2	2.7	27.4	25.0	26.6
30	6.5- 6.4	38.8	33.1	34.3	65.1	59.0	60.6	3.4	28.8	22.9	26.3
31	6.5- 6.4	33.8	32.0	32.7	59.9	57.4	58.6	2.5	26.5	25.2	26.0
MONTH	7.0- 6.1	42.8	30.4	34.3	66.7	36.3	59.0	7.9	29.9	1.1	24.7

PH RANGE = HIGHEST AND LOWEST PH AT DISCHARGE CANAL (PH UNITS)

ALL TEMPERATURES ARE IN DEGREES FAHRENHEIT

MRC = MAXIMUM RATE OF CHANGE IN DISCHARGE TEMPERATURE (DEGREES / HR.)

**** MEANS LACK OF DATA FROM CONTINUOUS MONITORING SYSTEM DUE TO SENSOR MALFUNCTION (REQUIRED GRAB SAMPLE DATA HAVE BEEN TAKEN)

3.0 ENVIRONMENTAL SURVEILLANCE

3.1.1 Fish Impingement

Once each week, fish washed from the traveling screens and collected in trash baskets over a 24-hour period were identified, counted, and separated into three length categories (< 3", 3"-6", > 6"). The number impinged per month was estimated by averaging the weekly counts in any one month and multiplying the average by the number of days in the month. The estimates are presented in Table 3.1.

Environmental Technical Specifications Section 3.1.1 Fish Impingement: Reporting Requirements, which specified reporting of overruns was deleted as of March, 1979.

3.1.2 Meteorological Monitoring

As required in the technical specifications, a meteorological monitoring system conforming to the specification of Regulatory Guide 1.23 and including a dewpoint monitor is maintained at Connecticut Yankee. Summaries of the meteorological data are available upon request of the NRC.

Table 3.1 CONNECTICUT YANKEE IMPINGEMENT ESTIMATES DURING 1980

Impinged Species	January <3" 3"-6" >6"	February <3" 3"-6" >6"	March <3" 3"-6" >6"	April <3" 3"-6" >6"	May <3" 3"-6" >6"	June <3" 3"-6" >6"	July <3" 3"-6" >6"	August <3" 3"-6" >6"
Alewife							6	
American Eel	12	7 7			8	6	23	
American Shad								
Black Crappie	12	46		8				
Bluegill		7		263 53	99		8	
Brown Bullhead			16		8			
Carp						6	8	
Darters	6		53	8				
Freshwater Killifish			16					
Glut Herring								
Golden Shiner	25 12		16 8					
Hogchoker			8		31			
Lamprey Eel	6 4867							
Largemouth Bass								
Longear Sunfish			16		8	6		
Northern Pike							6	
Pickereel			22					
Pumpkinseed	6	7	8			19 6	6	
Silverside								
Smelt					23			
Spottail Shiner	12 2320	46 305	116 194	23 128				
Striped Killifish								
Sucker								
Three-spined Stickelback		7						
White Catfish	6		7	8	8		50 12	62 52
White Perch	25 12	7 16	85 16	8 8 8 165		6 304	8	12 8
Yellow Perch	118 291	23 23	31 388	669 15 248 330		43 43	6	8
Monthly Totals	-7730-	-508-	-1686-	-1320-	-569-	-47-	-98-	-140-

Table 3.1 (cont'd) CONNECTICUT YANKEE IMPINGEMENT ESTIMATES DURING 1980

Impinged Species	September			October			November			December			Total			Grand Total	Percent
	<3"	3"-6"	>6"	<3"	3"-6"	>6"	<3"	3"-6"	>6"	<3"	3"-6"	>6"	<3"	3"-6"	>6"		
Alewife	8	23		62	43		8						78	66	6	150	0.3
American Eel								38		9			0	7	66	73	0.2
American Shad							15						0	15	37	52	0.1
Black Crappie					6		8						8	20	52	80	0.2
Bluegill				37	12					5	25		42	406	61	509	1.0
Brown Bullhead											5		0	5	24	29	<0.1
Carp											10		0	0	24	24	<0.1
Darters													0	67	7	57	0.1
Freshwater Killifish							15		5	40			21	55	0	76	0.1
Glut Herring				105	6								105	6	0	111	0.2
Golden Shiner	2				6		23		45	15			0	138	77	173	0.3
Hogchoker				37	149		23						60	188	0	248	0.5
Lamprey Eel													6	4867	0	4873	9.8
Largemouth Bass					6		8			10			8	0	16	24	<0.1
Longear Sunfish							8						0	8	30	38	<0.1
Northern Pike													0	0	6	6	<0.1
Pickereel													0	0	22	22	<0.1
Pumpkinseed	90	45	75	31	43					5	10		103	114	134	351	0.7
Silverside							8						0	8	0	8	<0.1
Smelt													0	0	23	23	<0.1
Spottail Shiner		8					30	83					2356	31372	1333	2583	76.9
Striped Killifish										10	10		10	10	0	20	<0.1
Sucker					6						45	5	0	45	11	56	0.1
Three-spined Stickel- back													7	0	0	7	<0.1
White Catfish	15	45	105	25	31		8			20	15		62	185	248	495	9.9
White Perch			15	19	6		38	225	60	10	105		148	420	598	1166	2.3
Yellow Perch	8	30			12				30		235	285	46	1063	1727	2836	5.7
Monthly Totals	-490-			-642-			-628-			-35,985-			-49,843-				

4.0 SPECIAL SURVEILLANCE, RESEARCH, OR STUDY ACTIVITIES

4.1 Fish Deterrent Studies

An electrical fish deterrent study was performed during August 1974, as a part of a continuing fish impingement study. Results of this study were provided in the 1975 Annual Environmental Operating Report, Part A: Nonradiological Report dated March 29, 1976.

4.2 Shad Monitoring Program

The objective of the shad monitoring program is to determine the size and population dynamics of American Shad comprising the annual spawning run in the Connecticut River.

In 1974, the State of Connecticut and the Connecticut Yankee Atomic Power Company entered into a cooperative agreement to continue studies on the Connecticut River shad population, begun by Essex Marine Laboratory in 1965. The project is to run for eight years.

Approximately 5,100 American shad were tagged and released at the mouth of the Connecticut River during 1980. In this tag and recover method of estimating population size, commercial fishermen act as the recovery mechanism. Representative fish samples are taken for age, size and sex analysis. This study program design has been followed since 1965.

The seventh annual report, prepared by Peter Minta of the Connecticut Department of Environmental Protection covering the 1980 shad run appears in the Appendix.

4.3 Phytoplankton Studies

The impact of Connecticut Yankee on phytoplankton populations in the Connecticut River adjacent to the plant was studied between October 1965 and September 1969 by researchers from the Marine Research Laboratory of the University of Connecticut. However, in issuing the Final Environmental Statement for the Haddam Neck plant, the Nuclear Regulatory Commission (then the AEC) required an additional investigation into the increases of phytoplankton, and the decline of the diatom Melosira in favor of bluegreen algae. In compliance with that requirement, an additional year of phytoplankton studies was conducted during 1975. A final report describing the results of this investigation was provided in the Annual Environmental Operating Report, Part A: Nonradiological Report dated March 29, 1976. This fulfills our requirements as per Technical Specification 4.3 of December 27, 1974.

APPENDIX

Seventh Annual Report
Connecticut River Shad Study

Submitted to:

Northeast Utilities Company

Prepared by:

Peter Minta
Anadromous Fisheries Biologist

Connecticut Department of Environmental Protection
Marine Fisheries
March 25, 1981

Introduction

Population size of American shad (Alosa sapidissima) entering the Connecticut River has been annually estimated since 1965 using the Petersen mark and recapture method. Each years age and sex structure has also been determined using scales taken from the shad commercial fishery and recreational fishery with additional information in 1980 from a pound net operating at the mouth of the river.

This study is supported in part by Northeast Utilities and the National Marine Fisheries Service.

Materials and Methods

The tagging procedures utilized during the 1980 Connecticut River Shad Study were similar to all the previous years dating to the project's beginning; and the time frame, early April to late May was essentially the same.

From April through May, adult American shad were captured near the mouth using monofilament drift gill nets, (stretch mesh size 14-cm, 182-cm deep, and 122 to 124-m long), tagged with a yellow dart tag, and released to continue their upriver migration. To minimize tag-induced mortality, the duration of each drift varied according to the number of shad taken and to river water temperatures. Fork length, sex, and tag number were recorded into a tape recorder and later transcribed onto an IBM printout log. The annual sex ratio is based on this information.

Tagged and untagged shad, subsequently captured by commercial fishermen at various locations along the river, were reported to the Connecticut Department of Environmental Protection after which a three dollar reward was paid

for returned tags. Commercial fishermen are required to report their catch on an annual basis to the DEP. Because some fishermen fail to maintain adequate records and/or purposely under-report their total catch, the catch returns from certain fishermen are believed to be unreliable. This bias could seriously affect the population estimate by altering the true ratio of recoveries to total catch.

In an effort to determine which fishermen reported reliable catch data, and to calculate an adjusted commercial catch, the ratio of recaptures to total catch for each fisherman was analyzed using Chi square analysis (Leggett 1976). This method assumes that catchability of both tagged and untagged fish are similar, and that the probability of recapturing a tagged fish is similar among all fishermen. A uniform ratio between recaptures and total commercial catch (R/C) is assumed for all fishermen, considering differences due to random variation. The number of fishermen whose catch data are considered reliable by Chi square analysis are used to calculate an adjusted commercial catch (C) for all fishermen with the following equation:

$$C = \frac{R_1 C}{R_2}$$

where R_1 = number of tagged fish recaptured by the original fishermen

C = total catch from the fishermen considered reliable by Chi square analysis

R_2 = number of tagged fish recaptured by the fishermen who were considered reliable by Chi square analysis

(Pr) $R = R_2/C$ = (probability of recapturing a tagged fish)

The adjusted commercial catch (C) is then used to estimate the adult shad population (N) by applying the Petersen equation as follows:

$$N = \frac{MC}{R_1}$$

where M = the number of tagged fish. However, according to Leggett (1976) tag shedding and mortality of tagged fish accounted for three and two percent of the total respectively. Hence, the number of tagged fish (M) is reduced by five percent.

The 95% confidence limits on the recaptures (R_1) was obtained using an equation from Ricker (1975):

$$R_1 \pm 1.92 \pm 1.96 R_1 + 1.0.$$

Substituting the upper and lower limits for the number of recaptures (R) into the equation: $N = \frac{MC}{R_1}$, 95% confidence limit around the population estimate (N) was obtained which was valid assuming that tagged fish (M) were randomly distributed throughout the population.

The fraction (u) of the adult run harvested by commercial fishermen was estimated using:

$$U = \frac{R_1}{M}.$$

Shad scales used in age determination were collected from the commercial fishery in Saybrook, the sport fishery at Enfield and a pound net at the mouth of the river. Each fish was measured to fork length (cm), weight (gr), sexed, and 10-12 scales were taken from the left side at a point mid-center between the anterior edge of the dorsal fin and the lateral line. Scale analysis also provided an estimate of repeat spawners. Age was determined by counting annuli and the repeat spawners were identified by a distinct scar on the annulus.

The Connecticut Department of Environmental Protection fished the pound net in Long Island Sound located at a site off the Saybrook West Breakwater at the twelve to fourteen foot contour. Total length of the pound net was 692 feet. It was equipped with a 540 foot lead, two 125 foot

hearts, and a 30 foot square pound or trap. The depth of all netting was 20 feet and the whole system was set on 57 piers with seven additional piers used for bracing. The length of the piers were 30 feet with a bole diameter at the base of 3.5 to 5.0 inches. Hardwood poles were mixed with spruce during 1980 but the spruce was found to be inadequate with breakage at the water line during storms. The spruce poles had to be replaced throughout the season with hardwoods.

Results and Discussion

The number of commercial shad boats operating on the Connecticut River has varied considerably over the years since the Connecticut Department of Environmental Protection assumed the Connecticut River Shad Study in 1974. A peak of 63 shad boats was reached in 1977 after which the number declined to 40 by 1980. The number of boats operating apparently reflects the previous one or two years shad abundance and is relative to the estimated population increases or decreases. Commercial shad licenses issued in 1980 numbered 147 of which 107 were fishermen who served as "strikers" or assistants to the 40 boats.

Reported catch by the commercial shad fishermen was 72,591. Using the Chi square technique to eliminate reporting errors in the commercial fisheries reports, the adjusted figure was calculated at 77,312 shad for an exploitation rate of 14.8 percent (Table 1). The 1980 shad population was estimated to be 522,000 \pm 39,000 based on the techniques utilized since the inception of the study (Table 2). Analysis is presently underway which may adjust upward this and all previous estimates to account for gill net selectivity in the tagging capture operation and the commercial operation.

In 1980, 5,111 adult American shad were captured and tagged in the Connecticut River's Saybrook-Old Lyme Reach, 719 of which were subsequently returned by commercial fishermen. Tag recoveries from this and other areas of the Connecticut River are listed in Table 3. Outside of southern New England, two of the previous years tags (1979) were recovered from Pamlico Sound, North Carolina and one offshore New Hampshire.

The sex ratio in the tagging catch is shown on Table 4. Assuming unbiased sex ratios were gathered from the pound net, it was clearly demonstrated that the gill net samples are selective toward the female cohort. Since it is known the gill net under-samples the male segment of the shad population, a simple method can be applied to estimate the under-sampled segment. The sex ratio in the gill net sample was 60:40 female to male and in the pound net was 48:52 female to male. When the number of females taken in the gill net is applied to the pound net female ratio, the number of males in the population increases by 21 percent.

Comparisons are made in percentage composition by length classes in Figures 1 and 2 for male and female shad, respectively, between the tagging and the pound net catch. The mean length of males in the tagging catch was 46.47 cm while the pound net mean length was 43.47 cm. Again, this data supports the premise of under-sampling the male segment by gill nets. The mean length of females was not substantially different, being 49.69 cm in the tagging sample and 48.78 in the pound net sample.

Similar age structures of female shad were also evident from scale samples taken in three areas; the pound net, the commercial fishery, and the recreational fishery (Table 5). There is a noticeable lack of age IV females in the 1980 structure which may indicate a lower population level in 1981. Age III males are also depressed in number which further supports

the indication of a smaller 1981 population level. Table 6 compares the 1980 age structure to the mean over the years of the shad study. The older age group shad have been declining for the past few years.

Repeat spawning shad percentage which involves the older age groups have steadily declined since 1975 when the Holyoke Fishlift Facility began expanded operation lifting large numbers of adult shad into the Holyoke impoundment. Downstream migrant facilities were operable in 1980 over the Holyoke Dam but the impact will not be apparant until the 1981 migration. Figure 3 depicts the continuous downward trend with an all-time low in 1980 of 14.3 percent. This figure as in the past is based on the commercial fishery and recreational fishery scale samples weighed equally. If the pound net repeat spawning percentage is calculated into the figure, the repeat spawning segment would rise to 20.1 percent. The impact of adult mortality and the increase of shad production within the Holyoke pool may increase the size of the adult virgin population and create a disproportionately low number of older shad in the annual run.

Figure 1. Percentage composition of male American shad in the tagging catch compared to the pound net catch (1980)
Tagging catch ———
Pound net - - - - -

P
e
r
c
e
n
t
a
g
e

20.0

17.5

15.0

12.5

10.0

7.5

5.0

2.5

0

32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54
Length Groups (cm)

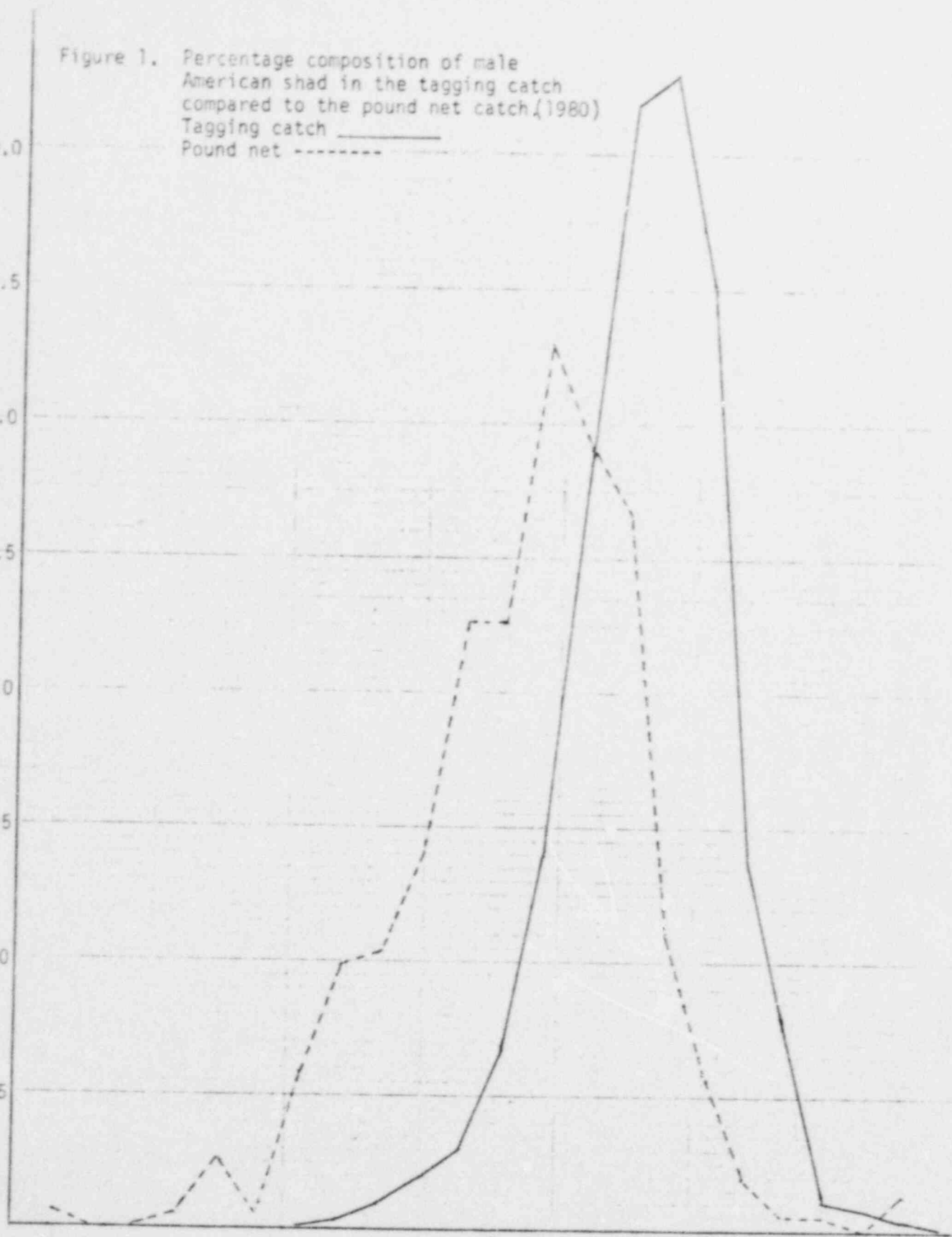


Figure 2. Percentage composition of female American shad in the tagging catch compared to the pound net catch. (1980)
Tagging catch ———
Pound net catch - - - - -

P
e
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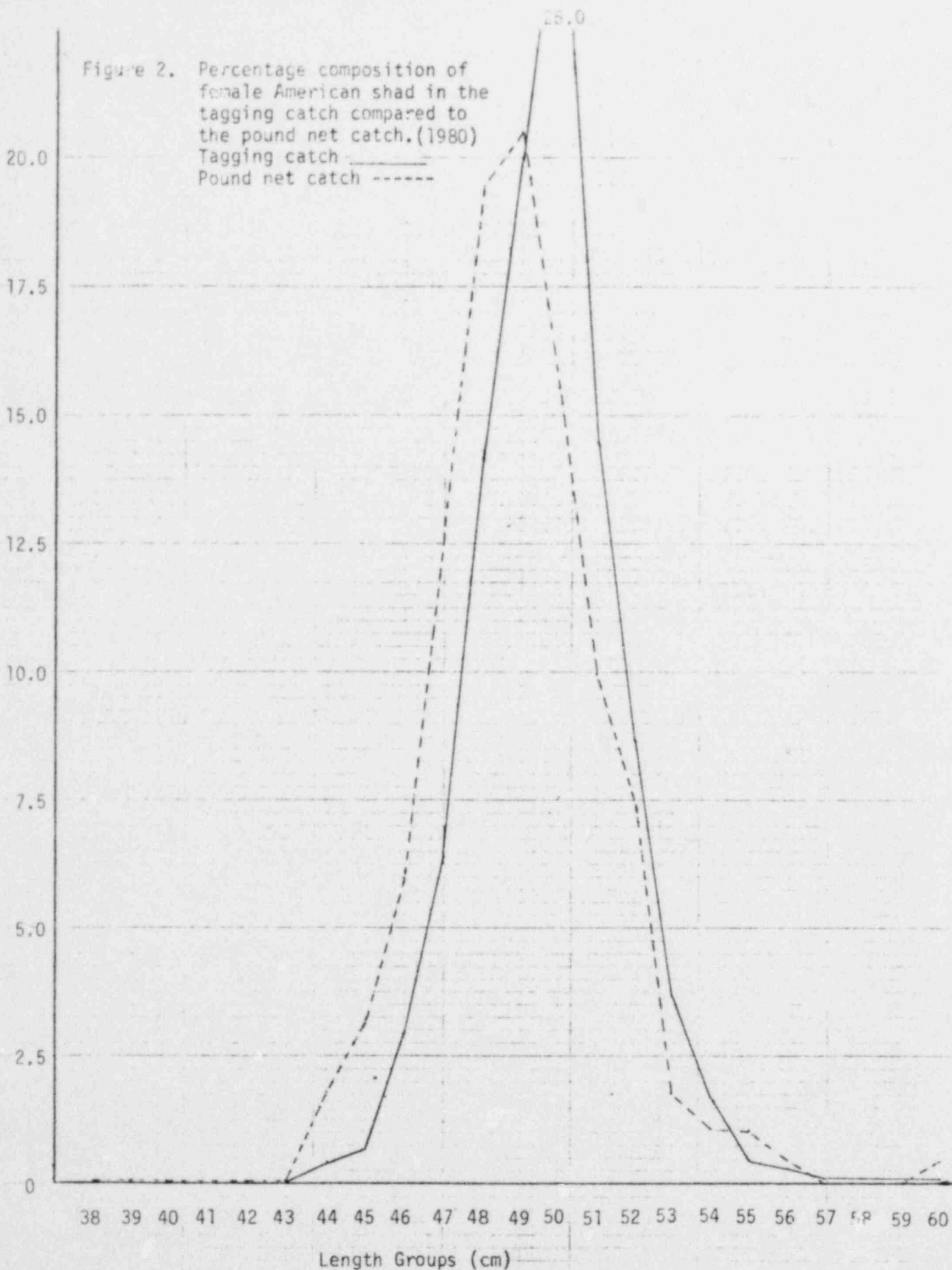


Figure 3. Percent repeat spawners in American shad population each year, 1965-1980 (Connecticut River)

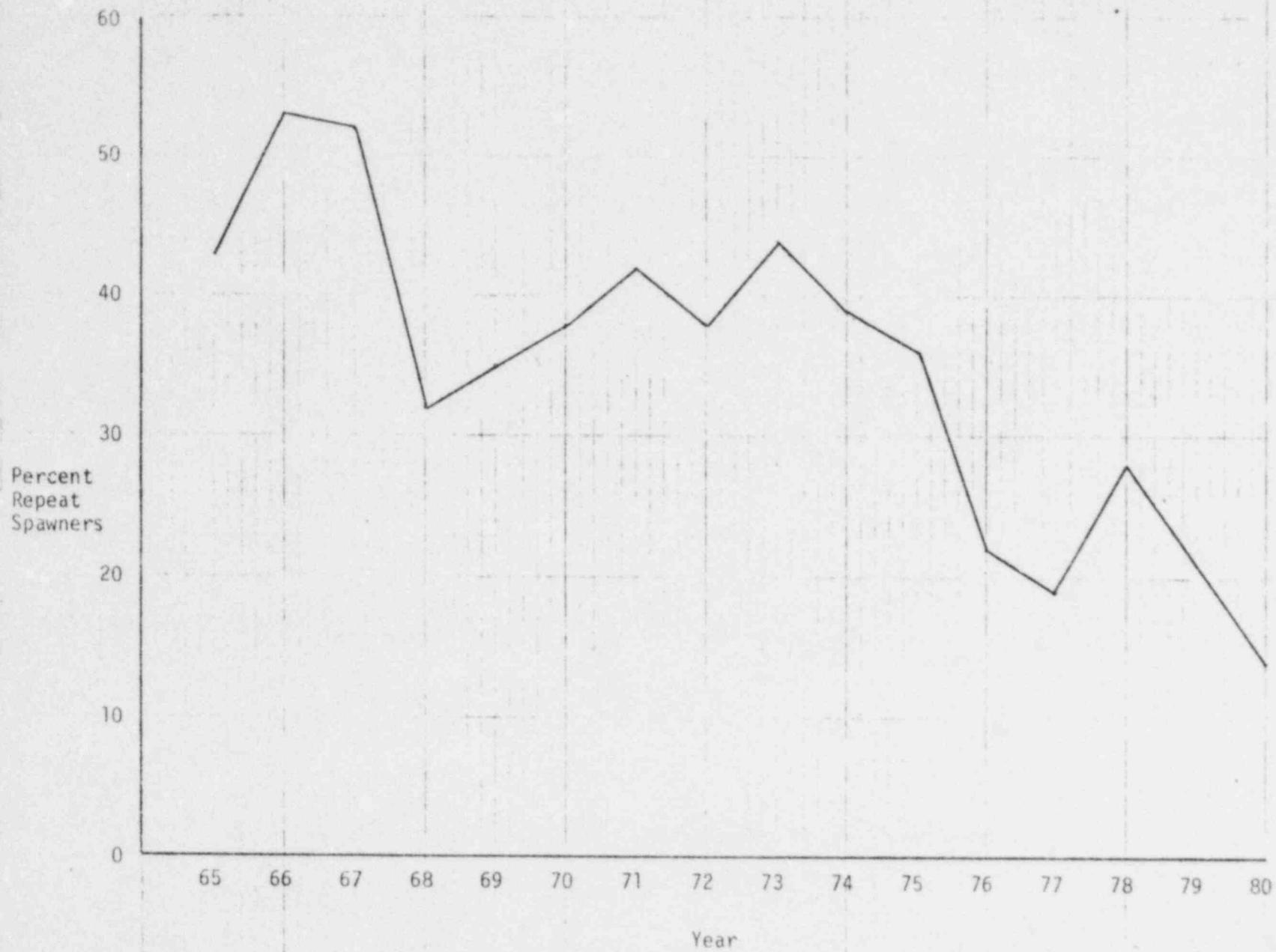


Table 1. The adjusted commercial catch calculated for each year along with the exploitation rate based on the adjusted catch.

Year	Adjusted Catch	Exploitation rate (%)
1965	173,103	11.8
1966	80,853	22.0
1967	75,869	20.6
1968	58,173	20.8
1969	68,767	20.7
1970	71,367	17.0
1971	74,718	17.5
1972	51,197	18.6
1973	68,524	20.6
1974	61,509	16.5
1975	65,000	10.9
1976	107,761	14.5
1977	72,425	16.1
1978	68,850	15.9
1979	50,000	14.1
1980	77,312	14.8

Table 2. Size of the Connecticut River American shad population 1965-1980.

<u>Year</u>	<u>Estimate</u>
1965	400,000* ± 15%
1966	367,000 ± 25,000
1967	363,000 ± 24,000
1968	280,000 ± 19,000
1969	333,000 ± 22,000
1970	419,000 ± 37,000
1971	428,000 ± 31,000
1972	275,000 ± 17,000
1973	332,000 ± 28,000
1974	372,000 ± 28,000
1975	598,000 ± 70,000
1976	740,000 ± 52,000
1977	450,000** ± 20,000
1978	432,000 ± 39,000
1979	355,000 ± 33,000
1980	522,000 ± 39,000

*Recalculated due to the inordinately high number of repeat spawners in the 1965 run of over 700,000 and the total population of 1964 being 400,000.

**Adjusted for imbalance in sex ratio.

Table 3. Total Southern New England tag recoveries of American shad tagged in 1980.

Total shad tagged at mouth of river	5,111
Tags returned by:	
Commercial fishery	719
Enfield Sport fishery	28
Holyoke Sport fishery	48
Westfield River sport fishery	2
Farmington River sport fishery	2
New Haven Harbor	1
Rhode Island Sound	1
Montauk, N. Y.	1
Tags collected at Holyoke Fishlift (1980 tags)	<u>56</u>
Total tags recovered	858
Tags observed in the Holyoke fishlift	579

Table 4. Proportion of females to males in tagging catches 1967-1980

<u>Year</u>	<u>% Females</u>	<u>% Males</u>
1967	42	58
1968	59	41
1969	58	42
1970	53	47
1971	48	52
1972	50	50
1973	54	46
1974	49	51
1975	52	48
1976	56	44
1977	82	18
1978	52	48
1979	59	41
1980	60	40

Table 5. Age structure of American shad taken in the Pound Net, Commercial Fishery, and the Enfield Recreational Fishery and repeat spawning information.

Age Class	III	IV	V	VI	VII	VIII	IX	X	% Repeat Spawners	
									#	%
<u>Pound Net</u>										
Female (279)									7	26
Number	0	35	204	31	7	1	0	1		
Mean Fork Length		46.03	48.60	51.32	54.00	55.00		60.00		
Male (307)									104	34
Number	12	128	131	36	0	0	0	0		
Mean Fork Length	37.67	41.58	45.00	46.78						
<u>Commercial</u>										
Female (311)									25	8
Number	0	30	245	33	3	0	0	0		
Mean Fork Length		46.13	48.37	50.64	53.67					
Male (219)									65	30
Number	1	26	134	55	3	0	0	0		
Mean Fork Length	40.00	42.58	44.95	47.46	50.00					
<u>Enfield</u>										
Female (290)									40	14
Number	0	21	220	41	8	0	0	0		
Mean Fork Length	46.43	49.05	50.68	53.88						
Male (151)									9	6
Number	23	72	45	10	1	0	0	0		
Mean Fork Length	40.52	41.92	45.76	47.60	48.00					

Total Repeat Spawning Percentage, all weighed equally - 20.1%

Pound Net - 30.2%

Commercial- 17.1%

Enfield - 11.3%

Table 6. 1980 age structure in percentage compared to the mean for 1967-1980.

Age Class	III	IV	V	VI-VII	VIII-X
Male					
1967-1980	10.1	40.2	31.8	15.7	0
1980	5.3	33.4	45.3	15.5	0
Female					
1967-1980	0.4	21.4	59.9	23.0	2.6
1980	0	9.8	76.0	14.0	0.2