CONNECTICUT YANKEE ATOMIC POWER COMPANY

HADDAM NECK PLANT

HADDAM, CONNECTICUT

ANNUAL ENVIRONMENTAL OPERATING REPORT

PART A: NONRADIOLOGICAL REPORT

January 1, 1979 --- December 31, 1979

Operating License No. DPR-61

Docket No. 50-213

March 31, 1980

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Connecticut Yankee

This environmental report has been prepared for the Connecticut Yankee Atomic Power Company (CYAPC), by the Northeast Utilities Service Company (NUSCO). CYAPC 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 accordarce 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 1473 MWt or about 490 MW of gross electrical power. On March 11, 1969, the plant was licensed to operate at its design rating of 1825 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, 1979 through December 31, 1979.

2.0 LIMITING CONDITIONS FOR OPERATION

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 Δ T 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, 1979. When the primary monitoring system was inoperative, data from the secondary system were incorporated into the record.

Intake temperatures ranged from 30.4°F in January and December to 88.5°F in July. Discharge temperatures ranged from ambient during periods of shutdown to 111.4°F on July 31.

The specified maximum temperature increase (Δ T) of 26°F was exceeded for serveral periods less than 24 hours during routine operation. Most of the occasions were during the period of deicing when a 10% allowance is made. The maximum Δ T of 33°F was not exceeded during 1979.

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:

$$T_{PI} = 1.018\ T_{SI} - 0.19 \qquad (2.1\text{-}1)$$

where T_{PI} = primary intake temperature

T_{SI} = secondary intake temperature

with a correlation coefficient of r = 0.9895

Prior to April 21 and after November 18, the intake water was warmed for purposes of deicing as permitted by section 2.1.3. During those periods,

$$T_{PI} = 1.042\ T_{SI} - 0.84 \qquad (2.1\text{-}2)$$

with a correlation coefficient of r = 0.9807.

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:

$$T_{PD} = 0.990 T_{SD} + 0.28 \qquad (2.1\text{-}3)$$

where T_{PD} = primary discharge temperature (°C)

T_{SD} = secondary discharge temperature (°C)

with a correlation coefficient of r = 0.9975.

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 July 14 due to an emergency load drop caused by the loss of a pump seal. Since this was for the protection of plant equipment, it was not a violation as specified in Section 2.1.2.2.

On January 27, the discharge temperature changed by more than 8°F during a shutdown for refueling. A Licensee Event Report was filed on February 12.

2.1.3 Deicing Operations

The periods of deicing operations in 1979 were January 1 through April 21 and November 18 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 except as noted below.

On two occasions, the chlorinator pump operated for more than two hours consecutively. In each instance, all four forebay injection valves were closed except for the normal permitted chlorination time. In both instances, the discharge pressure relief line carried the hypochlorite solution through the tank overflow line to a point near the intake structure. On May 17, approximately 230 gallons of 12% hypochlorite solution was inadvertently released to the river's edge over a six-hour period. This occurred at a time when the chlorination schedule was interrupted for maintenance of a circulating pump. On November 16, approximately 460 gallons of 12% hypochlorite solution was discharged to the river near the intake structure over a fifteen hour period. In this case, the pump ran continuously after being returned to service following a shutdown of the chlorinator while divers cleaned the trash racks. These events were reported by License Event Reports filed May 25 and November 26, respectively. The tank overflow line has been rerouted to prevent discharge to the river.

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 of these instances, the change in pH is less than 1 as permitted by Section 2.3.2.

2.2.3 Dissolved Oxygen

Dissolved oxygen concentration (D.O.) was continuously monitored at the intake and the discharge canal until March 15, when Section 2.3.3 was deleted. During that period, one or both of the sensors was inoperative, and grab samples were analyzed weekly, or more often, for dissolved oxygen. The results are shown in Table 2.2.

Weekly grab samples were collected and analyzed, using standard methods, for purposes of calibration of the primary system dissolved oxygen monitor.

TABLE 2.1 (CONT.)

CONNECTICUT YANKEE STATION

MONTHLY WATER QUALITY DATA SUMMARY

DATA PERIOD - 1 JAN 79/0015 - 31 JAN 79/2345

PARAMETER

DAY	PH RANGE	INTAKE TEMPERATURE			DISCHARGE TEMPERATURE				TEMPERATURE RISE		
		MAX.	MIN.	AVE.	MAX.	MIN.	AVE.	MRL	MAX.	MIN.	AVE.
1	7.3- 7.0	42.1	32.5	36.0	66.4	59.0	61.4	7.4	28.1	23.6	25.4
2	7.3- 7.0	43.6	34.9	37.9	67.8	66.1	63.6	6.7	27.6	19.8	25.1
3	7.3- 7.0	37.4	35.6	36.4	62.6	60.8	61.5	0.5	25.9	23.6	25.2
4	7.1- 6.9	35.4	31.5	32.7	61.0	57.4	58.4	-0.7	25.9	24.7	25.3
5	7.0- 6.9	32.9	30.9	31.9	59.5	57.4	57.9	-1.3	27.7	25.2	26.2
6	7.0- 7.0	32.5	30.4	31.7	58.1	57.0	57.6	0.5	27.4	24.5	25.8
	7.1- 7.0	32.4	30.4	31.7	58.1	56.8	57.5	-0.5	27.0	24.1	25.8
8	7.1- 6.9	33.8	31.5	32.7	58.8	57.2	58.0	-0.7	26.8	24.1	25.4
9	6.9- 6.8	32.4	31.8	32.5	58.8	56.5	57.9	-1.6	26.3	24.3	25.4
10	6.9- 6.9	32.0	31.1	31.7	57.2	56.1	56.7	0.5	25.9	24.3	25.0
11	7.4- 7.4	32.7	30.9	31.7	57.9	56.5	57.2	0.5	26.5	24.3	25.6
12	6.9- 6.9	32.7	30.6	31.6	58.3	57.0	57.5	-0.5	27.4	25.0	25.9
13	6.9- 6.9	32.5	30.6	31.9	58.1	56.5	57.4	-0.5	27.5	24.5	25.5
14	7.0- 6.9	32.7	30.4	32.1	57.9	56.3	57.3	-0.5	26.8	23.8	25.2
15	7.0- 6.9	32.9	31.1	31.9	58.8	57.2	58.1	-0.7	27.5	24.7	26.2
16	6.9- 6.8	32.5	31.1	31.9	58.8	57.0	57.9	-0.7	27.5	24.5	26.1
17	6.9- 6.8	32.9	30.6	31.8	57.4	56.1	56.9	0.5	26.1	23.2	25.1
18	6.9- 6.8	32.5	31.1	31.8	58.3	56.5	57.2	0.5	26.6	23.9	25.4
19	6.9- 6.8	32.5	31.1	31.7	57.9	56.1	56.8	-0.5	26.3	23.9	25.2
20	6.9- 6.6	32.3	30.6	31.6	57.4	56.1	56.7	0.5	26.6	24.1	25.1
21	6.9- 6.6	39.7	31.3	32.5	61.9	55.6	56.7	4.7	26.1	19.1	24.1
22	6.9- 6.6	32.5	31.5	31.9	57.4	56.1	56.8	0.5	25.7	24.1	24.9
23	6.9- 6.6	32.9	31.1	32.0	58.3	56.8	57.5	-0.4	26.3	24.5	25.5
24	6.8- 6.6	33.4	31.1	31.9	57.9	56.1	57.1	0.5	26.6	23.6	25.2
25	6.8- 6.6	33.1	30.6	32.5	57.4	56.1	56.8	0.4	26.6	23.0	24.3
26	6.6- 6.4	33.1	32.0	32.4	57.4	53.8	56.2	-2.3	25.2	21.2	23.8
27	6.6- 6.3	33.1	31.3	32.4	56.1	33.1	36.0	-6.8	23.9	0.5	3.5
28	6.8- 6.8	33.8	32.0	33.1	34.5	33.4	34.1	0.4	2.3	0.0	1.0
29	6.8- 6.8	34.0	32.9	33.4	34.9	34.0	34.3	0.4	1.3	0.5	0.9
30	6.9- 6.6	34.7	32.7	33.5	35.2	34.0	34.4	-0.5	1.8	0.0	0.9
31	6.9- 6.6	34.6	32.7	33.4	35.2	33.8	34.2	-0.7	1.6	0.2	0.8
MONTH	7.4- 6.3	43.0	30.4	32.7	67.8	33.1	54.6	7.4	28.1	0.0	21.4

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

ALL TEMPERATURES ARE IN DEGREES FAHRENHEIT

MRL = 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 79/0015 - 28 FEB 79/2315

PARAMETER

DAY	PH RANGE	INTAKE TEMPERATURE MAX.	INTAKE TEMPERATURE MIN.	INTAKE TEMPERATURE AVE.	DISCHARGE TEMPERATURE MAX.	DISCHARGE TEMPERATURE MIN.	DISCHARGE TEMPERATURE AVE.	DISCHARGE TEMPERATURE MRC	TEMPERATURE RISE MAX.	TEMPERATURE RISE MIN.	TEMPERATURE RISE AVE.
1	6.9- 6.8	33.0	32.2	33.0	34.5	33.1	33.8	-0.5	1.4	0.5	0.8
2	7.0- 6.9	32.5	31.3	31.9	33.1	32.5	32.7	-0.2	1.3	0.4	0.8
3	7.0- 6.8	32.2	31.3	31.8	32.9	32.2	32.5	0.5	1.3	0.0	0.8
4	7.0- 6.9	32.3	31.3	31.8	32.9	32.2	32.5	0.4	1.1	0.2	0.7
5	7.0- 6.9	32.0	31.3	31.7	32.7	32.0	32.3	-0.4	0.9	0.2	0.6
6	7.0- 6.9	32.1	31.3	31.7	32.9	31.8	32.3	-0.7	1.4	0.0	0.6
7	7.4- 7.0	32.0	31.3	31.7	32.5	32.2	32.3	-0.4	1.1	0.2	0.6
8	9.1- 7.0	32.0	31.5	31.7	32.7	32.2	32.4	-0.4	1.1	0.4	0.7
9	7.3- 7.0	32.2	31.5	31.8	32.7	32.2	32.4	-0.4	0.9	0.2	0.6
10	7.1- 7.0	32.0	31.3	31.7	32.7	32.2	32.3	-0.4	1.1	0.2	0.6
11	7.0- 6.8	32.5	31.5	31.9	35.4	32.2	33.3	-0.7	3.6	0.4	1.5
12	6.8- 6.6	32.0	31.5	31.9	37.6	34.9	36.3	-1.3	5.8	3.1	4.4
13	6.6- 6.6	32.2	31.5	31.9	38.8	36.5	37.9	0.9	7.0	4.7	5.9
14	6.6- 6.6	32.2	31.5	31.9	39.2	37.9	38.7	-0.5	7.4	5.9	6.8
15	6.6- 6.5	32.1	31.3	31.8	39.4	38.3	38.9	0.5	7.9	6.3	7.6
16	6.6- 6.5	32.2	31.5	31.9	39.4	37.9	38.8	-0.9	8.1	5.9	6.9
17	7.0- 6.6	32.2	31.5	31.9	39.1	32.5	34.4	-3.4	7.9	0.5	2.5
18	7.0- 7.0	32.0	31.5	31.9	32.7	32.2	32.6	0.4	1.3	0.4	0.7
19	7.0- 6.9	32.5	31.5	31.9	33.1	32.5	32.7	0.5	1.3	0.0	0.8
20	7.6- 7.6	32.2	31.5	31.8	32.7	32.2	32.6	-0.4	1.3	0.4	0.8
21	7.3- 7.0	32.2	31.3	31.9	32.7	32.2	32.6	0.4	1.1	0.4	0.7
22	7.0- 6.9	32.3	31.5	32.0	32.9	32.5	32.8	-0.2	1.3	0.4	0.8
23	7.0- 6.9	32.2	31.3	32.0	33.1	32.1	32.9	0.2	1.4	0.7	0.9
24	7.0- 6.9	32.1	31.5	32.2	33.4	32.9	33.0	-0.5	1.4	0.4	0.8
25	7.0- 6.9	32.2	31.8	32.0	32.9	32.7	32.8	0.2	1.1	0.5	0.8
26	6.9- 6.8	32.0	31.5	32.0	32.9	32.5	32.7	-0.2	1.4	0.7	0.9
27	6.9- 6.8	32.2	31.5	31.9	32.9	32.7	32.8	0.2	1.1	0.7	0.9
28	6.9- 6.8	33.1	31.3	32.3	34.5	32.5	33.3	-0.5	1.6	0.4	1.0
MONTH	9.1- 6.5	33.0	31.3	31.9	39.4	31.8	33.1	-3.4	8.1	0.0	1.8

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 79/0615 - 31 MAR 79/2315

PARAMETER

DAY	PH RANGE	INTAKE TEMPERATURE MAX.	INTAKE TEMPERATURE MIN.	INTAKE TEMPERATURE AVE.	DISCHARGE TEMPERATURE MAX.	DISCHARGE TEMPERATURE MIN.	DISCHARGE TEMPERATURE AVE.	DISCHARGE TEMPERATURE MRC	TEMPERATURE RISE MAX.	TEMPERATURE RISE MIN.	TEMPERATURE RISE AVE.
1	6.9- 6.8	33.4	32.0	32.7	34.0	32.7	33.4	0.4	1.1	0.2	0.7
2	6.9- 6.8	33.6	32.7	33.2	34.7	33.8	34.4	0.4	1.6	0.4	1.2
3	6.9- 6.8	34.9	33.1	34.1	36.3	34.5	35.2	-0.5	2.2	0.5	1.1
4	6.9- 6.8	36.1	34.5	35.1	36.5	35.4	35.8	0.4	1.4	0.4	0.7
5	7.0- 6.9	37.9	36.1	36.8	37.9	36.5	37.3	0.4	1.3	0.0	0.5
6	7.0- 6.9	39.9	37.4	38.3	40.1	37.9	38.8	0.4	0.9	0.2	0.5
7	6.9- 6.6	39.4	36.3	38.3	39.9	37.0	38.9	-0.4	1.1	0.2	0.6
8	6.6- 6.5	36.5	34.5	35.4	36.7	35.2	35.8	-0.4	0.7	0.0	0.4
9	7.3- 6.6	35.6	34.3	35.0	35.8	34.9	35.4	0.4	0.7	0.2	0.4
10	6.6- 6.6	35.6	34.5	34.9	35.8	35.2	35.5	0.2	1.1	0.0	0.7
11	6.6- 6.6	35.2	34.3	34.6	35.8	34.9	35.3	0.4	1.3	0.2	0.7
12	6.8- 6.4	34.5	33.1	33.9	40.8	34.5	37.1	3.4	7.7	0.0	3.2
13	6.6- 6.5	34.1	32.9	33.3	42.6	34.3	40.3	2.0	9.5	0.5	7.0
14	6.6- 6.6	35.8	33.4	34.3	47.3	40.8	45.3	0.9	12.8	7.4	10.9
15	6.6- 6.6	35.4	33.8	34.5	53.6	46.9	49.9	1.1	19.4	11.7	15.4
16	6.6- 6.5	34.5	33.1	33.8	58.6	54.3	57.5	1.1	25.0	20.9	23.7
17	6.9- 6.6	34.7	32.2	33.8	59.6	47.8	55.9	-5.2	25.7	13.9	22.1
18	6.8- 6.8	36.1	32.2	34.5	60.6	58.3	59.7	0.5	26.8	24.3	25.2
19	6.8- 6.8	37.0	34.5	35.6	61.7	59.5	60.8	0.5	26.3	23.8	25.2
20	6.9- 6.8	37.6	34.0	36.3	63.1	60.8	62.0	0.5	27.0	25.0	25.6
21	6.9- 6.8	39.0	36.1	37.5	65.1	61.7	63.3	0.7	27.5	24.7	25.8
22	6.8- 6.8	40.1	36.5	38.6	64.6	61.9	63.4	0.7	25.7	23.0	24.6
23	6.9- 6.8	41.0	38.3	39.5	65.1	62.6	63.7	0.5	25.2	23.2	24.1
24	6.9- 6.8	41.2	38.8	39.6	64.2	62.8	63.6	-0.4	24.1	22.5	23.9
25	6.9- 6.8	41.5	39.2	40.3	64.9	63.3	63.9	0.5	24.3	22.7	23.6
26	6.9- 6.8	43.0	40.6	41.4	65.1	63.1	64.6	-0.5	23.9	22.0	23.2
27	6.8- 6.6	41.2	39.7	40.5	63.7	62.8	63.3	0.5	23.6	21.6	22.8
28	6.8- 6.6	40.3	39.6	40.2	63.1	62.2	62.7	-0.4	23.8	22.3	23.0
29	6.8- 6.6	40.3	37.7	38.9	63.1	62.4	62.7	-0.4	25.6	22.1	23.8
30	6.6- 6.6	39.9	38.3	39.0	63.5	62.6	62.9	-0.5	24.7	23.4	23.9
31	6.8- 6.3	40.1	37.6	39.2	65.1	63.1	64.1	0.4	26.1	24.1	24.9
MONTH	7.3- 6.4	43.0	32.0	36.6	65.1	32.7	50.5	-5.2	27.5	0.0	14.0

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 APR 79/0015 - 30 APR 79/2315

PARAMETER

DAY	PH RANGE	INTAKE TEMPERATURE MAX.	INTAKE TEMPERATURE MIN.	INTAKE TEMPERATURE AVE.	DISCHARGE TEMPERATURE MAX.	DISCHARGE TEMPERATURE MIN.	DISCHARGE TEMPERATURE AVE.	MRC	TEMPERATURE RISE MAX.	TEMPERATURE RISE MIN.	TEMPERATURE RISE AVE.
1	6.8- 6.8	41.9	39.2	40.3	66.7	64.4	65.7	0.5	26.6	23.8	25.4
2	6.8- 6.8	41.5	38.8	40.3	66.2	65.1	65.7	-0.5	26.5	23.9	25.4
3	6.8- 6.6	41.6	39.2	39.9	65.5	64.9	65.2	-0.2	26.3	23.9	25.3
4	6.8- 6.8	40.3	38.8	39.5	64.9	64.2	64.6	-0.4	26.1	24.1	25.1
5	6.8- 6.6	40.1	39.0	39.5	64.9	64.0	64.5	-0.4	25.6	24.3	25.0
6	6.8- 6.6	40.1	37.9	39.4	65.8	64.2	65.0	0.5	27.4	24.7	25.5
7	6.9- 6.6	41.1	38.3	39.6	66.6	64.2	64.9	-0.9	26.6	24.3	25.3
8	6.9- 6.6	40.8	38.5	39.4	66.2	64.6	65.3	-0.5	26.5	24.7	25.8
9	6.8- 6.8	40.6	38.5	39.6	66.2	64.6	65.4	-0.5	27.5	24.7	25.9
10	6.8- 6.8	40.8	38.5	39.4	66.4	64.6	65.5	-0.5	27.0	25.2	26.1
11	6.9- 6.8	42.1	38.3	40.1	68.2	65.1	66.6	0.7	27.7	25.6	26.5
12	6.9- 6.8	42.8	40.1	41.6	69.8	66.7	68.2	-0.7	27.5	25.7	26.6
13	7.0- 6.8	45.1	41.2	42.8	70.7	67.6	69.1	-0.5	27.7	25.2	26.3
14	7.0- 6.9	45.1	42.8	43.6	70.9	68.5	69.7	-0.7	27.9	24.1	26.1
15	6.9- 6.6	43.9	42.8	43.5	69.6	60.8	67.8	-4.7	26.3	17.5	24.2
16	6.9- 6.8	43.9	42.6	43.2	68.1	67.6	68.2	-0.5	25.9	23.9	24.9
17	7.0- 6.9	43.7	42.1	43.1	68.9	67.1	68.2	0.5	26.5	23.8	25.2
18	7.0- 6.9	45.1	42.4	43.6	76.5	67.3	69.1	0.7	26.3	23.9	25.3
19	7.0- 6.9	46.2	43.5	44.8	71.6	68.2	70.1	0.7	25.9	24.3	25.3
20	6.9- 6.8	47.3	44.2	45.6	72.5	69.4	70.9	0.7	26.5	23.9	25.3
21	6.9- 6.8	48.4	45.3	46.8	71.8	68.1	70.3	-1.1	25.6	22.7	23.5
22	6.9- 6.8	48.9	46.4	47.8	72.3	70.0	71.2	0.5	24.1	21.6	23.4
23	7.0- 6.9	50.5	47.3	48.8	74.1	71.2	72.4	0.5	24.8	22.9	23.6
24	6.9- 6.8	51.4	48.4	50.1	75.2	72.5	73.6	0.7	24.3	22.9	23.5
25	6.9- 6.8	51.8	49.6	50.5	74.8	73.4	73.9	-0.4	24.1	22.9	23.4
26	6.8- 6.6	51.4	49.8	50.7	74.5	73.6	74.2	0.4	24.7	22.9	23.5
27	6.9- 6.6	52.9	50.7	51.6	75.4	73.9	74.8	0.4	24.1	22.1	23.2
28	6.6- 6.5	54.3	52.0	53.1	77.5	75.2	76.3	-0.5	24.3	22.7	23.2
29	6.6- 6.5	54.7	52.3	53.5	77.5	75.9	76.8	0.4	23.9	22.1	23.3
30	7.3- 6.5	55.4	53.0	54.0	78.4	77.2	77.7	-0.9	23.9	22.5	23.1
MONTH	7.3- 6.5	55.4	37.9	44.0	78.4	60.8	69.4	-4.7	27.9	17.5	24.8

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 (GRAB SAMPLE DATA HAVE BEEN TAKEN)

TABLE 2.1 (CONT.)

CONNECTICUT YANKEE STATION

MONTHLY WATER QUALITY DATA SUMMARY

DATA PERIOD = 1 MAY 79/0015 - 31 MAY 79/2315

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	56.3	54.1	55.4	79.3	77.5	78.4	0.5	23.9	22.5	23.0
2	7.5- 6.6	57.2	54.5	55.8	80.8	78.4	79.5	0.7	24.5	23.0	23.7
3	6.8- 6.4	57.4	53.4	55.7	81.1	79.5	80.3	0.5	24.7	23.8	24.6
4	6.8- 6.6	57.6	54.7	56.0	81.7	79.7	80.7	0.5	25.4	23.8	24.7
5	6.9- 6.6	57.9	54.7	56.4	82.0	79.0	80.4	-0.9	25.2	23.4	24.2
6	6.9- 6.8	57.9	55.0	56.4	82.2	79.3	80.6	0.7	24.7	23.4	24.2
7	7.0- 6.8	58.3	55.2	56.8	82.9	79.7	81.2	0.7	25.7	23.4	24.4
8	7.0- 6.9	59.9	55.9	58.0	84.2	80.8	82.2	-0.5	24.8	23.4	24.2
9	7.0- 6.9	62.4	58.1	60.0	86.7	82.6	84.4	0.9	25.4	23.8	24.4
10	6.9- 6.9	65.8	60.6	62.7	89.4	85.8	87.2	0.9	25.4	23.6	24.5
11	7.0- 6.8	68.2	63.3	64.9	90.5	88.3	89.4	2.0	25.6	22.2	24.5
12	6.9- 6.8	68.5	64.0	65.5	91.6	89.6	90.2	1.8	25.7	23.0	24.8
13	6.9- 6.6	69.1	62.8	65.4	92.5	84.7	89.9	-4.7	24.0	19.6	24.5
14	6.8- 6.8	65.3	62.8	64.2	90.5	88.7	89.4	1.3	26.5	23.6	25.2
15	6.9- 6.8	67.1	62.6	64.1	91.9	86.9	88.7	2.2	25.9	22.0	24.7
16	6.9- 6.8	66.0	63.1	64.6	91.2	86.2	89.8	3.6	27.4	20.7	25.2
17	7.0- 6.8	66.5	63.5	64.6	93.2	61.1	90.0	-6.7	27.5	16.7	25.2
18	7.1- 6.8	66.2	63.3	64.5	92.3	61.1	85.2	2.7	27.5	15.7	20.7
19	7.0- 6.8	66.4	62.8	64.3	94.8	89.8	90.9	1.3	27.5	25.4	26.6
20	7.0- 6.8	65.8	62.8	63.6	91.2	85.6	89.6	-3.2	27.7	19.8	25.8
21	7.1- 6.8	67.8	63.3	64.8	90.3	66.6	87.6	2.5	24.1	20.5	22.8
22	7.1- 6.8	68.0	64.0	65.2	90.5	86.7	88.0	2.5	24.1	20.2	22.8
23	6.9- 6.8	67.6	64.2	65.2	90.3	87.4	88.4	1.6	23.9	21.6	23.0
24	7.5- 7.0	66.4	64.2	65.4	89.4	87.3	88.3	-1.4	24.1	21.6	22.6
25	7.0- 6.9	67.6	62.2	63.4	89.6	84.4	86.1	-1.4	23.4	22.0	22.7
26	7.0- 6.9	61.9	56.1	60.8	84.2	61.1	82.9	-0.7	23.4	21.4	22.1
27	7.0- 6.8	59.7	57.0	58.2	81.1	78.8	79.9	-0.4	22.5	20.9	21.8
28	7.0- 6.8	57.9	56.8	57.4	79.7	78.8	79.4	0.4	22.9	21.1	21.9
29	7.0- 6.9	59.2	57.7	58.5	81.5	79.5	80.6	0.4	23.2	20.9	22.1
30	6.9- 6.9	59.9	58.1	59.1	82.6	81.1	81.8	0.5	24.5	22.1	22.7
31	7.0- 6.9	61.3	58.8	59.9	83.5	81.5	82.6	0.4	23.6	22.0	22.7
MONTH	7.5- 6.4	69.1	53.4	61.2	93.2	77.5	84.9	-6.7	27.7	15.7	23.8

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 (PREVIOUS GRAB SAMPLE DATA HAVE BEEN TAKEN)

TABLE 2.1 (CONT.)

CONNECTICUT YANKEE STATION

MONTHLY WATER QUALITY DATA SUMMARY

DATA PERIOD - 1 JUN 79/0015 - 30 JUN 79/2315

PARAMETER

DAY	PH RANGE	INTAKE TEMPERATURE MAX.	INTAKE TEMPERATURE MIN.	INTAKE TEMPERATURE AVE.	DISCHARGE TEMPERATURE MAX.	DISCHARGE TEMPERATURE MIN.	DISCHARGE TEMPERATURE AVE.	DISCHARGE TEMPERATURE MRC	TEMPERATURE RISE MAX.	TEMPERATURE RISE MIN.	TEMPERATURE RISE AVE.
1	6.9- 6.9	62.4	59.7	61.1	85.3	82.6	83.9	0.7	24.1	22.0	22.9
2	7.0- 6.9	63.3	60.8	62.0	86.0	84.6	85.6	0.7	23.9	22.6	23.6
3	7.0- 6.9	63.3	61.7	62.8	86.5	85.3	85.9	-0.4	24.1	22.7	23.1
4	7.0- 7.0	65.1	62.4	63.3	87.4	85.8	86.4	-0.4	23.8	21.4	23.1
5	7.1- 6.6	66.4	62.8	64.6	88.0	84.9	86.5	-1.4	23.9	21.1	21.9
6	7.0- 7.0	67.3	64.0	65.8	88.7	86.5	87.7	0.4	22.7	21.1	22.0
7	7.6- 7.6	69.8	65.1	66.9	91.6	87.6	89.0	1.1	22.7	20.9	22.1
8	7.1- 6.9	71.7	66.4	67.7	90.5	81.3	88.8	-4.7	22.9	16.8	21.1
9	7.1- 7.0	71.2	67.0	68.6	92.5	80.5	80.0	1.8	23.0	17.6	17.4
10	7.3- 7.0	74.3	68.5	70.6	95.7	91.0	92.1	1.6	22.9	21.2	22.1
11	7.4- 7.0	75.9	69.1	71.3	96.4	91.4	93.3	-2.2	22.9	20.2	22.0
12	7.5- 7.1	72.3	68.7	70.0	92.8	90.7	91.9	-0.7	23.4	20.5	21.9
13	7.3- 7.1	71.6	67.8	69.2	93.4	90.3	91.5	-0.7	23.4	21.6	22.3
14	7.4- 7.0	70.3	67.1	68.3	91.4	89.4	90.5	0.9	23.8	20.9	22.3
15	7.5- 7.0	70.3	67.1	69.2	94.3	90.3	91.6	-1.6	23.6	17.5	22.3
16	7.3- 7.0	71.2	69.1	70.1	96.6	91.6	93.3	2.2	24.1	18.9	22.6
17	7.3- 6.9	76.1	70.0	72.3	98.8	92.8	95.0	2.2	24.3	21.2	22.6
18	7.1- 6.9	76.3	71.2	73.6	98.4	94.3	96.3	1.4	23.6	21.6	22.7
19	7.5- 7.0	76.3	72.5	74.1	98.4	95.2	96.6	1.4	23.6	22.1	22.5
20	8.0- 7.1	77.9	73.0	74.7	99.7	95.9	97.0	1.8	23.9	18.7	22.3
21	8.4- 7.3	77.9	72.1	75.0	100.2	95.5	97.7	2.5	24.5	20.9	22.6
22	8.3- 7.8	79.2	73.4	75.5	100.4	96.1	97.9	2.7	23.2	20.3	22.5
23	8.4- 7.6	80.2	73.6	75.4	100.2	95.9	98.0	2.2	24.3	20.0	22.6
24	8.4- 7.9	77.0	72.5	74.5	99.5	95.0	97.3	2.7	23.6	21.2	22.8
25	8.4- 7.9	76.3	71.6	73.5	99.1	95.0	96.8	3.1	23.6	21.6	23.0
26	8.3- 7.9	77.5	71.6	74.2	99.1	95.2	97.1	2.5	23.9	20.9	22.9
27	8.0- 7.6	77.5	71.4	73.7	99.7	95.0	96.7	3.1	24.5	19.4	23.0
28	7.6- 7.4	78.1	71.6	74.2	99.7	95.5	97.1	3.6	23.9	20.7	23.0
29	7.6- 7.3	77.9	71.8	74.3	100.4	95.2	97.2	2.5	23.8	20.0	22.8
30	7.5- 7.3	78.6	72.5	74.4	101.1	95.5	97.5	4.7	23.6	22.5	23.6
MONTH	8.4- 6.6	80.2	59.7	70.5	101.1	80.8	92.9	4.7	24.5	10.8	22.4

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 F / HR.)

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

CONNECTICUT YANKEE STATION

MONTHLY WATER QUALITY DATA SUMMARY

DATA PERIOD = 1 JUL 79/0001 - 31 JUL 79/2315

PARAMETER

DAY	PH RANGE	INTAKE TEMPERATURE			DISCHARGE TEMPERATURE				TEMPERATURE RISE		
		MAX.	MIN.	AVE.	MAX.	MIN.	AVE.	MRC	MAX.	MIN.	AVE.
1	7.3- 7.6	78.6	71.6	74.6	101.5	95.9	97.8	4.9	24.8	20.9	22.9
2	7.0- 6.9	76.8	72.7	74.8	100.0	96.4	97.9	2.7	23.8	20.3	23.1
3	7.1- 6.9	78.1	72.7	74.7	101.1	95.5	97.7	2.0	22.9	22.1	23.1
4	7.1- 6.9	76.8	73.9	74.8	98.8	96.6	97.7	2.2	23.9	21.2	22.9
5	7.4- 6.9	75.0	71.8	73.3	98.8	95.2	96.5	-2.7	24.3	22.1	23.1
6	7.4- 7.0	76.6	71.2	73.0	98.6	94.3	96.1	2.7	23.9	22.0	23.1
7	7.3- 7.1	75.2	70.5	72.3	97.5	93.9	95.9	2.4	24.5	22.6	23.3
8	7.4- 7.1	76.1	70.9	73.2	98.2	88.5	94.7	6.3	23.6	16.2	21.5
9	7.3- 7.1	77.2	71.6	74.3	98.8	95.7	96.4	2.5	23.0	20.3	22.0
10	8.8- 7.1	77.7	72.7	74.9	98.8	94.6	96.7	2.7	22.5	19.8	21.8
11	8.6- 7.8	78.1	73.4	75.1	100.2	95.7	97.9	2.3	23.6	20.9	22.2
12	8.6- 7.8	78.8	75.0	76.9	101.3	97.9	99.6	1.6	23.9	21.8	22.7
13	8.8- 7.8	81.7	76.3	78.7	104.6	99.5	101.4	2.5	23.8	21.2	22.7
14	8.8- 8.0	82.9	77.7	80.0	103.6	94.5	99.0	-9.0	23.4	10.8	18.9
15	8.1- 7.6	83.3	78.1	80.5	97.7	93.7	95.5	2.2	16.2	14.4	15.0
16	8.1- 7.4	84.1	79.3	81.3	99.1	94.8	96.3	2.2	16.6	13.6	15.6
17	7.9- 7.3	84.7	80.6	82.2	99.3	95.7	97.1	1.8	16.0	13.5	14.9
18	8.0- 7.3	84.7	81.3	83.1	99.7	96.6	97.6	2.3	15.7	13.7	14.9
19	8.4- 7.4	84.9	80.4	82.1	100.0	95.5	97.1	2.2	16.0	13.6	15.0
20	8.4- 7.3	83.8	80.6	81.9	98.6	95.5	96.7	2.0	15.8	13.3	14.8
21	8.6- 7.3	82.9	79.7	81.3	97.7	91.2	95.8	-3.6	15.8	8.8	14.5
22	8.0- 7.1	82.6	78.8	80.2	83.5	79.5	80.8	-7.7	1.1	0.7	0.6
23	7.9- 7.3	82.3	79.9	81.1	96.1	88.7	89.8	1.6	10.1	7.7	8.7
24	7.3- 7.1	84.0	79.5	81.5	100.9	92.5	96.4	2.7	17.6	10.4	14.9
25	7.1- 7.0	86.2	80.2	83.1	106.0	100.2	102.7	2.5	22.7	18.0	20.6
26	7.0- 6.9	87.1	80.2	82.8	107.6	103.1	105.2	2.2	23.4	20.0	22.4
27	7.1- 6.9	86.5	80.4	83.6	107.4	104.0	106.6	2.2	24.1	20.9	22.8
28	7.1- 6.9	85.1	81.7	83.4	108.3	104.9	106.2	1.8	23.4	22.1	22.7
29	7.1- 6.9	86.1	82.0	84.3	109.2	104.9	106.5	2.0	23.4	21.6	22.5
30	7.0- 6.9	87.6	82.2	84.6	109.9	105.1	107.2	-1.4	23.2	22.0	22.6
31	7.0- 6.9	88.5	84.2	85.9	111.4	106.5	108.0	3.2	23.0	19.6	22.1
MONTH	8.8- 6.9	88.5	70.5	78.9	111.4	79.5	98.3	-9.0	24.8	0.2	15.4

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)

CONNECTICUT VALLEY STATION

MONTHLY WATER QUALITY DATA SUMMARY

DATA PERIOD - 1 AUG 79/0015 - 31 AUG 79/2315

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	87.6	83.5	85.5	109.9	106.0	107.9	2.2	23.6	20.7	22.4
2	7.0- 6.8	87.1	83.5	85.2	110.1	106.0	107.8	2.3	23.6	21.6	22.6
3	7.0- 6.8	87.1	83.5	84.9	109.8	106.0	107.4	1.6	23.8	20.7	22.5
4	6.9- 6.8	85.8	82.9	84.6	107.8	105.6	106.6	2.6	23.8	21.1	22.6
5	7.0- 6.8	86.0	82.0	84.4	109.4	105.4	107.1	1.6	23.9	21.4	22.7
6	6.9- 6.6	86.5	82.6	84.6	108.5	105.8	107.2	1.6	23.4	21.8	22.6
7	6.8- 6.6	84.4	81.1	83.0	106.7	104.2	105.7	2.2	23.2	21.8	22.7
8	6.8- 6.5	84.7	80.8	82.7	106.9	103.6	105.2	1.8	23.2	21.8	22.6
9	6.8- 6.6	84.4	80.6	82.7	106.3	103.6	105.2	1.1	23.4	21.6	22.5
10	7.0- 6.6	84.4	79.3	82.1	107.4	103.1	105.2	2.9	23.8	21.6	23.0
11	6.8- 6.5	83.7	78.4	80.9	106.2	102.9	104.7	2.6	24.1	22.3	23.3
12	6.8- 6.5	81.3	74.5	77.9	103.3	99.3	101.6	2.0	23.9	22.0	23.2
13	7.4- 6.5	77.0	72.3	74.2	97.9	94.8	95.9	2.0	22.5	20.2	21.7
14	7.3- 7.1	74.8	69.6	72.2	95.5	92.1	94.0	2.5	22.7	20.7	21.9
15	7.1- 6.6	70.7	66.9	68.3	92.1	88.3	90.4	2.3	23.2	20.5	22.2
16	7.3- 7.0	72.7	67.3	69.3	93.9	89.8	91.4	2.2	23.6	20.7	22.1
17	7.6- 7.0	72.3	67.6	69.6	94.3	89.6	91.9	2.5	23.0	21.1	22.3
18	7.3- 7.6	72.1	66.7	69.4	93.2	89.8	91.5	3.2	23.4	20.9	22.1
19	7.3- 7.0	70.7	67.1	68.7	92.8	89.2	90.9	3.1	22.7	21.6	22.2
20	7.3- 6.9	72.3	67.3	69.6	93.9	90.1	91.8	2.3	23.2	20.9	22.2
21	7.3- 7.6	72.7	68.9	70.7	94.8	91.6	93.2	1.6	23.0	21.1	22.4
22	7.3- 7.0	74.8	69.6	71.6	95.9	92.3	94.0	2.2	23.4	20.5	22.4
23	7.3- 7.0	77.0	70.0	72.7	97.5	93.4	95.2	3.1	23.9	19.6	22.4
24	8.6- 7.3	73.7	72.5	74.2	100.0	95.2	96.6	4.3	23.2	20.3	22.4
25	8.3- 7.4	77.5	73.6	75.2	99.7	96.4	97.7	2.3	23.8	20.0	22.5
26	8.8- 7.8	79.3	74.3	76.5	100.6	93.7	97.7	-3.8	22.7	17.1	21.2
27	8.8- 8.1	81.7	75.6	77.4	101.3	97.3	99.2	2.9	22.5	16.6	21.8
28	8.8- 8.1	80.2	75.0	77.1	101.5	97.9	99.2	2.5	23.0	20.0	22.1
29	8.6- 8.0	83.1	77.3	78.7	103.1	98.8	100.4	3.5	22.7	20.0	21.8
30	8.4- 7.6	79.9	77.0	78.4	102.4	99.3	100.5	2.3	23.6	20.6	22.1
31	7.6- 7.1	81.3	76.8	78.6	102.4	99.3	100.6	1.6	22.9	19.8	22.0
MONTH	8.8- 6.5	87.6	66.7	76.7	110.1	88.3	99.0	4.3	24.1	16.6	22.3

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 79/0815 - 30 SEP 79/2315

PARAMETER

DAY	PH RANGE	INTAKE TEMPERATURE MAX.	INTAKE TEMPERATURE MIN.	INTAKE TEMPERATURE AVE.	DISCHARGE TEMPERATURE MAX.	DISCHARGE TEMPERATURE MIN.	DISCHARGE TEMPERATURE AVE.	MRC	TEMPERATURE RISE MAX.	TEMPERATURE RISE MIN.	TEMPERATURE RISE AVE.
1	7.9- 7.6	81.1	76.8	78.4	103.1	99.3	100.8	2.7	22.9	21.8	22.3
2	7.9- 7.1	81.1	77.2	78.5	103.1	99.3	100.8	2.9	23.4	20.9	22.3
3	7.4- 7.0	80.6	75.7	78.5	103.1	99.1	101.1	2.3	23.9	21.6	22.6
4	7.6- 6.8	86.8	77.2	79.1	102.9	99.3	101.4	2.3	22.9	21.2	22.3
5	6.8- 6.6	80.8	76.3	78.6	103.1	99.5	101.0	2.7	23.2	21.6	22.4
6	6.6- 6.6	82.6	76.1	78.0	103.3	98.6	100.3	3.2	23.0	20.7	22.3
7	6.6- 6.5	77.9	75.4	76.3	99.1	97.3	98.6	0.9	23.0	20.9	22.3
8	6.6- 6.5	78.1	73.4	74.4	98.4	95.5	96.8	-1.3	22.9	22.0	22.4
9	6.5- 6.5	75.4	71.4	72.7	96.8	94.3	95.2	1.3	23.0	21.8	22.4
10	6.5- 6.5	75.7	70.3	72.6	97.7	93.7	95.2	2.9	23.9	21.2	22.6
11	6.8- 6.5	74.8	69.8	71.8	96.4	93.4	94.5	2.7	24.5	20.7	22.7
12	8.4- 6.8	74.3	69.6	71.6	96.4	91.9	94.2	2.3	23.4	21.6	22.6
13	6.4- 7.3	75.9	69.1	71.6	97.9	92.5	94.2	2.9	23.6	19.1	22.6
14	7.8- 7.3	75.2	70.0	72.3	97.7	93.0	95.0	3.2	23.4	21.8	22.7
15	8.1- 7.1	73.4	70.0	71.1	96.4	92.8	93.8	1.8	23.4	21.6	22.7
16	8.0- 7.1	73.2	69.1	70.8	95.7	92.3	93.7	2.5	23.8	21.2	22.9
17	7.8- 7.1	74.1	68.5	71.1	95.9	92.1	94.0	2.7	24.5	20.2	22.6
18	8.0- 7.1	76.1	69.1	71.6	95.9	92.3	94.3	2.9	23.6	19.8	22.7
19	7.9- 7.4	73.4	67.8	70.4	95.5	90.5	93.3	2.2	24.1	21.1	22.8
20	7.9- 7.3	71.2	66.9	68.7	93.2	89.2	91.3	2.2	23.9	21.1	22.6
21	8.3- 7.1	69.6	65.5	67.9	91.6	88.7	90.6	2.3	23.2	19.8	22.1
22	7.3- 7.3	70.7	64.6	66.9	91.9	87.4	89.1	-1.6	23.0	20.7	22.2
23	7.3- 6.9	67.8	63.5	65.3	89.2	85.6	87.4	1.4	23.0	20.9	22.1
24	7.1- 6.9	66.9	62.8	64.5	88.3	85.6	86.8	2.5	24.1	21.4	22.2
25	7.3- 6.9	67.1	62.4	64.0	86.0	84.7	86.1	1.8	22.9	19.8	22.1
26	7.3- 6.9	70.9	62.4	64.1	89.2	84.9	86.4	2.3	23.2	18.4	22.3
27	7.4- 6.9	66.9	62.6	64.3	88.9	84.9	86.5	2.9	23.4	20.5	22.2
28	7.3- 6.9	67.3	62.4	64.3	89.4	84.9	86.4	3.2	22.9	18.9	22.1
29	7.4- 6.9	66.2	63.3	64.6	82.9	64.6	67.2	-5.0	19.6	0.2	2.7
30	7.1- 7.0	65.1	63.7	64.5	65.3	64.6	65.0	0.4	1.4	0.0	0.5
MONTH	8.4- 6.5	82.6	62.4	71.0	103.3	64.6	92.0	-5.0	24.5	0.0	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 (FREQUENCY GRAB SAMPLE DATA HAVE BEEN TAKEN)

CONNECTICUT YANKEE STATION

MONTHLY WATER QUALITY DATA SUMMARY

DATA PERIOD = 1 OCT 79/0015 - 31 OCT 79/2315

PARAMETER

DAY	PH RANGE	INTAKE TEMPERATURE MAX.	INTAKE TEMPERATURE MIN.	INTAKE TEMPERATURE AVE.	DISCHARGE TEMPERATURE MAX.	DISCHARGE TEMPERATURE MIN.	DISCHARGE TEMPERATURE AVE.	DISCHARGE TEMPERATURE MRL	TEMPERATURE RISE MAX.	TEMPERATURE RISE MIN.	TEMPERATURE RISE AVE.
1	7.0- 6.9	64.9	63.5	64.0	64.9	64.2	64.4	-0.4	0.7	0.0	0.4
2	7.0- 6.9	65.3	63.3	64.6	65.5	64.0	64.8	0.4	0.9	0.0	0.3
3	6.9- 6.8	64.1	62.8	63.4	64.9	63.7	64.1	0.4	1.4	0.2	0.7
4	6.8- 6.1	63.1	62.6	62.8	67.8	63.3	65.7	1.1	5.2	0.7	2.9
5	6.9- 6.4	62.8	61.5	62.2	69.8	62.2	66.1	-7.6	7.6	0.6	3.9
6	6.6- 6.5	61.9	61.0	61.5	62.2	61.5	61.8	-0.4	0.7	0.0	0.4
7	6.6- 6.6	61.3	59.9	60.5	61.5	60.4	60.6	-0.4	0.7	0.2	0.3
8	7.0- 6.6	60.6	58.8	59.3	66.9	59.5	60.6	5.5	7.9	0.0	1.2
9	6.9- 6.6	59.5	57.2	58.1	77.9	65.8	69.0	2.5	20.5	7.4	10.9
10	6.8- 6.5	58.3	54.5	56.3	79.3	76.8	78.0	-0.7	22.3	20.3	21.7
11	6.6- 6.5	57.2	52.9	54.1	77.7	75.6	75.9	-2.5	22.5	20.5	21.8
12	6.6- 6.5	55.6	50.9	52.2	76.3	73.7	74.2	2.9	23.0	20.5	22.0
13	6.6- 6.5	51.8	50.0	51.1	73.9	72.7	73.3	-0.4	23.0	21.6	22.2
14	6.6- 6.6	51.1	50.2	50.6	73.6	72.5	73.1	0.4	23.2	22.0	22.5
15	6.8- 6.6	50.9	49.1	50.0	73.4	72.1	72.7	-0.4	23.4	21.6	22.7
16	6.8- 6.6	54.1	49.1	50.1	74.3	72.1	72.7	1.6	23.6	20.2	22.7
17	6.8- 6.5	53.8	49.1	50.5	75.4	72.1	72.9	-2.3	23.4	21.4	22.4
18	6.5- 6.6	53.2	50.2	51.3	76.1	72.7	73.9	-1.8	23.4	21.8	22.6
19	6.8- 6.8	55.6	50.5	52.1	77.5	73.2	74.6	2.5	23.2	21.1	22.6
20	6.8- 6.6	56.5	51.8	53.5	78.4	74.5	76.1	2.2	23.4	21.2	22.5
21	6.9- 6.6	58.6	52.5	54.4	79.9	75.2	77.1	2.5	23.6	20.5	22.7
22	6.8- 6.8	57.7	54.1	55.9	80.8	77.5	79.1	2.3	23.9	22.3	23.1
23	6.8- 6.6	61.7	56.1	58.2	83.3	79.5	81.1	2.0	23.8	21.2	22.9
24	6.9- 6.6	61.9	57.9	59.2	84.0	79.9	81.7	2.0	23.8	20.5	22.5
25	6.8- 6.8	59.0	57.4	58.0	81.5	80.4	80.7	1.1	23.2	22.3	22.8
26	6.9- 6.8	60.1	55.9	57.4	82.6	79.3	80.3	-1.8	23.6	21.6	22.8
27	6.9- 6.7	55.9	54.0	54.6	79.5	77.5	78.4	-1.6	24.3	22.7	23.8
28	6.9- 6.7	55.6	52.6	52.8	77.5	75.2	76.2	1.4	24.3	22.3	23.4
29	6.9- 6.7	51.4	49.8	50.6	75.4	73.6	74.4	-1.6	24.5	22.9	23.8
30	6.9- 6.6	54.1	43.9	50.5	76.6	72.3	73.7	5.1	24.3	21.6	23.2
31	6.9- 6.8	53.1	48.4	50.4	76.8	71.6	73.6	2.7	24.3	21.1	23.2
MONTH	7.0- 6.4	65.3	48.4	55.7	84.0	59.5	72.5	-7.0	24.5	0.0	16.8

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

ALL TEMPERATURES ARE IN DEGREES FAHRENHEIT

MRL = 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 2.3 (CONT.)

CONNECTICUT YANKEE STATION

MONTHLY WATER QUALITY DATA SUMMARY

DATA PERIOD - 1 NOV 79/0001 - 30 NOV 79/2315

PARAMETER

DAY	PH RANGE	INTAKE TEMPERATURE MAX.	INTAKE TEMPERATURE MIN.	INTAKE TEMPERATURE AVE.	DISCHARGE TEMPERATURE MAX.	DISCHARGE TEMPERATURE MIN.	DISCHARGE TEMPERATURE AVE.	DISCHARGE TEMPERATURE MRC	TEMPERATURE RISE MAX.	TEMPERATURE RISE MIN.	TEMPERATURE RISE AVE.
1	6.9- 6.8	53.2	49.1	50.6	75.2	71.8	73.6	2.3	24.1	21.4	23.0
2	7.0- 6.8	55.2	48.4	51.1	77.5	70.9	74.3	3.6	24.8	20.3	22.2
3	7.0- 6.8	55.6	56.7	51.9	76.1	71.7	74.0	-2.3	22.9	19.6	22.1
4	7.1- 6.8	52.8	50.0	51.1	74.8	72.3	73.5	1.3	23.6	21.4	22.5
5	6.9- 6.8	54.1	49.3	50.8	75.0	72.5	73.6	-1.3	23.9	20.2	22.7
6	6.9- 6.6	52.7	48.8	49.5	75.0	71.8	72.4	2.3	24.1	21.6	22.9
7	6.8- 6.6	50.0	48.2	48.8	72.1	71.2	71.5	-0.9	23.8	22.1	22.9
8	6.8- 6.8	48.9	46.8	47.8	71.6	70.7	71.1	0.5	24.3	22.5	23.3
9	6.9- 6.8	50.5	46.9	47.8	74.3	70.5	71.3	2.7	24.5	22.5	23.5
10	6.9- 6.8	50.9	47.5	48.8	74.5	71.2	72.1	-2.9	24.7	22.1	23.5
11	6.9- 6.8	49.1	47.8	48.8	72.5	64.8	70.3	-3.4	24.3	15.8	21.7
12	6.8- 6.8	49.8	47.1	48.5	71.8	70.5	71.1	-0.4	23.8	21.8	22.8
13	6.8- 6.8	48.7	46.9	47.9	70.9	69.8	70.4	-0.4	23.8	21.8	22.5
14	6.8- 6.8	48.8	45.7	47.3	73.6	69.8	71.1	-2.8	27.4	21.8	23.8
15	6.9- 6.8	47.5	44.8	46.4	71.8	70.6	70.9	-0.7	26.5	22.7	24.5
16	6.8- 6.8	47.5	44.6	45.9	70.9	67.1	69.2	-0.9	24.8	21.2	23.3
17	6.9- 6.8	46.2	43.5	44.7	68.5	66.2	67.7	-1.6	25.0	20.0	23.0
18	6.9- 6.8	50.0	42.1	45.4	73.0	67.3	69.8	3.4	26.8	22.7	24.4
19	6.8- 6.8	49.1	42.1	45.0	72.7	67.8	69.9	-2.2	27.4	22.1	24.9
20	6.8- 6.8	49.8	42.8	45.3	73.4	69.4	70.7	4.0	27.5	21.8	25.4
21	6.8- 6.8	46.9	44.2	45.6	71.2	69.4	70.4	1.4	26.3	23.8	25.4
22	6.8- 6.8	50.0	43.9	45.9	74.3	69.8	71.2	2.2	26.5	23.8	25.3
23	6.8- 6.5	50.2	45.1	46.7	74.8	70.3	72.0	3.4	26.3	23.9	25.3
24	6.8- 6.5	50.7	45.1	47.4	75.7	70.9	72.8	3.1	27.2	23.8	25.4
25	6.9- 6.5	53.4	46.4	49.1	78.1	71.8	73.8	-3.6	26.3	22.7	24.7
26	6.9- 6.8	56.3	48.4	51.9	78.6	72.5	74.9	4.2	24.7	21.4	23.0
27	6.8- 6.8	52.7	50.7	51.7	74.5	73.4	73.9	-0.7	23.2	22.0	22.7
28	6.8- 6.5	52.5	50.5	51.5	75.0	73.4	74.2	0.5	23.4	21.8	22.6
29	6.8- 6.5	50.5	46.7	49.6	73.2	71.4	72.3	-0.5	23.4	24.0	22.7
30	6.8- 6.8	48.9	45.7	46.9	71.2	69.1	69.9	-0.5	23.4	21.4	23.0
MONTH	7.0- 6.5	56.3	42.1	48.2	78.6	64.8	71.7	4.3	27.5	15.8	23.5

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 4.1 (CONT.)

CONNECTICUT YANKEE STATION

MONTHLY WATER QUALITY DATA SUMMARY

DATA PERIOD - 1 DEC 79/0015 - 31 DEC 79/2345

PARAMETER

DAY	PH RANGE	INTAKE TEMPERATURE MAX.	INTAKE TEMPERATURE MIN.	INTAKE TEMPERATURE AVE.	DISCHARGE TEMPERATURE MAX.	DISCHARGE TEMPERATURE MIN.	DISCHARGE TEMPERATURE AVE.	DISCHARGE TEMPERATURE MKL	RIVER TEMPERATURE MAX.	RIVER TEMPERATURE MIN.	RIVER TEMPERATURE AVE.
1	6.8- 6.5	46.2	43.9	44.6	68.9	67.3	68.2	-0.7	24.7	22.7	23.4
2	6.8- 6.6	44.8	42.4	43.3	69.1	66.2	67.8	1.6	26.6	22.9	24.5
3	6.9- 6.6	42.4	39.9	41.1	67.3	64.4	66.3	-0.9	26.3	23.6	25.1
4	6.9- 6.8	41.9	38.8	39.6	66.2	64.4	65.5	-0.7	27.0	23.2	25.6
5	6.9- 6.8	46.0	39.0	40.1	70.3	64.9	66.3	4.1	27.0	23.0	26.1
6	6.9- 6.8	42.6	39.0	39.9	67.6	64.4	65.8	-2.7	27.0	24.5	25.9
7	6.9- 6.8	43.7	39.2	40.2	67.8	65.3	66.3	-2.3	27.5	23.9	26.1
8	6.8- 6.8	41.2	39.2	40.2	67.8	65.3	66.9	6.5	28.3	23.1	26.7
9	6.9- 6.6	40.1	37.9	39.1	67.6	64.0	65.0	-1.4	27.9	24.1	25.9
10	6.9- 6.8	40.1	37.2	38.4	65.1	63.5	64.3	1.1	26.6	24.1	25.9
11	7.0- 6.6	43.9	37.0	38.8	67.8	61.9	64.3	4.9	27.0	22.9	25.5
12	6.9- 6.8	41.0	36.5	38.6	66.2	64.8	64.2	-2.0	27.5	23.4	25.6
13	6.9- 6.8	42.4	36.8	39.7	67.3	64.2	65.1	2.9	26.6	22.5	25.4
14	6.9- 6.6	40.1	37.9	39.3	65.5	63.3	64.5	0.7	26.3	23.6	25.2
15	6.5- 6.6	39.7	37.2	38.1	64.6	61.9	63.3	2.7	26.6	23.0	25.2
16	6.9- 6.5	42.8	36.1	38.4	67.3	56.1	63.0	-4.7	27.4	18.5	24.7
17	6.9- 6.6	38.8	35.6	36.8	65.5	61.5	63.0	-2.3	27.4	25.4	26.1
18	6.8- 6.6	37.2	34.5	35.2	62.4	60.4	61.5	1.4	27.4	24.7	26.3
19	7.6- 6.6	41.7	32.2	34.6	64.4	58.1	60.5	7.7	27.4	23.4	25.9
20	7.0- 6.6	39.4	36.9	37.6	64.4	57.7	58.8	6.7	29.7	24.7	26.2
21	6.9- 6.8	34.3	30.6	32.0	59.7	57.4	58.3	2.3	27.7	24.8	26.3
22	6.9- 6.6	41.0	30.4	32.9	65.8	57.7	59.3	-4.5	29.9	22.5	26.4
23	6.9- 6.5	42.1	31.1	34.0	66.4	58.1	60.1	6.8	28.3	21.2	26.1
24	6.9- 6.5	42.6	32.0	34.6	66.0	56.8	60.5	5.2	28.8	21.8	25.9
25	6.9- 6.5	41.5	32.2	35.6	64.9	59.2	61.5	4.3	27.7	22.9	25.7
26	6.8- 6.6	39.7	35.4	36.8	63.5	61.0	62.3	0.5	26.8	23.4	25.5
27	6.6- 6.6	38.3	36.3	37.4	64.0	62.6	63.2	-0.5	26.8	24.3	25.9
28	6.8- 6.6	37.9	35.2	36.6	64.0	61.9	63.0	-0.5	27.5	25.4	26.4
29	6.9- 6.8	36.5	34.0	35.6	63.1	61.0	62.1	-0.7	28.6	25.7	26.5
30	6.9- 6.8	36.1	34.5	35.2	62.6	60.6	61.6	-0.5	28.1	24.8	26.4
31	6.9- 6.6	36.3	33.6	34.7	62.2	59.5	61.2	1.1	27.9	25.6	26.6
MONTH	7.0- 6.5	46.2	30.4	37.6	70.3	56.1	63.3	7.7	29.9	18.5	25.8

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

ALL TEMPERATURES ARE IN DEGREES FAHRENHEIT

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

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

TABLE 2.2

GRAB SAMPLES TAKEN DURING PERIODS OF SENSOR MALFUNCTION

DISSOLVED OXYGEN

DATE	INTAKE	DISCHARGE	CHANGE
JAN. 04	12.4	11.8	-0.6
13	12.6	12.0	-0.6
19	12.4	11.6	-0.8
25	12.3	12.1	-0.2
31	12.6	13.0	0.4
FEB. 07	12.4	13.4	1.0
16	12.4	12.2	-0.2
24	12.6	12.6	0.0
MAR. 02	13.2	12.1	-1.1
09	12.4	12.1	-0.3
16	12.6	12.4	-0.2

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.

Due to a change in Environmental Technical Specifications (Section 3.1.1 Fish Impingement: Reporting Requirements), report levels in effect prior to March 1979 were no longer in effect after that date. During January and February 1979, report levels were exceeded once; impingement of spottail shiner greater than 6 in. long exceeded report levels in January. This overrun was reported within thirty days of the incident.

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 1979

	January			February			March			April			May			June			July			August		
Impinged Species	<3"	3"-6"	>6"	<3"	3"-6"	>6"	<3"	3"-6"	>6"	<3"	3"-6"	>6"	<3"	3"-6"	>6"	<3"	3"-6"	>6"	<3"	3"-6"	>6"	<3"	3"-6"	>6"
Alewife																			8					6
American Eel						7			8			8												19
American Shad														12			45				16			
Anchovy																								
Black Crappie																					8			
Bluegill			6									15	6	6										
Brown Bullhead		6	25						16						6		8				31			12
Common Shiner		25	6																					
Darters		6																						
Freshwater Killifish																								
Glut Herring								8														583	19	6
Golden Shiner		6			14	7															16		6	
Hogchoker													118	25									6	
Lamprey Eel															31		8							
Largemouth Bass													6											
Longear Sunfish														19		45	45		8		16			6
Northern Pike									16															
Pickerel			6																					
Pumpkinseed														31	12									
Spottail Shiner	428	2114	223	28	245		23	78			38			19										
Sucker						7																		
White Catfish			6														30					6	6	74
White Perch			12										6	6	112		23				31			6
Yellow Perch	50	267	304	7	7	35	23	62	132		45	30	12	12	25	23	45		8		39			
Monthly Totals		-3490-			-357-			-366-			-136-			-464-			-272-			-181-		-755-*	

* Does not include one shortnose sturgeon, 74 cm long, impinged on August 11, 1979. This information was relayed to the U. S. National Marine Fisheries Service and state agencies.

Table 3.1 (con'd) CONNECTICUT YANKEE IMPINGEMENT ESTIMATES DURING 1979

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			15		47								8	47	21	76	0.4
American Eel					8	16			8			71		8	137	145	0.7
American Shad												8			81	81	0.4
Anchovy							8		8				8		8	16	0.1
Black Crappie											8			8	8	16	0.1
Bluegill				8									14	6	21	41	0.2
Brown Bullhead				16		8							16	6	106	128	0.7
Common Shiner								8	8					33	14	47	0.2
Darters								15			8			29		29	0.1
Freshwater Killifish											16			16		16	0.1
Glut Herring	40	2513		147	1527		158	8					1158	4075	6	5239	26.7
Golden Shiner			8		31					16	47		16	104	31	151	0.8
Hogchoker					23	8		15					118	69	8	195	1.0
Lamprey Eel												8			47	47	0.2
Largemouth Bass						8							6		8	14	0.1
Longear Sunfish						8								72	75	147	0.7
Northern Pike															16	16	0.1
Pickerel												47			53	53	0.3
Pumpkinseed		8	8											39	20	59	0.3
Spottail Shiner				8			8			47	6093		542	8617	223	9382	47.8
Sucker			8			8									23	23	0.1
White Catfish	8	30		31	16	8		31	23	8	8		53	91	141	285	1.5
White Perch			23		109	16	62	83	8	16	71		84	269	231	584	3.0
Yellow Perch			15	8	8	16	8	165	120		657	729	108	1254	1490	2852	14.5
Monthly Totals		-2936-			-2083-			-744-			-7858-					-19642-	

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 1976 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 3,400 American shad were tagged and released at the mouth of the Connecticut River during 1979. 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 sixth annual report, prepared by Peter Minta of the Connecticut Department of Environmental Protection covering the 1979 shad run appears in Appendix A.

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 A

Sixth Annual Report

Connecticut River Shad Study

Submitted to:

Northeast Utilities Company

prepared by:

Peter Minta
Anadromous Fisheries Biologist

Connecticut Department of Environmental Protection
Marine Region
March 14, 1980

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. Data from the three years, 1977 through 1979, are presented and compared to data from 1965-1976.

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

Materials and Methods

The tagging procedures utilized during the three years of the 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 the same.

From April through May, 1977-1979, adult American shad were captured near the river mouth using monofilament drift gill nets, (stretch mesh size 14-cm, 182-cm deep, and 122 to 244-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. (Appendix I). 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 fishemen 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):

$$R_1 + 1.92 \pm 1.96 \sqrt{R_1 + 1.0}.$$

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 as well as from the sport fishery at Enfield. 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 annulis.

Results and Discussion

A total of 147 individuals acquired licenses to commercially fish for shad in 1979. The majority served as strikers or assistants to 46 commercial shad fishermen who reported catching 49,728 shad. Using the Chi square technique

to eliminate reporting errors in the commercial fisheries reports, the adjusted catch, calculated at 50,000, did not significantly differ from the reported catch. The adult American shad population entering the Connecticut River was estimated at 355,000 $\pm$ 33,000 which denotes a steady decline in the adult shad run since 1976 (Table 1).

In 1979, 3,402 adult shad were captured and tagged in the Connecticut River's Saybrook-Old Lyme Reach, 455 of which were returned by commercial fishermen indicating a fishing rate on reported catch of 13.4%. The exploitation rates calculated from the adjusted catch are listed in Table 2. Tag returns from other areas of the Connecticut River from 1977-1979 are listed in Table 3.

There were tag returns from outside the Southern New England area, most of which originated from the previous years tagging effort(Table 4). Tag recoveries ranged from Georgia in the south to Nova Scotia in the north.

Further information was acquired from the commercial fishermen in 1978 and 1979 on the gill net mesh size employed. Number and weight of shad taken by mesh size clearly demonstrates mesh selection (Table 5). The larger mesh sizes select for the older, larger females in the annual run whose overall marketable value is higher. These shad are mostly repeat spawners and have a higher fecundity than virgin fish. Leggett (1976) considered that these large females were important in stabilizing the population against annual variations in year class recruitment which might otherwise initiate long term oscillations in population abundance.

Mesh size selection was evident after examining the recapture data because the proportion of recaptures was consistently higher for female than for male shad, indicating that mesh selection occurred by sex and size. The sex ratio from 1979 was 59:41 female to male approaching Leggett's (1976) assumed ratio

of 50:50. However, because of net selectivity, these sex ratios should be considered qualitative rather than quantitative estimates. The 1978 and 1979 ratios were incontrast to the 1977 ratio of 82:18 (Table 6). The high proportion and number of females in the 1977 population was consistent with the larger percentage of repeat spawning females during the 1978 migration (Table 7). During most years the percent of repeat spawning males was higher than that of female shad.

Percentage composition by length classes are given in Figures 1 and 2 for male and female shad, respectively. The mean fork length of male shad in 1978 was 44.70 cm., the smallest mean length since the study began in 1974 whereas the mean length for female shad was similar during the period 1977-1979. Following are the male and female means for the three years.

	Male		Female	
Year	Number	Mean length (cm)	Number	Mean length (cm)
1977	871	46.06	3,921	49.33
1978	1,510	44.70	1,607	48.66
1979	1,279	45.05	1,886	48.51

Based on scale analysis from the commercial fishery in 1978, 30% of the age IV males had spawned the previous year (Table 8). The Enfield sport fishery scale analysis also gives a percentage of 16% repeat spawners in the age IV males. These figures suggest that there were more age III males in each year's run than were evident in any data because many were small enough to pass through the nets. Because age IV male repeat spawners in 1979 were 27% in the sport catch and 14% in the commercial catch, the number and proportion of age III males in the run may be considerably higher than previously postulated.

Repeat spawners have comprised a smaller proportion of the shad runs since 1975, during which the Holyoke fish lift facilities annually passed 50-80% of the run into the Holyoke impoundment (Figure 3). The size of the shad runs from 1977-1979 has been fairly stable. The potential impact of the Holyoke facility

should be evident in 1980 during which the 1974 and 1975 year classes become fully recruited to the fishery. Although downstream migrant facilities will become operable in 1980 (though yet untested), the impact of adult and juvenile mortality in the Holyoke pool during the period 1975-1979 will not be known until 1980-1983.

Age composition, fork length and weight, and spawning history data are given in Table 9. The age composition from 1977-1979 were compared to the mean from the period 1967 to 1979 (Table 10). The older age classes have declined considerably during the last three years.

Literature Cited

Leggett, W. C. 1976. The American shad, *Alosa sapidissima*, with special reference to the migration and population dynamics in the Connecticut River. Am. Fish. Soc. Monograph No. 1:169-225.

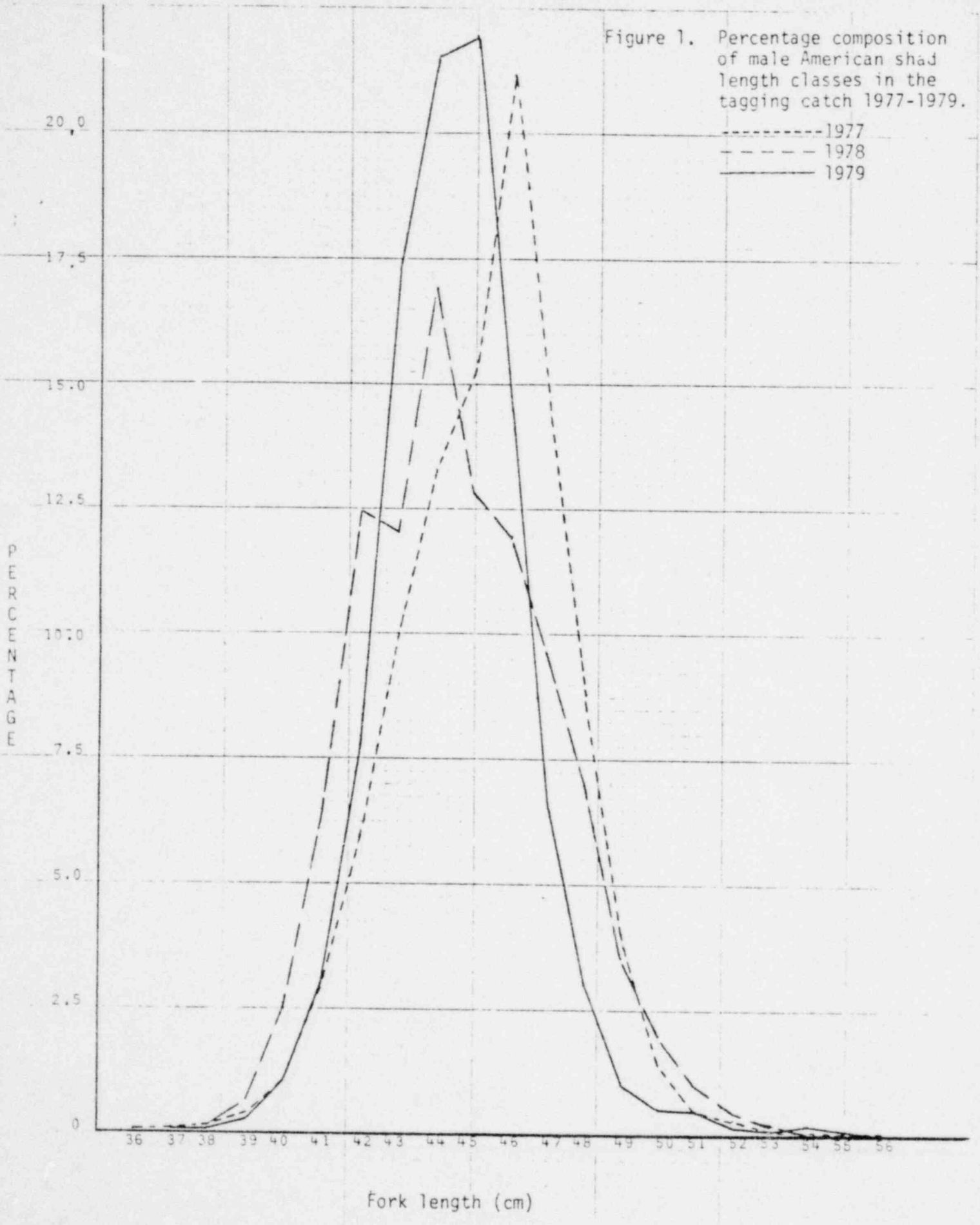

Figure 1. Percentage composition of male American shad length classes in the tagging catch 1977-1979.

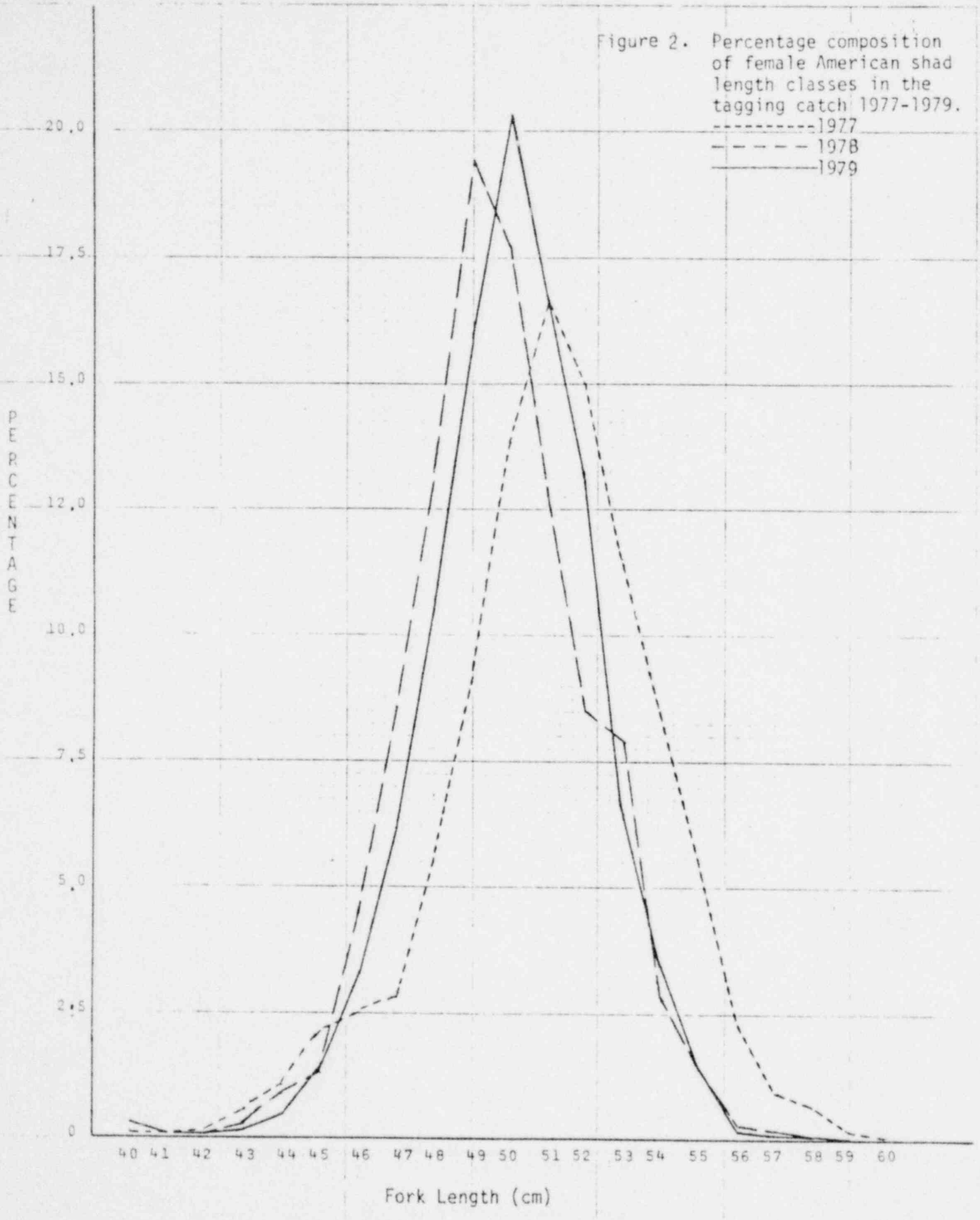

Figure 2. Percentage composition of female American shad length classes in the tagging catch 1977-1979.

Figure 3. Percent repeat spawners in American shad population each year. 1965-1979 (Connecticut River)

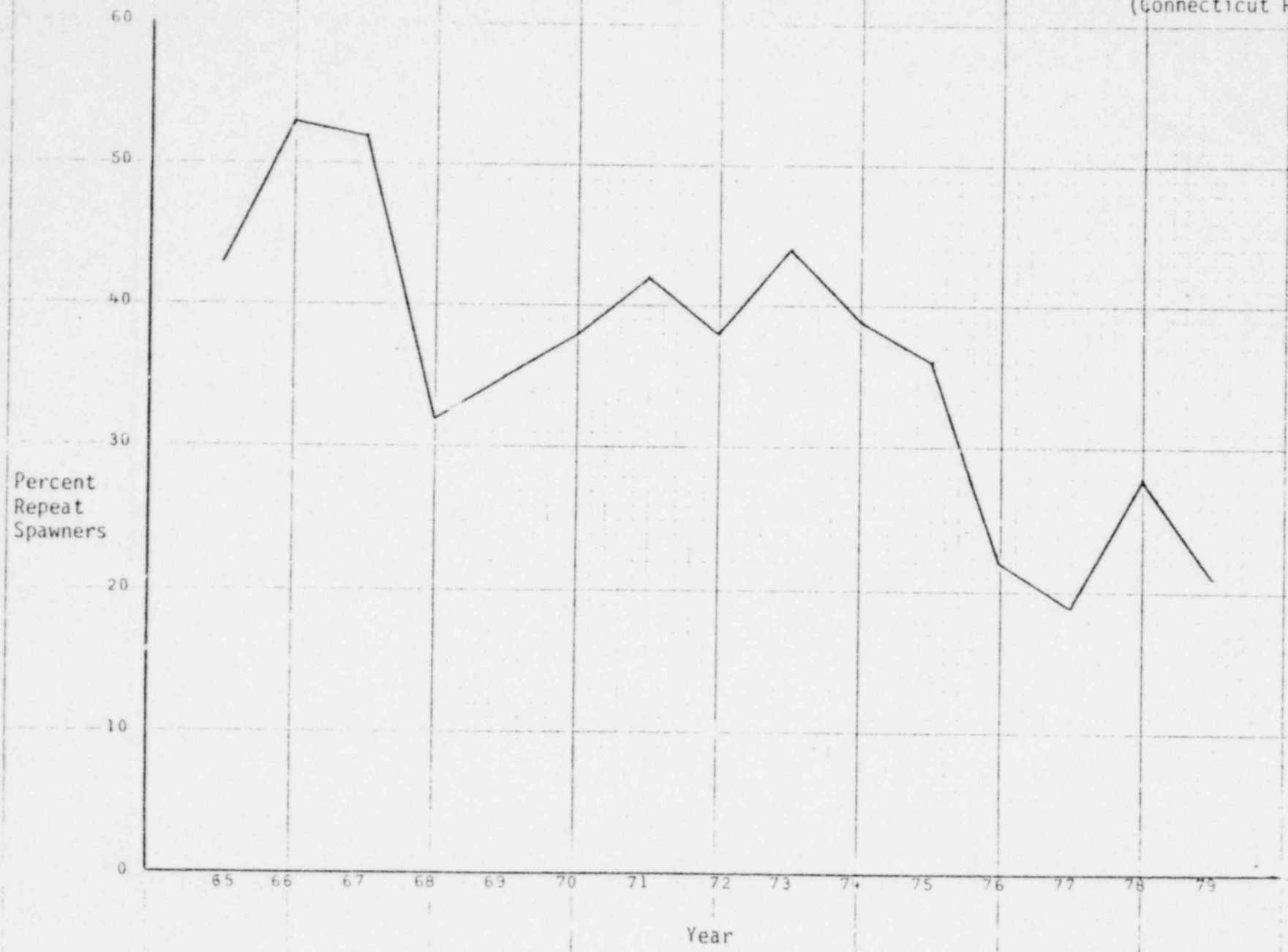

Table #1. Size of the Connecticut River American shad population 1965-1979.

Year	Estimate
1965	400,000** ± 15%
1966	367,000 ± 25,000
1967	368,000 ± 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

*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 2. 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

Table 3. Total Southern New England tag recoveries of American shad tagged in 1977, 1978 and 1979.

	1977	1978	1979
Total shad tagged at mouth of river	5,010	3,125	3,402
Tags returned by:			
Commercial fishery	1,069	473	455
Enfield sport fishery	34	13	10
Holyoke sport fishery	39	12	31
Turners Falls sport fishery	6	0	0
Farmington River sport fishery	4	1	1
Agawam River	0	0	1
Sebethe River	0	0	1
New Haven Harbor	0	0	1
Guilford	1	0	0
Rhode Island Sound	1	1	0
South Shore, Long Island	1	2	1
Tags collected at Holyoke Fishlift	38	40	51
Total tags recovered	1,193	542	552
Tags observed in Holyoke Fishlift	490	141	268

Table 4. Recoveries of tagged American shad from other than the Southern New England Area - 1977-1979.

Area Recovered	Date Recovered	Date Tagged	Sex and Length when tagged	
New Jersey	April 18, 1977	April 15, 1976	Female	46 cm.
New Jersey	April 21, 1977	April 9, 1976	Female	49 cm.
Hudson River, N.Y.	May 19, 1977	April 24, 1977	Female	51 cm.
Ogeechee R., GA (mile 17)	March 30, 1978	May 26, 1977	Female	47 cm.
Pamlico Sound, N.C.	March 18, 1978	April 22, 1977	Male	47 cm.
North Carolina	March 17, 1978	May 6, 1977	Female	48 cm.
Chesapeake Bay	March, 1978	April 21, 1977	Female	51 cm.
Chesapeake Bay	March 31, 1978	April 25, 1977	Female	48 cm.
Delaware Bay	April 6, 1978	Tag # not available		
Hudson River,N.Y.	May 15, 1978	April 30, 1978	Female	45 cm.
Croatian Sound,N,C.	April 1, 1979	April 29, 1978	Buck	44 cm.
Offshore,Delaware	April 25, 1979	May 20, 1978	Female	47 cm.
Offshore,Maryland	June 4, 1979	April 28, 1979	Female	49 cm.
Five Islands, Nova Scotia	June 23, 1979	April 29, 1979	Female	49 cm.
Manasquan Inlet, New Jersey	January 2, 1980	May 3, 1979	Female	50 cm.

Table 5. Selectivity of drift gill nets employed by the commercial shad fishermen on the Connecticut River in 1978 and 1979.

Stretched mesh size(in.)	Number Taken	Weight(lb.)	Mean weight/shad
1978-Female			
5 1/2"	18,400	83,365	4.53
5 5/8"	10,678	51,417	4.82
5 3/4"	10,672	50,836	4.76
5 7/8"	2,019	11,790	5.84
1979-Female			
5 1/2"	11,826	51,684	4.37
5 5/8"	10,082	45,972	4.56
5 3/4"	10,985	50,102	4.56
5 7/8"	1,629	7,285	4.47
1978-Male*			
5 1/2"	10,478	39,877	3.81
5 5/8"	3,281	11,780	3.59
5 3/4"	2,398	8,491	3.54
5 7/8"	443	1,728	3.90
1979-Male*			
5 1/2"	6,770	20,981	3.10
5 5/8"	2,664	9,145	3.43
5 3/4"	2,816	9,330	3.31
5 7/8"	345	1,376	3.99

*All males are not retained for market by the fishermen.
The mean length of all tagged and recaptured fish taken by the commercial fishermen is as follows:

1978 - Females - 48.91 (324 recaptures)
Males - 45.53 (129 recaptures)

1979 - Females - 48.71 (320 recaptures)
Males - 46.03 (99 recaptures)

Table #6. Proportion of females to males in tagging catches 1967-1979.

Year	% Females	% Males
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

Table 7. Repeat spawning American shad in the Enfield sport fishery catch and the Saybrook commercial catch combined.

	Site	Sex	Total Number	Number Repeats	% Repeats
1977	Enfield	Male	50	11	22%
	Enfield	Female	83	7	8%
	Saybrook	Male	100	34	34%
	Saybrook	Female	448	78	17%
1978	Enfield	Male	283	46	16%
	Enfield	Female	200	58	29%
	Saybrook	Male	129	51	40%
	Saybrook	Female	219	78	36%
1979	Enfield	Male	134	37	28%
	Enfield	Female	110	16	15%
	Saybrook	Male	174	40	23%
	Saybrook	Female	374	70	19%

Total male repeat spawners (1977) = 30%

Total male repeat spawners (1978) = 24%

Total male repeat spawners (1979) = 25%

Total female repeat spawners (1977) = 15.6%

Total female repeat spawners (1978) = 33 %

Total female repeat spawners (1979) = 18 %

Total Enfield repeat spawners (1977) = 13.5%

Total Enfield repeat spawners (1978) = 21.5%

Total Enfield repeat spawners (1979) = 21.7%

Total Saybrook repeat spawners (1977) = 20.4%

Total Saybrook repeat spawners (1978) = 37.5%

Total Saybrook repeat spawners (1979) = 20.1%

Total combined repeat spawners (1977) = 19.1%

Total combined repeat spawners (1978) = 28.2%

Total combined repeat spawners (1979) = 20.6%

(all weighed equally)

Table 8. Repeat spawners within age groups by sex at Enfield and Saybrook 1977-1979.

	1977			1978			1979		
	Number	Age	% Repeat spawners	Number	Age	% Repeat spawners	Number	Age	% Repeat spawners
Enfield Males	10	III	0	28	III	4	11	III	0
	25	IV	12	183	IV	16	88	IV	27
	13	V	46	59	V	19	33	V	39
	2	VI	100	13	VI	38	4	VI	0
Enfield Females	30	IV	0	54	IV	0	42	IV	.5
	45	V	13	116	V	31	63	V	175
	8	VI	13	29	VI	72	5	VI	60
				1	VII	100			
Saybrook Males	7	III	0				9	III	0
	38	IV	26	53	IV	30	92	IV	14
	50	V	42	61	V	46	67	V	37
	5	VI	60	15	VI	47	6	VI	33
Saybrook Females	92	IV	0	55	IV	2	147	IV	.4
	283	V	20	115	V	34	205	V	22
	71	VI	28	42	VI	74	19	VI	79
	2	VII	100	5	VII	100	2	VII	100
				1	VIII	100	1	VII+	100
				1	IX	100			

Table 9. Age determinations, mean fork lengths, and mean weights by sex for American shad from Saybrook and Enfield combined.

Age Class	III	IV	V	VI	VII	VIII	IX
Female 1977 (531)							
Number	0	122	328	79	2	0	0
Mean fork length (cm)		47	49	51	55		
Mean weight (gr)		1755	2072	2432	2860		
Female 1978 (419)							
Number	0	109	231	71	6	1	1
Mean fork length (cm)		46	48.5	52	54	57	61
Mean weight (gr)		1618	1901	2403	2715	3600	3260
Female 1979 (484)							
Number	0	189	268	24	2	1	0
Mean fork length (cm)		47	49	53	57	60	
Mean weight (gr)		1904	1995	2232	2370	3200	
Male 1977 (150)							
Number	17	63	63	7	0	0	0
Mean fork length (cm)	39	43	46	46			
Mean weight (gr)	977	1295	1546	1503			
Male 1978 (412)							
Number	28	236	120	28	0	0	0
Mean fork length (cm)	39	42	45	47			
Mean weight (gr)	882	1125	1372	1628			
Male 1979 (310)							
Number	20	180	100	10	0	0	0
Mean fork length (cm)	39	43	46	48			
Mean weight (gr)	933	1251	1555	1636			

Table 10. Age structure in percentage for each year, 1977 through 1979, compared to the mean for 1967 - 1979.

Age Class	III	IV	V	VI-VII	VIII-X
Male					
1967-1979	10.5	40.7	30.7	15.7	0
1977	11.0	42.0	42.0	5.0	0
1978	6.8	57.3	29.1	6.8	0
1979	6.5	58.1	32.3	3.2	0
Female					
1967-1979	0.4	22.3	51.1	23.7	2.8
1977	0	23.0	62.0	15.0	0
1978	0	26.0	55.1	18.4	0.5
1979	0	39.0	55.4	5.4	0.2