1.0 Non Radiological Monitoring Program Table of Contents

7903220265

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNITS 1 and 2

NONRADIOLOGICAL ENVIRONMENTAL
OPERATING REPORT FOR 1978

1.1 MODIFICATION OF TECHNICAL SPECIFICATIONS

The Virginia Electric and Power Company was notified in November, 1978 that its request for modification of the Non-Radiological Environmental Monitoring Program had been granted. This will be the last report under the original Technical Specifications.

2.0 NON-RADIOLOGICAL MONITORING PROGRAM - THERMAL AND PHYSICAL CHARACTERISTICS

The Non-radiological Monitoring Program - Thermal and Physical Characteristics applies to the monitoring of the temperature-salinity distribution in the ten (10) mile segment of the James River centered at Hog Island. The objective of the program is to determine the relationship between the thermal discharge and the physical-chemical characteristics of the water mass within the ten (10) mile tidal segment of the James River and the effects of the operation of the Surry Power Station on the physical and chemical variables of the James River Estuary.

2.1 TEMPERATURE AND SALINITY MONITORING

Summary

Temperatures are monitored continuously at points in the James River at thirteen (13) stations (Figure 2.1.1-1) of the tidal segment encompassing Hog Point. Near surface and bottom temperatures are recorded as indicated on the figure.

Salinity is continuously monitored at the station intakes.

Results

The results of the temperature and salinity monitoring programs are summarized in Sections 2.1.1, 2.1.2, and 2.1.3.

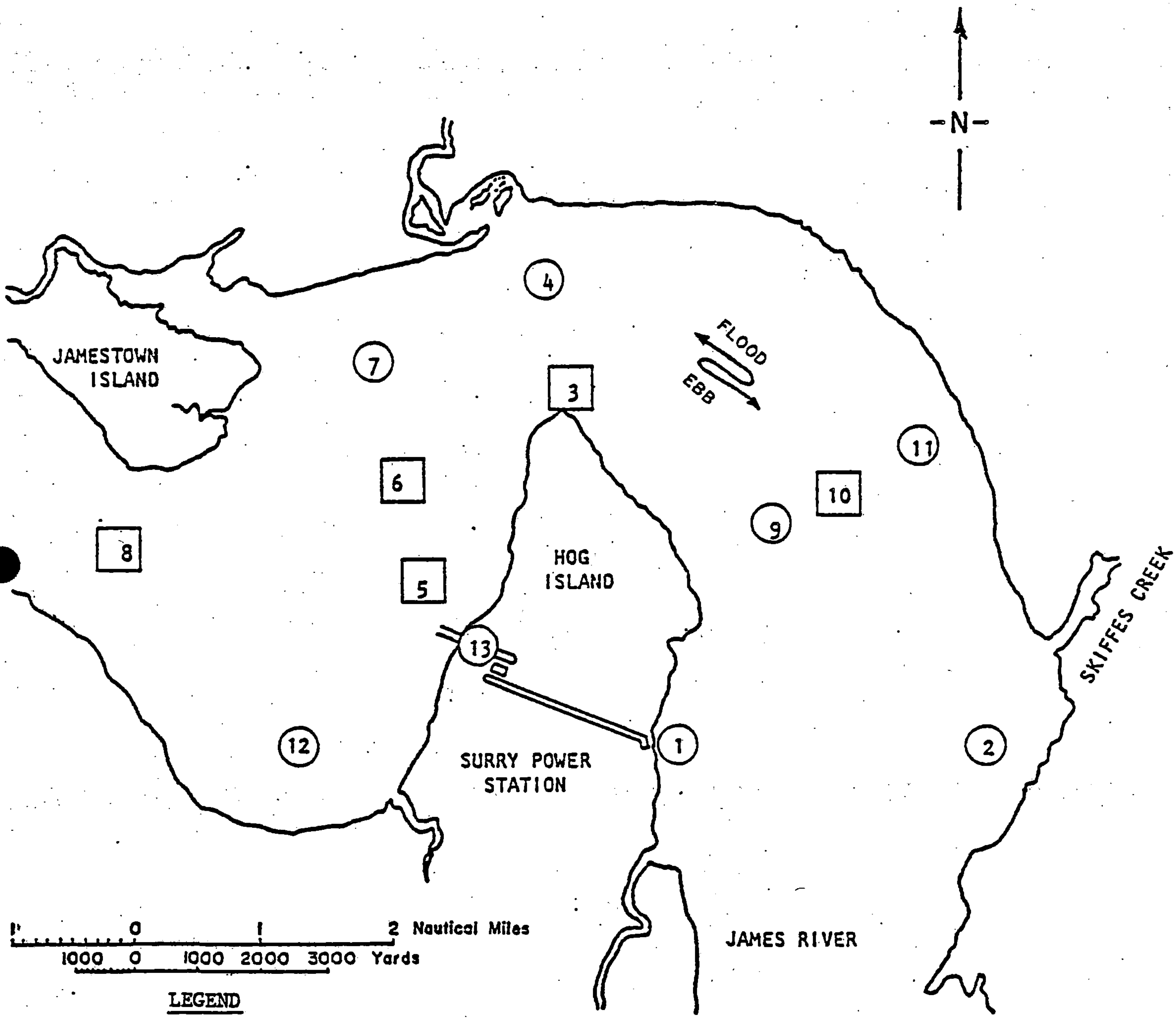
2.1.1 TEMPERATURE AND SALINITY MONITORING STATIONS IN THE JAMES RIVER

Tables 2.1.1-1 and 2.1.1-2 summarize results of the temperature and salinity monitoring program in the James River. The monthly means of the daily highs, lows, and means are reported for each month of the reporting period.

Figure 2.1.1-1

TEMPERATURE MONITORING STATIONS

SURRY POWER STATION



LEGEND

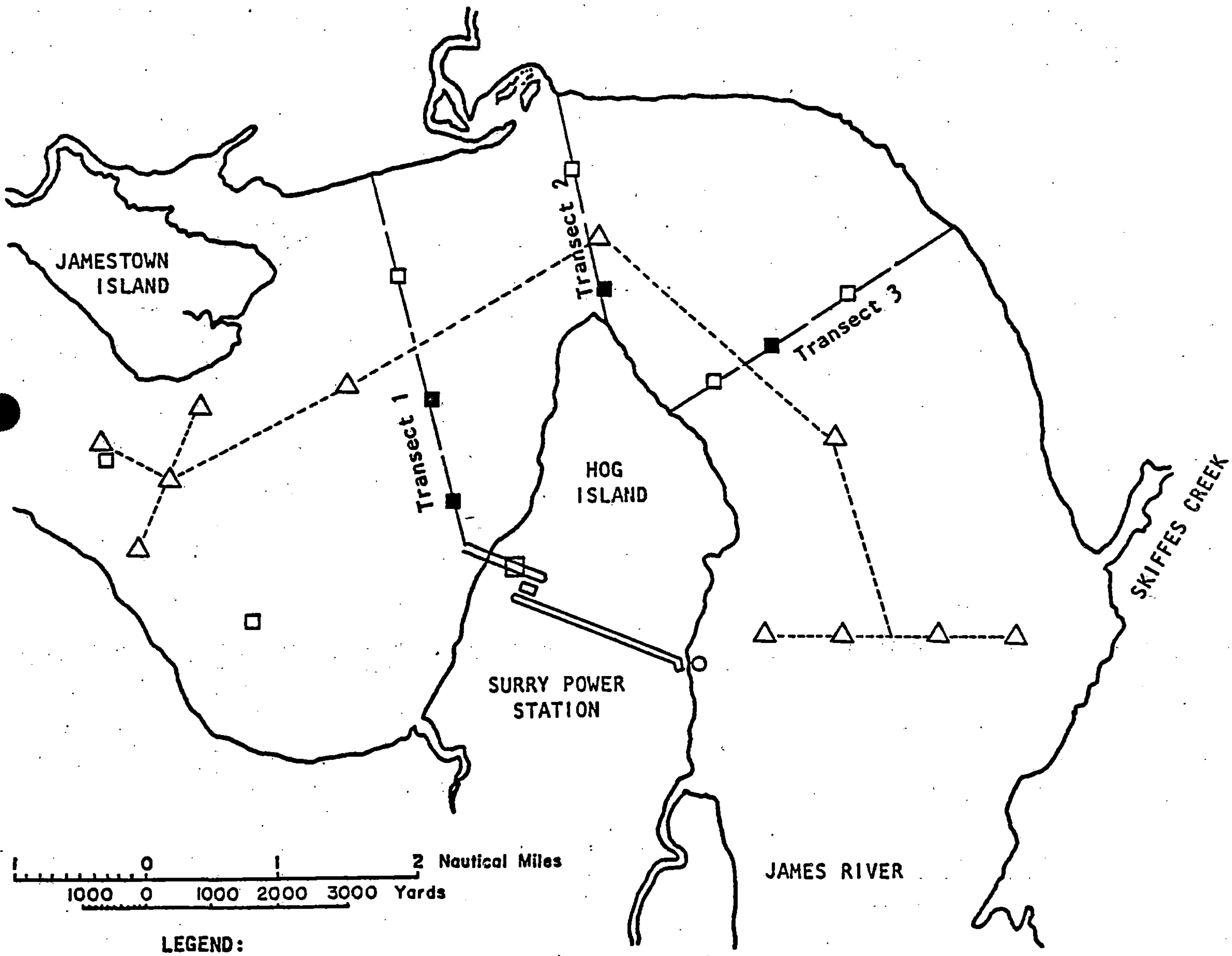
1. Station Intakes - SE2INT
2. Deepwater Shoals - SE1TAT
3. Hog Point - South - SC2TCT,B
4. Hog Point - North - SC1TBT
5. Cobham Bay - South - SB3TFT,B
6. Cobham Bay - Middle - SB2TET,B
7. Cobham Bay - North - SB1TDT
8. Jamestown Island - SA1TGT
9. Transect 3 - SA2BAT
10. Transect 3 - SD2BDT,B
11. Transect 3 - SD1BCT
12. Lower Cobham Bay - SD3BBT
13. Station Discharge - SA3GRT

○ Near Surface Temperature

□ Near Surface and Bottom Temperature

Figure 2.1.1-2

TEMPERATURE AND SALINITY
MONITORING STATIONS



LEGEND:

- △ Monthly Salinity - Temperature Profile Station
- ○ Continuous Salinity - Temperature Monitoring Station
- □ Near Surface Temperature Monitoring Station
- ■ Near Surface and Bottom Temperature Monitoring Station
- ---- Boat Cruise

TABLE 2.1.1-1

JAMES RIVER TEMPERATURE DATA
VALUES ARE MEANS OF DAILY HIGH, MEAN, AND LOW VALUES
ANNUAL REPORT FOR 1978

MONTH=1

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
1	HIGH	.	5.4	12.5	2.9	3.3	4.6	5.8	5.7	3.8	7.7	7.9	3.8	4.1	3.3	6.4	2.9	4.6
1	MEAN	.	3.4	11.7	2.3	2.2	3.4	3.4	3.3	3.1	5.1	5.4	3.2	3.3	2.6	4.0	2.3	3.8
1	LOW	.	2.3	10.8	1.7	1.5	2.7	1.9	1.8	2.4	3.4	3.9	2.7	2.9	2.2	2.5	1.7	2.9

MONTH=2

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
2	HIGH	.	3.3	12.2	2.3	3.1	3.3	5.7	6.3	2.4	5.4	.	2.2	2.4	2.4	5.5	1.7	3.1
2	MEAN	.	1.7	10.8	1.8	1.9	2.0	2.8	3.4	1.8	3.1	.	1.7	1.8	1.8	3.0	1.2	2.3
2	LOW	.	1.0	9.9	1.3	1.2	1.3	1.2	1.7	1.4	1.7	.	1.2	1.3	1.4	1.8	0.7	1.6

MONTH=3

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
3	HIGH	12.2	8.2	16.5	7.0	8.2	8.1	10.5	10.1	7.5	10.6	13.6	7.4	4.6	8.8	10.1	7.1	8.6
3	MEAN	11.9	6.9	15.1	6.4	7.1	7.0	7.7	7.9	6.9	8.5	11.7	6.8	4.0	8.2	8.1	6.2	7.3
3	LOW	11.6	5.9	14.2	5.8	6.4	6.3	6.0	6.3	6.4	7.1	10.5	6.3	3.4	7.8	7.0	5.6	6.2

MONTH=4

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
4	HIGH	15.3	15.9	22.7	14.8	15.7	15.5	17.3	16.8	15.4	17.6	17.1	15.4	.	15.3	16.9	14.9	16.2
4	MEAN	14.6	14.7	21.5	14.2	15.0	14.9	15.3	15.5	14.8	15.9	15.5	14.9	.	14.7	15.6	13.9	14.8
4	LOW	14.1	13.7	20.6	13.6	14.3	14.2	14.0	14.5	14.3	14.8	14.4	14.3	.	14.2	14.6	13.2	13.6

MONTH=5

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
5	HIGH	19.0	19.6	25.6	19.3	19.3	19.2	21.4	19.6	19.2	21.1	20.5	19.0	.	18.4	20.3	19.3	20.6
5	MEAN	18.4	18.4	24.3	18.6	18.8	18.6	20.1	18.9	18.6	19.6	19.3	18.6	.	17.9	19.4	18.4	18.9
5	LOW	18.0	17.7	23.2	18.1	18.2	18.2	19.2	18.1	18.1	18.7	18.4	18.2	.	17.5	18.6	17.6	17.7

MONTH=6

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
6	HIGH	26.1	26.8	32.9	26.1	24.8	26.0	28.1	26.6	26.2	28.1	27.7	26.1	26.5	26.1	27.0	26.2	27.2
6	MEAN	25.5	25.5	31.5	25.5	24.3	25.5	26.0	25.6	25.6	26.5	26.0	25.5	25.9	25.5	25.9	25.1	25.4
6	LOW	25.1	24.6	30.4	25.0	23.8	25.1	25.0	24.8	25.1	25.3	25.0	25.1	25.4	25.0	25.0	24.2	23.9

TABLE 2.1.1-1

JAMES RIVER TEMPERATURE DATA
VALUES ARE MEANS OF DAILY HIGH, MEAN, AND LOW VALUES
ANNUAL REPORT FOR 1978

MONTH=7

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
7	HIGH	28.0	28.3	33.9	27.6	.	27.8	29.9	28.4	28.3	29.7	29.5	28.1	28.1	27.7	28.8	28.1	29.1
7	MEAN	27.4	27.2	32.5	27.0	.	27.4	28.2	27.5	27.6	28.1	27.8	27.5	27.5	27.1	27.7	27.2	27.4
7	LOW	27.0	26.4	31.4	26.6	.	27.0	27.2	26.8	27.1	27.0	26.9	27.0	27.0	26.7	26.9	26.5	26.0

MONTH=8

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
8	HIGH	29.6	30.5	38.4	29.8	30.1	29.8	32.1	30.8	29.9	32.7	32.1	29.7	29.7	29.4	31.3	29.5	30.0
8	MEAN	28.9	28.9	37.1	29.2	29.5	29.2	30.1	29.6	29.3	30.5	30.0	29.2	29.1	28.8	29.9	28.7	28.5
8	LOW	28.5	28.1	36.0	28.7	29.0	28.7	28.9	28.7	28.9	29.0	28.7	28.8	28.6	28.4	28.9	28.0	27.3

MONTH=9

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
9	HIGH	26.9	27.4	35.8	27.4	27.1	26.9	29.3	27.8	27.0	29.4	29.0	27.0	26.8	26.7	28.2	26.4	26.8
9	MEAN	26.2	26.1	34.5	26.8	26.5	26.4	26.9	26.8	26.5	27.4	26.9	26.5	26.2	26.2	26.8	25.8	25.4
9	LOW	25.8	25.3	33.3	26.2	26.0	25.9	25.7	26.0	26.0	26.0	25.7	26.1	25.8	25.7	25.9	25.2	24.2

MONTH=10

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
10	HIGH	19.4	19.3	27.7	19.8	21.2	19.7	21.7	21.0	19.7	21.9	21.9	19.4	19.4	19.4	21.0	19.1	19.0
10	MEAN	18.8	18.4	26.7	19.3	20.8	19.0	19.4	19.6	19.3	20.0	19.7	18.9	19.0	19.0	19.5	18.5	17.9
10	LOW	18.4	17.6	25.9	18.9	20.3	18.5	18.2	18.7	18.8	18.8	18.5	18.6	18.6	18.6	18.6	17.9	16.8

MONTH=11

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
11	HIGH	15.8	15.8	24.6	15.9	.	16.1	18.8	18.0	16.1	18.9	18.7	15.9	16.1	15.6	17.9	15.1	14.7
11	MEAN	15.1	14.9	23.7	15.5	.	15.3	16.4	16.4	15.7	16.6	16.3	15.4	15.6	15.2	15.9	14.7	14.1
11	LOW	14.7	14.2	22.9	15.1	.	14.8	14.9	15.2	15.2	15.2	14.9	15.0	15.2	14.7	14.9	14.3	13.4

MONTH=12

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
12	HIGH	12.1	12.0	15.9	.	.	12.6	14.9	15.3	12.1	15.6	15.4	12.2	12.7	12.4	15.4	12.3	9.5
12	MEAN	11.3	11.2	14.8	.	.	11.9	12.7	13.2	11.7	13.5	13.3	11.9	12.1	11.9	13.2	11.4	8.8
12	LOW	10.9	10.6	13.7	.	.	11.3	11.1	11.9	11.4	12.1	11.9	11.6	11.7	11.5	11.9	10.6	8.0

TABLE 2.1.1-2
JAMES RIVER SALINITY DATA
VALUES (IN O/OO) WERE COMPUTED FROM DAILY MEAN VALUES

YEAR	MONTH	MAXIMUM	MEAN	MINIMUM
78	1	1.0	0.9	0.8
78	2	2.2	2.0	1.8
78	3	1.4	1.2	1.0
78	4	1.4	1.1	0.9
78	5	0.6	0.5	0.4
78	6	2.4	2.1	1.9
78	7	5.9	5.6	5.3
78	8	5.2	4.9	4.6
78	9	8.0	7.7	7.4
78	10	9.0	8.7	8.4
78	11	10.6	10.4	10.1
78	12	7.1	6.8	6.5

2.1.2 INTAKE CANAL MONITORING STATION

Table 2.1.2-1 summarizes the data recorded at the intake canal temperature monitoring station as column SE2INT. Temperatures from other river stations are given for comparison (Figure 2.1.1-1 gives stations locations). Values shown are monthly means of daily highs, lows, and means in degrees Celsius.

TABLE 2.1.2-1

JAMES RIVER TEMPERATURE DATA
VALUES ARE MEANS OF DAILY HIGH, MEAN, AND LOW VALUES
ANNUAL REPORT FOR 1978

MONTH=1

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
1	HIGH	.	5.4	12.5	2.9	3.3	4.6	5.8	5.7	3.8	7.7	7.9	3.8	4.1	3.3	6.4	2.9	4.6
1	MEAN	.	3.4	11.7	2.3	2.2	3.4	3.4	3.3	3.1	5.1	5.4	3.2	3.3	2.6	4.0	2.3	3.8
1	LOW	.	2.3	10.8	1.7	1.5	2.7	1.9	1.8	2.4	3.4	3.9	2.7	2.9	2.2	2.5	1.7	2.9

MONTH=2

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
2	HIGH	.	3.3	12.2	2.3	3.1	3.3	5.7	6.3	2.4	5.4	.	2.2	2.4	2.4	5.5	1.7	3.1
2	MEAN	.	1.7	10.8	1.8	1.9	2.0	2.8	3.4	1.8	3.1	.	1.7	1.8	1.8	3.0	1.2	2.3
2	LOW	.	1.0	9.9	1.3	1.2	1.3	1.2	1.7	1.4	1.7	.	1.2	1.3	1.4	1.8	0.7	1.6

MONTH=3

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
3	HIGH	12.2	8.2	16.5	7.0	8.2	8.1	10.5	10.1	7.5	10.6	13.6	7.4	4.6	8.8	10.1	7.1	8.6
3	MEAN	11.9	6.9	15.1	6.4	7.1	7.0	7.7	7.9	6.9	8.5	11.7	6.8	4.0	8.2	8.1	6.2	7.3
3	LOW	11.6	5.9	14.2	5.8	6.4	6.3	6.0	6.3	6.4	7.1	10.5	6.3	3.4	7.8	7.0	5.6	6.2

MONTH=4

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
4	HIGH	15.3	15.9	22.7	14.8	15.7	15.5	17.3	16.8	15.4	17.6	17.1	15.4	.	15.3	16.9	14.9	16.2
4	MEAN	14.6	14.7	21.5	14.2	15.0	14.9	15.3	15.5	14.8	15.9	15.5	14.9	.	14.7	15.6	13.9	14.8
4	LOW	14.1	13.7	20.6	13.6	14.3	14.2	14.0	14.5	14.3	14.8	14.4	14.3	.	14.2	14.6	13.2	13.6

MONTH=5

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
5	HIGH	19.0	19.6	25.6	19.3	19.3	19.2	21.4	19.6	19.2	21.1	20.5	19.0	.	18.4	20.3	19.3	20.6
5	MEAN	18.4	18.4	24.3	18.6	18.8	18.6	20.1	18.9	18.6	19.6	19.3	18.6	.	17.9	19.4	18.4	18.9
5	LOW	18.0	17.7	23.2	18.1	18.2	18.2	19.2	18.1	18.1	18.7	18.4	18.2	.	17.5	18.6	17.6	17.7

MONTH=6

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
6	HIGH	26.1	26.8	32.9	26.1	24.8	26.0	28.1	26.6	26.2	28.1	27.7	26.1	26.5	26.1	27.0	26.2	27.2
6	MEAN	25.5	25.5	31.5	25.5	24.3	25.5	26.0	25.6	25.6	26.5	26.0	25.5	25.9	25.5	25.9	25.1	25.4
6	LOW	25.1	24.6	30.4	25.0	23.8	25.1	25.0	24.8	25.1	25.3	25.0	25.1	25.4	25.0	25.0	24.2	23.9

TABLE 2.1.2-1

JAMES RIVER TEMPERATURE DATA
VALUES ARE MEANS OF DAILY HIGH, MEAN, AND LOW VALUES
ANNUAL REPORT FOR 1978

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
MONTH=7																		
7	HIGH	28.0	28.3	33.9	27.6	.	27.8	29.9	28.4	28.3	29.7	29.5	28.1	28.1	27.7	28.8	28.1	29.1
7	MEAN	27.4	27.2	32.5	27.0	.	27.4	28.2	27.5	27.6	28.1	27.8	27.5	27.5	27.1	27.7	27.2	27.4
7	LOW	27.0	26.4	31.4	26.6	.	27.0	27.2	26.8	27.1	27.0	26.9	27.0	27.0	26.7	26.9	26.5	26.0
MONTH=8																		
8	HIGH	29.6	30.5	38.4	29.8	30.1	29.8	32.1	30.8	29.9	32.7	32.1	29.7	29.7	29.4	31.3	29.5	30.0
8	MEAN	28.9	28.9	37.1	29.2	29.5	29.2	30.1	29.6	29.3	30.5	30.0	29.2	29.1	28.8	29.9	28.7	28.5
8	LOW	28.5	28.1	36.0	28.7	29.0	28.7	28.9	28.7	28.9	29.0	28.7	28.8	28.6	28.4	28.9	28.0	27.3
MONTH=9																		
9	HIGH	26.9	27.4	35.8	27.4	27.1	26.9	29.3	27.8	27.0	29.4	29.0	27.0	26.8	26.7	28.2	26.4	26.8
9	MEAN	26.2	26.1	34.5	26.8	26.5	26.4	26.9	26.8	26.5	27.4	26.9	26.5	26.2	26.2	26.8	25.8	25.4
9	LOW	25.8	25.3	33.3	26.2	26.0	25.9	25.7	26.0	26.0	26.0	25.7	26.1	25.8	25.7	25.9	25.2	24.2
MONTH=10																		
10	HIGH	19.4	19.3	27.7	19.8	21.2	19.7	21.7	21.0	19.7	21.9	21.9	19.4	19.4	19.4	21.0	19.1	19.0
10	MEAN	18.8	18.4	26.7	19.3	20.8	19.0	19.4	19.6	19.3	20.0	19.7	18.9	19.0	19.0	19.5	18.5	17.9
10	LOW	18.4	17.6	25.9	18.9	20.3	18.5	18.2	18.7	18.8	18.8	18.5	18.6	18.6	18.6	18.6	17.9	16.8
MONTH=11																		
11	HIGH	15.8	15.8	24.6	15.9	.	16.1	18.8	18.0	16.1	18.9	18.7	15.9	16.1	15.6	17.9	15.1	14.7
11	MEAN	15.1	14.9	23.7	15.5	.	15.3	16.4	16.4	15.7	16.6	16.3	15.4	15.6	15.2	15.9	14.7	14.1
11	LOW	14.7	14.2	22.9	15.1	.	14.8	14.9	15.2	15.2	15.2	14.9	15.0	15.2	14.7	14.9	14.3	13.4
MONTH=12																		
12	HIGH	12.1	12.0	15.9	.	.	12.6	14.9	15.3	12.1	15.6	15.4	12.2	12.7	12.4	15.4	12.3	9.5
12	MEAN	11.3	11.2	14.8	.	.	11.9	12.7	13.2	11.7	13.5	13.3	11.9	12.1	11.9	13.2	11.4	8.8
12	LOW	10.9	10.6	13.7	.	.	11.3	11.1	11.9	11.4	12.1	11.9	11.6	11.7	11.5	11.9	10.6	8.0

2.1.3 DISCHARGE CANAL MONITORING STATION

Table 2.1.3-1 summarizes the data recorded at the discharge canal temperature monitoring station as column SA3GRT. Temperatures from other river stations are given for comparison (Figure 2.1.1-1 gives station locations). Temperatures shown are monthly means of daily highs, lows, and means in degrees Celsius.

TABLE 2.1.3-1

JAMES RIVER TEMPERATURE DATA
VALUES ARE MEANS OF DAILY HIGH, MEAN, AND LOW VALUES
ANNUAL REPORT FOR 1978

MONTH=1

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
1	HIGH	.	5.4	12.5	2.9	3.3	4.6	5.8	5.7	3.8	7.7	7.9	3.8	4.1	3.3	6.4	2.9	4.6
1	MEAN	.	3.4	11.7	2.3	2.2	3.4	3.4	3.3	3.1	5.1	5.4	3.2	3.3	2.6	4.0	2.3	3.8
1	LOW	.	2.3	10.8	1.7	1.5	2.7	1.9	1.8	2.4	3.4	3.9	2.7	2.9	2.2	2.5	1.7	2.9

MONTH=2

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
2	HIGH	.	3.3	12.2	2.3	3.1	3.3	5.7	6.3	2.4	5.4	.	2.2	2.4	2.4	5.5	1.7	3.1
2	MEAN	.	1.7	10.8	1.8	1.9	2.0	2.8	3.4	1.8	3.1	.	1.7	1.8	1.8	3.0	1.2	2.3
2	LOW	.	1.0	9.9	1.3	1.2	1.3	1.2	1.7	1.4	1.7	.	1.2	1.3	1.4	1.8	0.7	1.6

MONTH=3

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
3	HIGH	12.2	8.2	16.5	7.0	8.2	8.1	10.5	10.1	7.5	10.6	13.6	7.4	4.6	8.8	10.1	7.1	8.6
3	MEAN	11.9	6.9	15.1	6.4	7.1	7.0	7.7	7.9	6.9	8.5	11.7	6.8	4.0	8.2	8.1	6.2	7.3
3	LOW	11.6	5.9	14.2	5.8	6.4	6.3	6.0	6.3	6.4	7.1	10.5	6.3	3.4	7.8	7.0	5.6	6.2

MONTH=4

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
4	HIGH	15.3	15.9	22.7	14.8	15.7	15.5	17.3	16.8	15.4	17.6	17.1	15.4	.	15.3	16.9	14.9	16.2
4	MEAN	14.6	14.7	21.5	14.2	15.0	14.9	15.3	15.5	14.8	15.9	15.5	14.9	.	14.7	15.6	13.9	14.8
4	LOW	14.1	13.7	20.6	13.6	14.3	14.2	14.0	14.5	14.3	14.8	14.4	14.3	.	14.2	14.6	13.2	13.6

MONTH=5

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
5	HIGH	19.0	19.6	25.6	19.3	19.3	19.2	21.4	19.6	19.2	21.1	20.5	19.0	.	18.4	20.3	19.3	20.6
5	MEAN	18.4	18.4	24.3	18.6	18.8	18.6	20.1	18.9	18.6	19.6	19.3	18.6	.	17.9	19.4	18.4	18.9
5	LOW	18.0	17.7	23.2	18.1	18.2	18.2	19.2	18.1	18.1	18.7	18.4	18.2	.	17.5	18.6	17.6	17.7

MONTH=6

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
6	HIGH	26.1	26.8	32.9	26.1	24.8	26.0	28.1	26.6	26.2	28.1	27.7	26.1	26.5	26.1	27.0	26.2	27.2
6	MEAN	25.5	25.5	31.5	25.5	24.3	25.5	26.0	25.6	25.6	26.5	26.0	25.5	25.9	25.5	25.9	25.1	25.4
6	LOW	25.1	24.6	30.4	25.0	23.8	25.1	25.0	24.8	25.1	25.3	25.0	25.1	25.4	25.0	25.0	24.2	23.9

TABLE 2.1.3-1

JAMES RIVER TEMPERATURE DATA
VALUES ARE MEANS OF DAILY HIGH, MEAN, AND LOW VALUES
ANNUAL REPORT FOR 1978

MONTH=7

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
7	HIGH	28.0	28.3	33.9	27.6	.	27.8	29.9	28.4	28.3	29.7	29.5	28.1	28.1	27.7	28.8	28.1	29.1
7	MEAN	27.4	27.2	32.5	27.0	.	27.4	28.2	27.5	27.6	28.1	27.8	27.5	27.5	27.1	27.7	27.2	27.4
7	LOW	27.0	26.4	31.4	26.6	.	27.0	27.2	26.8	27.1	27.0	26.9	27.0	27.0	26.7	26.9	26.5	26.0

MONTH=8

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
8	HIGH	29.6	30.5	38.4	29.8	30.1	29.8	32.1	30.8	29.9	32.7	32.1	29.7	29.7	29.4	31.3	29.5	30.0
8	MEAN	28.9	28.9	37.1	29.2	29.5	29.2	30.1	29.6	29.3	30.5	30.0	29.2	29.1	28.8	29.9	28.7	28.5
8	LOW	28.5	28.1	36.0	28.7	29.0	28.7	28.9	28.7	28.9	29.0	28.7	28.8	28.6	28.4	28.9	28.0	27.3

MONTH=9

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
9	HIGH	26.9	27.4	35.8	27.4	27.1	26.9	29.3	27.8	27.0	29.4	29.0	27.0	26.8	26.7	28.2	26.4	26.8
9	MEAN	26.2	26.1	34.5	26.8	26.5	26.4	26.9	26.8	26.5	27.4	26.9	26.5	26.2	26.2	26.8	25.8	25.4
9	LOW	25.8	25.3	33.3	26.2	26.0	25.9	25.7	26.0	26.0	26.0	25.7	26.1	25.8	25.7	25.9	25.2	24.2

MONTH=10

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
10	HIGH	19.4	19.3	27.7	19.8	21.2	19.7	21.7	21.0	19.7	21.9	21.9	19.4	19.4	19.4	21.0	19.1	19.0
10	MEAN	18.8	18.4	26.7	19.3	20.8	19.0	19.4	19.6	19.3	20.0	19.7	18.9	19.0	19.0	19.5	18.5	17.9
10	LOW	18.4	17.6	25.9	18.9	20.3	18.5	18.2	18.7	18.8	18.8	18.5	18.6	18.6	18.6	18.6	17.9	16.8

MONTH=11

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
11	HIGH	15.8	15.8	24.6	15.9	.	16.1	18.8	18.0	16.1	18.9	18.7	15.9	16.1	15.6	17.9	15.1	14.7
11	MEAN	15.1	14.9	23.7	15.5	.	15.3	16.4	16.4	15.7	16.6	16.3	15.4	15.6	15.2	15.9	14.7	14.1
11	LOW	14.7	14.2	22.9	15.1	.	14.8	14.9	15.2	15.2	15.2	14.9	15.0	15.2	14.7	14.9	14.3	13.4

MONTH=12

MONTH	TYPE	SA1TGT	SA2BAT	SA3GRT	SB1TDT	SB2TET	SB2TEB	SB3TFT	SB3TFB	SC1TBT	SC2TCT	SC2TCB	SD1BDT	SD2BCT	SD2BCB	SD3BBT	SE1TAT	SE2INT
12	HIGH	12.1	12.0	15.9	.	.	12.6	14.9	15.3	12.1	15.6	15.4	12.2	12.7	12.4	15.4	12.3	9.5
12	MEAN	11.3	11.2	14.8	.	.	11.9	12.7	13.2	11.7	13.5	13.3	11.9	12.1	11.9	13.2	11.4	8.8
12	LOW	10.9	10.6	13.7	.	.	11.3	11.1	11.9	11.4	12.1	11.9	11.6	11.7	11.5	11.9	10.6	8.0

2.2 SALINITY AND TEMPERATURE SPECIAL SURVEYS

Summary

The salinity and temperature monitoring program encompasses the segment of the James River Estuary which extends from the southern shore of Jamestown Island to below the intake of the Surry Power Station. The horizontal and vertical salinity and temperature of this tidal segment is determined at monthly intervals as follows: Cruises are conducted at slack before flood tide. A four (4) station transect, which is between the intake structure and Skiffes Creek, is sampled from surface to bottom at two (2) meter intervals. A second transect is made near the upper limits of the segment, the exact location of which is based on the salinity regime of the system. The approximate locations of the sampling stations and the cruise route are shown on T.S. Figure 2.2-1.

Results

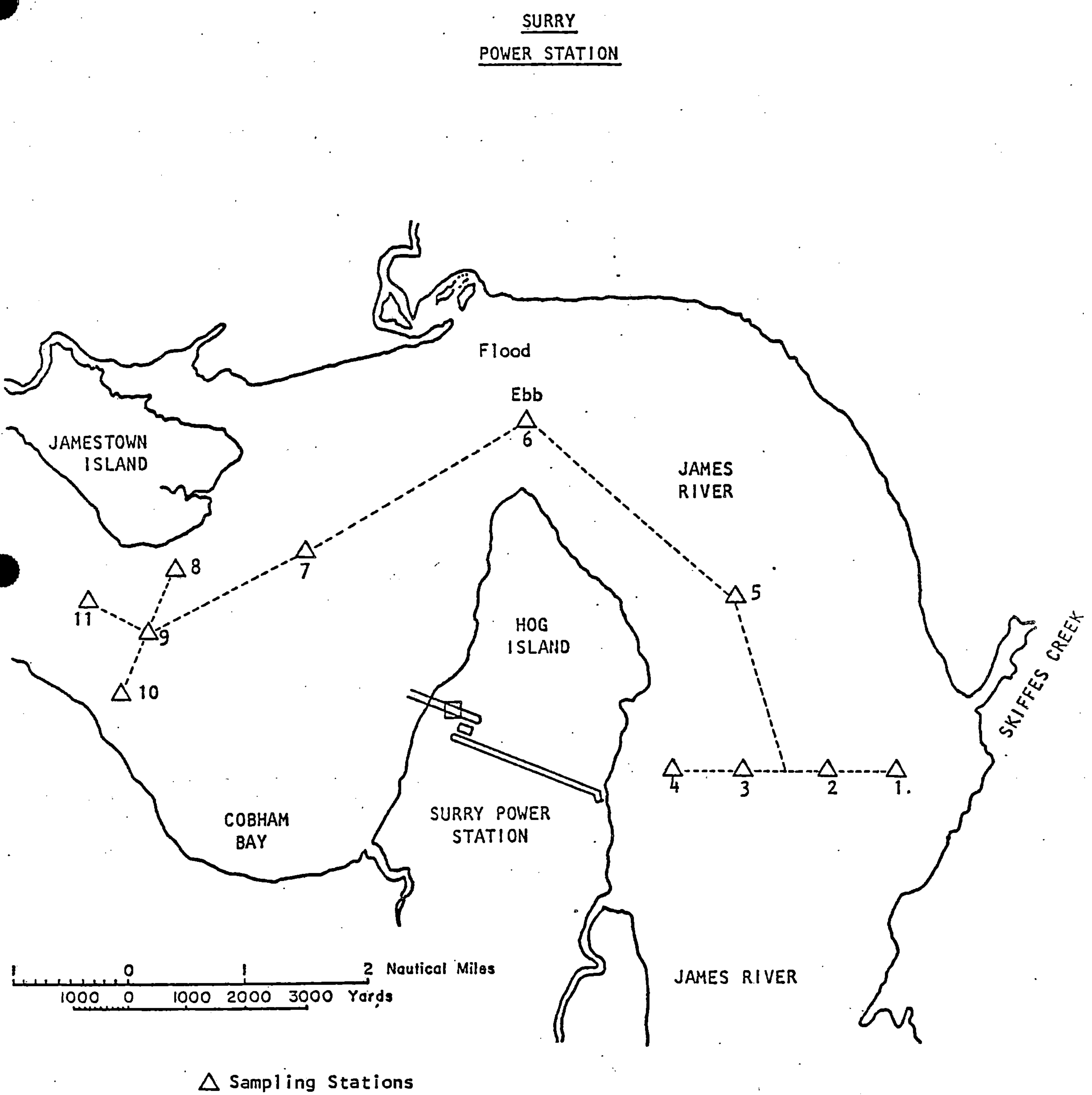
Monthly temperature and salinity surveys were conducted at eleven (11) sampling stations as shown in Figure 2.2-1. Data obtained from these surveys are summarized in graphical form in Figures 2.2-2 through 2.2-13.

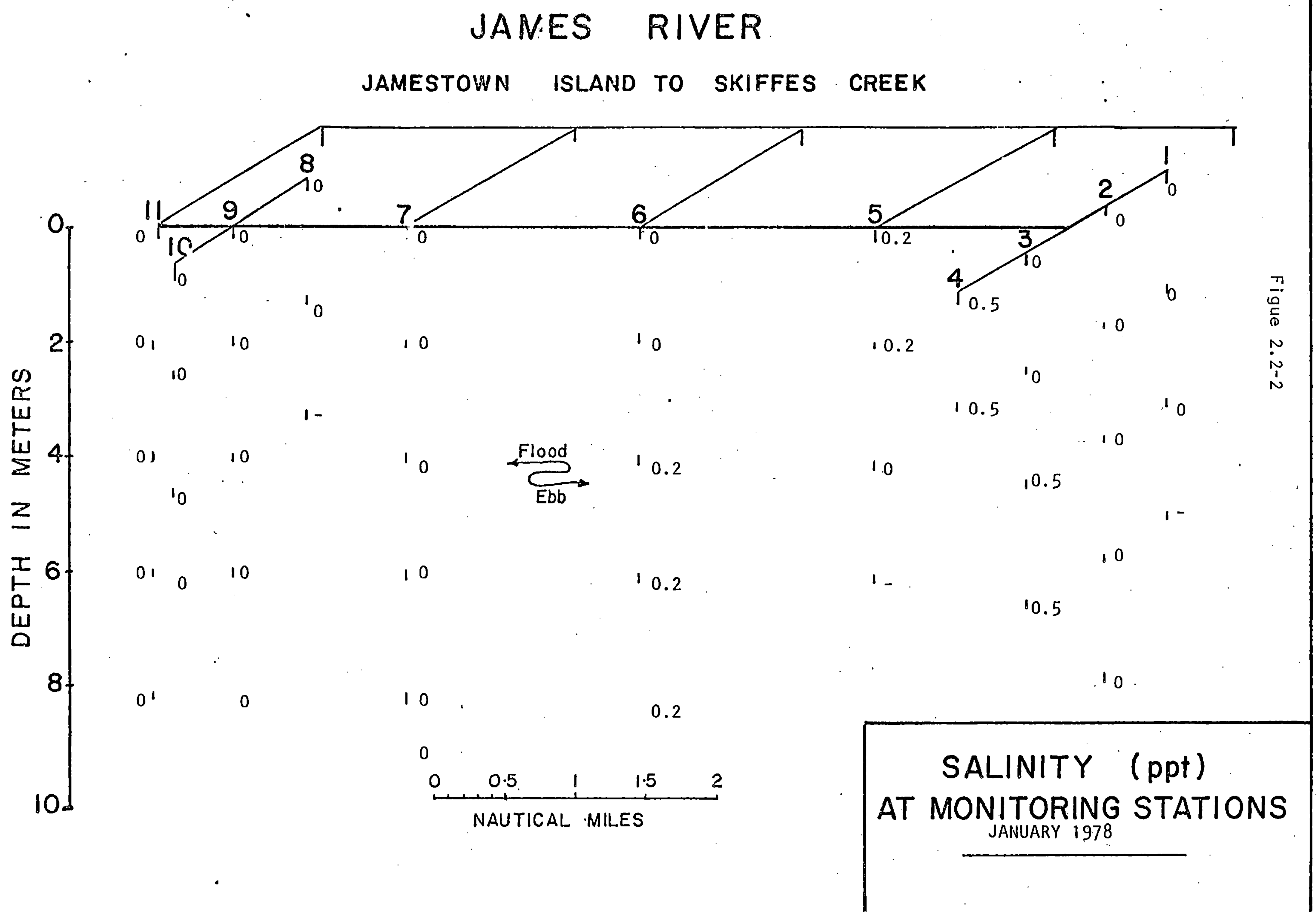
Conclusions

The salinity in this segment of the river varied between 0 and 11.0 parts per thousand (ppt) during the reporting period. There is no measurable difference in salinity occurring as a result of the diversion of water through the cooling system. Therefore, it is concluded that the operation of the station had no significant effect on the salinity structure of the James River.

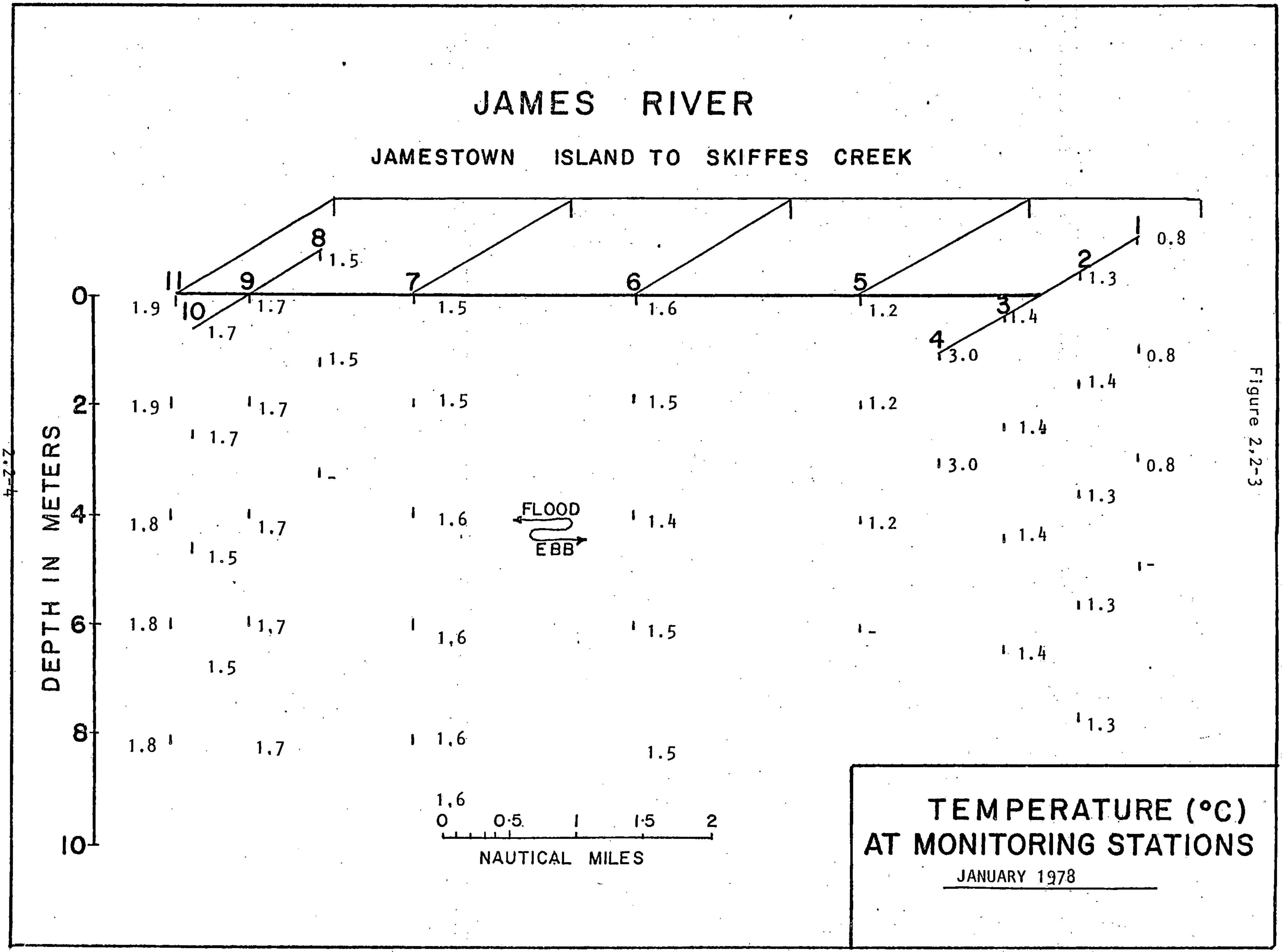
Temperature readings taken in conjunction with the salinity surveys are also presented.

Figure 2.2-1


SURRY
POWER STATION
Flood
Ebb
6
JAMESTOWN
ISLAND
JAMES
RIVER
7
8
5
11
9
HOG
ISLAND
10
SKIFFES CREEK
4
3
2
1.
COBHAM
BAY
SURRY POWER
STATION
1 0 1 2 Nautical Miles
1000 0 1000 2000 3000 Yards
JAMES RIVER
△ Sampling Stations


JAMES RIVER
JAMESTOWN ISLAND TO SKIFFES CREEK
DEPTH IN METERS
Flood
Ebb
NAUTICAL MILES
SALINITY (ppt)
AT MONITORING STATIONS
JANUARY 1978

Figue 2.2-2

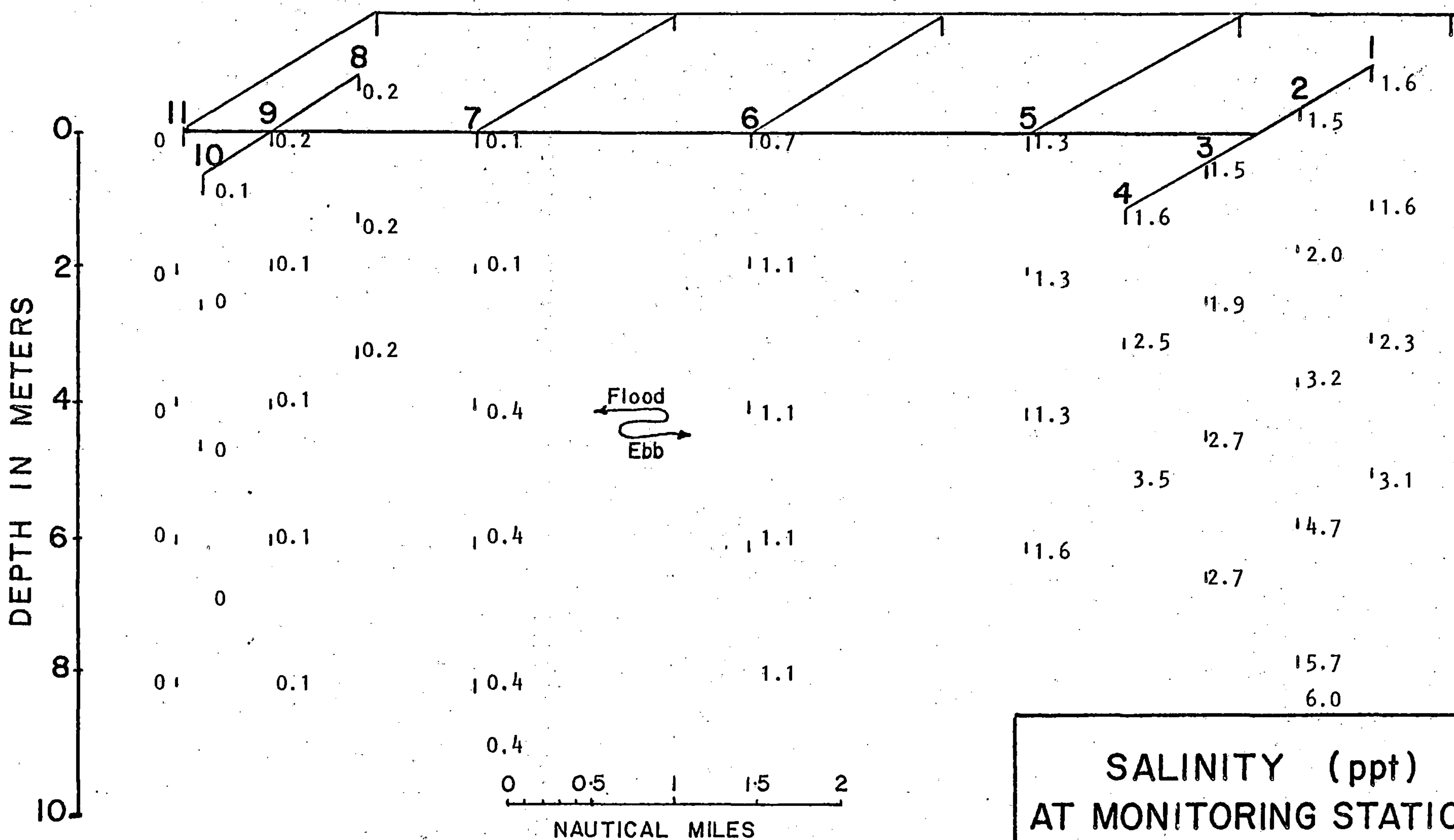


JAMES RIVER
JAMESTOWN ISLAND TO SKIFFES CREEK
DEPTH IN METERS
0
2
4
6
8
10
11
10
9
8
7
6
5
4
3
2
1
1.9
1.9
1.8
1.8
1.8
1.7
1.7
1.5
1.5
1.7
1.7
1.7
1.7
1.7
1.5
1.5
1.5
1.5
1.6
1.6
1.6
1.6
1.6
1.5
1.4
1.5
1.5
1.2
1.2
1.2
3.0
3.0
1.4
1.4
1.4
1.4
1.3
1.4
1.3
1.3
1.3
0.8
0.8
0.8
FLOOD
EBB
0
0·5
1
1·5
2
NAUTICAL MILES
TEMPERATURE (°C)
AT MONITORING STATIONS
JANUARY 1978

Figure 2,2-3

JAMES RIVER

JAMESTOWN ISLAND TO SKIFFES CREEK



SALINITY (ppt) AT MONITORING STATIONS

FEBRUARY 1978

Figure 2.2-4

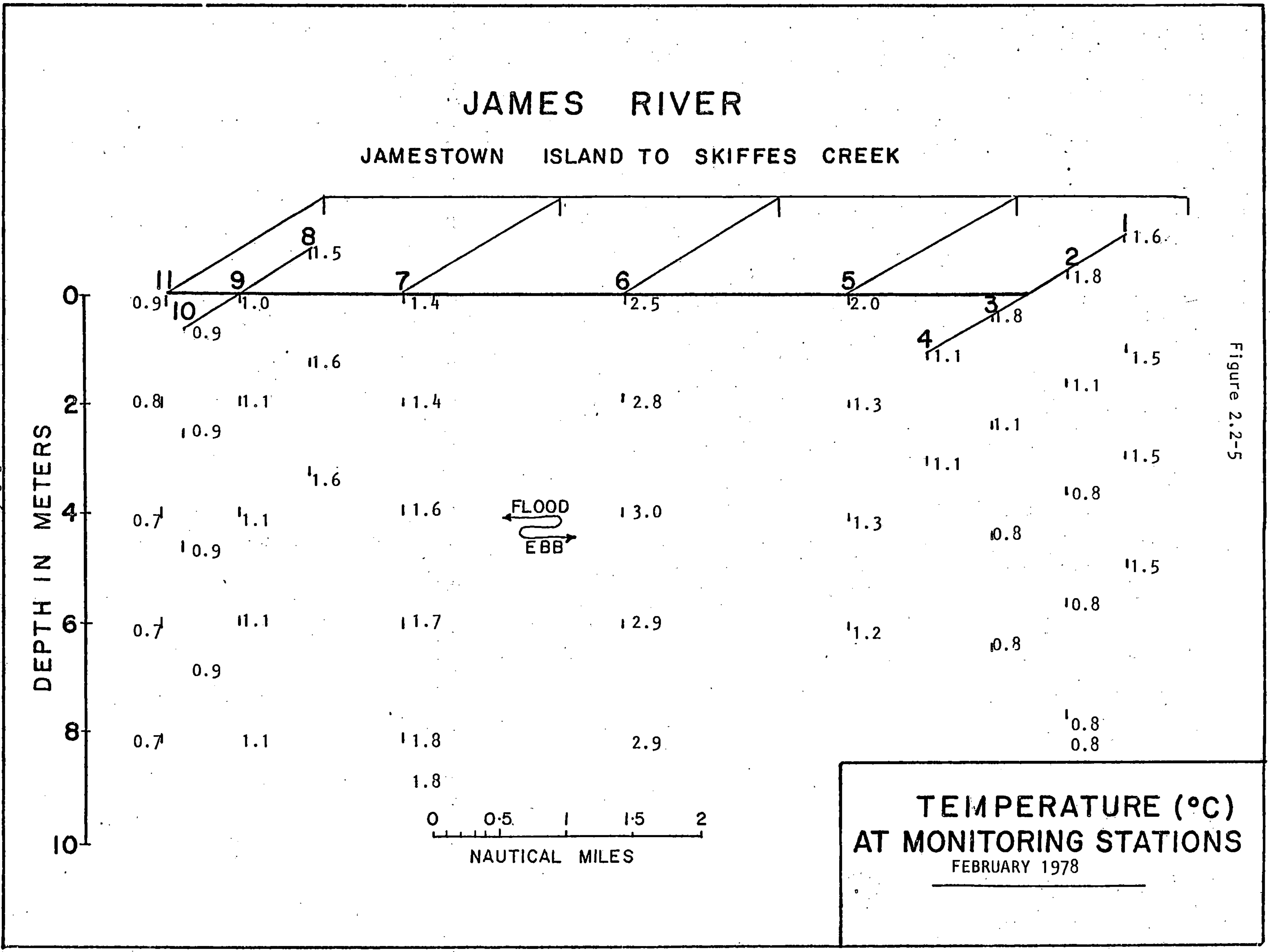
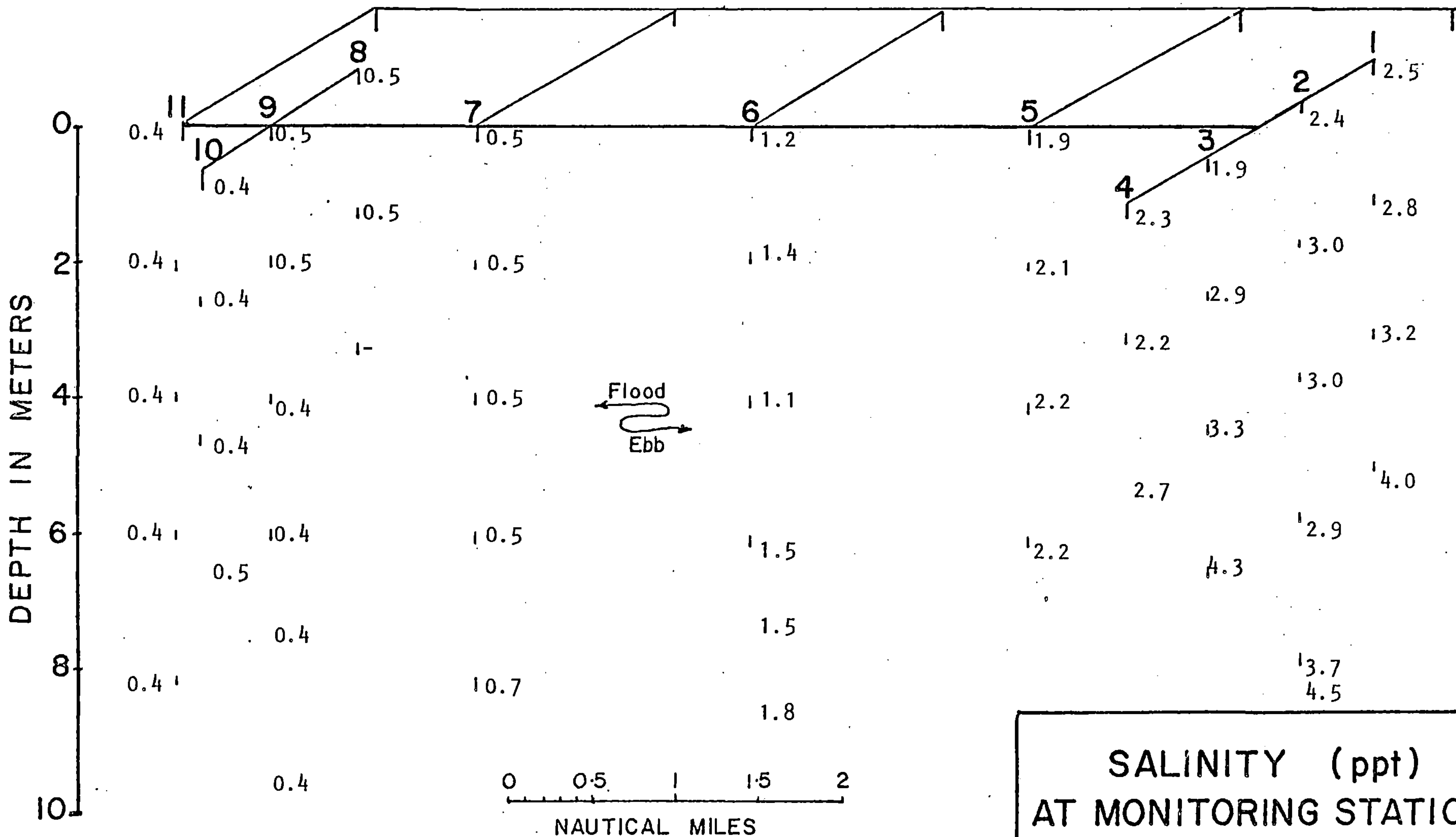

JAMES RIVER
JAMESTOWN ISLAND TO SKIFFES CREEK
DEPTH IN METERS
FLOOD
EBB
NAUTICAL MILES
TEMPERATURE (°C)
AT MONITORING STATIONS
FEBRUARY 1978

Figure 2.2-5

JAMES RIVER

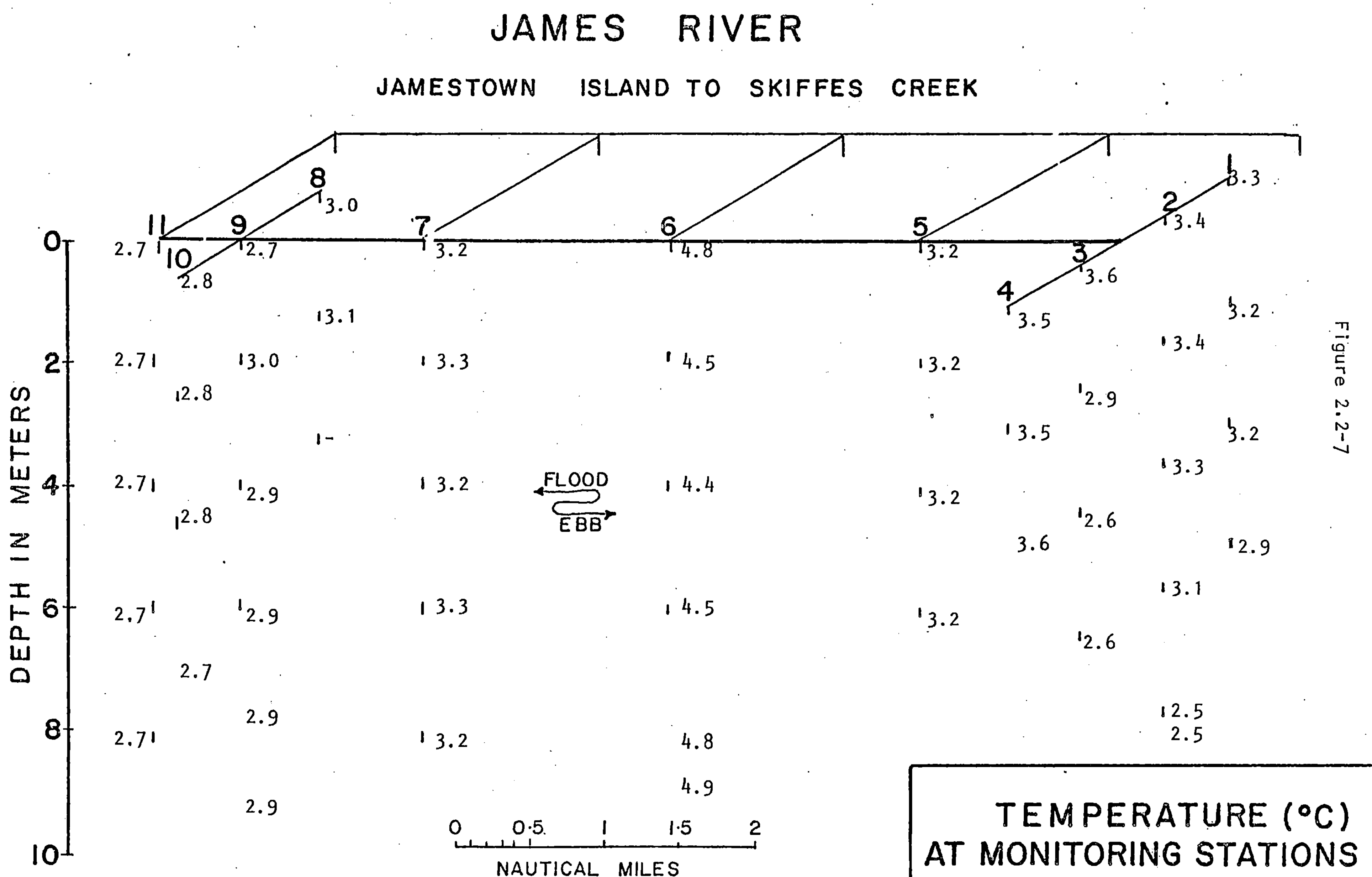
JAMESTOWN ISLAND TO SKIFFES CREEK



SALINITY (ppt)
AT MONITORING STATIONS
MARCH 1978

Figure 2.2-6

2.2-7



TEMPERATURE (°C) AT MONITORING STATIONS

MARCH 1978

Figure 2.2-7

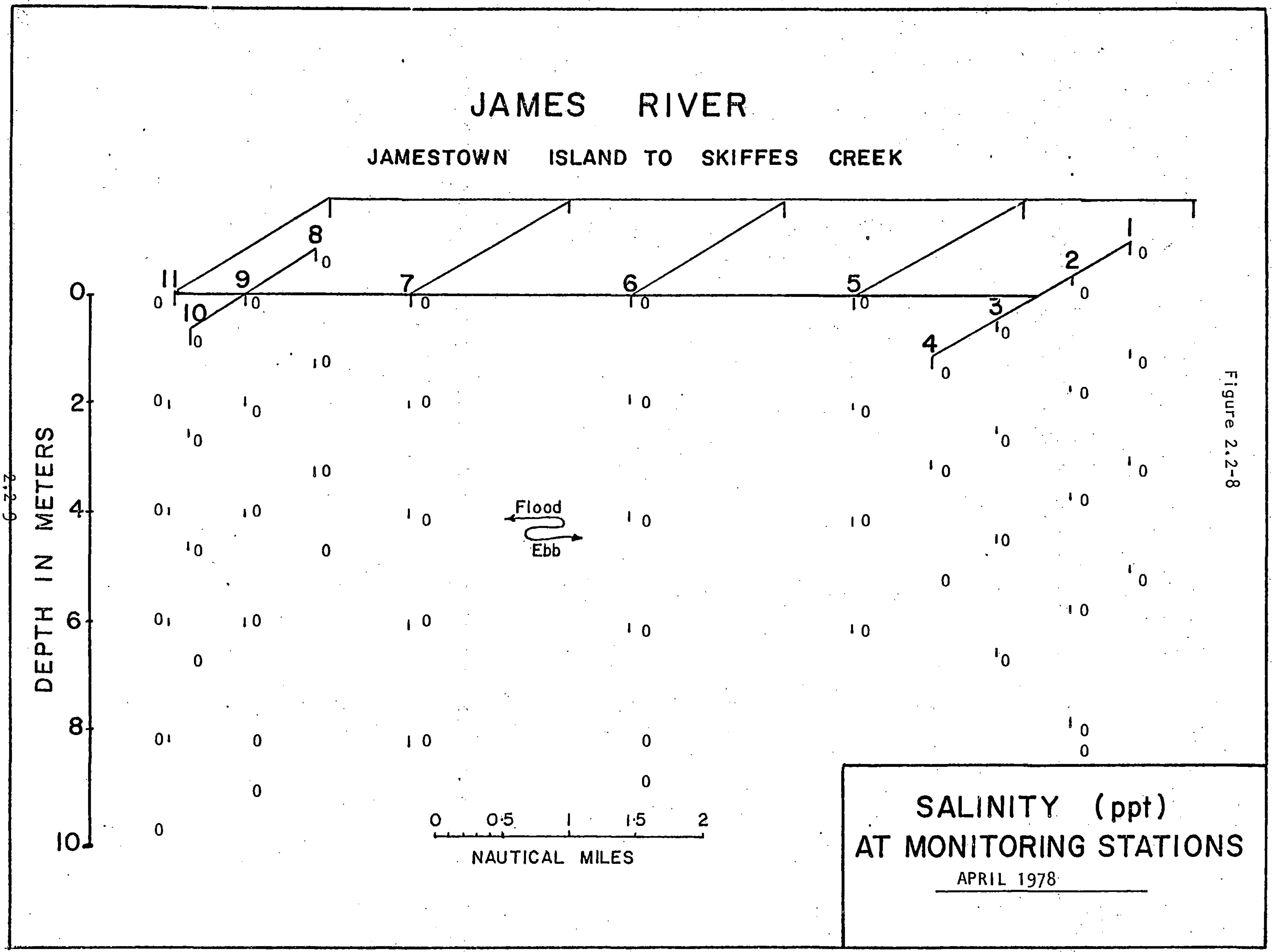
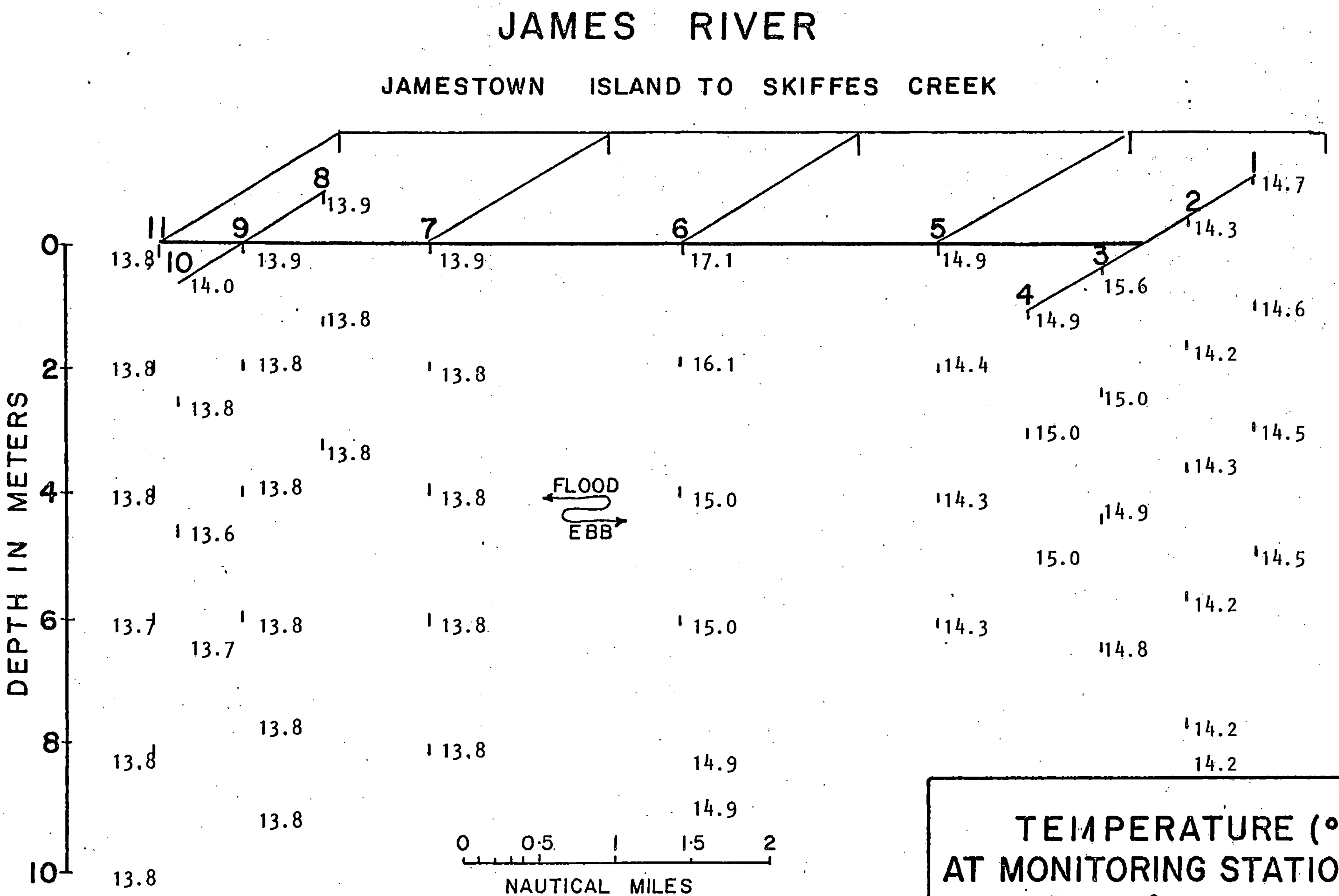

JAMES RIVER
JAMESTOWN ISLAND TO SKIFFES CREEK
DEPTH IN METERS
0
2
4
6
8
10
Flood
Ebb
0 0.5 1 1.5 2
NAUTICAL MILES
SALINITY (ppt)
AT MONITORING STATIONS
APRIL 1978

Figure 2.2-8



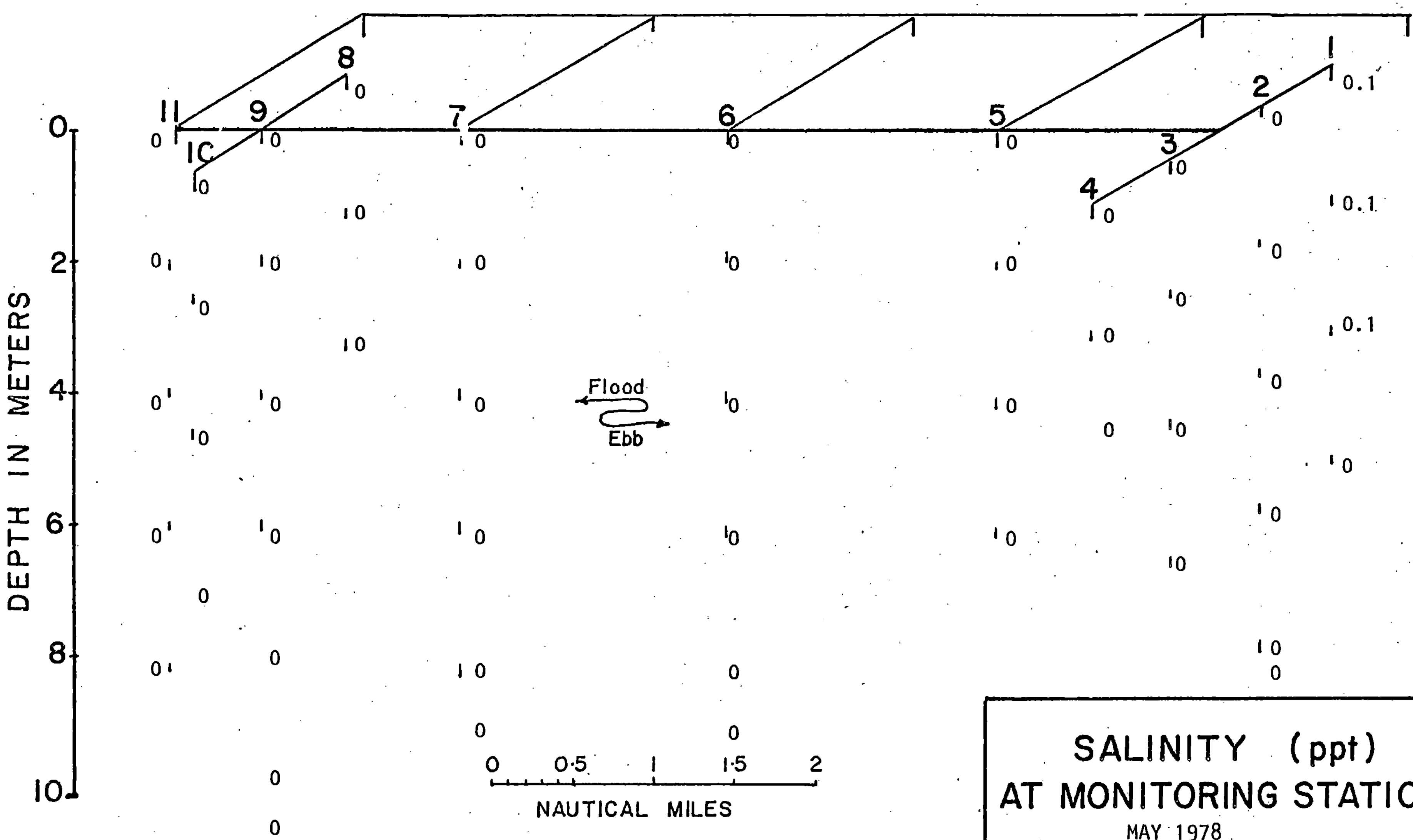
TEMPERATURE (°C) AT MONITORING STATIONS

APRIL 1978

Figure 2.2-9

JAMES RIVER

JAMESTOWN ISLAND TO SKIFFES CREEK



SALINITY (ppt)
AT MONITORING STATIONS
MAY 1978

Figure 2.2-10

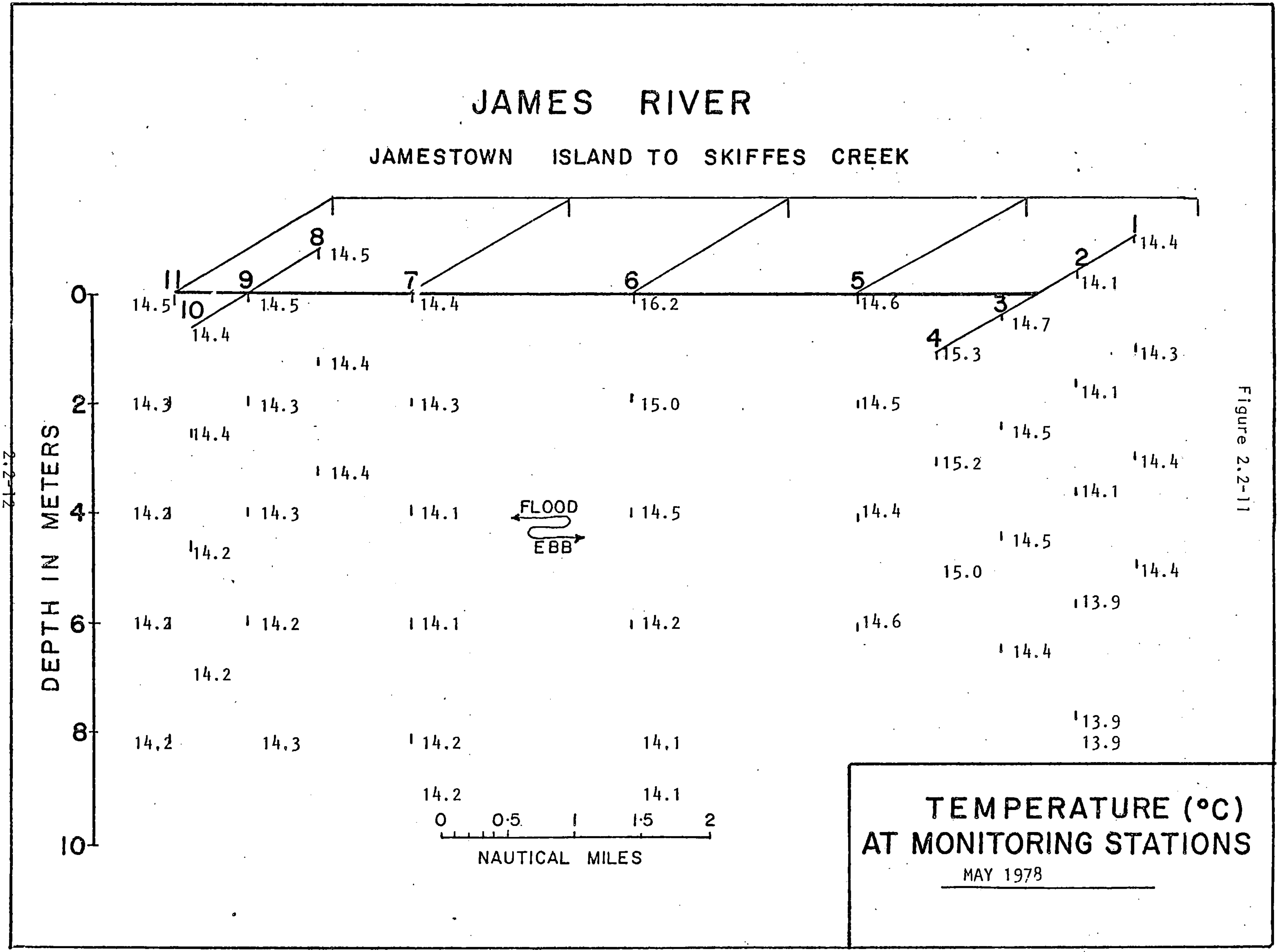
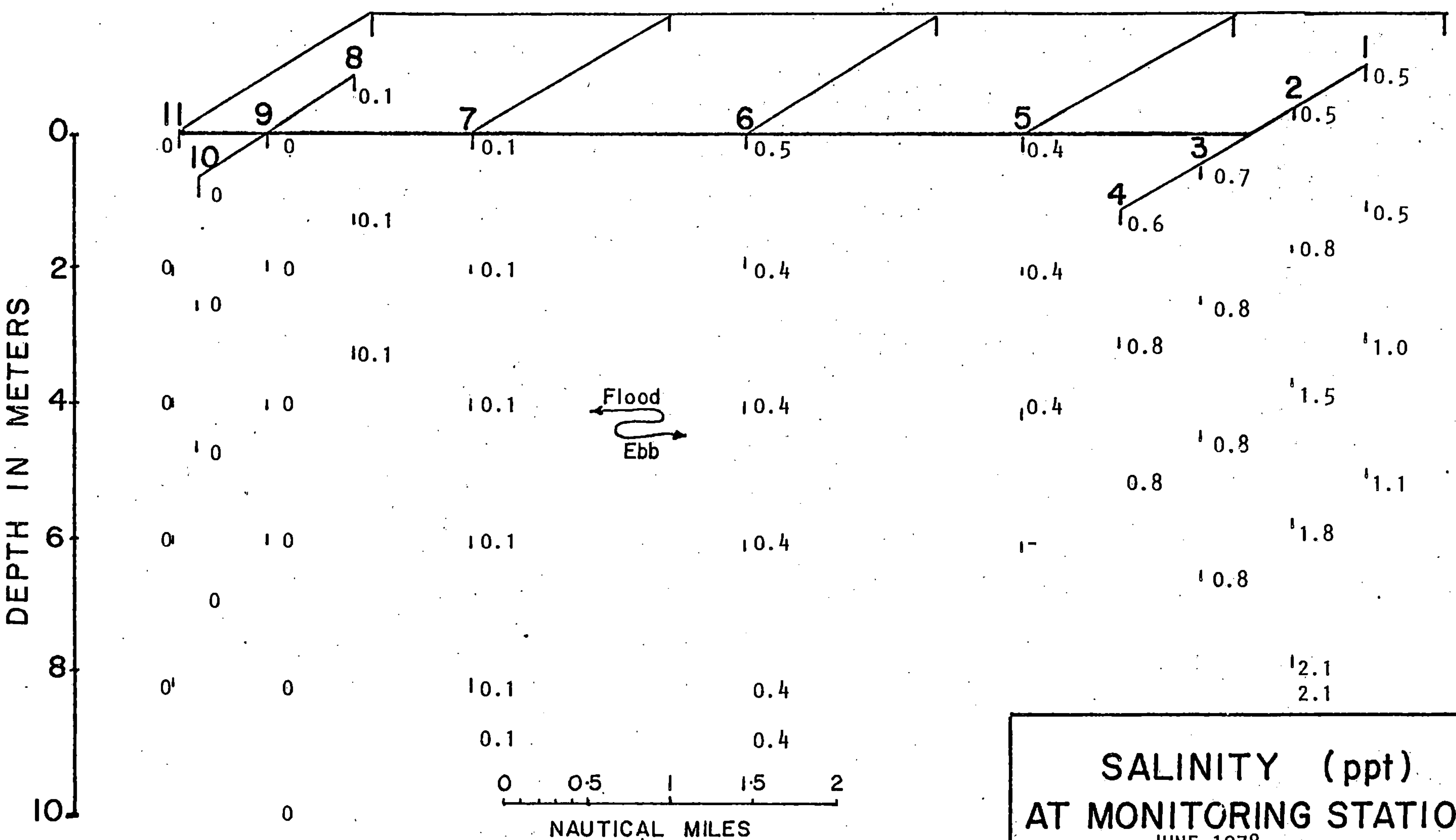

JAMES RIVER
JAMESTOWN ISLAND TO SKIFFES CREEK
DEPTH IN METERS
0
2
4
6
8
10
11
10
9
8
7
6
5
4
3
2
1
14.5
14.4
14.3
14.2
16.2
15.0
14.6
15.3
15.2
14.7
14.1
13.9
FLOOD
EBB
0 0·5 1 1·5 2
NAUTICAL MILES
TEMPERATURE (°C)
AT MONITORING STATIONS
MAY 1978

Figure 2.2-11

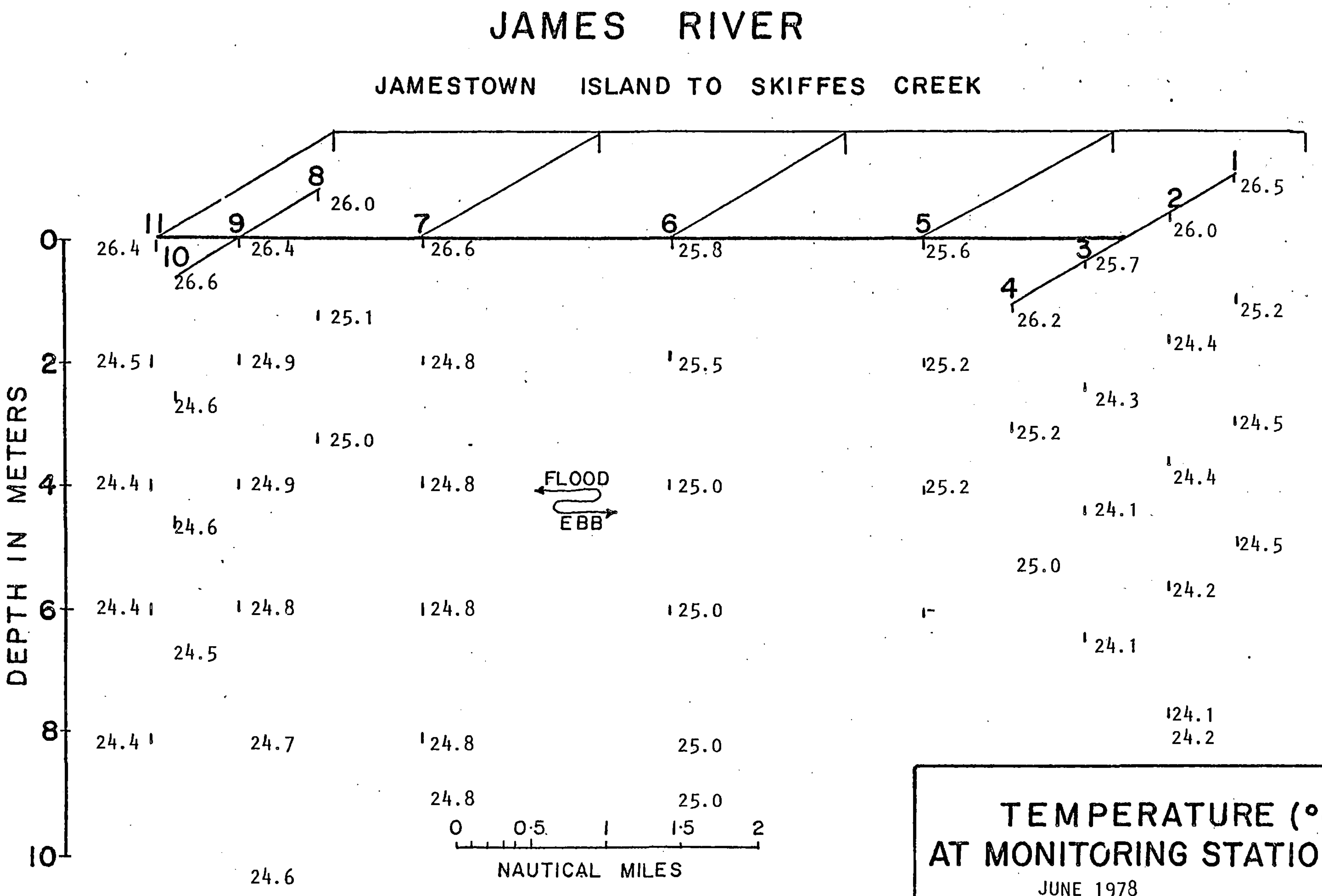
JAMES RIVER

JAMESTOWN ISLAND TO SKIFFES CREEK



SALINITY (ppt)
AT MONITORING STATIONS
JUNE 1978

Figure 2.2-12

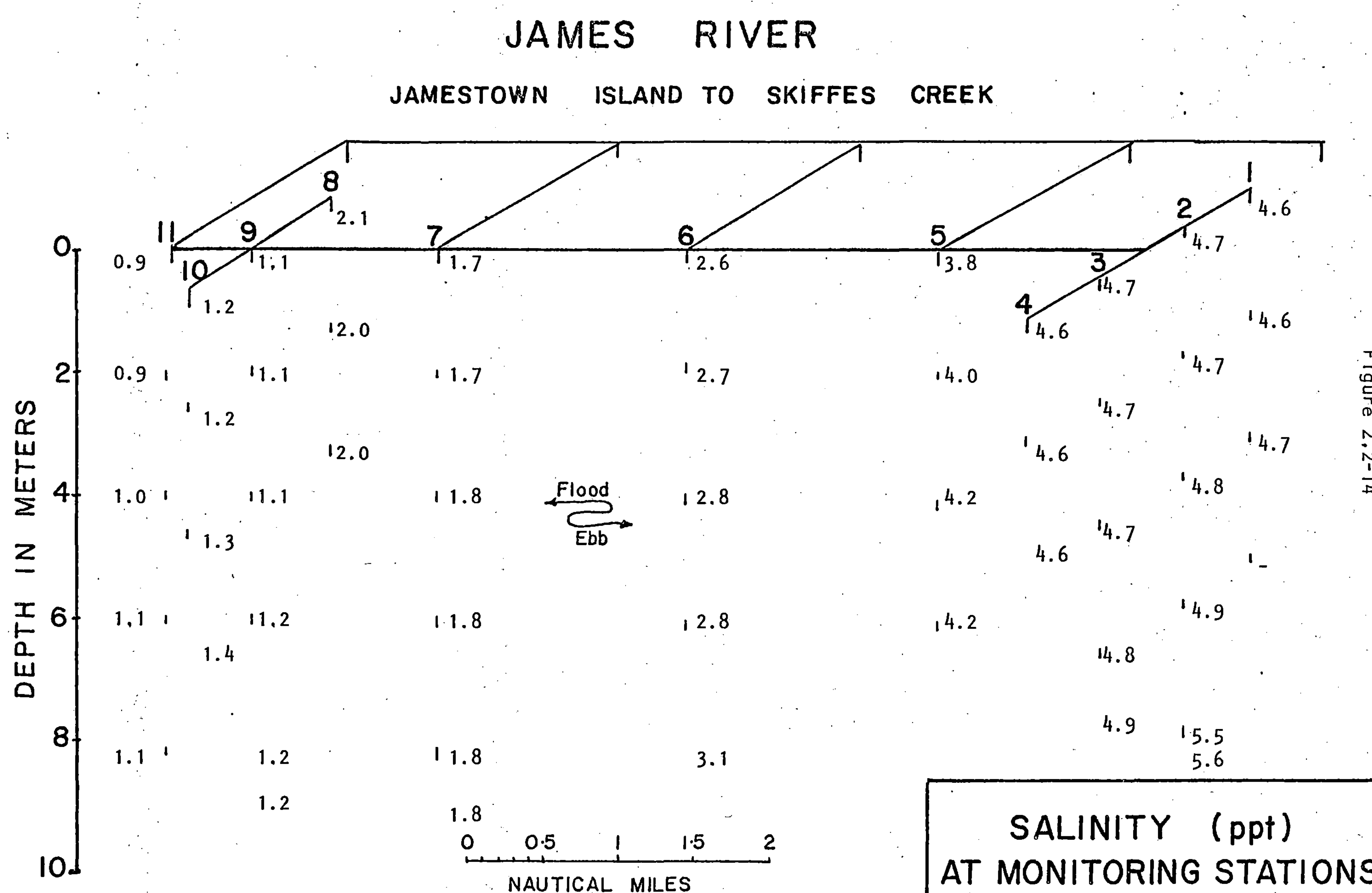


TEMPERATURE (°C) AT MONITORING STATIONS

JUNE 1978

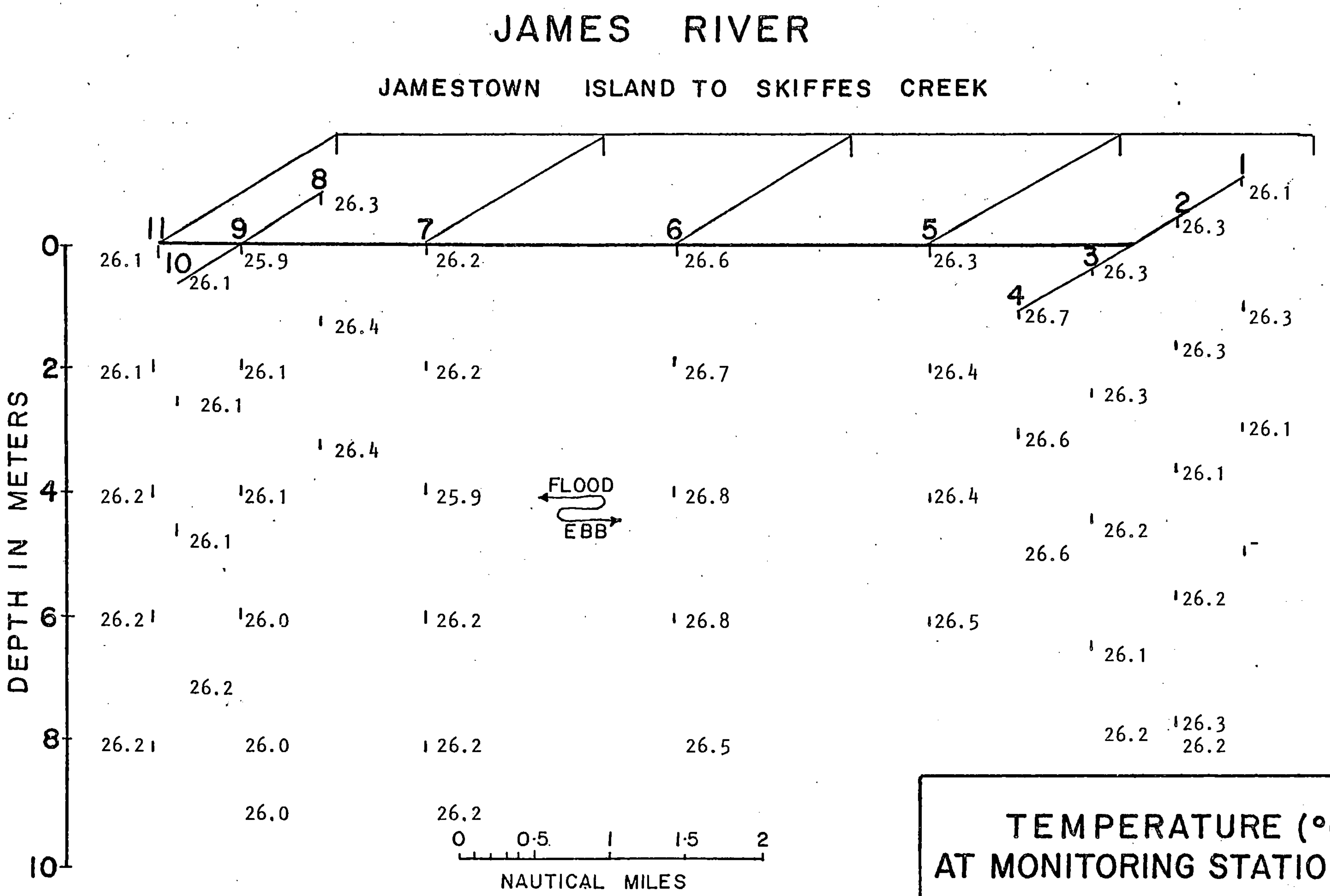
Figure 2.2-13

2.2-41



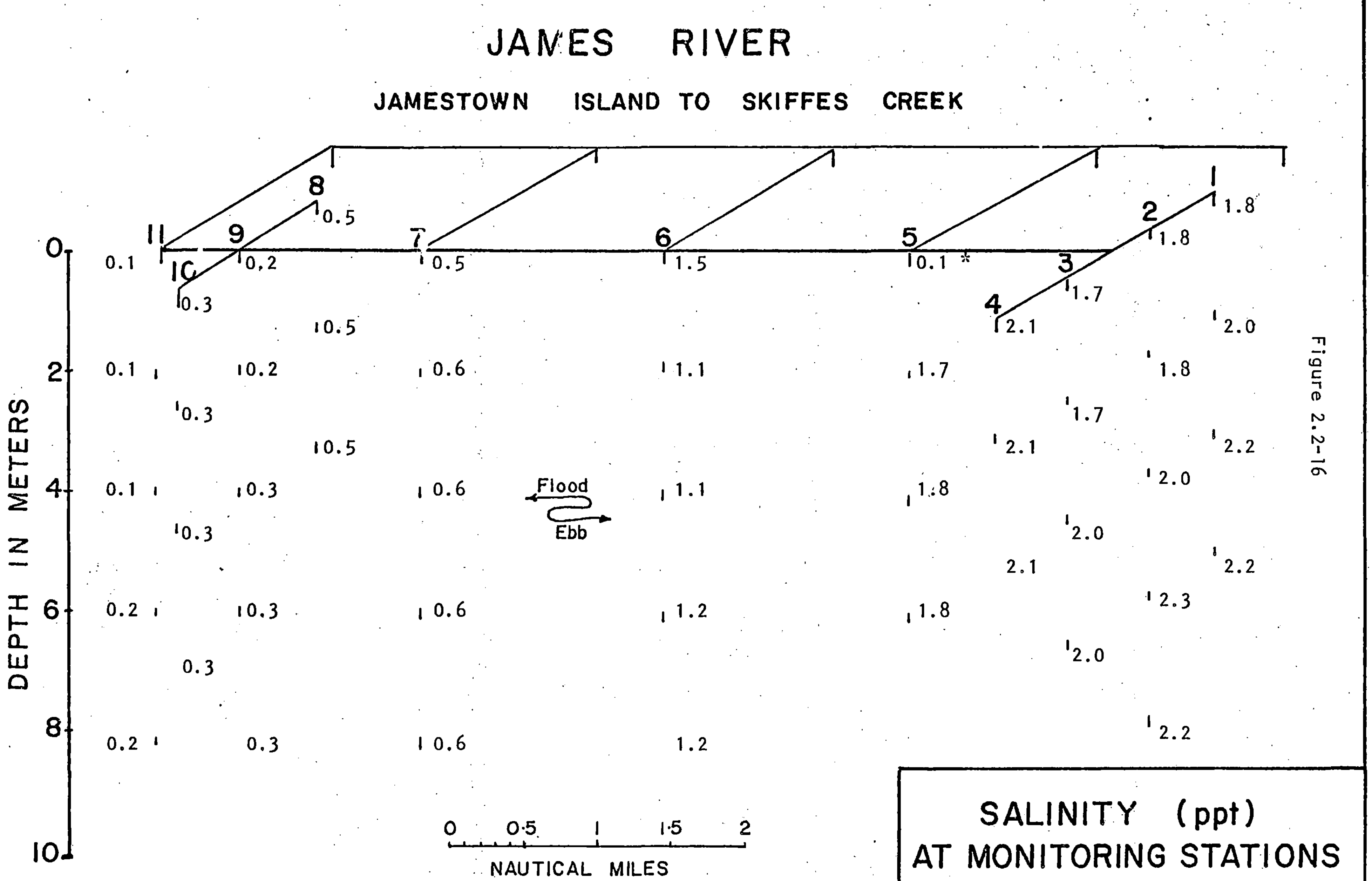
SALINITY (ppt)
AT MONITORING STATIONS
JULY 1978

Figure 2.2-14



TEMPERATURE (°C)
AT MONITORING STATIONS
JULY 1978

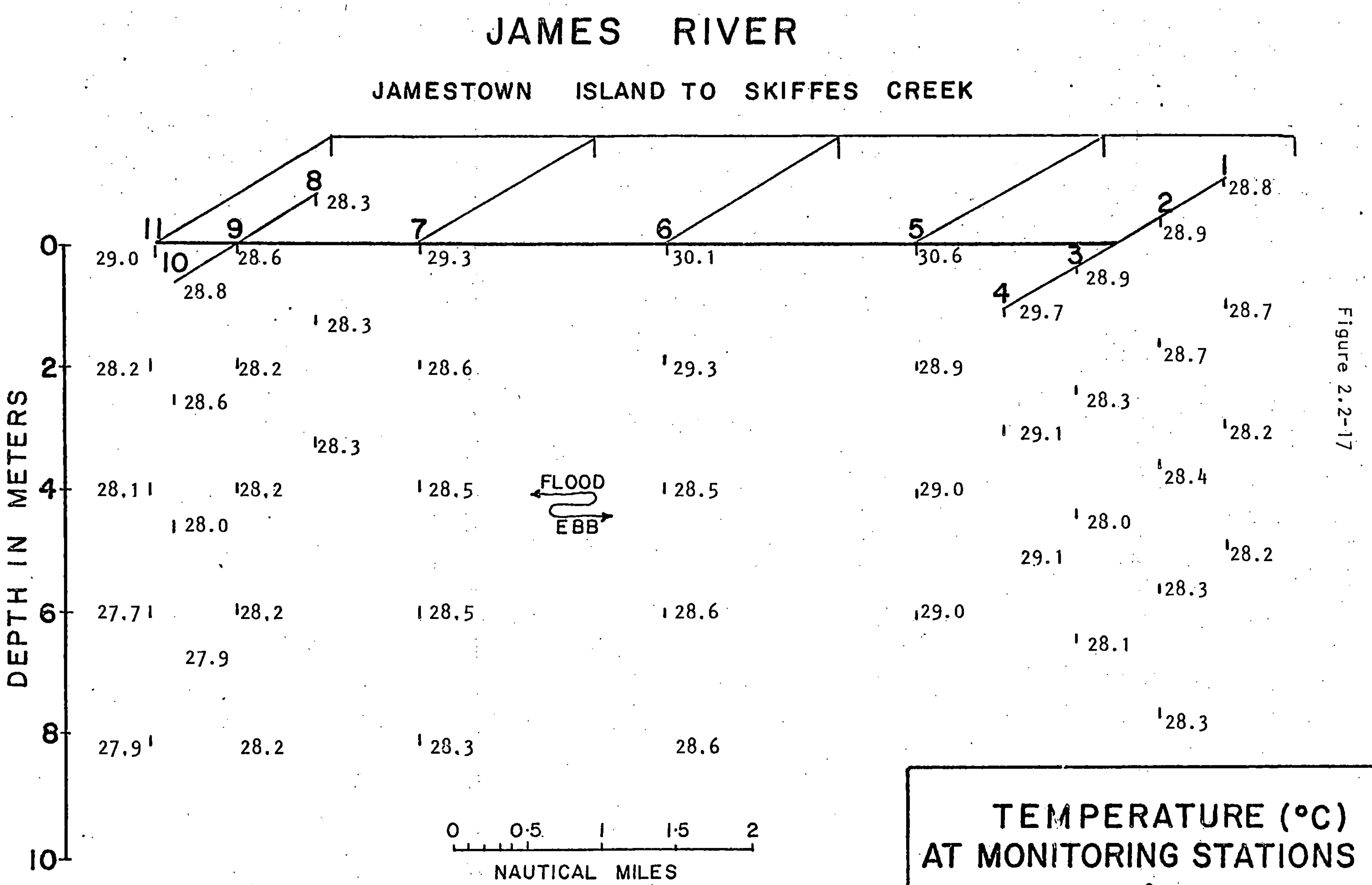
Figure 2.2-15



* Reading was taken twice for verification.

Figure 2.2-16

2.2-17



TEMPERATURE (°C)
AT MONITORING STATIONS
AUGUST 1978

Figure 2.2-17

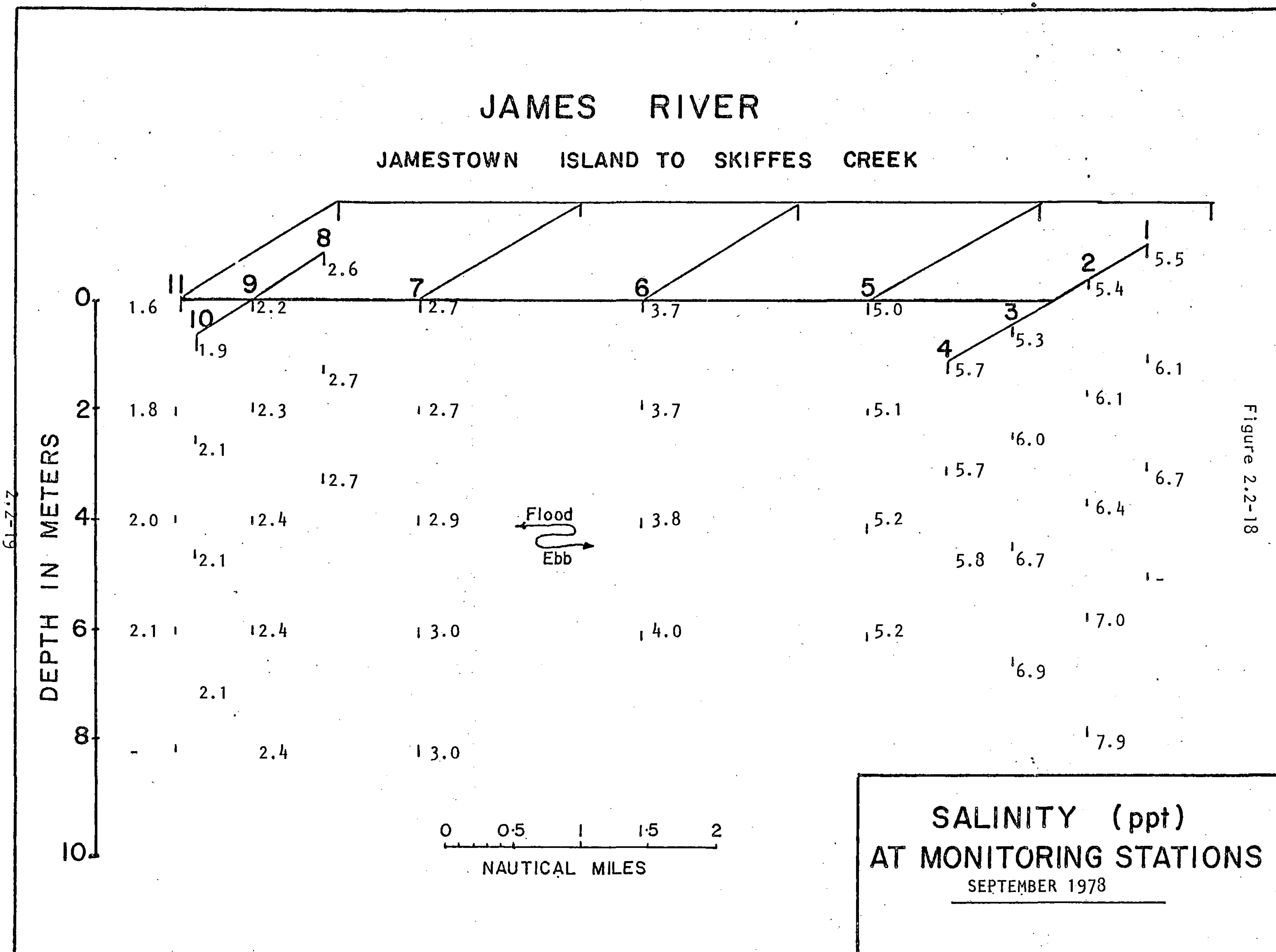
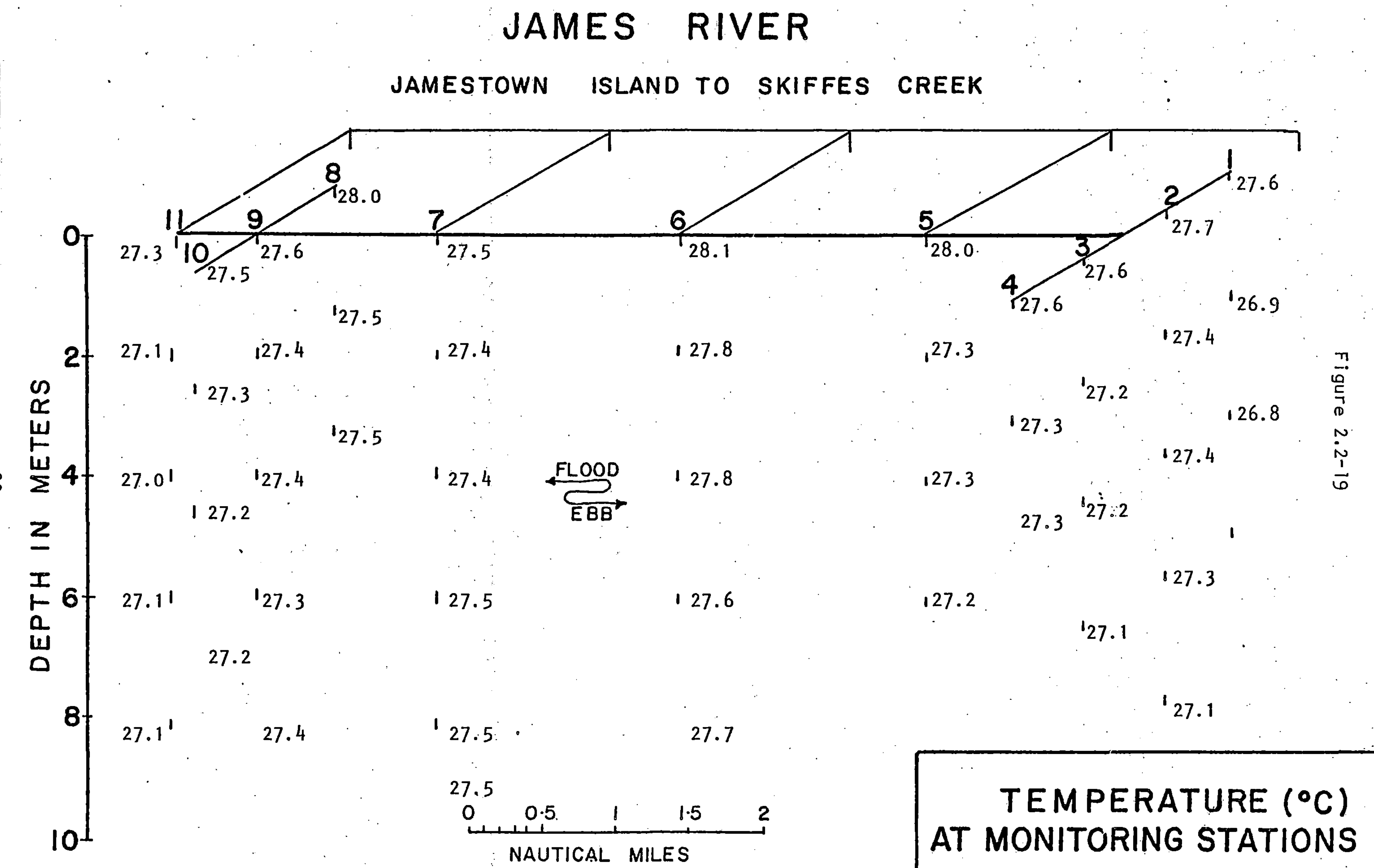

JAMES RIVER
JAMESTOWN ISLAND TO SKIFFES CREEK
DEPTH IN METERS
0
2
4
6
8
10
11
10
9
8
7
6
5
4
3
2
1
1.6
1.8
2.0
2.1
1.9
2.1
2.1
2.1
2.2
2.3
2.4
2.4
2.4
2.6
2.7
2.7
2.7
2.7
2.9
3.0
3.0
3.7
3.7
3.8
4.0
5.0
5.1
5.2
5.2
5.7
5.7
5.8
5.3
6.0
6.7
6.9
5.4
6.1
6.4
7.0
7.9
5.5
6.1
6.7
Flood
Ebb
0
0.5
1
1.5
2
NAUTICAL MILES
SALINITY (ppt)
AT MONITORING STATIONS
SEPTEMBER 1978

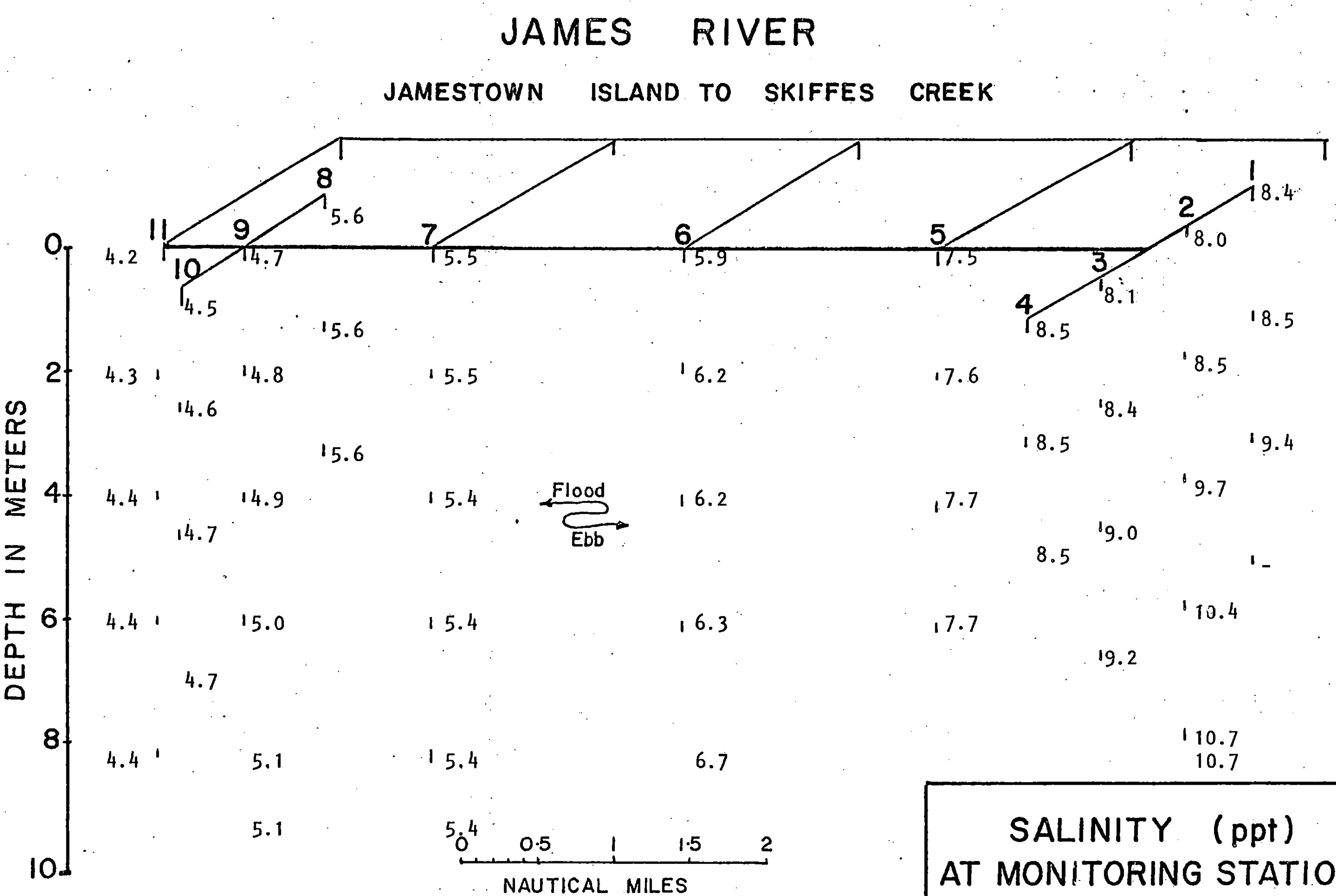
Figure 2.2-18



TEMPERATURE (°C) AT MONITORING STATIONS

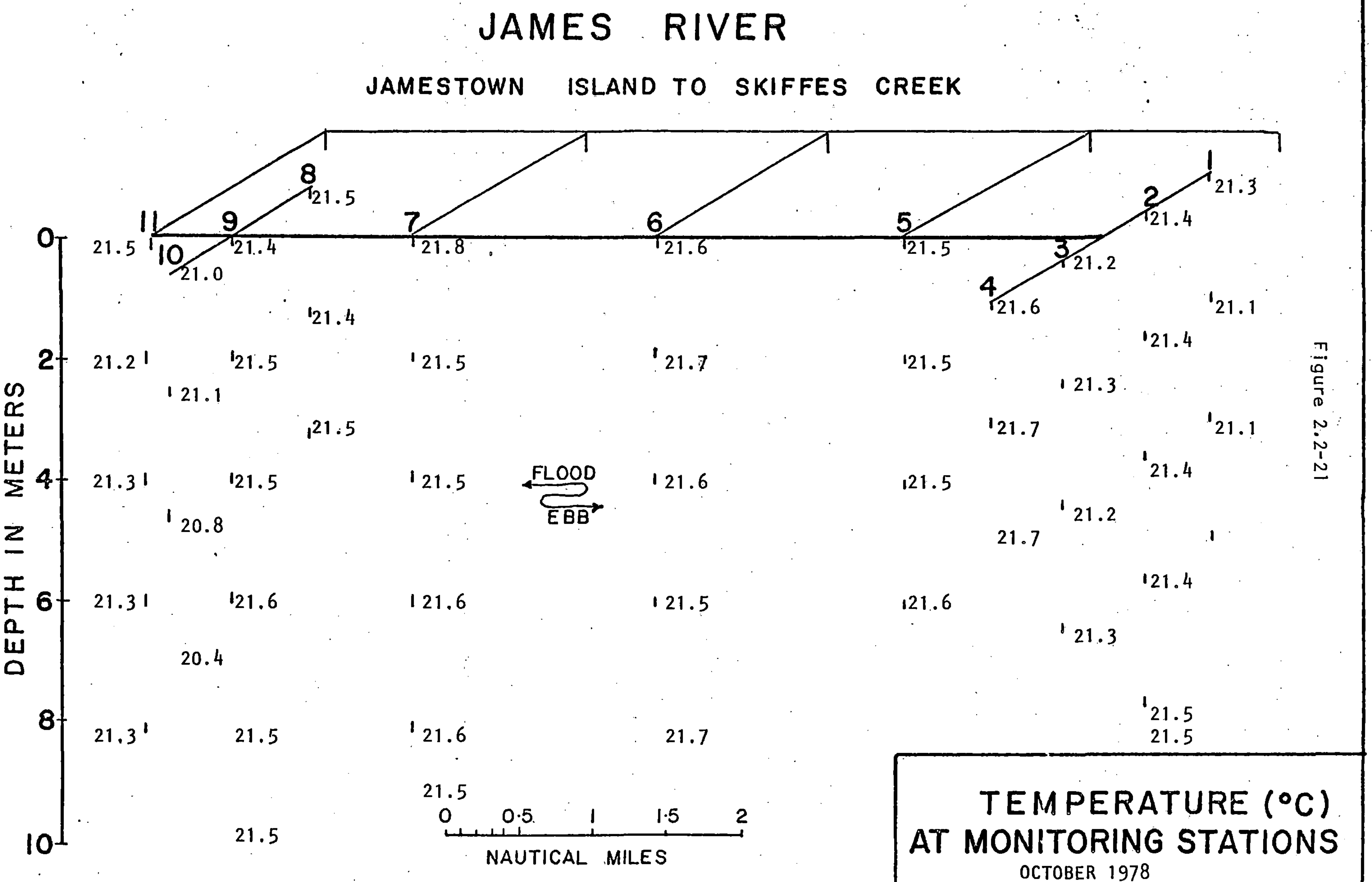
SEPTEMBER 1978

Figure 2.2-19



SALINITY (ppt)
AT MONITORING STATIONS
OCTOBER 1978

Figure 2.2-20



TEMPERATURE (°C) AT MONITORING STATIONS

OCTOBER 1978

Figure 2.2-21

2.2-22

JAMES RIVER

JAMESTOWN ISLAND TO SKIFFES CREEK

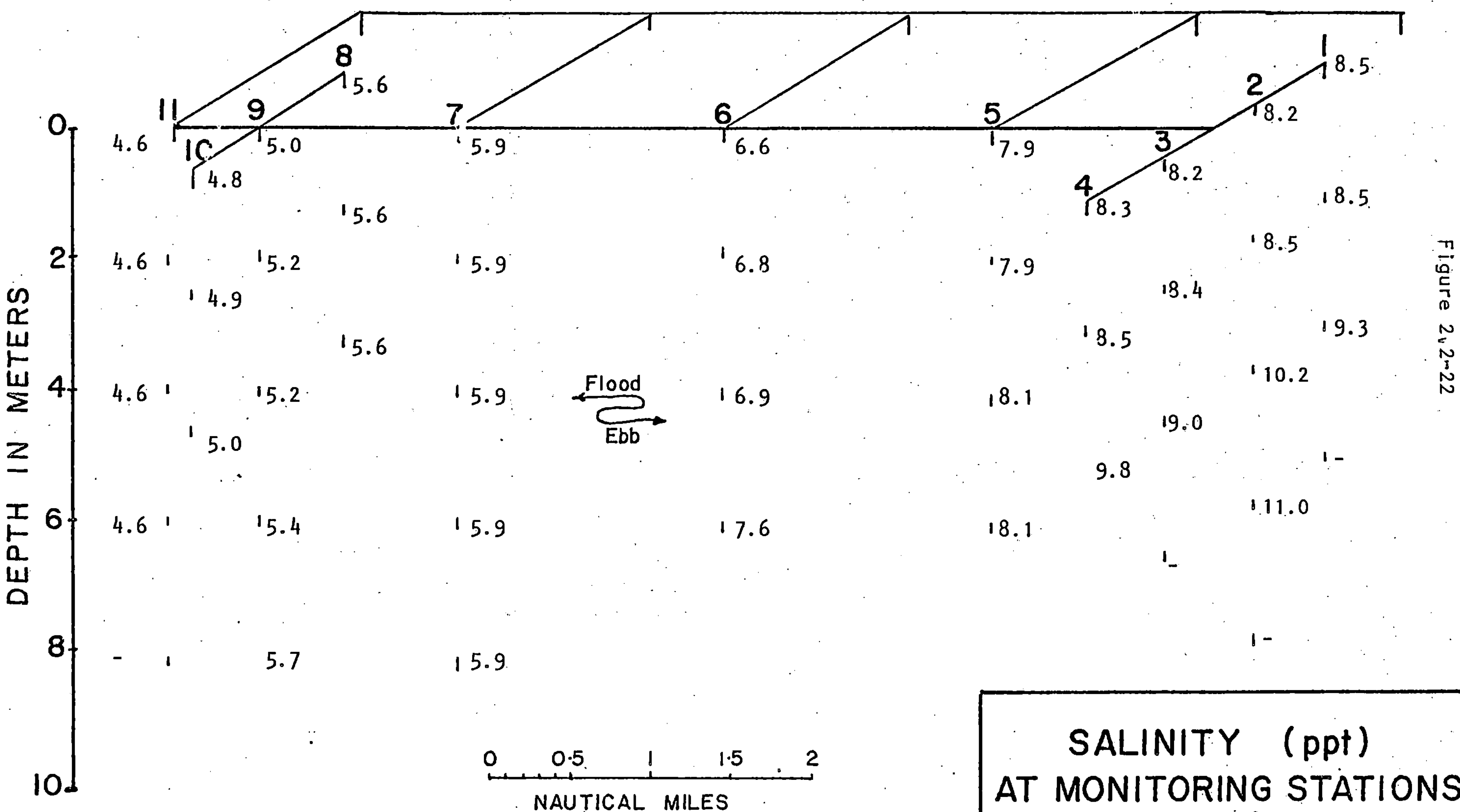
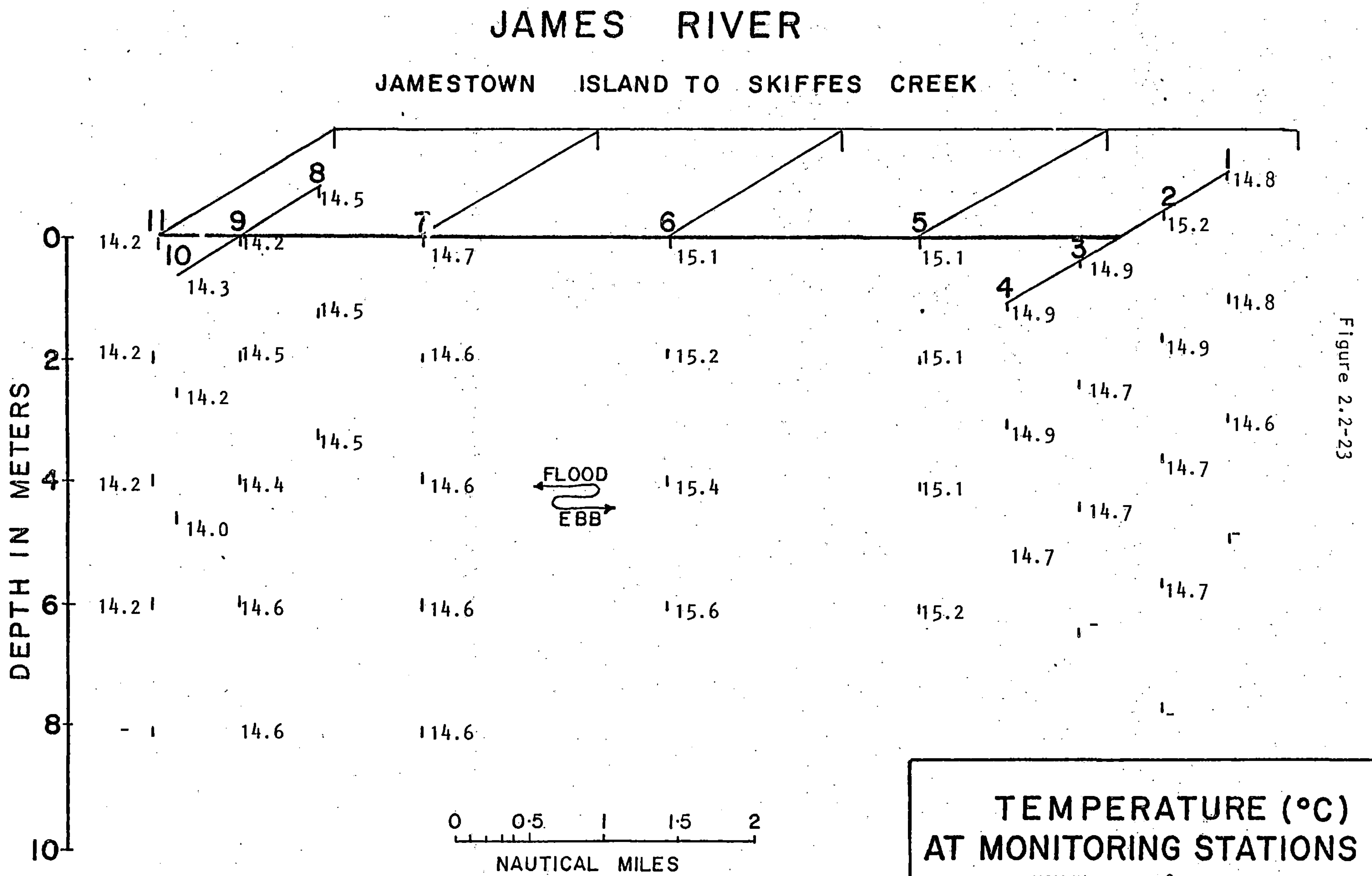


Figure 2.2-22

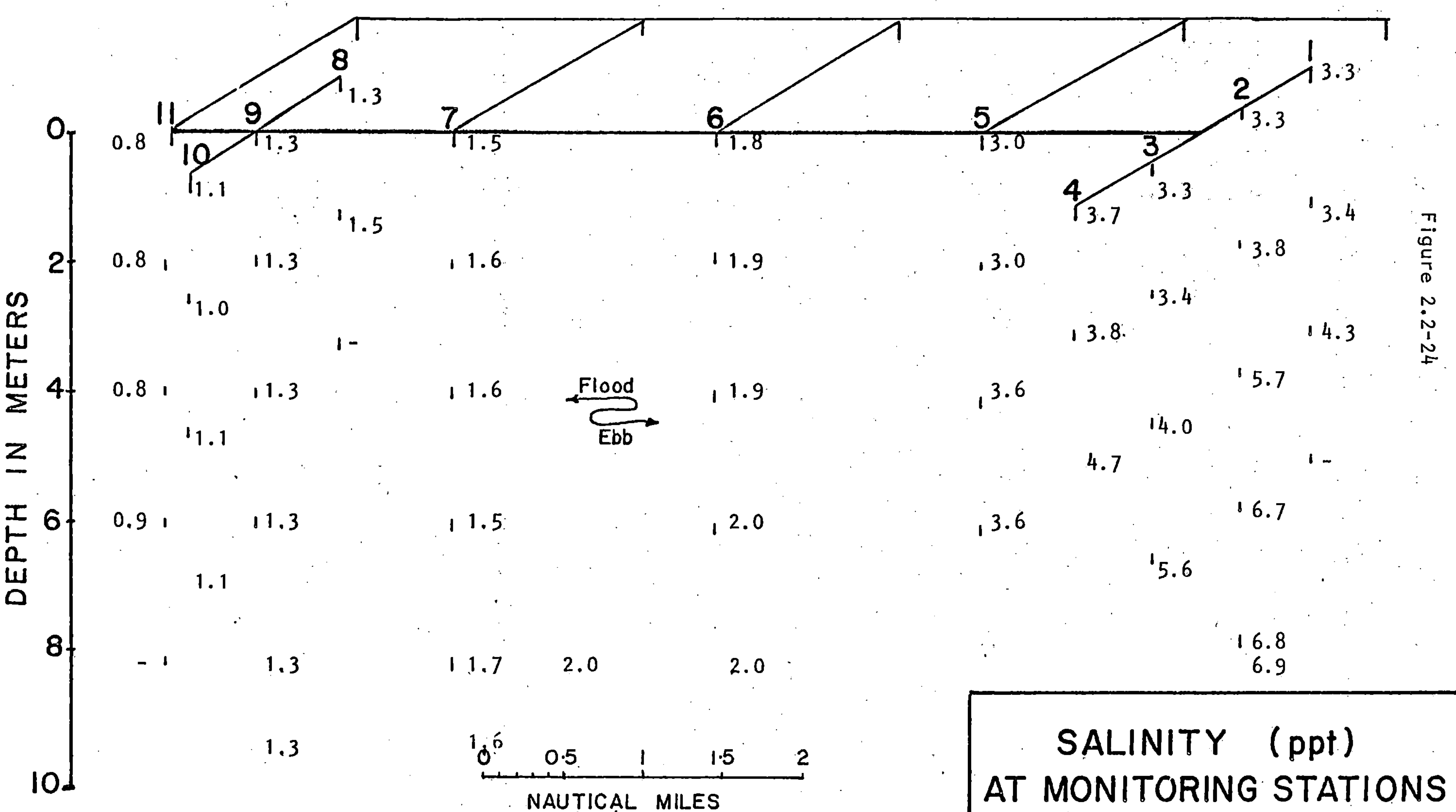
SALINITY (ppt)
AT MONITORING STATIONS
NOVEMBER 1978



TEMPERATURE (°C)
AT MONITORING STATIONS
NOVEMBER 1978

Figure 2.2-23

2.2-24



SALINITY (ppt)
AT MONITORING STATIONS
DECEMBER 1978

Figure 2.2-24

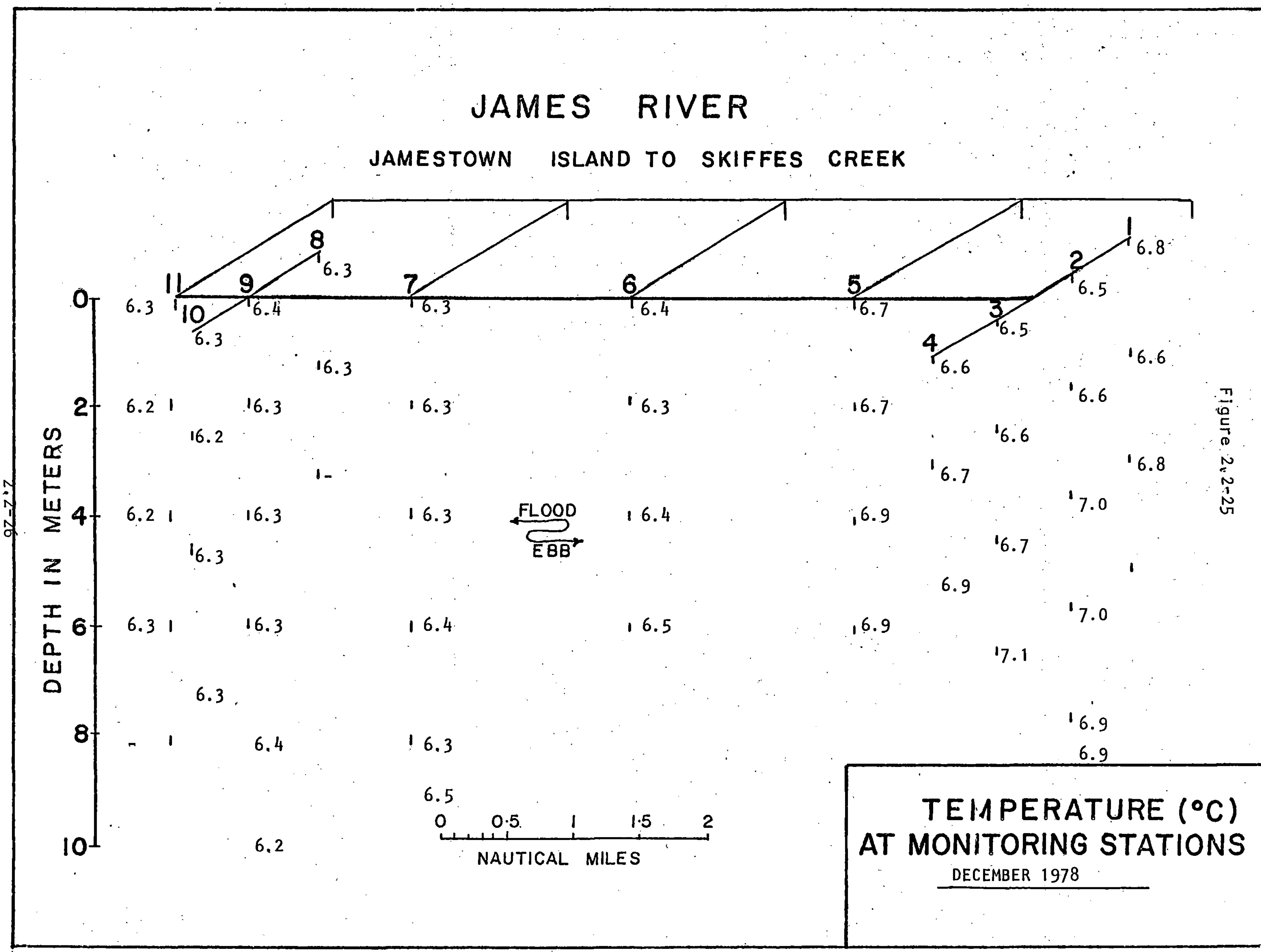

JAMES RIVER
JAMESTOWN ISLAND TO SKIFFES CREEK
DEPTH IN METERS
FLOOD
EBB
NAUTICAL MILES
TEMPERATURE (°C)
AT MONITORING STATIONS
DECEMBER 1978

Figure 2.2-25

2.3 FRESHWATER DISCHARGE OF THE JAMES RIVER AT RICHMOND AND HOG ISLAND

The daily freshwater discharge of the James River and the James River and Kanawha Canal gages at Richmond have been combined and tabulated in Table 2.3-1. The calculated freshwater flow at Hog Island is also tabulated in Table 2.3-1.

The freshwater flow of the James River at Hog Island has been calculated using the flow at Richmond and the relative drainage area of the James River above and below Richmond to Hog Island. The area above Richmond is 6757 square miles and the area from Richmond to Hog Island is 2760 square miles.

Therefore:

$$B = A \times \frac{(6757 + 2760)}{6757}$$

Where: B = Flow at Hog Island

A = Flow at Richmond

The time of flow from Richmond to Hog Island is variable, being dependent upon the flow at Richmond.

TABLE 2.3.1

FRESHWATER DISCHARGE OFTHE JAMES RIVER AT RICHMOND AND HOG ISLAND

JANUARY - DECEMBER, 1978

DATE	JAMES RIVER DISCHARGE AT RICHMOND C.F.S.	CALCULATED JAMES RIVER DISCHARGE AT HOG POINT C.F.S.
JANUARY 1, 1978	6520	9183
JANUARY 2, 1978	6370	8972
JANUARY 3, 1978	6090	8578
JANUARY 4, 1978	5560	7831
JANUARY 5, 1978	5542	7806
JANUARY 6, 1978	5274	7428
JANUARY 7, 1978	5422	7637
JANUARY 8, 1978	5780	8141
JANUARY 9, 1978	23380	32930
JANUARY 10, 1978	43980	61945
JANUARY 11, 1978	30340	42733
JANUARY 12, 1978	20940	29493
JANUARY 13, 1978	14940	21043
JANUARY 14, 1978	14922	21017
JANUARY 15, 1978	17360	24451
JANUARY 16, 1978	14022	19750
JANUARY 17, 1978	11022	15524
JANUARY 18, 1978	16880	23775
JANUARY 19, 1978	19360	27268
JANUARY 20, 1978	16360	23043
JANUARY 21, 1978	13560	19099
JANUARY 22, 1978	10700	15071
JANUARY 23, 1978	8860	12479
JANUARY 24, 1978	7720	10873
JANUARY 25, 1978	9030	12718
JANUARY 26, 1978	50920	71719
JANUARY 27, 1978	98100	138171
JANUARY 28, 1978	76440	107663
JANUARY 29, 1978	27590	38860
JANUARY 30, 1978	26372	37144
JANUARY 31, 1978	18840	26536

TABLE 2.3.1 (CONT'D)

DATE	JAMES RIVER DISCHARGE AT RICHMOND C.F.S.	CALCULATED JAMES RIVER DISCHARGE AT HOG POINT C.F.S.	
FEBRUARY 1, 1978	15440	21747	
FEBRUARY 2, 1978	13140	18507	
FEBRUARY 3, 1978	11040	15550	
FEBRUARY 4, 1978	9902	13947	
FEBRUARY 5, 1978	9002	12679	
FEBRUARY 6, 1978	7992	11256	
FEBRUARY 7, 1978	7682	10820	
FEBRUARY 8, 1978	6642	9355	
FEBRUARY 9, 1978	6352	8947	
FEBRUARY 10, 1978	6352	8947	
FEBRUARY 11, 1978	6212	8749	
FEBRUARY 12, 1978	6072	8552	
FEBRUARY 13, 1978	5942	8369	
FEBRUARY 14, 1978	5664	7978	
FEBRUARY 15, 1978	5720	8056	**
FEBRUARY 16, 1978	5580	7859	**
FEBRUARY 17, 1978	5860	8254	**
FEBRUARY 18, 1978	5580	7859	**
FEBRUARY 19, 1978	5720	8056	**
FEBRUARY 20, 1978	5580	7859	**
FEBRUARY 21, 1978	5580	7859	**
FEBRUARY 22, 1978	5720	8056	**
FEBRUARY 23, 1978	5860	8254	**
FEBRUARY 24, 1978	6010	8465	**
FEBRUARY 25, 1978	5580	7859	**
FEBRUARY 26, 1978	5720	8056	**
FEBRUARY 27, 1978	6450	9085	**
FEBRUARY 28, 1978	7230	10183	**

** CALCULATION BASED ON JAMES RIVER FLOW ONLY DUE TO MALFUNCTION OF KANAWAH CANAL GAGE.

TABLE 2.3.1 (CONT'D)

DATE	JAMES RIVER DISCHARGE AT RICHMOND C.F.S.	CALCULATED JAMES RIVER DISCHARGE AT HOG POINT C.F.S.	
MARCH 1, 1978	7400	10423	**
MARCH 2, 1978	7070	9958	**
MARCH 3, 1978	6910	9733	**
MARCH 4, 1978	6790	9564	**
MARCH 5, 1978	6300	8873	**
MARCH 6, 1978	6160	8676	**
MARCH 7, 1978	5720	8056	**
MARCH 8, 1978	5860	8254	**
MARCH 9, 1978	5720	8056	**
MARCH 10, 1978	8980	12648	**
MARCH 11, 1978	29700	41832	**
MARCH 12, 1978	33600	47325	**
MARCH 13, 1978	33000	46480	**
MARCH 14, 1978	30300	42677	**
MARCH 15, 1978	35000	49296	**
MARCH 16, 1978	50800	71550	**
MARCH 17, 1978	55200	77748	**
MARCH 18, 1978	33600	47325	**
MARCH 19, 1978	22600	31831	**
MARCH 20, 1978	17400	24507	**
MARCH 21, 1978	15000	21127	**
MARCH 22, 1978	13500	19014	**
MARCH 23, 1978	13500	19014	**
MARCH 24, 1978	13100	18451	**
MARCH 25, 1978	12200	17183	**
MARCH 26, 1978	12600	17747	**
MARCH 27, 1978	29100	40986	**
MARCH 28, 1978	57000	80283	**
MARCH 29, 1978	52600	74086	**
MARCH 30, 1978	28500	40141	**
MARCH 31, 1978	21000	29578	**

** CALCULATION BASED ON JAMES RIVER FLOW ONLY DUE TO MALFUNCTION OF KANAWAH CANAL GAGE.

TABLE 2.3.1 (CONT'D)

DATE	JAMES RIVER DISCHARGE AT RICHMOND C.F.S.	CALCULATED JAMES RIVER DISCHARGE AT HOG POINT C.F.S.	
APRIL 1, 1978	16900	23803	**
APRIL 2, 1978	14500	20423	**
APRIL 3, 1978	12600	17747	**
APRIL 4, 1978	11300	15916	**
APRIL 5, 1978	10100	14226	**
APRIL 6, 1978	9550	13451	**
APRIL 7, 1978	8610	12127	**
APRIL 8, 1978	8250	11620	**
APRIL 9, 1978	7730	10887	**
APRIL 10, 1978	7230	10183	**
APRIL 11, 1978	7070	9958	**
APRIL 12, 1978	6600	9296	**
APRIL 13, 1978	6450	9085	**
APRIL 14, 1978	6160	8676	**
APRIL 15, 1978	5860	8254	**
APRIL 16, 1978	5720	8056	**
APRIL 17, 1978	5430	7648	**
APRIL 18, 1978	5290	7451	**
APRIL 19, 1978	5430	7648	**
APRIL 20, 1978	6600	9296	**
APRIL 21, 1978	6010	8465	**
APRIL 22, 1978	5430	7648	**
APRIL 23, 1978	5290	7451	**
APRIL 24, 1978	5150	7254	**
APRIL 25, 1978	5010	7056	**
APRIL 26, 1978	6450	9085	**
APRIL 27, 1978	37070	52212	
APRIL 28, 1978	66600	93804	**
APRIL 29, 1978	50000	70424	**
APRIL 30, 1978	24800	34930	**

** CALCULATION BASED ON JAMES RIVER FLOW ONLY DUE TO MALFUNCTION OF KANAWAH CANAL GAGE.

TABLE 2.3.1 (CONT'D)

DATE	JAMES RIVER DISCHARGE AT RICHMOND C.F.S.	CALCULATED JAMES RIVER DISCHARGE AT HOG POINT C.F.S.	
MAY 1, 1978	17900	25212	**
MAY 2, 1978	14500	20423	**
MAY 3, 1978	12200	17183	**
MAY 4, 1978	11800	16620	**
MAY 5, 1978	29100	40986	**
MAY 6, 1978	27800	39155	**
MAY 7, 1978	17900	25212	**
MAY 8, 1978	15400	21690	**
MAY 9, 1978	19400	27324	**
MAY 10, 1978	24300	34226	**
MAY 11, 1978	22000	30986	**
MAY 12, 1978	16900	23803	**
MAY 13, 1978	14440	20338	
MAY 14, 1978	19880	28000	
MAY 15, 1978	44180	62226	
MAY 16, 1978	36000	50705	
MAY 17, 1978	30100	42395	
MAY 18, 1978	25060	35296	
MAY 19, 1978	21380	30113	
MAY 20, 1978	18420	25944	
MAY 21, 1978	15500	21831	
MAY 22, 1978	13180	18564	
MAY 23, 1978	11480	16169	
MAY 24, 1978	10340	14564	
MAY 25, 1978	9610	13535	
MAY 26, 1978	9060	12761	
MAY 27, 1978	8230	11592	
MAY 28, 1978	7910	11141	
MAY 29, 1978	7280	10254	
MAY 30, 1978	6850	9648	
MAY 31, 1978	6700	9437	

** CALCULATION BASED ON JAMES RIVER FLOW ONLY DUE TO MALFUNCTION OF KANAWAH CANAL GAGE.

TABLE 2.3.1 (CONT'D)

DATE	JAMES RIVER DISCHARGE AT RICHMOND C.F.S.	CALCULATED JAMES RIVER DISCHARGE AT HOG POINT C.F.S.
JUNE 1, 1978	6700	9437
JUNE 2, 1978	6990	9845
JUNE 3, 1978	7300	10282
JUNE 4, 1978	7600	10704
JUNE 5, 1978	6990	9845
JUNE 6, 1978	6110	8606
JUNE 7, 1978	5820	8197
JUNE 8, 1978	5690	8014
JUNE 9, 1978	5422	7637
JUNE 10, 1978	5422	7637
JUNE 11, 1978	5162	7271
JUNE 12, 1978	4774	6724
JUNE 13, 1978	4644	6541
JUNE 14, 1978	4644	6541
JUNE 15, 1978	4774	6724
JUNE 16, 1978	4386	6178
JUNE 17, 1978	4156	5854
JUNE 18, 1978	4108	5786
JUNE 19, 1978	3988	5617
JUNE 20, 1978	4126	5811
JUNE 21, 1978	4792	6749
JUNE 22, 1978	5460	7690
JUNE 23, 1978	5460	7690
JUNE 24, 1978	5310	7479
JUNE 25, 1978	4404	6203
JUNE 26, 1978	3986	5614
JUNE 27, 1978	4086	5755
JUNE 28, 1978	5860	8254
JUNE 29, 1978	6390	9000
JUNE 30, 1978	5042	7102

TABLE 2.3.1 (CONT'D)

DATE	JAMES RIVER DISCHARGE AT RICHMOND C.F.S.	CALCULATED JAMES RIVER DISCHARGE AT HOG POINT C.F.S.
JULY 1, 1978	4256	5994
JULY 2, 1978	4026	5671
JULY 3, 1978	3688	5194
JULY 4, 1978	3280	4620
JULY 5, 1978	3606	5079
JULY 6, 1978	4274	6020
JULY 7, 1978	4226	5952
JULY 8, 1978	3608	5082
JULY 9, 1978	3756	5290
JULY 10, 1978	4810	6775
JULY 11, 1978	4524	6372
JULY 12, 1978	3856	5431
JULY 13, 1978	3756	5290
JULY 14, 1978	3418	4814
JULY 15, 1978	3418	4814
JULY 16, 1978	3488	4913
JULY 17, 1978	3786	5332
JULY 18, 1978	4144	5837
JULY 19, 1978	4056	5713
JULY 20, 1978	3826	5389
JULY 21, 1978	3608	5082
JULY 22, 1978	3090	4352
JULY 23, 1978	2832	3989
JULY 24, 1978	2692	3792
JULY 25, 1978	2812	3961
JULY 26, 1978	4162	5862
JULY 27, 1978	4542	6397
JULY 28, 1978	3906	5501
JULY 29, 1978	3230	4549
JULY 30, 1978	3248	4575
JULY 31, 1978	3090	4352

TABLE 2.3.1 (CONT'D)

DATE	JAMES RIVER DISCHARGE AT RICHMOND C.F.S.	CALCULATED JAMES RIVER DISCHARGE AT HOG POINT C.F.S.	
AUGUST 1, 1978	2990	4211	
AUGUST 2, 1978	3366	4741	
AUGUST 3, 1978	4174	5879	
AUGUST 4, 1978	4960	6986	
AUGUST 5, 1978	5330	7507	
AUGUST 6, 1978	5730	8071	
AUGUST 7, 1978	5580	7859	
AUGUST 8, 1978	4792	6749	
AUGUST 9, 1978	5200	7324	
AUGUST 10, 1978	5180	7296	
AUGUST 11, 1978	4644	6541	
AUGUST 12, 1978	6000	8451	
AUGUST 13, 1978	5560	7831	
AUGUST 14, 1978	4792	6749	
AUGUST 15, 1978	4626	6516	
AUGUST 16, 1978	4120	5803	**
AUGUST 17, 1978	4370	6155	**
AUGUST 18, 1978	4184	5893	
AUGUST 19, 1978	3568	5025	
AUGUST 20, 1978	3280	4620	
AUGUST 21, 1978	2632	3707	
AUGUST 22, 1978	2392	3369	
AUGUST 23, 1978	2302	3242	
AUGUST 24, 1978	2194	3090	
AUGUST 25, 1978	2122	2989	
AUGUST 26, 1978	2422	3411	
AUGUST 27, 1978	2014	2837	
AUGUST 28, 1978	2052	2890	
AUGUST 29, 1978	3544	4992	
AUGUST 30, 1978	4088	5758	
AUGUST 31, 1978	3128	4406	

** CALCULATION BASED ON JAMES RIVER FLOW ONLY DUE TO MALFUNCTION OF KANAWAH CANAL GAGE.

TABLE 2.3.1 (CONT'D)

DATE	JAMES RIVER DISCHARGE AT RICHMOND C.F.S.	CALCULATED JAMES RIVER DISCHARGE AT HOG POINT C.F.S.	
SEPTEMBER 1, 1978	3456	4868	
SEPTEMBER 2, 1978	3944	5555	
SEPTEMBER 3, 1978	3986	5614	
SEPTEMBER 4, 1978	3568	5025	
SEPTEMBER 5, 1978	2990	4211	
SEPTEMBER 6, 1978	832	1172	***
SEPTEMBER 7, 1978	832	1172	***
SEPTEMBER 8, 1978	814	1146	***
SEPTEMBER 9, 1978	1994	2808	
SEPTEMBER 10, 1978	1924	2710	
SEPTEMBER 11, 1978	1854	2611	
SEPTEMBER 12, 1978	1814	2555	
SEPTEMBER 13, 1978	1814	2555	
SEPTEMBER 14, 1978	1814	2555	
SEPTEMBER 15, 1978	1792	2524	
SEPTEMBER 16, 1978	1769	2492	
SEPTEMBER 17, 1978	1746	2459	
SEPTEMBER 18, 1978	1724	2428	
SEPTEMBER 19, 1978	1638	2307	
SEPTEMBER 20, 1978	1594	2245	
SEPTEMBER 21, 1978	1551	2185	
SEPTEMBER 22, 1978	1551	2185	
SEPTEMBER 23, 1978	1679	2365	
SEPTEMBER 24, 1978	1852	2608	
SEPTEMBER 25, 1978	2122	2989	
SEPTEMBER 26, 1978	1924	2710	
SEPTEMBER 27, 1978	1769	2492	
SEPTEMBER 28, 1978	1656	2332	
SEPTEMBER 29, 1978	1531	2156	
SEPTEMBER 30, 1978	1451	2044	

*** CALCULATION BASED ON KANAWAH CANAL FLOW ONLY DUE TO MALFUNCTION OF JAMES RIVER GAGE

TABLE 2.3.1 (CONT'D)

DATE	JAMES RIVER DISCHARGE AT RICHMOND C.F.S.	CALCULATED JAMES RIVER DISCHARGE AT HOG POINT C.F.S.
OCTOBER 1, 1978	1471	2072
OCTOBER 2, 1978	1451	2044
OCTOBER 3, 1978	1351	1903
OCTOBER 4, 1978	1391	1959
OCTOBER 5, 1978	1415	1993
OCTOBER 6, 1978	1471	2072
OCTOBER 7, 1978	1589	2238
OCTOBER 8, 1978	2032	2862
OCTOBER 9, 1978	1854	2611
OCTOBER 10, 1978	1571	2213
OCTOBER 11, 1978	1476	2079
OCTOBER 12, 1978	1384	1949
OCTOBER 13, 1978	1522	2144
OCTOBER 14, 1978	1471	2072
OCTOBER 15, 1978	1471	2072
OCTOBER 16, 1978	1347	1897
OCTOBER 17, 1978	1459	2055
OCTOBER 18, 1978	1692	2383
OCTOBER 19, 1978	1746	2459
OCTOBER 20, 1978	1746	2459
OCTOBER 21, 1978	1679	2365
OCTOBER 22, 1978	1724	2428
OCTOBER 23, 1978	1769	2492
OCTOBER 24, 1978	1511	2128
OCTOBER 25, 1978	1471	2072
OCTOBER 26, 1978	1431	2016
OCTOBER 27, 1978	1471	2072
OCTOBER 28, 1978	1531	2156
OCTOBER 29, 1978	1511	2128
OCTOBER 30, 1978	1531	2156
OCTOBER 31, 1978	1531	2156

TABLE 2.3.1 (CONT'D)

DATE	JAMES RIVER DISCHARGE AT RICHMOND C.F.S.	CALCULATED JAMES RIVER DISCHARGE AT HOG POINT C.F.S.	
NOVEMBER 1, 1978	1511	2128	
NOVEMBER 2, 1978	1491	2100	
NOVEMBER 3, 1978	1746	2459	
NOVEMBER 4, 1978	1702	2397	
NOVEMBER 5, 1978	1679	2365	
NOVEMBER 6, 1978	1661	2339	
NOVEMBER 7, 1978	1571	2213	
NOVEMBER 8, 1978	1594	2245	
NOVEMBER 9, 1978	1724	2428	
NOVEMBER 10, 1978	1724	2428	
NOVEMBER 11, 1978	1746	2459	
NOVEMBER 12, 1978	1769	2492	
NOVEMBER 13, 1978	1746	2459	
NOVEMBER 14, 1978	1702	2397	
NOVEMBER 15, 1978	1616	2276	
NOVEMBER 16, 1978	1679	2365	
NOVEMBER 17, 1978	1884	2654	
NOVEMBER 18, 1978	1992	2806	
NOVEMBER 19, 1978	2460	3465	
NOVEMBER 20, 1978	3162	4454	
NOVEMBER 21, 1978	1960	2761	**
NOVEMBER 22, 1978	1630	2296	**
NOVEMBER 23, 1978	1340	1887	**
NOVEMBER 24, 1978	1340	1887	**
NOVEMBER 25, 1978	1250	1761	**
NOVEMBER 26, 1978	1220	1718	**
NOVEMBER 27, 1978	1320	1859	**
NOVEMBER 28, 1978	1430	2014	**
NOVEMBER 29, 1978	1660	2338	**
NOVEMBER 30, 1978	3266	4600	

** CALCULATION BASED ON JAMES RIVER FLOW ONLY DUE TO MALFUNCTION OF KANAWAH CANAL GAGE.

TABLE 2.3.1 (CONT'D)

DATE	JAMES RIVER DISCHARGE AT RICHMOND C.F.S.	CALCULATED JAMES RIVER DISCHARGE AT HOG POINT C.F.S.	
DECEMBER 1, 1978	3366	4741	
DECEMBER 2, 1978	3436	4840	
DECEMBER 3, 1978	3406	4797	
DECEMBER 4, 1978	3348	4716	
DECEMBER 5, 1978	3404	4794	
DECEMBER 6, 1978	4310	6071	
DECEMBER 7, 1978	5180	7296	
DECEMBER 8, 1978	4542	6397	
DECEMBER 9, 1978	4680	6592	
DECEMBER 10, 1978	5350	7535	
DECEMBER 11, 1978	6010	8465	**
DECEMBER 12, 1978	5860	8254	**
DECEMBER 13, 1978	7560	10648	
DECEMBER 14, 1978	6230	8775	
DECEMBER 15, 1978	5292	6155	
DECEMBER 16, 1978	4662	6566	
DECEMBER 17, 1978	4102	5778	
DECEMBER 18, 1978	3100	4366	**
DECEMBER 19, 1978	3200	4507	**
DECEMBER 20, 1978	3070	4324	**
DECEMBER 21, 1978	2970	4183	**
DECEMBER 22, 1978	3248	4575	
DECEMBER 23, 1978	2988	4209	
DECEMBER 24, 1978	2888	4068	
DECEMBER 25, 1978	3824	5386	
DECEMBER 26, 1978	6720	9465	
DECEMBER 27, 1978	6700	9437	
DECEMBER 28, 1978	7010	9873	
DECEMBER 29, 1978	7010	9873	
DECEMBER 30, 1978	5560	7831	
DECEMBER 31, 1978	5042	7102	

** CALCULATION BASED ON JAMES RIVER FLOW ONLY DUE TO MALFUNCTION OF KANAWAH CANAL GAGE.

3.1 PLANKTON

Summary

Water samples for plankton analyses are collected at each of six (6) stations as indicated in Figure 3.1-1. Samples are also collected in the intake and discharge canals. Phytoplankton samples are taken monthly and are analyzed quantitatively in terms of sample volume to determine both the dominant genera of the community and the chlorophyll "a" content. Zooplankton samples are analyzed quantitatively in terms of sample volume to determine generic composition, life history stage and, where possible, species. The sampling interval is approximately monthly, taking into consideration life-history information about important species in the area which have planktonic stages in their life histories.

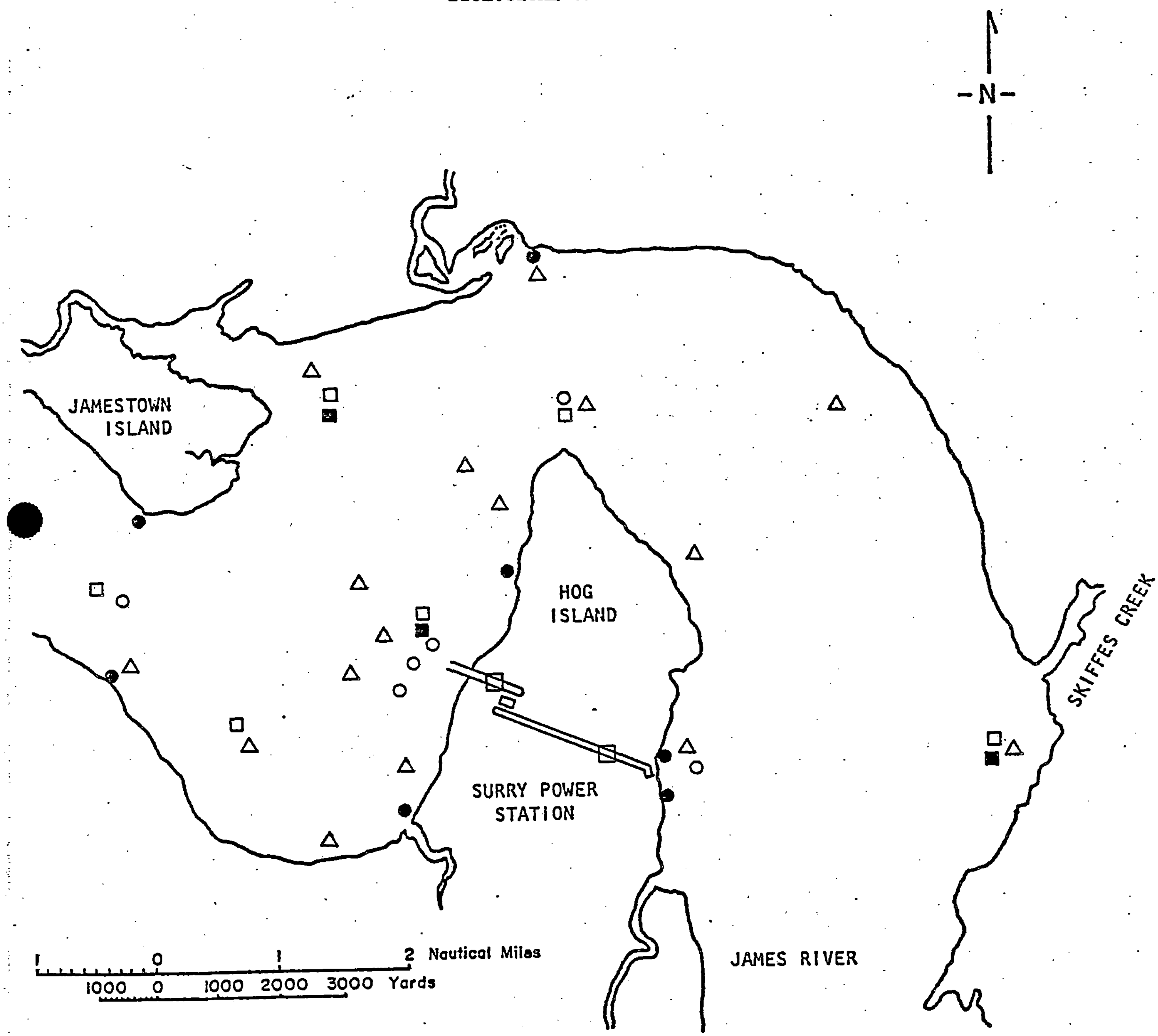
Results

The results of this survey are contained in the report prepared by the Virginia Institute of Marine Science entitled "Ecological Study of the Tidal Segment of the James River Encompassing Hog Point, 1978 Final Technical Report" dated February, 1979 which is appended to this section as Appendix 3.0.

Conclusions

Please refer to the referenced report.

BIOLOGICAL SAMPLE STATIONS



○ Trawl (Nekton)
● Seine (Nekton)
□ Plankton
■ Fouling Plates
△ Benthos

3.2 ATTACHED BENTHIC COMMUNITY

Summary

Fouling plates made of 125 x 75 asbestos boards are suspended 1 meter above the bottom at the instrument tower locations shown in Figure 3.1-1 and are used to obtain samples. Two vertical and two horizontal plates are suspended at each indicated location. One of each pair is removed and replaced at bimonthly intervals; the other part is left in place for one year before being removed and replaced. The benthic communities attached to the plates are analyzed for species composition and diversity.

Results

The results of this survey are contained in the report prepared by the Virginia Institute of Marine Science entitled "Ecological Study of the Tidal Segment of the James River Encompassing Hog Point, 1978 Final Technical Report" dated February, 1979 which is appended to this section as Appendix 3.0.

Conclusions

Please refer to the referenced report.

3.3 EPIBENTHOS

Summary

Replicate benthic grab samples are collected at the stations shown in Figure 3.1.1. Collection is made on a quarterly basis, except during June, July, and August when they are made monthly. Population characteristics such as species composition, diversity, evenness, redundancy, and richness are determined. The data are analyzed to detect changes in specific components of the epibenthic community including the brackish water clam Rangia cuneata and blue crab Callinectes sapidus.

Results

The results of this survey are contained in the report prepared by the Virginia Institute of Marine Science entitled "Ecological Study of the Tidal Segment of the James River Encompassing Hog Point, 1978 Final Technical Report" dated February, 1979 which is appended to this report as Appendix 3.0.

Conclusions

Please refer to the referenced report.

3.4 NEKTON

Fisheries investigations will be reported separately as results from monthly surveys, from special seine surveys, from ichthyoplankton entrainment study, and from thermal plume entrainment study.

3.4.1 MONTHLY SURVEYS

Monthly surveys employing beach seines and otter trawls have been conducted since May, 1970. Six years of data were analyzed and reported in the Semiannual Operating Report, July 1, 1975 through December 31, 1975 as a comparison of pre- and postoperative conditions. Data through August, 1976 have been analyzed and included in a report entitled "The Effects of Surry Power Station Operations on Fishes of the Oligohaline Zone, James River, Virginia."

Data for January-December, 1978 are presented as Tables 3.4.1-1 through 3.4.1-7. The cumulative account of the number of species, diversity, evenness, and richness by year by season is presented as Figure 3.4.1-1.

In all of the cases the following formulae were used:

Diversity -- H' (Shannon-Wiener formula)

$$H' = -\sum_{i=1}^{S} \left(\frac{Ni}{N} \log_2 \frac{Ni}{N}\right)$$

Evenness -- J

$$J = H'/\log_2 S$$

Richness -- D

$$D = (S-1) / \log_2 N$$

where

N = total number of fish

Ni = number of fish in a sample

S = number of species

i = sample number

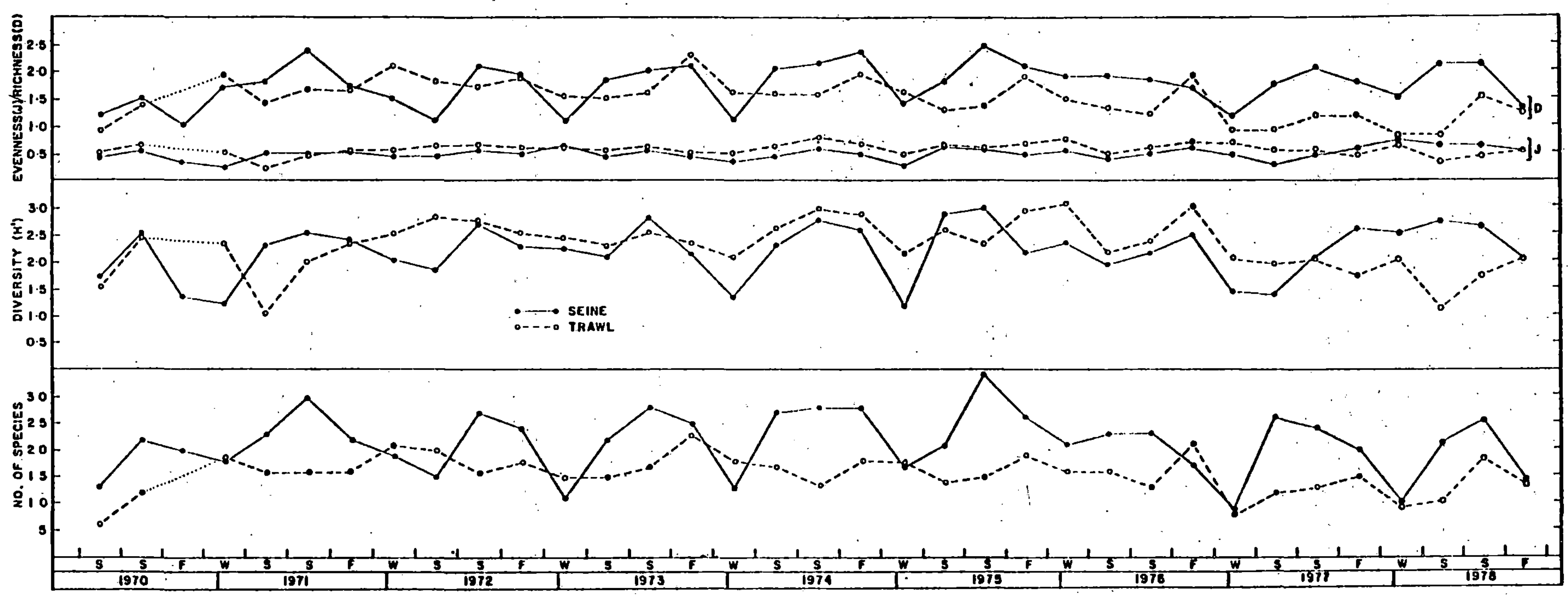


Figure 3.4.1-1

COMPOSITE OF NUMBERS OF SPECIES, DIVERSITY (H'), EVENNESS (J), AND RICHNESS (D) BY SEASON FOR SEINE AND TRAWL SAMPLES - SURRY POWER STATION

TABLE 3.4.1-1 -- DIVERSITY (H'), EVENESS (J), AND RICHNESS (D): COMPOSITES BY SEASON

	SEINE			TRAWL		
	H'	J	D	H'	J	D
WINTER 1977	2.4630	0.7414	1.5115	1.9593	0.6181	0.7753
SPRING 1978	2.6870	0.6117	2.1275	1.0853	0.3267	0.8309
SUMMER 1978	2.5593	0.5511	2.0853	1.6885	0.4049	1.5298
FALL 1978	1.9949	0.5240	1.2881	2.0087	0.5428	1.1890

TABLE 3.4.1-2 -- DIVERSTIY (H') FOR SEINE DATE -- SURRY

STATION

DATE	INTAKE SOUTH	INTAKE NORTH	HOG POINT WEST	CHIPOAKES CREEK	GOOSE HILL	JAMESTOWN ISLAND	COLLEGE CREEK	COMPOSITE
1-78	0.0000	0.0000	1.6764	0.8454	.	1.5850	0.9183	2.2547
2-78	1.0000	.	1.7925	1.5000	.	1.0000	.	2.5216
3-78	1.0842	1.0949	0.0000	2.1181	1.4238	0.6988	1.1863	2.5549
4-78	1.5197	1.2389	0.9183	0.0000	1.5850	1.0714	0.8842	1.7297
5-78	2.0000	3.0333	2.1800	1.2075	2.2359	0.7295	2.2167	1.6649
6-78	0.7699	0.7728	2.2783	1.5519	1.6288	0.7778	1.5428	1.5379
7-78	1.5360	0.7669	1.7791	1.6620	2.0588	2.1877	2.3899	2.6924
8-78	0.7046	2.2758	2.4540	2.5281	1.8685	2.5152	2.2199	3.2575
9-78	0.4251	2.0252	2.5334	2.6145	1.3585	0.9792	1.0423	1.9949
12-78	0.1231	0.3912	0.0000	1.2403	0.0710	1.3548	0.2352	0.6219

TABLE 3.4.1-3 -- DIVERSTIY (H') FOR TRAWL DATE -- SURRY

STATION

DATE	HOG POINT	INTAKE	DISCHARGE NORTH	DISCHARGE MIDDLE	DISCHARGE SOUTH	GOOSE HILL	COMPOSITE
1-78	1.1326	1.3713	1.8979	1.5887	1.4207	0.5917	1.9681
2-78	1.2516	1.2635	1.3288	1.6313	1.5292	0.5665	1.6208
3-78	0.2543	0.5913	1.5686	1.4511	0.8796	0.5700	1.0406
4-78	0.1914	0.2223	0.7004	0.8550	0.4167	1.5339	0.7212
5-78	0.6998	0.8707	1.9657	1.5892	1.6106	1.9131	1.7577
6-78	1.4009	2.1194	0.2833	1.0978	1.7181	2.1266	1.5188
7-78	1.4514	1.6683	1.2733	1.2949	0.6951	1.9691	1.3915
8-78	2.1021	2.2929	1.5026	2.0887	1.5361	1.5962	2.0550
9-78	1.7611	2.5497	1.4329	1.6011	1.7015	1.6459	2.0087
12-78	0.9581	2.0461	2.2876	2.1367	2.5811	0.4808	1.7296

TABLE 3.4.1-4 -- EVENNESS (J) FOR SEINE DATA -- SURRY

STATION

DATE	INTAKE SOUTH	INTAKE NORTH	HOG POINT WEST	CHIPOAKES CREEK	GOOSE HILL	JAMESTOWN ISLAND	COLLEGE CREEK	COMPOSITE
1-78	0.0000	0.0000	0.8382	0.8454	.	1.0000	0.9183	0.8031
2-78	1.0000	.	0.8962	0.9464	.	1.0000	.	0.8982
3-78	0.4194	0.6908	0.0000	0.9122	0.7119	0.3494	0.5931	0.6710
4-78	0.7599	0.7817	0.9183	0.0000	1.0000	0.6760	0.5579	0.6161
5-78	1.0000	0.9131	0.8434	0.6038	0.9630	0.2301	0.6673	0.4261
6-78	0.2978	0.2753	0.8814	0.4896	0.5802	0.2593	0.5968	0.3762
7-78	0.6615	0.3834	0.5613	0.6429	0.8867	0.6103	0.9245	0.7072
8-78	0.7046	0.6578	0.7742	0.7610	0.6656	0.8959	0.8588	0.7669
9-78	0.1645	0.7835	0.9024	0.8248	0.8571	0.3788	0.5212	0.5240
12-78	0.1231	0.3912	0.0000	0.5342	0.0710	0.6774	0.2352	0.2406

TABLE 3.4.1-5 -- EVENNESS (J) FOR TRAWL DATA -- SURRY

STATION

DATE	HOG POINT	INTAKE	DISCHARGE NORTH	DISCHARGE MIDDLE	DISCHARGE SOUTH	GOOSE HILL	COMPOSITE
1-78	0.7146	0.6857	0.8174	0.6146	0.7104	0.5917	0.6560
2-78	0.7897	0.7972	0.5140	0.6311	0.5916	0.5665	0.5403
3-78	0.2543	0.3731	0.6068	0.5614	0.5550	0.2850	0.3707
4-78	0.1914	0.1111	0.3016	0.4275	0.1794	0.5934	0.2790
5-78	0.4416	0.5493	0.7604	0.6148	0.8053	0.7401	0.5859
6-78	0.7005	0.9128	0.1417	0.5489	0.6646	0.9159	0.4572
7-78	0.5170	0.8342	0.4536	0.4316	0.2193	0.7618	0.3881
8-78	0.7007	0.7643	0.4740	0.6962	0.5120	0.5686	0.5028
9-78	0.7585	0.9082	0.7165	0.5703	0.5672	0.4758	0.5428
12-78	0.3413	0.7288	0.8149	0.7122	0.8143	0.2071	0.4824

TABLE 3.4.1-6 -- RICHNESS (D) FOR SEINE DATA -- SURRY

STATION

DATE	INTAKE SOUTH	INTAKE NORTH	HOG POINT WEST	CHIPOAKES CREEK	GOOSE HILL	JAMESTOWN ISLAND	COLLEGE CREEK	COMPOSITE
1-78	1.0000	1.0000	0.6175	0.2891	.	1.2619	0.6309	1.0743
2-78	1.0000	.	1.1606	1.0000	.	1.0000	.	1.5759
3-78	0.8688	0.5253	1.0000	1.1563	0.7500	0.6382	0.7500	1.8288
4-78	0.7340	0.5405	0.6309	0.0000	1.2619	0.3509	0.4628	0.8831
5-78	1.5000	1.9380	1.2500	0.8368	1.4248	0.9745	1.4837	1.6022
6-78	0.8158	0.8628	0.8572	1.0835	1.0286	0.6905	0.7417	1.4900
7-78	0.6117	0.5372	1.1288	0.9460	1.2619	1.2414	1.2798	1.3468
8-78	0.1800	1.3466	1.6468	1.5639	1.1894	1.1433	1.0292	2.0807
9-78	0.5685	0.8365	1.3264	1.6148	0.3709	0.5649	0.6309	1.2881
12-78	0.1450	0.2702	0.0000	0.6483	0.1456	0.6000	0.2127	0.5817

TABLE 3.4.1-7 -- RICHNESS (D) FOR TRAWL DATA -- SURRY

	STATION						
DATE	HOG POINT	INTAKE	DISCHARGE NORTH	DISCHARGE MIDDLE	DISCHARGE SOUTH	GOOSE HILL	COMPOSITE
1-78	0.3459	0.6309	0.4990	0.6837	0.5495	0.3562	0.7687
2-78	0.7737	0.3899	0.5782	0.7087	0.7055	0.2560	0.7365
3-78	0.1295	0.2896	0.6837	0.7252	0.2901	0.5166	0.6240
4-78	0.1966	0.4173	0.5213	0.3896	0.5456	0.8333	0.5168
5-78	0.4076	0.3686	1.0000	0.8333	0.7879	0.9460	0.8981
6-78	0.5079	0.8152	0.4118	0.6055	0.9002	1.0000	1.0702
7-78	1.0426	0.4644	0.7168	1.0153	0.8680	0.8500	1.0697
8-78	1.2221	1.2822	1.0633	1.0810	0.9608	0.8992	1.7214
9-78	0.6504	0.9464	0.6727	0.7967	0.9314	1.0985	1.1890
12-78	0.7371	0.7835	1.1606	0.9354	1.3838	0.4786	1.0913

3.4.2 POPULATION ESTIMATES

Several fish species inhabit the waters of the James River around Hog Island at certain stages in their life cycle during certain times of the year. In an effort to estimate numbers of fish inhabiting the shore zone waters during times of expected high population density in an area from the intake structure to the discharge groin, three sample stations (Hog Point-West, Hog Point-North, Hog Point-East) were sampled (Figure 3.4.2-1). Data are reported as Table 3.4.2-1.

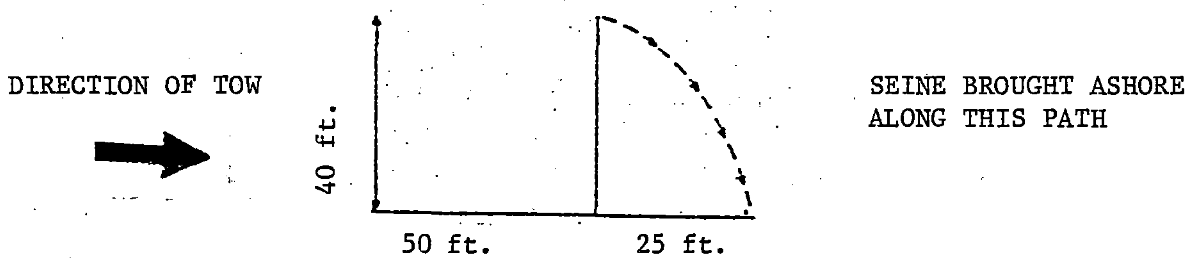
In order for population estimates to approach total populations of a species within a given area in any reliable manner, certain assumptions have to be made: (1) Fish are uniformly distributed throughout the area from the shoreline to 40 feet out from the shoreline; (2) Catch efficiency of a haul seine is about fifty percent; and (3) Sample station habitats, and therefore the entire multiplicity of shoreline habitats, are similar and equal in their ability to attract and support young fish.

That these assumptions do not hold true, especially in the oligohaline reaches of tidal estuaries, is shown by the high degree of variability between and within species, between and within stations, and between replicates of a station. However, to fulfill the requirements of this section of the Surry Technical Specifications, the following methodology was used in an attempt to estimate populations.

The shoreline between the discharge and intake is about 30,000 feet long and provides 400 possible 75-foot sampling stations. Sample values for all species have been projected to reflect the numbers of fish occupying a 40-foot wide strip along this shore on the given sample days.

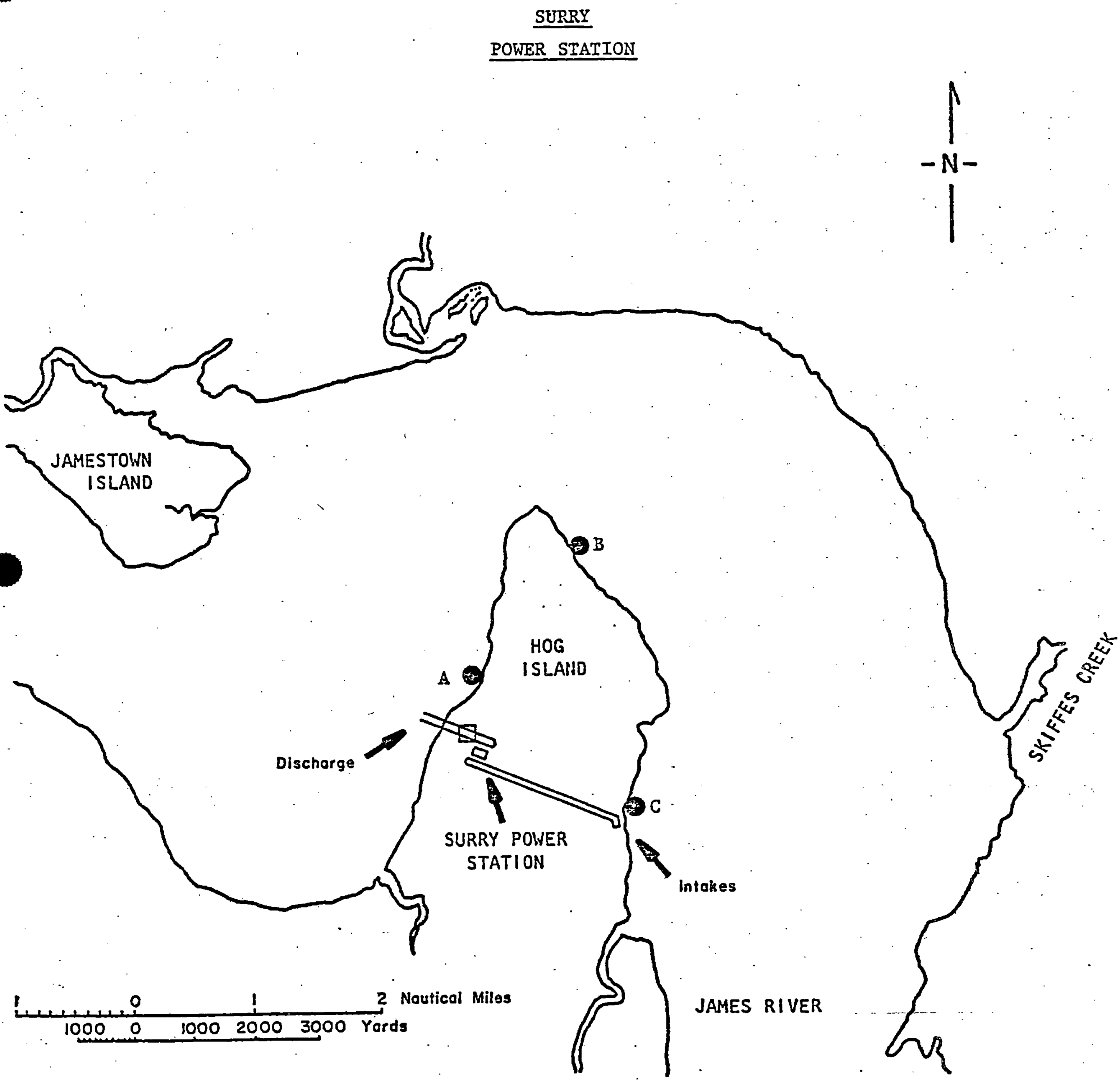
A fifty-foot haul seine having 1/4 inch bar mesh netting was used to sample a premeasured 75-foot stretch of beach. A replicate sample was taken within minutes of the first sample.

A sample consisted of stretching the seine perpendicular to the shore, hauling it 50 feet and then having the offshore man bring his end ashore in an arc about 25 feet further along the beach as shown below.



Hence, a small portion of the sample unit (about 8-10%) is not covered. The population estimates do not include an expansion for this unsampled area and thus should consistently underestimate the population values by a small amount.

It should be pointed out that all of the species sampled, within the size ranges taken, are schooling species except for possibly spottail shiner, golden shiner, channel catfish, and white perch. Schooling will also cause large variances to be associated with population estimates.



A--Hog Point-West
B--Hog Point-North
C--Hog Point-East

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=ALOSA AESTIVALIS

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780323	2	6	133.3	84.328	J
780504	1	6	66.7	66.659	J
780907	1	6	66.7	66.659	J
781012	1	10	66.7	51.634	J
781013	9	6	600.0	409.880	J

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=ANCHOA MITCHILLI

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780421	45	6	3000.2	1864.05	J/A
780504	35	6	2333.5	802.78	J/A
780602	1	6	66.7	66.66	A
780706	4	6	266.7	168.66	A
780727	11	6	733.4	733.34	J/A
780803	5	6	333.3	261.62	A
780822	1	6	66.7	66.66	A
780907	13	6	866.7	578.89	PL/J
781011	19	14	542.9	349.84	J/A
781012	51	10	2040.0	1014.47	J/A
781013	52	6	3466.8	2092.96	J/A

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=ANGUILLA ROSTRATA

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780330	1	6	66.7	66.6591	J

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=BREVOORTIA TYRANNUS

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780421	23	6	1533	1080	L
780504	2	6	133	84	L
780602	3051	6	203410	156618	L/J
780706	42	6	2800	2800	J
780727	72	6	4800	3207	J/A
780803	4592	6	306149	302300	J
780822	15	6	1000	771	J
780907	15	6	1000	683	J
781011	3	14	86	62	J
781012	12	10	480	341	J
781013	126	6	8400	8320	J

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=CYPRINUS CARPIO

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780330	2	6	133.3	84.328	A
780602	5	6	333.3	261.620	J
780907	1	6	66.7	66.659	A

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=DOROSOMA CEPEDIANUM

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780323	3	6	200.0	200.001	A
780330	4	6	266.7	84.328	J/A
780727	3	6	200.0	200.001	A
780803	5	6	333.3	261.620	J
780907	18	6	1200.1	677.252	J
781011	2	14	57.1	57.143	J
781012	4	10	160.0	160.000	J

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=FUNDULUS DIAPHANUS

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780616	6	6	400	103.28	A

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=FUNDULUS HETEROCLITUS

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780323	30	6	2000.1	946.58	J/A
780330	17	6	1133.4	747.74	J/A
780421	4	6	266.7	266.67	J/A
780504	15	6	1000.1	683.13	J/A
780602	15	6	1000.1	728.47	J/A
780616	36	6	2400.1	957.78	J/A
780706	29	6	1933.4	1698.37	A
780727	13	6	866.7	392.15	A
780822	6	6	400.0	252.98	J
780907	1	6	66.7	66.66	A
781011	82	14	2342.9	1212.29	J/A
781012	7	10	280.0	280.00	J/A

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=ICTALURUS NEBULOSUS

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780803	2	6	133.3	84.3278	J

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

------------------------------ SP=ICTALURUS PUNCTATUS ------------------------------

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780421	1	6	66.7	66.6591	A

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=LEIOSTOMUS XANTHURUS

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780421	4	6	266.7	84.33	J
780504	2	6	133.3	84.33	J
780602	71	6	4733.6	1320.27	J
780616	9	6	600.0	458.99	J
780706	10	6	666.7	304.05	J
780727	51	6	3400.2	1481.45	J
780803	14	6	933.4	552.97	J
780822	7	6	466.7	240.37	J
780907	59	6	3933.5	1888.69	J
781011	202	14	5771.4	1592.13	J
781012	197	10	13134.0	7111.64	J
781013	16	6	1066.7	910.19	J

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=LEPOMIS GIBBOSUS

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780727	1	6	66.7	66.6591	J
781012	1	10	66.7	51.6337	J
781013	1	6	66.7	66.6591	J

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=MEMBRAS MARTINICA

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780602	5	6	333.3	261.620	A
780706	2	6	133.3	84.328	A
780727	4	6	266.7	133.334	A
780803	1	6	66.7	66.659	A
780907	1	6	66.7	66.659	A
781011	5	14	142.9	142.857	J/A
781012	1	10	66.7	51.634	A

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=MENIDIA BERYLLINA

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780323	6	6	400.0	178.89	A
780330	15	6	1000.1	422.69	J/A
780421	11	6	733.4	510.34	J/A
780504	11	6	733.4	530.83	J/A
780602	9	6	600.0	322.49	A
780616	6	6	400.0	326.60	A
780706	2	6	133.3	133.33	A
780727	8	6	533.4	533.34	J/A
780803	2	6	133.3	133.33	A
780907	5	6	333.3	261.62	J
781011	136	14	3885.7	2276.08	J/A
781012	26	10	1040.0	400.89	J/A
781013	19	6	1266.7	747.74	J/A
781102	23	6	1533.4	443.22	J/A

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=MENIDIA MENIDIA

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780504	2	6	133.3	84.33	A
780616	15	6	1000.1	651.16	J
780706	34	6	2266.8	1250.78	J/A
780727	105	6	7000.4	2983.97	J/A
780803	27	6	1800.1	524.09	A
780822	11	6	733.4	578.89	A
780907	78	6	5200.3	1642.77	A
781011	427	14	12200.0	4537.85	A
781012	231	10	9240.0	3748.28	A
781013	34	6	2266.8	480.74	A
781102	114	6	7600.4	3088.05	A

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=MICROPOGON UNDULATUS

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780907	2	6	133.3	133.334	J

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=MORONE AMERICANA

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780330	3	6	200.0	136.627	J
780421	4	6	266.7	168.656	J
780504	2	6	133.3	84.328	J
780602	7	6	466.7	217.052	A
780706	13	6	866.7	316.931	J
780727	3	6	200.0	89.443	J
780803	2	6	133.3	84.328	J
780822	6	6	400.0	103.280	J/A
780907	23	6	1533.4	656.593	J/A
781011	58	14	1657.1	765.012	J/A
781012	12	10	480.0	271.948	J/A
781013	9	6	600.0	409.880	J/A
781102	9	6	600.0	524.089	J/A

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=MORONE SAXATILIS

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780504	3	6	200.0	136.627	J
780602	9	6	600.0	382.972	J
780616	23	6	1533.4	578.890	J
780706	5	6	333.3	261.620	J
780727	2	6	133.3	84.328	J
780803	6	6	400.0	326.600	J
780822	1	6	66.7	66.659	J
780907	5	6	333.3	160.555	J
781011	3	14	85.7	45.522	J
781012	5	10	200.0	89.443	J
781013	1	6	66.7	66.659	J

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=MUGIL CEPHALUS

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780421	16	6	1066.7	1066.67	J
780727	6	6	400.0	273.25	J
780803	2	6	133.3	84.33	J/A
781012	1	10	66.7	51.63	A
781102	3	6	200.0	200.00	A

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=NOTEMIGONUS CRYSOLEUCAS

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780330	2	6	133.3	133.334	J/A
780504	1	6	66.7	66.659	J
780602	2	6	133.3	84.328	A
780907	2	6	133.3	133.334	A
781013	1	6	66.7	66.659	A

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=NOTROPIS HUDSONIUS

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780323	1	6	66.7	66.659	A
780330	1	6	66.7	66.659	A
780421	1	6	66.7	66.659	A
780616	2	6	133.3	133.334	J
780706	1	6	66.7	66.659	J
780727	7	6	466.7	299.631	J
780803	4	6	266.7	197.766	J
780907	6	6	400.0	400.002	J
781011	6	14	171.4	69.082	J/A
781012	3	10	120.0	85.375	A
781013	1	6	66.7	66.659	A

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=PERCA FLAVESCENS

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780602	4	6	266.7	133.334	J
781013	1	6	66.7	66.659	J

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=POMATOMUS SALTATRIX

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780706	3	6	200.0	136.627	J
780727	4	6	266.7	133.334	J
780803	2	6	133.3	133.334	J
780822	3	6	200.0	89.443	J
781012	1	10	66.7	51.634	J

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=STRONGYLURA MARINA

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
780822	1	6	66.7	66.659	A
781012	3	10	120.0	85.375	A
781102	2	6	133.3	133.334	A

TABLE 3.4.2-1
POPULATION ESTIMATES AROUND HOG POINT
STD EST IS THE STANDARD DEVIATION OF THE ESTIMATE

SP=TRINECTES MACULATUS

DATE	TOTAL	SAMPLES	EST	STD EST	STAGE
781102	1	6	66.7	66.6591	A

3.5.1 THERMAL PLUME ENTRAINMENT OF ICHTHYOPLANKTON

Please refer to the following report by the Virginia Institute of Marine Science for preliminary results and conclusions.

Section II b.

THERMAL PLUME ENTRAINMENT OF ICHTHYOPLANKTON AT VEPCO NUCLEAR POWER STATION

by

John V. Merriner

A. Deane Estes

and

Robert K. Dias

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INTRODUCTION

Thermal plume ichthyoplankton sampling was initiated at VEPCO Surry Nuclear Power Plant in August 1975 by the Ichthyology Department of Virginia Institute of Marine Science. Objectives of this study were to assess the kinds and amounts of ichthyoplankton being entrained from the waters of Cobham Bay, James River by the thermal effluent from the facility.

Heated effluent from the Surry facility travels through the discharge canal where some cooling occurs. The canal is constricted at the discharge point to increase water velocity as it enters the river. In achieving this, considerable turbulence is created, promoting faster mixing, thus reducing the area of thermal impact to the immediate vicinity of the discharge point. Most ichthyoplankton are pelagic and unable to effectively negotiate water currents. As Cobham Bay water mixes with the thermal effluent, ichthyofauna therein are entrained and carried along with the thermal plume.

VEPCO Surry is located near the freshwater to marine transition zone of the James River, thus the ichthyofauna varies considerably as salinity fluctuates with seasonal and short-term weather patterns affecting the James River dishcharge. Eighty-four fish species representing 38 families have been reported from the vicinity of Hog Island (White, 1976); species reported ranged from strictly freshwater to polyhaline forms. Many species are represented only as juvenile and adult life stages. As such, they are capable of negotiating the currents in the thermal plume and are not subject to entrainment. Other species utilize the area as spawning areas (engraulids, gobiids), nursery areas (sciaenids, Brevoortia), and as migration route (Alosa, Morone, Anguilla). Many freshwater and several anadromous species spawn upriver from Hog Island; however, in years that salinities are depressed during spawning times, spawning may occur near Hog Island. Larvae and postlarvae of these species might then occur near VEPCO Surry and be subject to entrainment.

Species lists and abundance of ichthyoplankton captured in and near the thermal plume from VEPCO Surry are presented along with ranges of salinity, dissolved oxygen, and temperature during sampling visits. Species composition, trends of abundance, statistical analyses of the data set (1978), and entrainment impact upon the ichthyofauna near Hog Island are discussed.

Sampling visits for plant and thermal plume ichthyoplankton entrainment from January through December 1978 are presented in Table 1. Sampling intensity for plume entrainment reflects anticipated periods of greatest spawning activity (April, May) and periods of critical water temperature elevations (ΔT) i.e., August.

METHODS AND MATERIALS

Thermal plume ichthyoplankton sampling employed the use of a 0.5 meter paired net apparatus (Fig. 1) equipped with conical Nitex nets (505 μ mesh) and General Oceanics Digital Flowmeters (Model 2030). The unit was selected as the best sampling gear for the plume study after reviewing gear evaluation studies conducted for the plant entrainment sampling program (Merriner and Estes, 1975). Flowmeters were periodically calibrated in the VIMS flume. For towing, lead weights and a bridle of 0.25 inch braided nylon rope were added to the net apparatus.

Sampling sites (Fig. 2) were: (1) mid-channel in the discharge canal at the roadway bridge; (2) plume area where water temperatures exceed ambient water temperatures by 5 C; and (3) that area of Cobham Bay where ambient water temperatures exist. Two tows each were made in the plume area and ambient river water; one tow was made in the discharge canal. Stepped oblique tows of 5-minute duration were made with bottom, midwater, and surface steps per tow. The nets fished at each depth for approximately 1 minute and 40 seconds. The boat's engine was operated at 900 RPM, except in the discharge canal where the boat was tied to the roadway bridge.

Water temperature, dissolved oxygen, and salinity were taken in the discharge canal, at the end of tow 1, and at the end of tow 3. Data were taken at surface, midwater, and bottom depths except where water was less than 4 meters deep. For the latter, only surface and bottom data were obtained. Salinity samples were returned to VIMS for analysis with a Beckman RS-7 induction salinometer. Dissolved oxygen samples were fixed in the field for laboratory analysis by the Winkler Titration Method. Water temperature was measured to the nearest degree with a stem thermometer (-35 C to 50 C, 1 C interval). Sea state, weather, turbidity, etc. were recorded at the time of sampling.

Sampling at low slack tide would theoretically locate the plume in the same relative position during sampling visits, except for minor deviations due to meterological conditions (wind, rain, etc.) that influenced river flow during any given sampling period. This reduced total sampling time and provided relatively constant water depths for sampling. At low slack tide, the plume generally flowed straight out from the discharge canal and then bent slightly upriver (Fig. 2).

Ichthyoplankton samples were preserved with approximately 5% formalin, and returned to VIMS for sorting, enumeration, and identification. Data were tabulated and punched on ADP cards for analysis.

The most useful key for the identification of fish eggs and larvae has been a manual by Lippson and Moran (1974).

Where identification of larvae was dependent upon accurate myomere counts, larvae were cleared and stained (Mook and Wilcox, 1974).

Vessels and operators for sampling stations were provided by VEPCO. Two VIMS project personnel were required to conduct each shift (day; night) of plume sampling.

All calculations and conclusions presented in this report are based on number of organisms per 100 cubic meters of water strained unless otherwise stated.

Statistical Methods

Catch data were subjected to statistical analysis (a) to determine the significant spatial and temporal trends in the ichthyoplankton community, (b) to develop regression models which identify the major environmental factors of importance to community structure, and (c) to assess significant patterns in two dominant fish populations (*Anchoa mitchilli* and *Gobiosoma bosci*).

Six dependent or response variables (Y_i) which reflect overall community structure were included in the analysis; these were total abundance of fish, abundance of fish species, fish species diversity (Shannon index), total abundance of eggs, abundance of egg species, and egg species diversity. The abundance of *A. mitchilli* fish, *A. mitchilli* eggs, and *G. bosci* fish were also included as dependent variables. [NOTE: For simplicity throughout this report, the species abundance and species diversity of the egg stage are referred to as egg species abundance and egg species diversity, respectively.]

Measures of abundance were computed as $Y_i = \log_e (C_i + 1)$, where Y_i is abundance and C_i is standardized catch of collection i (i.e. number captured per 100 cubic meters of water strained per collection). Logarithmic transformation of the catch data was necessary to convert discrete variables to continuous form and to remove heterogeneity and non-normality from the data. Measures of species diversity were not log-transformed and were analyzed in their original scale.

Nine independent variables (X_j) were chosen for analysis: water temperature, salinity, dissolved oxygen and dummy variables for sampling locations (plume and ambient), period and seasons (fall, winter and spring). Table 2 summarizes notation and defines the dependent and independent variables.

Multiple regression was selected as the major method to analyze trends in the response variables for the following reasons:

(a) Complex multivariate relationships exist between the abundance of fish and eggs and environmental variables; as a descriptive tool, multiple regression can give a concise summary of these relationships.

(b) Field survey data are confounded by numerous factors since such surveys are observational in nature rather than controlled; multiple regression allows for control of some of these confounding factors by the use of "dummy" (categorical) variables. Also, each partial regression coefficient is computed as if the other variables in the equation are held constant, thereby removing their confounding effects.

(c) The ability to accurately predict the effects of environmental change or modification upon living resources is an ultimate goal; multiple regression techniques can be used to develop empirical models with predictive capabilities.

Stepwise regression techniques (Draper and Smith, 1966) were used to develop the "best" regression equation for each Y_i in the following manner:

(a) The dependent variables were plotted against environmental (independent) variables and the data were transformed where necessary.

(b) Matrices of simple correlation coefficients of dependent and independent variables and selected transformations were computed.

(c) Using the multiple regression model

$$Y_i = B_0 + B_1X_1 + B_2X_2 + \ldots + B_pX_p + \varepsilon,$$

where Y_i is abundance or species diversity, X_j is some function of one of the selected environmental variables, and B_j is a partial regression coefficient, a stepwise regression was performed to identify those parameters which explain a significant portion of the variation in the model.

(d) For each final regression equation residuals were analyzed to detect possible violations of the basic assumptions that the errors were independent, had zero mean, constant variance and followed a normal distribution.

Computations were made using SPSS version 6.02 (Nie, et. al., 1975). Independent variables were retained in the equations if their partial regression coefficients (b_j) could be declared significantly different from zero at $P<0.10$. Equations for the community structure variables (Y_1 through Y_6, Table 2) were based upon data from January through December 1978. Equations for A. mitchilli and G. bosci (Y_7 through Y_9) were based on data from May through October 1978, the time period in which eggs and larvae of these species are known to occur.

RESULTS AND DISCUSSION

Seasonal Trends in Species Composition and Abundance

Number of species (fish) increased slightly from January through March (Table 3; Fig. 3). Counts then increased two-fold in April and remained high through June though numbers fluctuated slightly. Species counts declined slightly in July and fluctuated at moderate counts (4 to 6) through October. November counts declined slightly, and early-December counts increased but mid-December counts decreased again. The highest species count was recorded during the night station on 31 May and lowest counts were recorded on the day stations of February and mid-March. Species counts at night generally exceeded counts in daylight.

Species counts during daytime in the thermal plume exceeded counts in the discharge canal on all but six sampling visits (Fig. 4). The thermal plume contained species that were not captured in the discharge canal on five of those six visits.

Specific counts during nighttime in the thermal plume exceeded counts in the discharge on all but five sampling visits (Fig. 5). The thermal plume contained species that were not captured in the discharge canal on three of those five visits.

Fish eggs were captured from March through September (Table 3; Fig. 6). Species counts of eggs were low in

March, increased to the highest counts in early-April, and remained high through mid-May. Counts thereafter declined to low numbers and remained low through September.

Species counts of fish eggs during daylight in the plume exceeded counts in the discharge canal on six sampling visits (Fig. 7). Discharge canal counts exceeded thermal plume counts on one occasion. Species counts in the thermal plume at night exceeded counts in the discharge canal on seven sampling visits (Fig. 8). Discharge canal counts exceeded thermal plume counts on two occasions. When counts were the same in the discharge canal and thermal plume, different species were captured in the thermal plume once.

Species counts of fish and fish eggs between the thermal plume and discharge canal indicate some ichthyoplankton entrainment by the thermal plume.

Average number of fish per sample (100 m^3) was low from January through March (Fig. 9). Concentrations increased in early-April but decreased gradually through the month. Abundance again increased in early-May but dropped during the last sampling visit in May. Concentrations then increased sharply with the influx of naked goby (Gobiosoma bosci) and bay anchovy (Anchoa mitchilli) and remained high throughout the summer months. Abundance then gradually declined through October but stabilized at low concentrations during November and December as postlarval and juvenile croaker entered the area.

Nighttime catch exceeded daytime catch on all but four sampling visits (Fig. 9). During summer months nighttime catches exceeded daytime catches two to three-fold.

Average catch per sample (by site) for both daytime and nighttime sampling revealed no consistent trends in catch at any sampling site (Table 4; Figs. 10 and 11). However, during August, sampling in the discharge canal yielded higher catches than the plume area except during daytime sampling on 22 August.

Catches of fish eggs in 1978 was greatly reduced from those in 1977 (Jordan et. al., 1978). Abundance of fish eggs was low except during early-April and early-May (Fig. 12). Several other sampling runs in June, July, and August yielded moderate concentrations of fish eggs. Highest catch of eggs tended to be in the discharge canal during daytime samples (Fig. 13). During April, highest nighttime catches were made in the plume but before and after April, no trends were evident (Fig. 14).

Bay anchovy and naked goby were the dominant species captured in 1978 plume entrainment samples (Tables 5 and 6). Bay anchovy eggs, larvae and postlarvae were taken from late spring through early fall. Juveniles and adult were taken all year, but they were captured more frequently in winter and early spring. Larval bay anchovy were taken from May through October in concentrations generally less than $1/m^3$

(Table 5). Naked goby larvae and postlarvae were captured from May through October and were the most abundant fishes captured (Table 5). Concentrations of naked goby were usually less than $2/m^3$ and highest concentrations were $6/m^3$.

Spot (Leiostomus xanthurus) and Atlantic croaker (Micropogon undulatus) were captured seasonally (Table 5); spot were captured in springtime samples and croaker were captured during fall samples. Both were usually present in concentrations less than $1/m^3$ at all sampling sites.

Sciaenids are hatched offshore and thereafter migrate into Atlantic coast estuaries which serve as nursery areas for postlarvae and juveniles. The James River is one such estuary and the area near Hog Point is part of the sciaenid nursery area. These postlarvae and juveniles are subject to entrainment by the thermal plume until they reach a size at which they can effectively overcome the turbulence in the mixing zone.

Atlantic menhaden (Brevoortia tyrannus) were taken in April and May samples as the pre-juveniles entered the estuarine nursery grounds (Table 5). However, densities were less than $1/m^3$.

Striped bass (Morone saxatilis) and white perch (Morone americana) larvae and postlarvae were frequently captured in springtime samples (Table 5). Concentrations were less than $1/m^3$ but more larvae were captured in 1978 than in any previous year. White perch were consistently taken in the thermal plume and ambient river areas but few were taken in the discharge canal. Striped bass were also captured most often in the thermal plume and ambient river areas. White perch eggs were taken frequently in April and May samples but only a few striped bass eggs were taken.

River herring (Alosa species) and American shad (Alosa sapidissima) eggs and larvae were also taken in greater concentrations than in all previous years (Tables 5 and 6). Generally, their concentrations were less than $1/m^3$.

Altantic silverside (Menidia menidia), Tidewater silverside (Menidia beryllina) and rough silverside (Membras martinica) were captured throughout the year (Tables 5 and 6). Eggs, larvae, and juveniles were captured during spring and summer; juveniles and adults were captured in fall and winter.

Other species were occasionally taken but numbers remained low.

Hydrographic Data

Salinity, water temperature, and dissolved oxygen data from 1978 plume entrainment samples are presented in Tables 7, 8, and 9 and Figures 15 and 16. Dissolved oxygen data are not depicted in graphic form.

Salinities (Table 7; Fig. 15) remained less than 1o/oo during all but two samples from March, through May. Salinity was less than 1.7o/oo on those two occasions. Accordingly, several anadromous and freshwater species were frequently taken as eggs and larvae. Salinities rose slightly in mid-June but remained below 4°/oo through August. Salinities rose again in the fall to the highest salinities in early-November.

Water temperature (Table 8; Fig. 16) peaked in August. Plume temperatures exceeded 35 C in August but did not always exceed ambient readings by 5 C. Water samples for the plume area are taken at the end of Tow 1 (Fig. 2) and some mixing occurs prior to this point. The thermal plume sometimes "dives" making exact location of the 5C ΔT area difficult.

No oxygen deficiencies (<4 mg/l) were recorded though a plume sample on 8 August recorded oxygen levels <5 mg/l (Table 9).

Statistical Results

An examination of simple correlation matrices of potential regression variables in the original and log-transformed scales was made to identify the final equation form of variables. In general, correlations were higher between transformed dependent variables (Y_i) and independent variables (X_j) in their original scale, except for fish and egg species diversities. Little or no improvement in correlations was found by transforming either species diversity or the independent variables.

Although many simple correlation coefficients (r) between the dependent and independent variables were declared highly significant ($P<0.001$), most correlations were not high (maximum r = 0.71). All independent variables except location variables, plume and ambient were significantly correlated ($P<0.05$ or better) with six or more of the dependent variables.

Table 10 presents descriptive statistics of the dependent and independent variables. Table 11 summarizes the results of regression analysis. Each final regression equation is discussed separately, then overall patterns are summarized.

In the following discussion, the regression coefficients are partial coefficients which estimate the effects of a particular variable while holding constant or controlling all other variables in the equation. Evaluation of the contribution of a particular independent variable is facilitated by controlling the influence of other variables which otherwise could confound or mask significant relationships.

Total Abundance of Fish (Y_1):

Temperature, salinity, period, fall and winter were retained in the final regression equation as significant predictors of fish abundance. The equation for Y_1 was highly significant ($P<0.001$) and explained three-fourths of the variation in fish abundance ($R^2 = 0.76$).

Temperature and period had positive partial regression coefficients (b_j's); i.e. their partial effects on Y_1 (fish abundance) were positive. The remaining independent variables had negative b_j's. Within the ranges of values observed, the equation predicts an increasing total abundance of fish with an increasing temperature or decreasing salinity. Fish abundance was significantly higher at night than during the day.

Seasons were included in the analysis as dummy variables to mathematically reduce the unexplained variation in the model and to remove factors which could confound the analysis. After allowing for the effects of other variables in the equation, fall and winter had a significantly lower fish abundance than the reference season (summer). Spring did not differ significantly from summer. Unmeasured seasonal effects (in addition to those accounted for by variables in the equation) tended to decrease fish abundance in fall and winter. Factors which may be reflected in the season variables include time and duration of migrations of parent populations, recruitment, wind direction, currents, fishing efficiency of gear, and other unmeasured factors which vary seasonally.

The location variables (plume and ambient) were included in the analysis to estimate the partial effects of location on fish abundance. Because neither were retained in the equation, no significant differences in fish abundance were found between plume and ambient river samples and samples from the discharge canal (the reference location). In other words, there was no evidence of significant plume entrainment after removing the effects of other variables in the equation.

Abundance of Fish Species (Y_2):

The highly significant equation for Y_2 explained two-thirds of the variation in fish species abundance ($R^2 = 0.69$). The partial regression coefficients for temperature, plume, ambient, period and spring were positive; those for salinity and winter were negative. Dissolved oxygen and fall were not retained in the equation for fish species abundance. Holding other variables constant, an increase in temperature or a decrease in salinity will increase the fish species abundance. A significantly higher fish species abundance was found at night. Unmeasured seasonal factors represented by the season winter tended to decrease abundance of fish species in this season; the converse was true for spring. A significantly higher abundance of fish species was found in plume and ambient river samples than in samples from the discharge canal.

Fish Species Diversity (Y_3):

The highly significant equation for Y_3 explained fifty-five percent of the variation in fish species diversity and retained temperature, dissolved oxygen, plume, ambient, period, and spring as significant independent variables. Samples at night had a significantly higher fish diversity than day samples. Seasonal factors (in addition those reflected in other variables in the equation) increased the fish diversity in spring. Thermal plume and ambient river samples had a significantly higher fish species diversity than discharge canal samples.

Total Abundance of Eggs (Y_4):

Thirty-nine percent of the variation in egg abundance was explained by the equation for Y_4. The partial effects of spring were positive; those of temperature, ambient, period, fall and winter were negative. Ambient river samples and night samples had a significantly lower egg abundance than did plume, discharge or day samples. Unmeasured seasonal factors in fall and winter tended to decrease egg abundance in these seasons compared to summer; the reverse held for spring. The equation predicts a lower egg abundance at higher temperatures, holding other variables constant.

Abundance of Egg Species (Y_5):

Forty-five percent of the variation in egg species abundance was explained by the equation for Y_5. Temperature, ambient, period, fall and winter had significant negative partial regression coefficients; spring had a significant positive coefficient. The abundance of egg species will increase as the former variables decrease. A significantly higher egg species abundance was found in spring than in summer, and a significantly lower egg species abundance was found in fall and winter.

Egg Species Diversity (Y_6):

Thirty-five percent of the variation in egg diversity was explained by the regression. The partial effects of temperature, plume, ambient, period, fall and winter were negative; that of spring was positive. Egg diversity was significantly higher in spring and significantly lower in fall and winter. Plume and ambient samples had a significantly lower egg species diversity than did discharge canal samples.

Abundance of Anchoa mitchilli Fish (Y_7):

Sixty-eight percent of the variation in anchovy abundance was explained by the final equation for Y_7. All independent variables except plume and fall were retained as significant independent variables. Temperature, ambient and period had positive partial effects on anchovy abundance, and salinity, dissolved oxygen and spring had negative effects.

Abundance of Gobiosoma bosci Fish (Y_8):

Almost one-half of the variation in goby abundance was explained by the final equation for Y_8. The partial regression coefficients for temperature and period were positive, and the coefficient for salinity was negative. Other independent variables were not retained as significant predictors of goby abundance.

Abundance of *Anchoa mitchilli* Eggs (Y_9):

Only twenty percent of the variation in anchovy egg abundance was explained by the regression which retained two independent variables. The partial effect of temperature was positive. Ambient river samples had significantly fewer anchovy eggs than the other two sampling locations.

Summary of Regression Analysis:

A nonparametric ranking procedure was developed to assess the relative importance of the independent variables. Direct comparisons of partial regression coefficients (b_j's) are not useful since the independent variables were measured in different units. However, comparisons between standardized coefficients (the dependent and independent variables were standardized to have unit variance) can be used to determine the relative effect of each independent variable on the dependent variables. The procedure consisted of ranking the absolute values of the standardized b_j's in each equation, summing the individual ranks for each variable across all equations, and ranking these sums to give an overall measure of relative importance. Ties were assigned average ranks, and dummy seasons were not included in the analysis. Table 12 summarizes these data.

Overall, temperature ranked first in relative importance of the independent variables and was retained in all of the regression equations as a significant predictor of fish and egg abundances and diversities. However, the relationship between temperature and the dependent variables was not consistent. For all measures of fish abundance and diversity (Y_1, Y_2, Y_3, Y_7, Y_8) and anchovy egg abundance (Y_9), the relationship was a positive one. As temperature increases, these dependent variables will increase. The converse was true for the relationship between temperature and measures of egg abundance and diversity (Y_4, Y_5, Y_6). Holding other variables constant, the partial effect of temperature on these three dependent variables was negative.

The location variables ambient and plume ranked second and fifth, respectively, in relative importance. Plume samples were not significantly higher in abundance and diversity of fish eggs and larvae than either discharge or ambient river samples. Thus, there was no evidence of significant plume entrainment of ichthyoplankton after removing the effects of other variables.

Period was third in relative importance and was retained in all but one of the equations. Night samples had a higher fish abundance and diversity than day samples. On the other hand, day samples had a higher egg abundance and diversity than night samples.

Salinity was fourth in relative importance and had a negative partial effect on total fish abundance, fish species abundance, anchovy abundance and goby abundance. These dependent variables increased as salinity decreased. Salinity was not a significant variable in the remaining equations.

Dissolved oxygen was the least important independent variable and was retained in only two equations. Fish species diversity and anchovy increased as dissolved oxygen decreased.

CONCLUSIONS

The ichthyoplankton data set collected in and around the thermal plume from VEPCO Surry Nuclear Power Plant during 1978 revealed no statistically significant entrainment of the Cobham Bay ichthyofauna by the thermal plume. Some entrainment is evidently occurring since samples from the plume (Figs. 4, 5, 7 and 8) often show higher number of species. Size of the individuals present should be considered when comparing species captured. Larger fish can overcome turbulence in the mixing zone and may even select the warmer waters in the plume area during colder months.

We can define the species and quantity of ichthyoplankton in and around the thermal plume from VEPCO Surry Nuclear Power Plant, however, we cannot determine the effects of the thermal plume on the ichthyofauna of Cobham Bay. Natural fluctuations in abundance (which may be one or more orders of magnitude from year to year), sampling variability and biological attributes of the ichthyofauna interact in such a way as to confound interpretation of the data set. Other sources of stress (i.e., organic and inorganic pollutants, siltation, flooding, etc.) also interact to add difficulty to impact assessment. Impact assessment for the VEPCO Surry Nucler Power Plant must contain an examination of all available data sets (trawl, seine, impingement, and entrainment) and take into consideration all factors affecting the estuarine ecosystem.

Adult fish population trends in the vicinity of the plant site have been monitored since the pre-operational period of the facility. VEPCO data (screen impingement, trawl, and seine) and VIMS trawl data reveal large increases and decreases in relative abundance of some fishes in the vicinity of Hog Point (J. White, personal communication and Bender et al., 1975). Ichthyoplankton studies have only been in progress since August, 1975 and pre-operational data are not available. Thus long term trends indicate relatively stable ichthyoplankton abundances.

Bay anchovy and naked goby were the dominant forms captured in 1978 plume entrainment samples. However, both species prefer higher salinities than those recorded in and around the thermal plume from VEPCO Surry in 1978 for spring (Lippson and Moran, 1974). It is unlikely that the centers of egg and larval abundances for these species are near the Cobham Bay area of the James River. Larval abundances could fluctuate yearly with salinity patterns within the river.

Bay anchovy egg and larval concentrations have been relatively stable during this study. Lower concentrations of anchovy eggs were recorded in 1978, probably due to lower salinities. Adult bay anchovy concentrations have also remained within the bounds of natural fluctuations over the long term [VIMS trawl surveys (Hoagman and Kriete, 1975) and VEPCO data (White, 1976)].

Adult naked goby inhabit oyster communities and other areas where crevices etc. afford shelter. Adults are seldom captured in trawl or seine surveys and it is difficult to obtain a realistic estimate of population levels.

Fishes of commercial importance were not a significant portion (relative to other species captured) of the catch in our samples. Several species (Atlantic croaker, spot, and Atlantic menhaden) utilize the area as nursery grounds while in the postlarval and juvenile stages. These species soon reach a size and swimming speed whereby they can effectively negotiate turbulence created in the mixing zone and no longer be subject to entrainment.

Multiple regression techniques were useful in explaining some of the complex relationships between environmental factors and the abundance and diversity of fish and eggs and in isolating factors which tend to confound the analysis of data from general field surveys. These techniques identified the dominant environmental factors and assessed their relative importance.

The data (species capture at each site) from in and around the thermal plume from VEPCO Surry Nuclear Power Plant indicate that limited entrainment of the Cobham Bay ichthyofauna is occurring. However, adult population levels have remained within the bounds of natural population fluctautions and we have found no evidence that suggests a cause and effect relationship between fluctuations in fish species abundance or fish populations in the Cobham Bay area of the James River and operation of VEPCO Surry Nuclear Power Plant.

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Figure 1. 0.5 paired-net apparatus with rope bridle and lead weight.

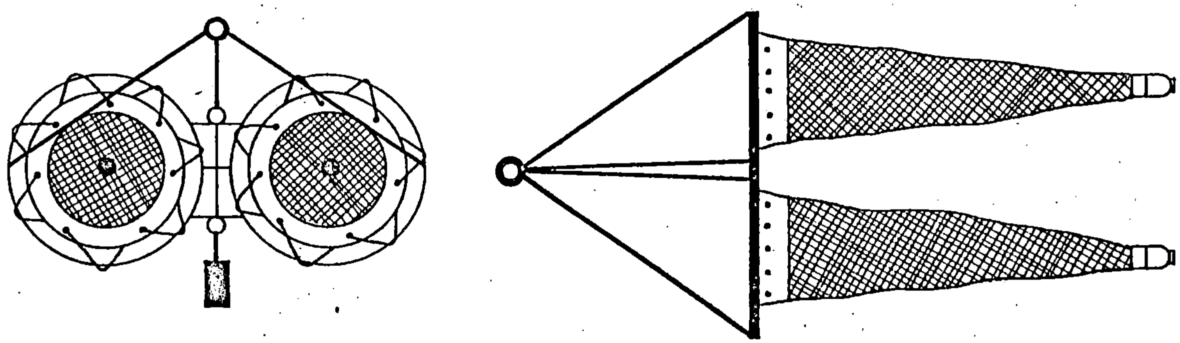
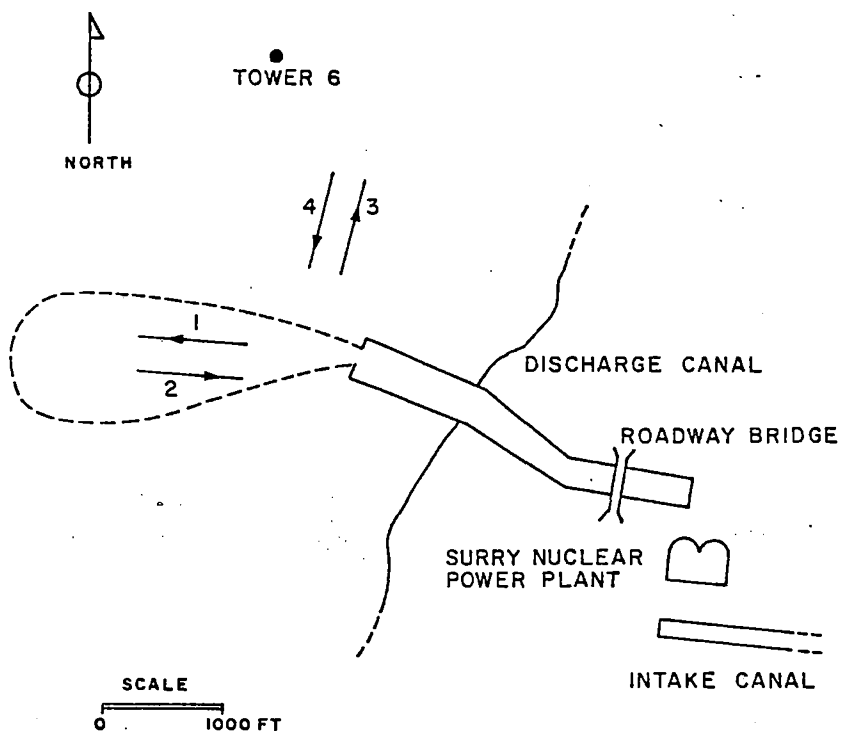


Figure 2. James River in vicinity of Surry Nuclear Power Station showing plume entrainment sampling locations.



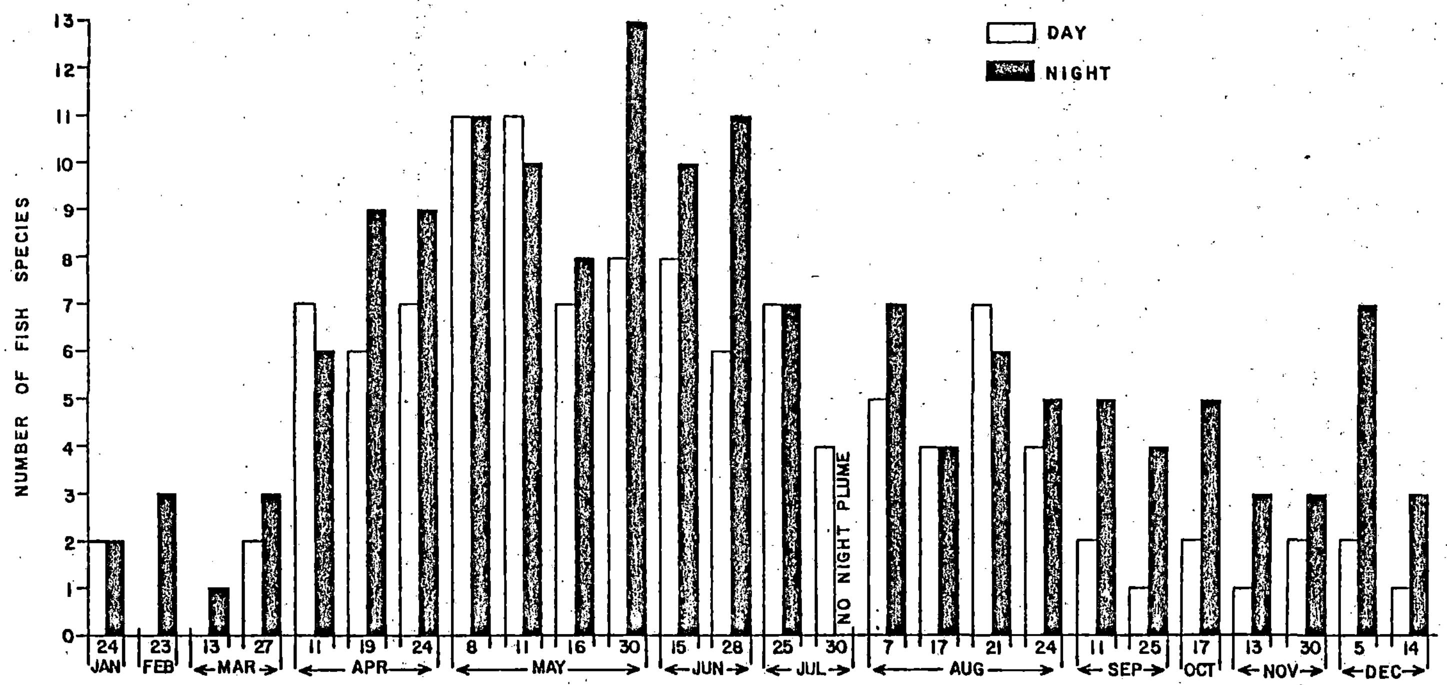


Figure 3. Number of fish species captured during plume entrainment stations at VEPCO Surry Nuclear Power Plant in 1978.

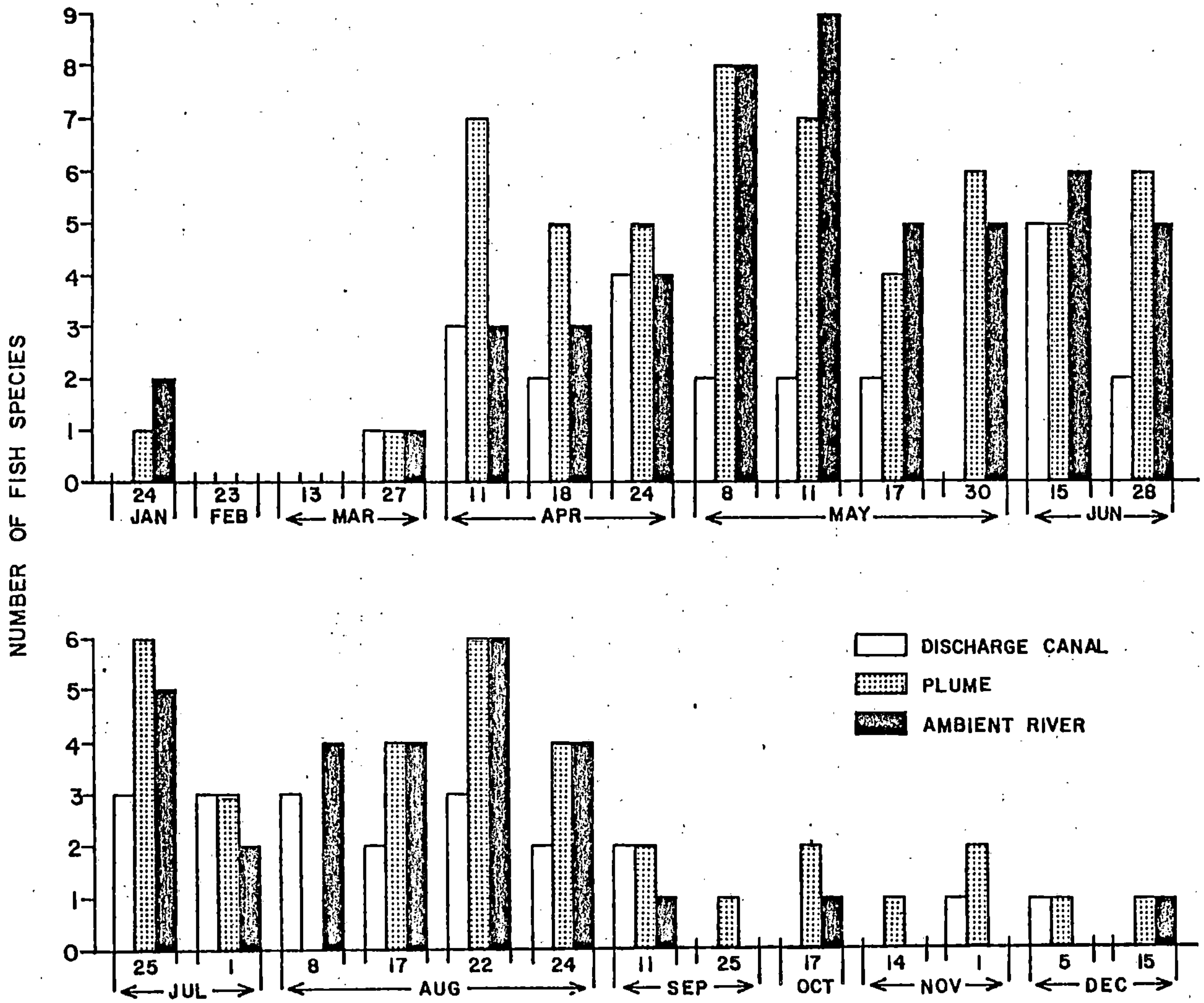


Figure 4. Number of fish species captured during day-plume entrainment stations at VEPCO Surry Nuclear Power Plant in 1978.

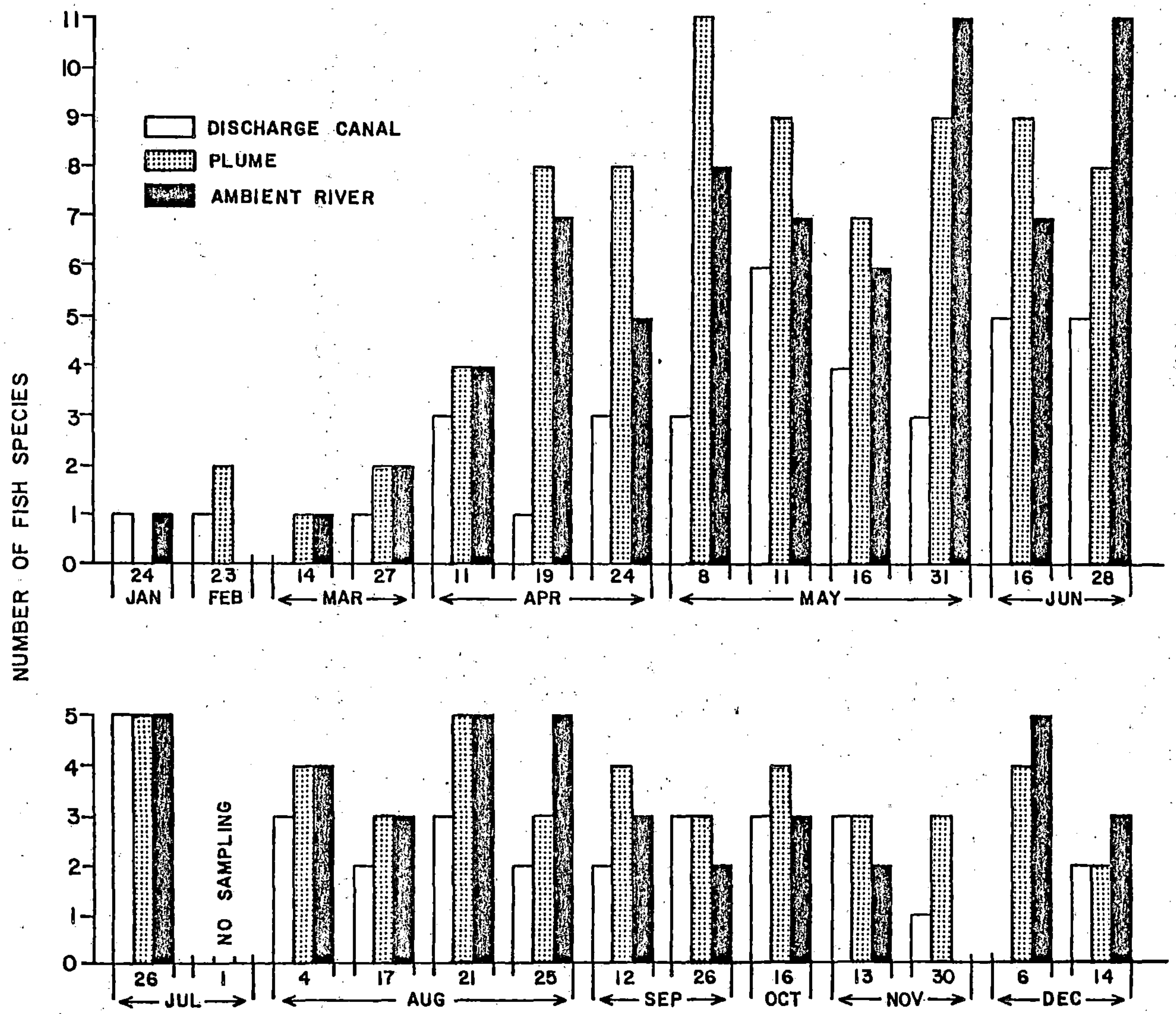


Figure 5. Number of fish species captured during night-plume entrainment stations at VEPCO Surry Nuclear Power Plant in 1978.

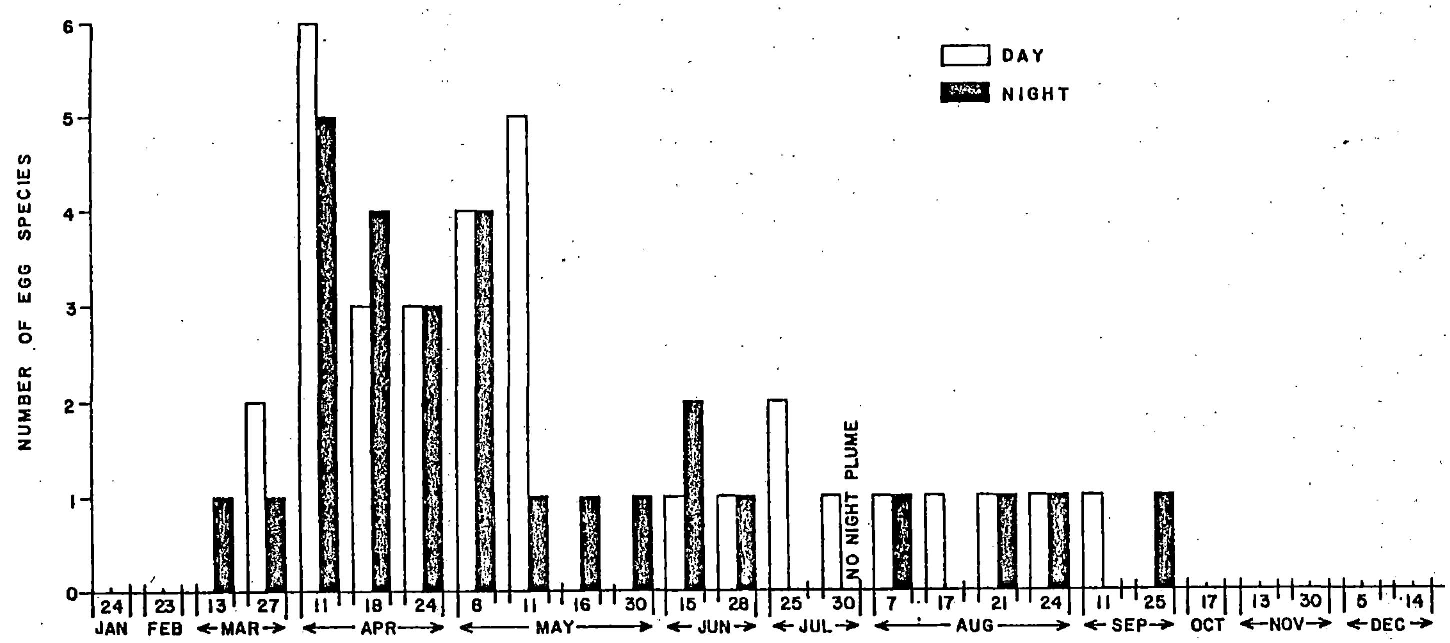


Figure 6. Number of egg species captured during plume entrainment stations at VEPCO Surry Nuclear Power Plant in 1978.

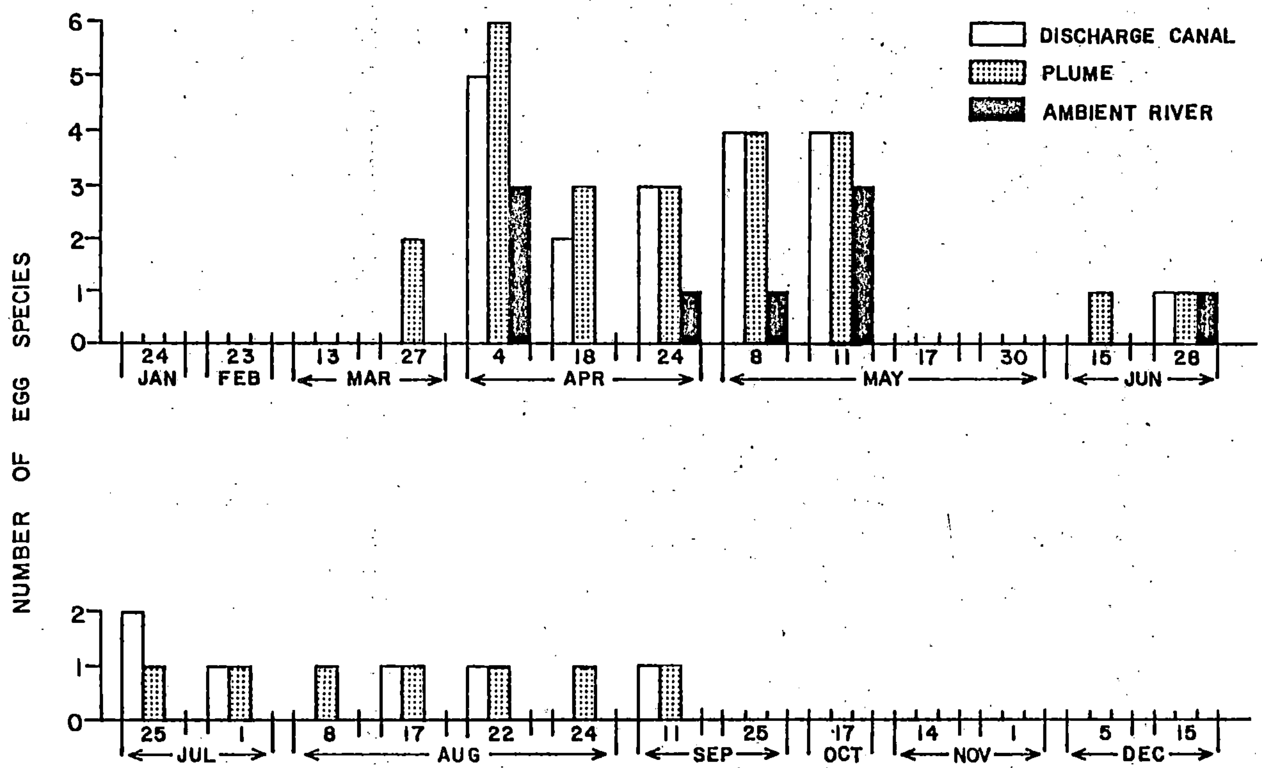


Figure 7. Number of egg species captured during day-plume entrainment stations at VEPCO Surry Nuclear Power Plant in 1978.

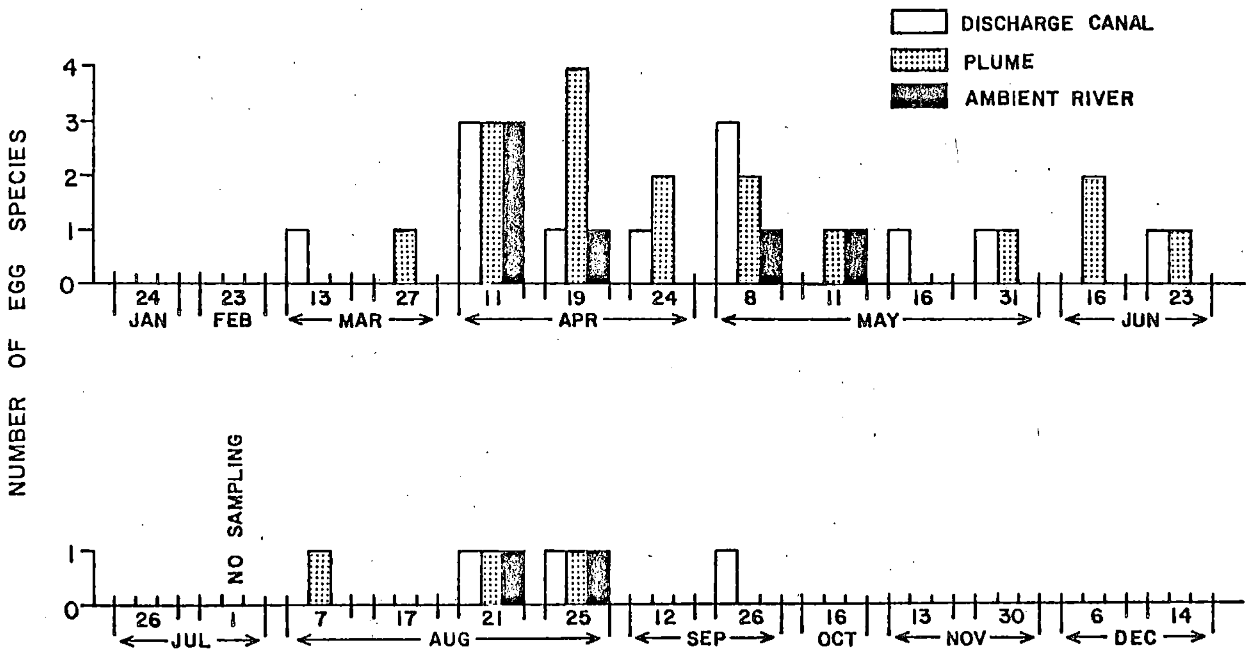


Figure 8. Number of egg species captured during night-plume entrainment stations at VEPCO Surry Nuclear Power Plant in 1978.

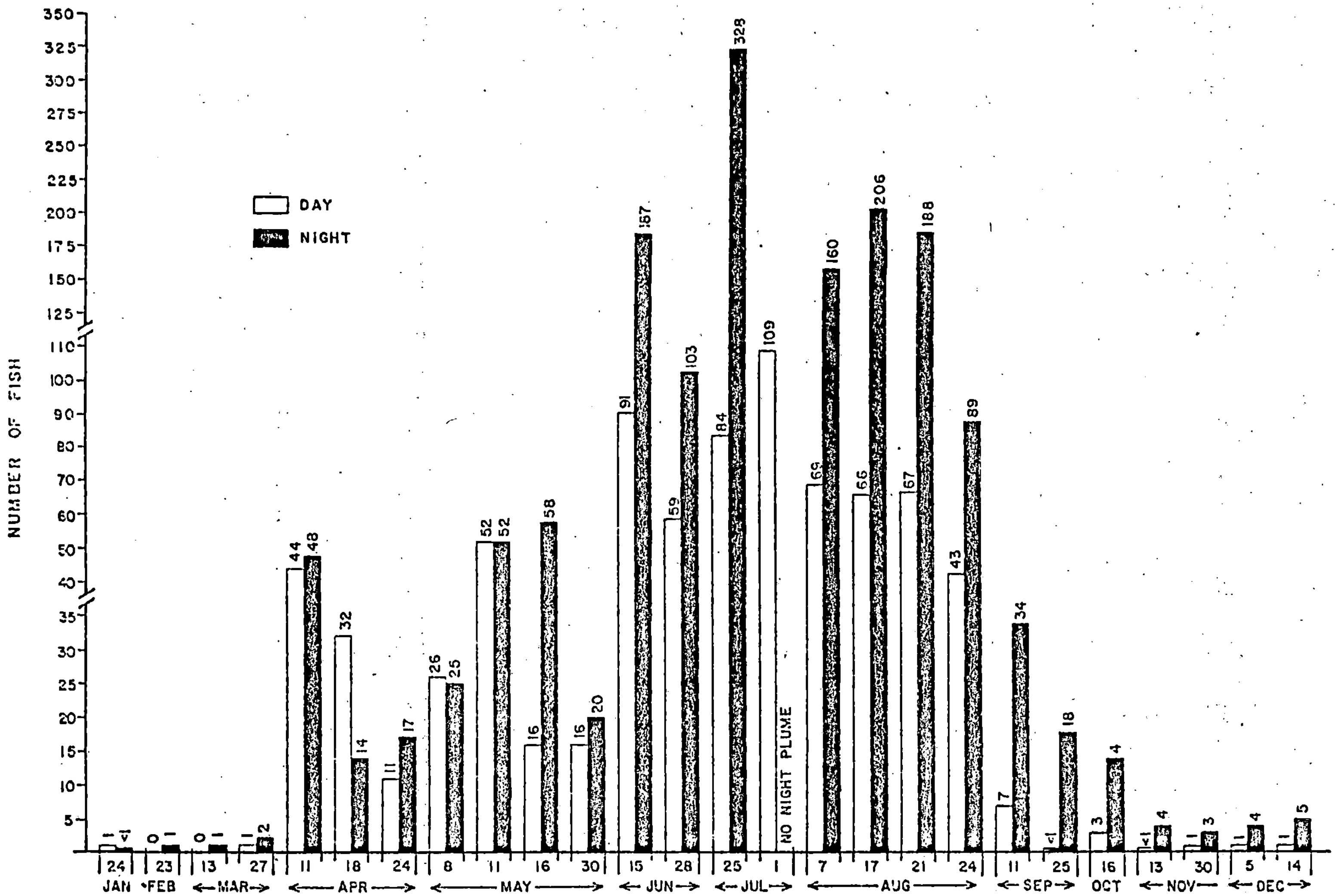


Figure 9. Average number of fish per sample (100 m^3) captured during plume entrainment stations at VEPCO Surry Nuclear Power Plant in 1978.

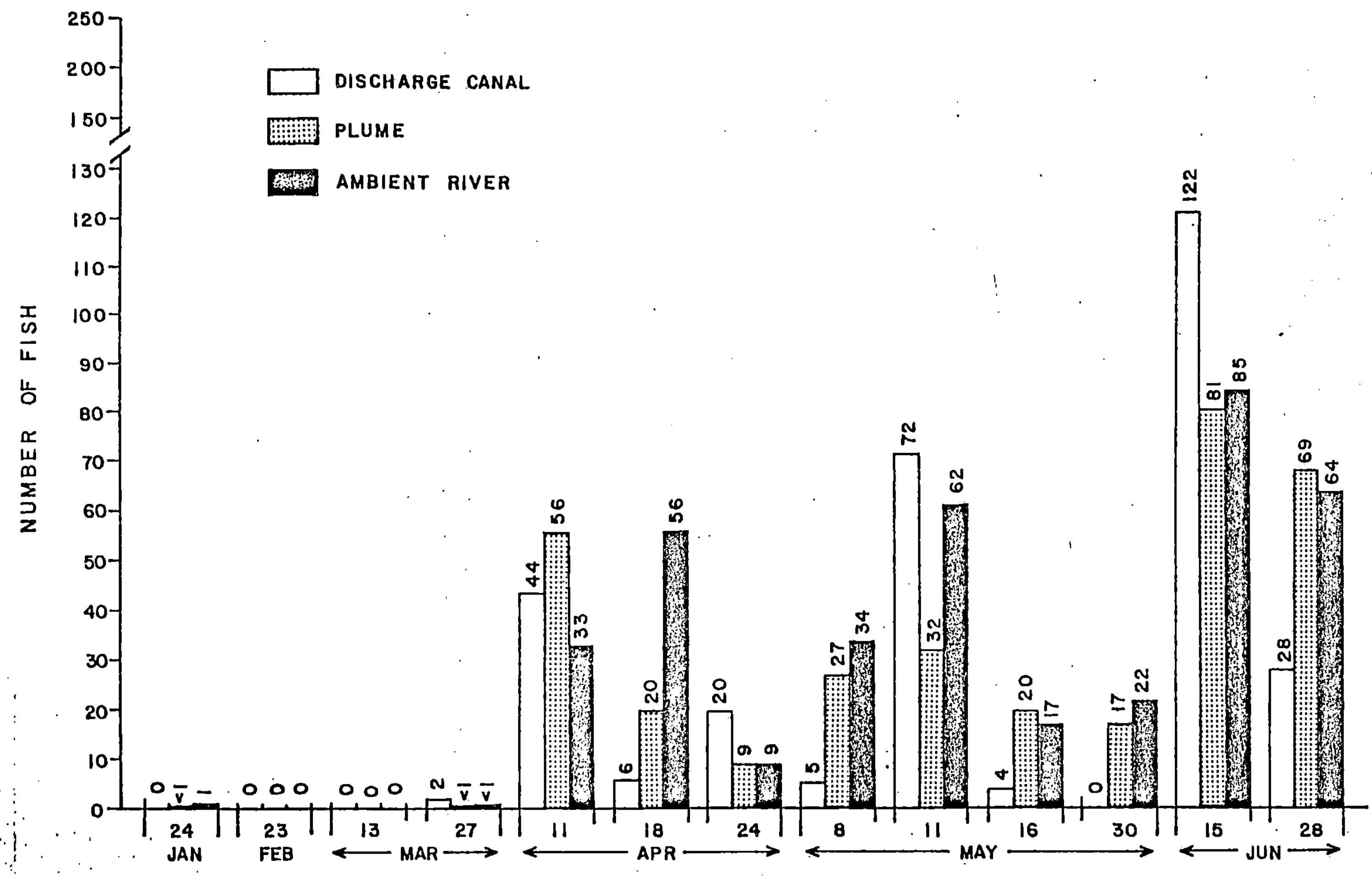


Figure 10. Average number of fish per sample (100 m^3) captured during day-plume entrainment stations at VEPCO Surry Nuclear Power Plant in 1978.

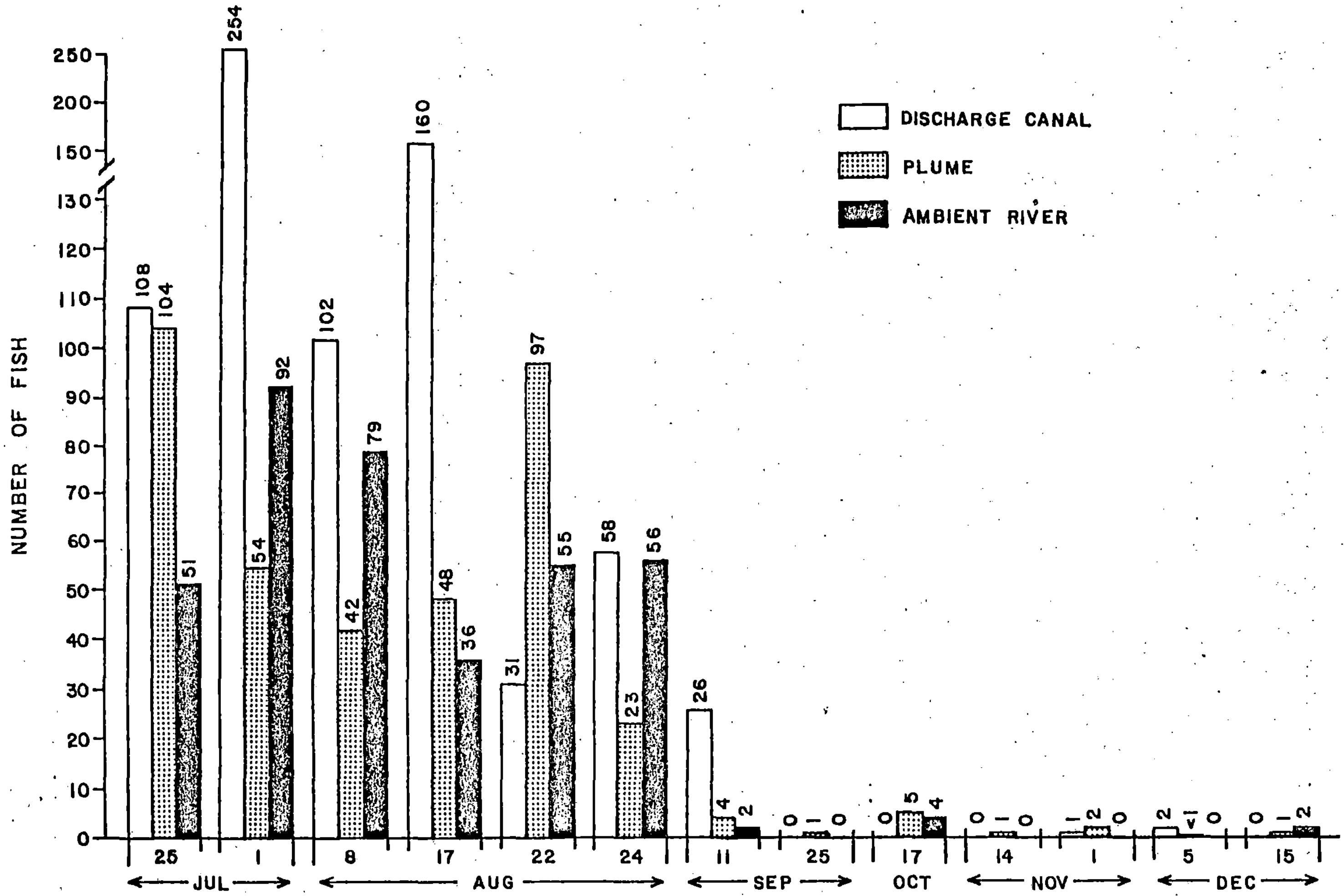


Figure 10. (continued).

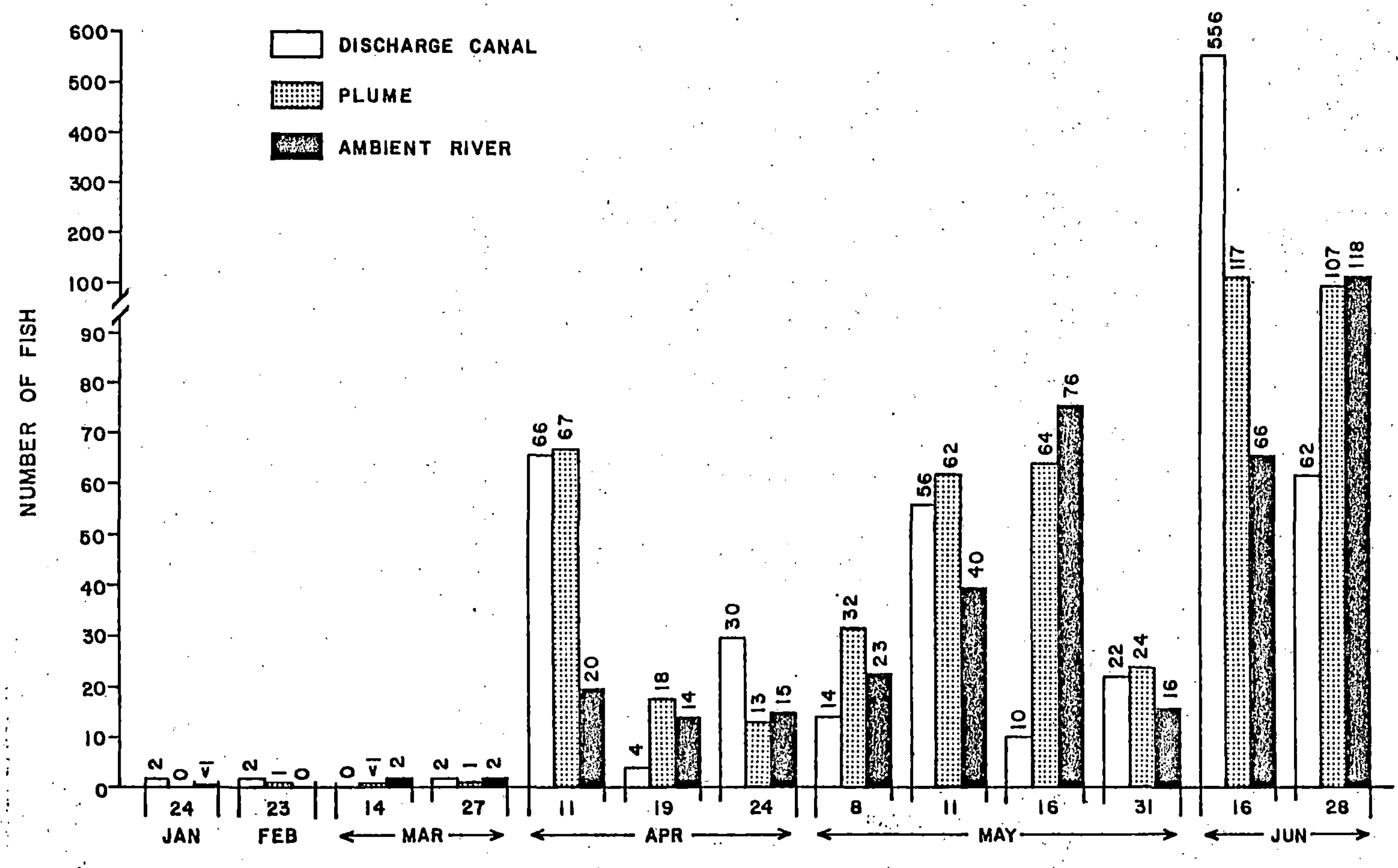


Figure 11. Average number of fish per sample (100 m^3) captured during night-plume entrainment stations at VEPCO Surry Nuclear Power Plant in 1978.

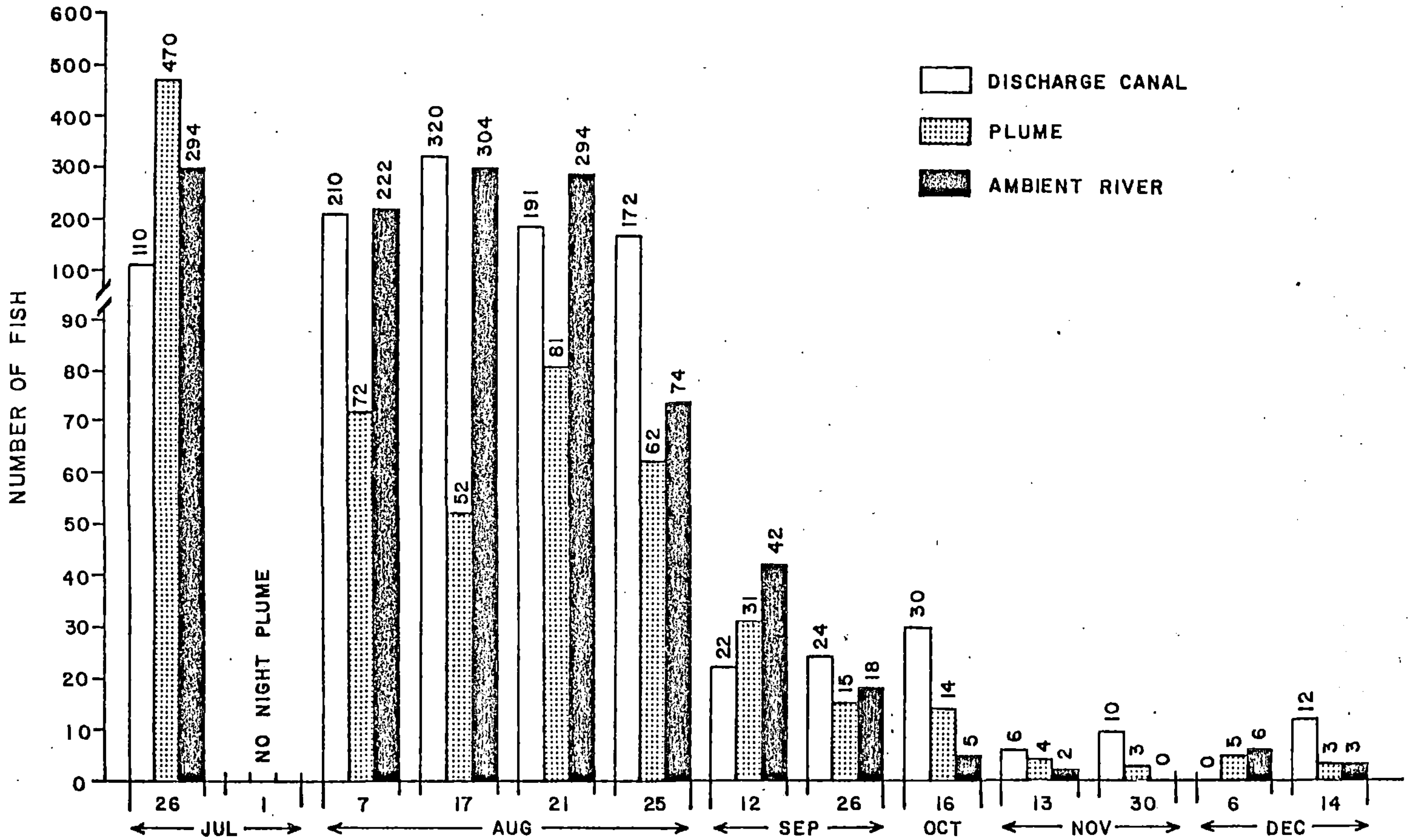


Figure 11. (continued).

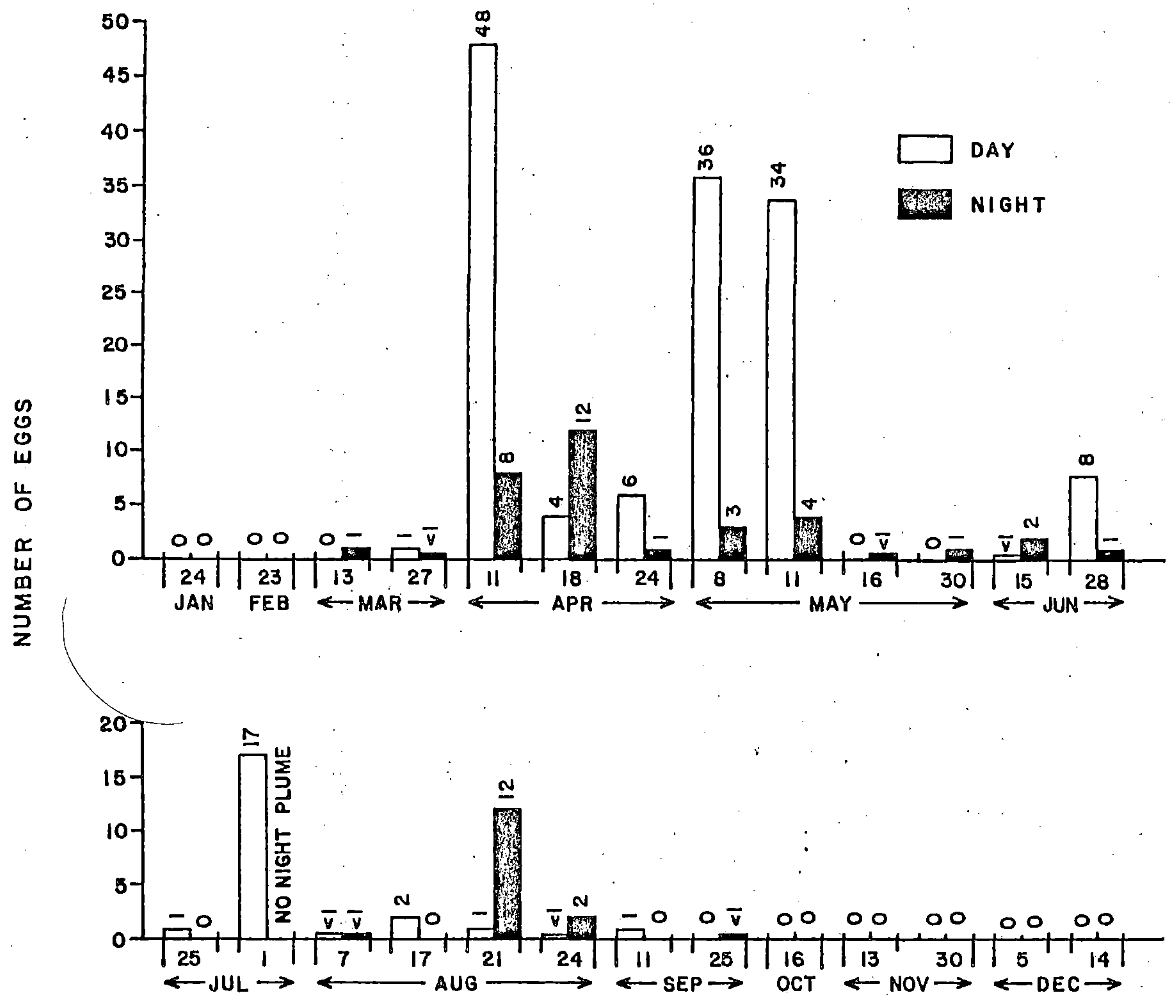


Figure 12. Average number of eggs per sample (100 m^3) captured during plume entrainment stations at VEPCO Surry Nuclear Power Plant in 1978.

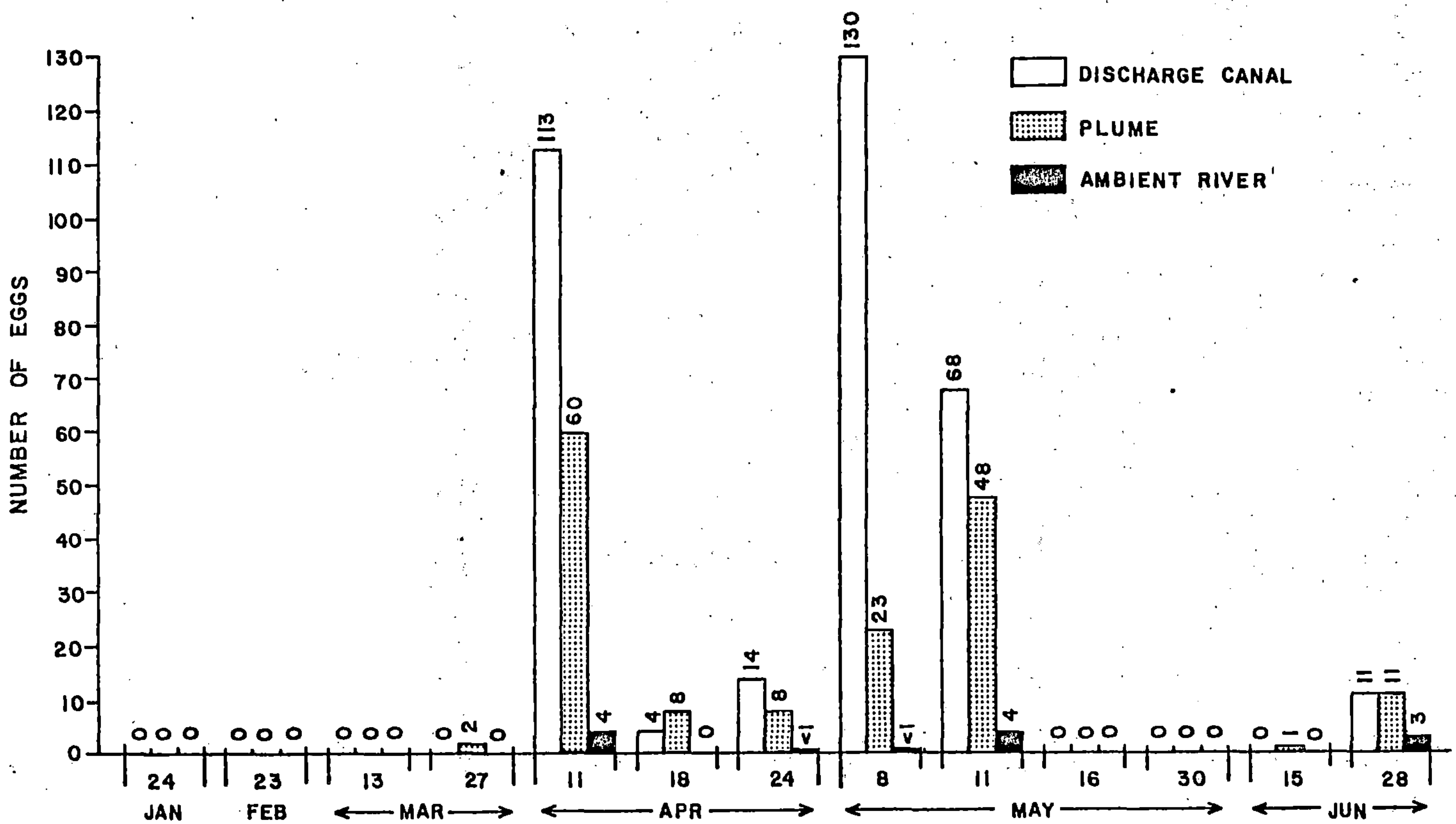
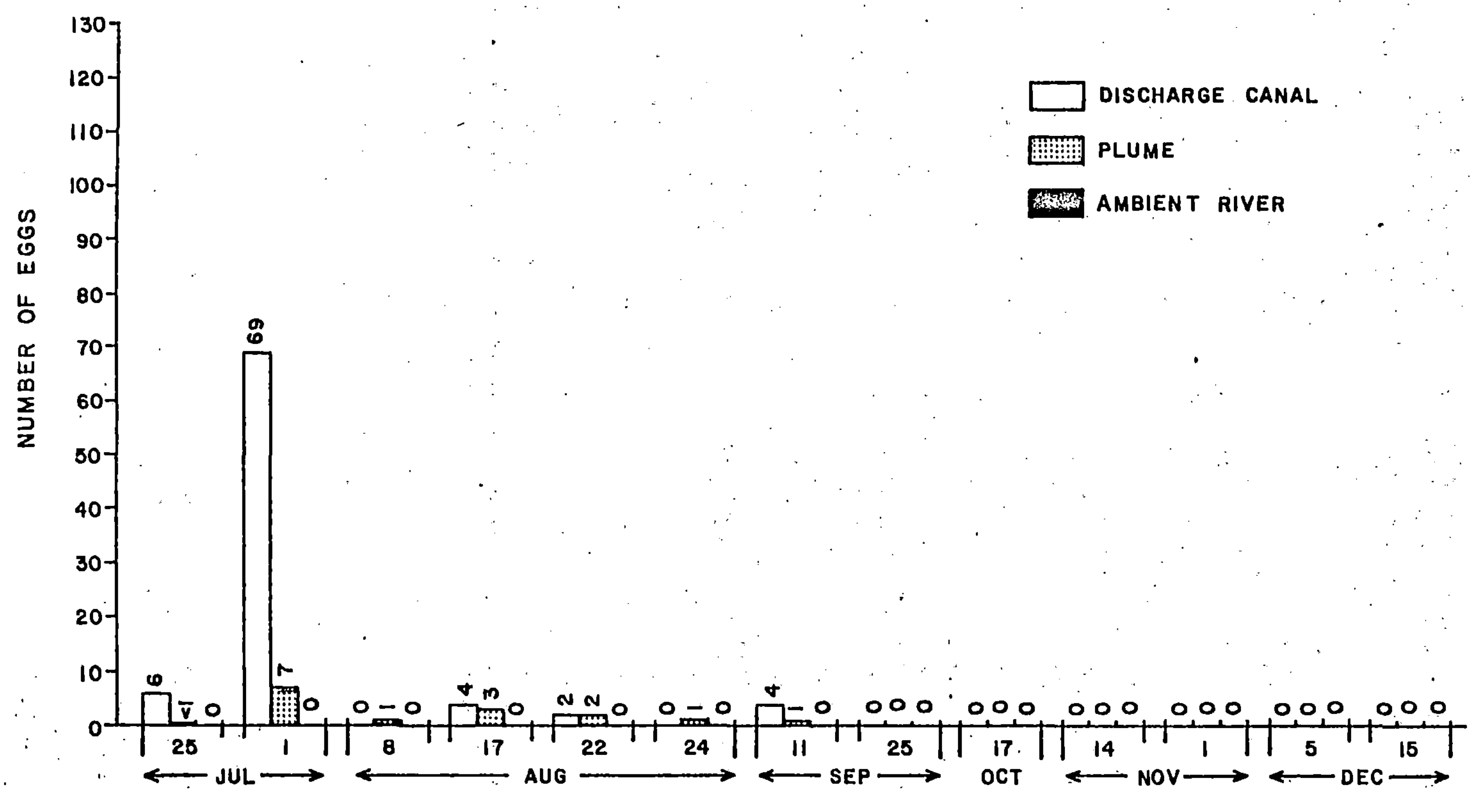


Figure 13. Average number of eggs per sample (100 m^3) captured during day-plume entrainment stations at VEPCO Surry Nuclear Power Plant in 1978.



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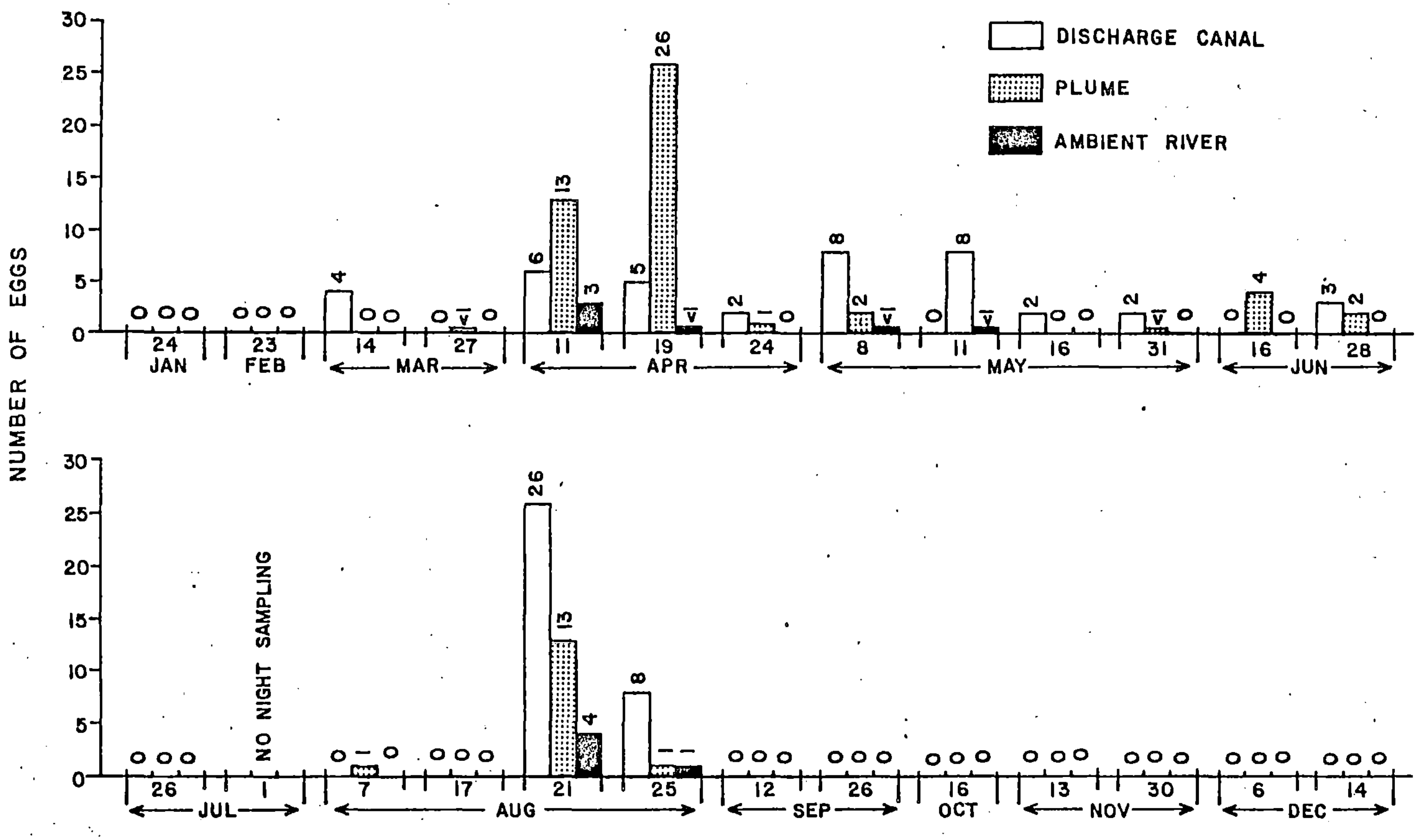

Figure 14. Average number of eggs per sample (100 m^3) captured during night-plume entrainment stations at VEPCO Surry Nuclear Power Plant in 1978.

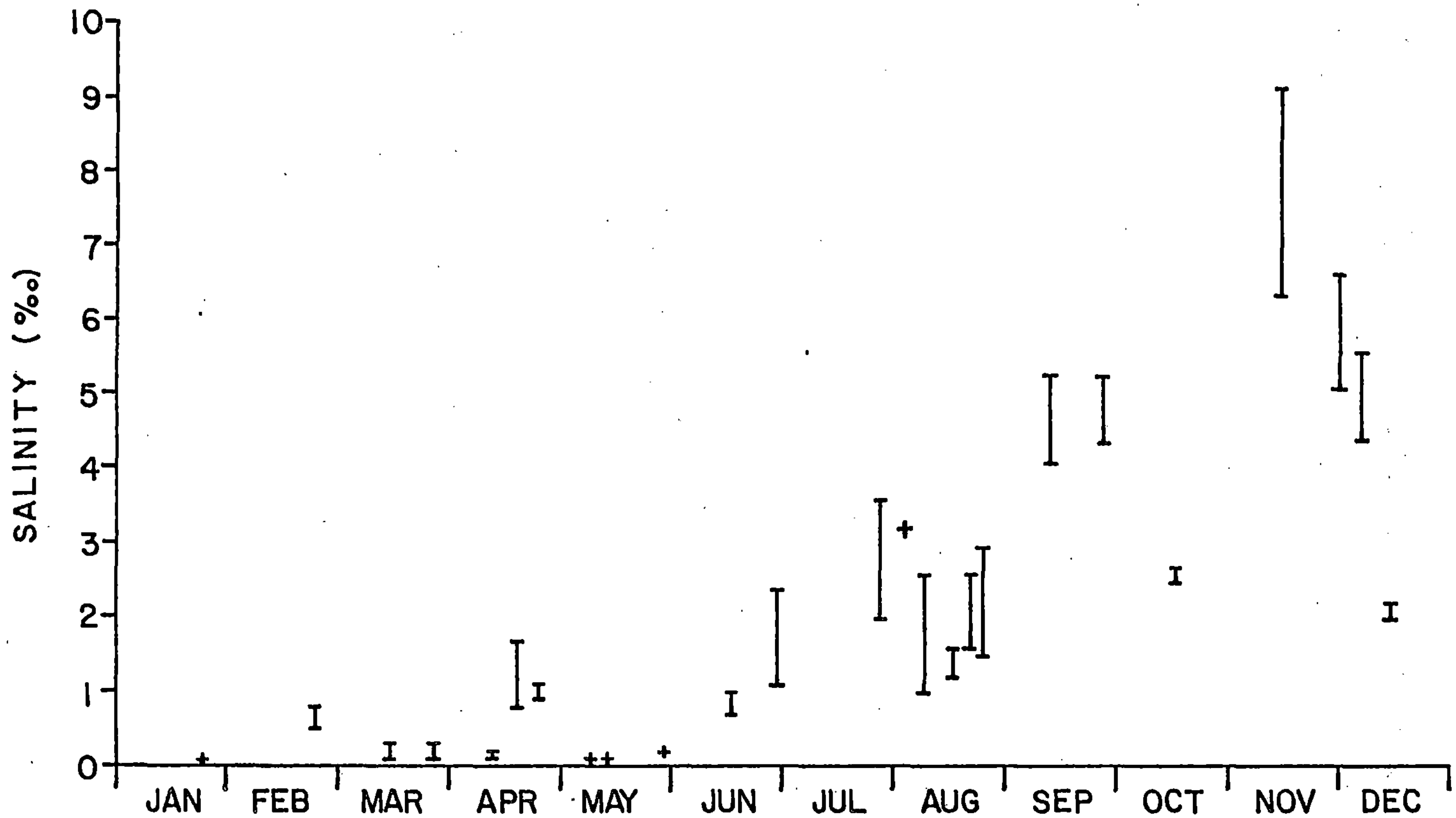

Figure 15. Ranges of salinity (°/oo) in ambient river water during plume entrainment stations at VEPCO Surry Nuclear Power Plant in 1978.

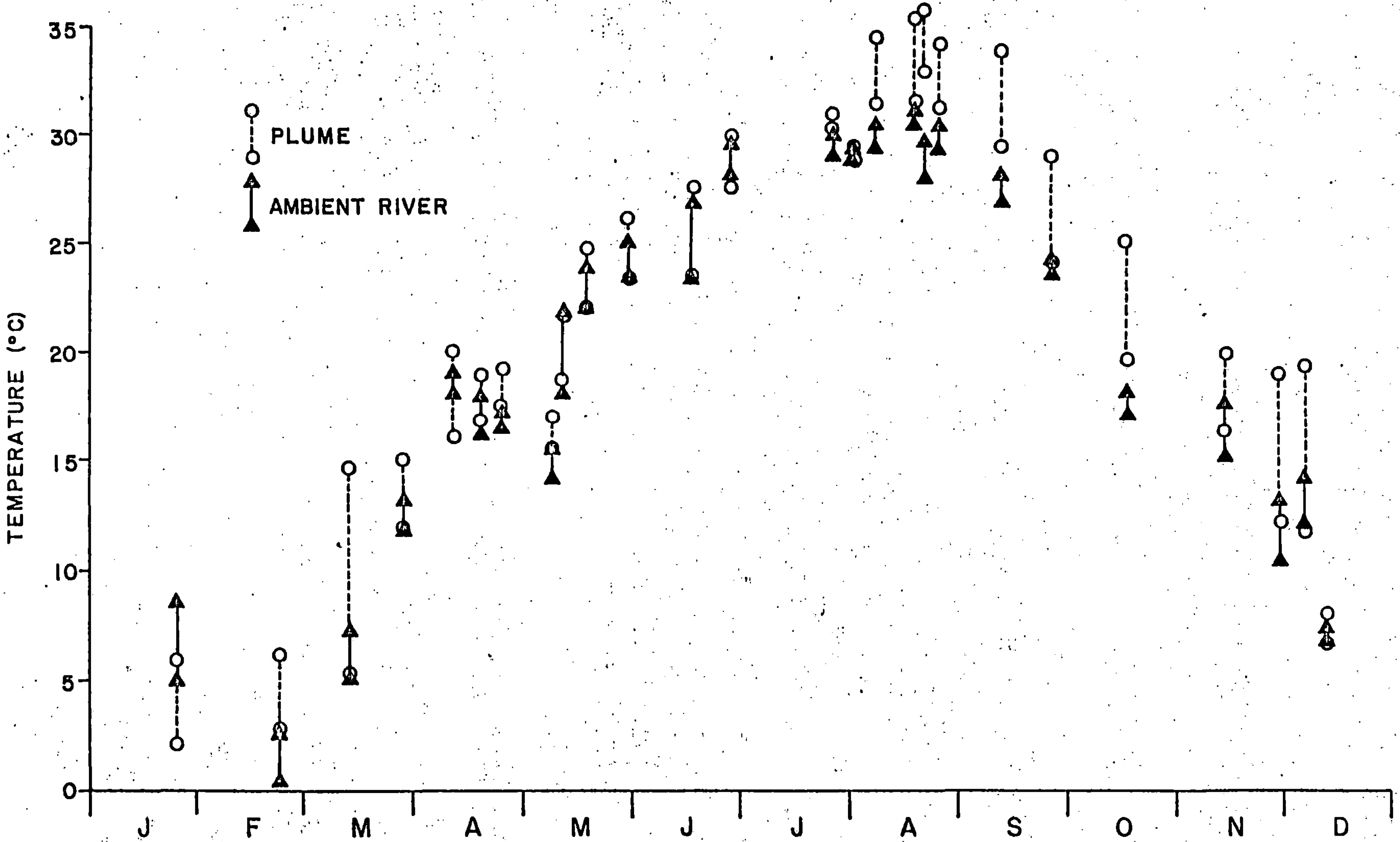

Figure 16. Ranges of water temperature (C) during plume entrainment stations at VEPCO Surry Nuclear Power Plant in 1978.

Table 1. Ichthyoplankton sampling schedule for plant and plume entrainment studies at VEPCO Surry Nuclear Power Plant (January through December 1978).

Study	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Plant Entrainment	X	X	XX	XXXX	XXXX	XX	X	X	X	X	X	X
Plume Entrainment	X	X	XX	XXXX	XXXX	XX	XX	XXXX	XX	X	XX	XX

Table 2. Dependent (Y_i) and independent (X_j) variables for statistical analysis (standardized catch is number collected per 100 cubic meters of water strained per collection).

Variable	Definition		
Y_1, Total abundance of fish	$Y_1 = \log_e (C_1 + 1)$, where C_1 = standardized catch of fish		
Y_2, Abundance of fish species	$Y_2 = \log_e (C_2 + 1)$, where C_2 = number of fish species		
Y_3, Fish species diversity	$Y_3 = -\Sigma p_k \log_e p_k$, where $p = \frac{n_k}{N}$, n_k = number of fish of the k^{th} species, and N = total number of fish		
Y_4, Total abundance of eggs	$Y_4 = \log_e (C_4 + 1)$, where C_4 = standardized catch of eggs		
Y_5, Abundance of egg species	$Y_5 = \log_e (C_5 + 1)$, where C_5 = number of egg species		
Y_6, Egg species diversity	$Y_6 = -\Sigma p_k \log_e p_k$, where $p_k = \frac{n_k}{N}$, n_k = number of eggs of the k^{th} species, and N = total number of eggs		
Y_7, Abundance of _A. mitchilli_ fish	$Y_7 = \log_e (C_7 + 1)$, where C_7 = standardized catch of _A. mitchilli_ fish		
Y_8, Abundance of _G. bosci_ fish	$Y_8 = \log_e (C_8 + 1)$, where C_8 = standardized catch of _G. bosci_ fish		
Y_9, Abundance of _A. mitchilli_ eggs	$Y_9 = \log_e (C_9 + 1)$, where C_9 = standardized catch of _A. mitchilli_ eggs		
X_1, Water temperature	°C		
X_2, Salinity	ppt		
X_3, Dissolved oxygen	mg/l		
X_4, X_5, Location dummy variables	Location	X_4, Plume =	X_5, Ambient =
	Discharge	0	0
	Plume	1	0
	Ambient	0	1

Table 2. (continued).

Variable	Definition			
X_6, Period dummy variable	0 = day (5 to 16.9 h EST), 1 = night (17.0 to 4.9 h EST)			
X_7, X_8, X_9, Season dummy variables	Season	X_7, Fall =	X_8, Winter =	X_9, Spring =
	Summer (July, Aug., Sept.)	0	0	0
	Fall (Oct., Nov., Dec.)	1	0	0
	Winter (Jan., Feb., March)	0	1	0
	Spring (April, May, June)	0	0	1

Table 3. Number of species captured in plume entrainment samples at VEPCO Surry Nuclear Power Plant in 1978.

DATE	DAY			NIGHT		
	Number of Species			Number of Species		
	FISH	EGGS	BOTH*	FISH	EGGS	BOTH*
Jan. 24-24	2	0	0	2	0	0
Feb. 23-23	0	0	0	3	0	0
Mar. 13-14	0	0	0	1	1	0
Mar. 27-27	2	2	0	3	1	1
Apr. 11-11	7	6	6	6	5	3
Apr. 18-19	6	3	2	9	4	2
Apr. 24-24	7	3	2	9	3	2
May 8-8	11	4	3	11	4	2
May 11-11	11	5	5	10	1	1
May 16-16	7	0	0	8	1	0
May 30-31	8	0	0	13	1	1
June 15-16	8	1	1	10	2	1
June 28-28	6	1	1	11	1	1
July 25-26	7	2	1	7	0	0
Aug. 1(only)	4	1	1	not applicable		
Aug. 7-8	5	1	1	7	1	1
Aug. 17-17	4	1	1	4	0	0
Aug. 21-22	7	1	1	6	1	1
Aug. 24-25	4	1	1	5	1	1
Sep. 11-12	2	1	1	5	0	0
Sep. 25-26	1	0	0	4	1	0

Table 3. (concluded).

DATE	DAY Number of Species FISH	EGGS	BOTH*	NIGHT Number of Species FISH	EGGS	BOTH*
Oct. 16-17	2	0	0	5	0	0
Nov. 13-14	1	0	0	3	0	0
Nov. 30-Dec. 1	2	0	0	3	0	0
Dec. 5-6	2	0	0	7	0	0
Dec. 14-15	1	0	0	3	0	0

* Number of species that occur as both fish and eggs within the same sample.

Table 4. Average number (100 m^3) of fish and fish eggs per sample captured in plume entrainment samples at VEPCO Surry Nuclear Power Plant in 1978.

DATE 1978		DISCHARGE CANAL		PLUME		AMBIENT RIVER	
		Larvae	Eggs	Larvae	Eggs	Larvae	Eggs
24 Jan.	(D)	0	0	<1	0	1	0
24 Jan.	(N)	2	0	0	0	<1	0
23 Feb.	(D)	0	0	0	0	0	0
23 Feb.	(N)	2	0	1	0	0	0
13 March	(D)	0	0	0	0	0	0
14 March	(N)	0	4	<1	0	2	0
27 March	(D)	2	0	<1	2	<1	0
27 March	(N)	2	0	1	<1	2	0
11 April	(D)	44	113	56	60	33	4
11 April	(N)	66	6	67	13	20	3
18 April	(D)	6	4	20	8	56	0
19 April	(N)	4	5	18	26	14	<1
24 April	(D)	20	14	9	8	9	<1
24 April	(N)	30	2	13	1	15	0
8 May	(D)	5	130	27	23	34	<1
8 May	(N)	14	8	32	2	23	<1
11 May	(D)	72	68	32	48	62	4
11 May	(N)	56	0	62	8	40	<1
16 May	(N)	10	2	64	0	76	0
16 May	(D)	4	0	20	0	17	0

Table 4. (continued).

DATE 1978		DISCHARGE CANAL Larvae	DISCHARGE CANAL Eggs	PLUME Larvae	PLUME Eggs	AMBIENT RIVER Larvae	AMBIENT RIVER Eggs
30 May	(D)	0	0	17	0	22	0
31 May	(N)	22	2	24	1	16	0
15 June	(D)	122	0	81	1	85	0
16 June	(N)	556	0	117	4	66	0
28 June	(N)	62	3	107	2	118	0
28 June	(D)	28	11	69	11	64	3
25 July	(D)	108	6	104	<1	51	0
26 July	(N)	110	0	470	0	294	0
1 Aug.	(D)	254	69	54	7	92	0
7 Aug.	(N)	210	0	72	1	222	0
8 Aug.	(D)	102	0	42	1	79	0
17 Aug.	(D)	160	4	48	3	36	0
17 Aug.	(N)	320	0	52	0	304	0
21 Aug.	(N)	191	26	81	13	294	4
22 Aug.	(D)	31	2	97	2	55	0
24 Aug.	(D)	58	0	23	1	56	0
25 Aug.	(N)	172	8	62	1	74	1
11 Sept.	(D)	26	4	4	1	2	0
12 Sept.	(N)	22	0	31	0	42	0
25 Sept.	(D)	0	0	1	0	0	0
26 Sept.	(N)	24	2	15	0	18	0
16 Oct.	(N)	30	0	14	0	5	0
17 Oct.	(D)	0	0	5	0	4	0

Table 4. (concluded).

DATE 1978		DISCHARGE CANAL		PLUME		AMBIENT RIVER	
		Larvae	Eggs	Larvae	Eggs	Larvae	Eggs
13 Nov.	(N)	6	0	4	0	2	0
14 Nov.	(D)	0	0	1	0	0	0
30 Nov.	(N)	10	0	3	0	0	0
1 Dec.	(D)	1	0	2	0	0	0
5 Dec.	(D)	2	0	<1	0	0	0
6 Dec.	(N)	0	0	5	0	6	0
14 Dec.	(N)	12	0	3	0	3	0
15 Dec.	(D)	0	0	1	0	2	0

Table 5. Species and calculated number of fish per 100 m^3 captured in plume entrainment samples at VEPCO Surry Nuclear Power Plant in 1978.

JANUARY 24 - 24, 1978

DAY PLUME

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
MENIDIA BERYLLINA					2				3	
MUGIL CEPHALUS							2			

NIGHT PLUME

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
ALOSA AESTIVALIS							2			
MENIDIA BERYLLINA		3								

Table 5. (continued).

FEBRUARY 23 - 23, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME	NO CATCH AT THIS TIME									

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME										
ANGUILLA ROSTRATA					3					
MORONE AMERICANA	3									
TRINECTES MACULATUS						2				

Table 5. (continued).

MARCH 13 - 14, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME	NO CATCH AT THIS TIME									

SPECIES			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME										
ANGUILLA ROSTRATA				2				2	4	

Table 5. (continued).

MARCH 27 - 27, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME										
ANGUILLA ROSTRATA		4								2
FUNDULUS HETEROCLITUS					2					
NIGHT PLUME										
ANGUILLA ROSTRATA	5					2		2	2	2
MENIDIA BERYLLINA				2						
MORONE AMERICANA								2		

Table 5. (continued).

APRIL 11 - 11, 1978

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	THERMAL PLUME TOW NO. 1 RIGHT	THERMAL PLUME TOW NO. 2 LEFT	THERMAL PLUME TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	AMBIENT RIVER TOW NO. 3 RIGHT	AMBIENT RIVER TOW NO. 4 LEFT	AMBIENT RIVER TOW NO. 4 RIGHT
DAY PLUME										
ALOSA SAPIDISSIMA				2						
BREVOORTIA TYRANNUS	8	8		3	3	6	1	2		
CYPRINUS CARPIO						2				
DOROSOMA CEPEDIANUM						2			3	
DOROSOMA SP.			2							
MORONE AMERICANA	24	46	49	46	52	50	13	35	38	40
MORONE SAXATILIS		3	2		2	2				

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	THERMAL PLUME TOW NO. 1 RIGHT	THERMAL PLUME TOW NO. 2 LEFT	THERMAL PLUME TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	AMBIENT RIVER TOW NO. 3 RIGHT	AMBIENT RIVER TOW NO. 4 LEFT	AMBIENT RIVER TOW NO. 4 RIGHT
NIGHT PLUME										
ALOSA SAPIDISSIMA			3		2					
ANGUILLA ROSTRATA			3	3	2	2		2	9	
BREVOORTIA TYRANNUS	7	12								
CYPRINUS CARPIO								2		
MORONE AMERICANA	72	40	29	25	82	67	20	33		12
MORONE SAXATILIS	2			3	30	17			3	

Table 5. (continued).

APRIL 18 - 19, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME										
ANCHOA MITCHILLI		5								
BREVOORTIA TYRANNUS	3	5	5			2				
CYPRINUS CARPIO			2	2	2	2				
DOROSOMA CEPEDIANUM			4	2					3	2
MORONE AMERICANA			13	12	14	7	36	41	51	64
MORONE SAXATILIS			2		9	2	4	4	9	8

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME										
ANCHOA MITCHILLI			2		5				3	
ANGUILLA ROSTRATA			2			2			3	
BREVOORTIA TYRANNUS		7	2		3				3	8
CYPRINUS CARPIO				2	3	5				3
DOROSOMA CEPEDIANUM				5					5	
FUNDULUS CONFLUENTUS					3					
MENIDIA BERYLLINA								2		
MORONE AMERICANA			5	2	13	12	6	12	5	8
MORONE SAXATILIS				2	3					

Table 5. (continued).

APRIL 24 - 24, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME										
ALOSA PSEUDOHARENGUS					2					
ALOSA SP.		3	4			2	4	4	13	2
ANCHOA MITCHILLI	3		2							
BREVOORTIA TYRANNUS	18	13	10	2	2	4		2		
DOROSOMA CEPEDIANUM	3									
MORONE AMERICANA			2		2	5		4		4
MORONE SAXATILIS									4	

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME										
ALOSA SAPIDISSIMA						2				
ALOSA SP.			6	4		4	15	7	6	4
ANCHOA MITCHILLI	20	29		2					2	4
ANGUILLA ROSTRATA		3		4	4					
BREVOORTIA TYRANNUS	3	6	4	4		2	2	2	2	
LEIOSTOMUS XANTHURUS			6	2						
MEMBRAS MARTINICA							2			
MORONE AMERICANA					2	2	4	2		7
MORONE SAXATILIS			2		2					

Table 5. (continued).

MAY 8 - 8, 1978

DAY PLUME

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	THERMAL PLUME TOW NO. 1 RIGHT	THERMAL PLUME TOW NO. 2 LEFT	THERMAL PLUME TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	AMBIENT RIVER TOW NO. 3 RIGHT	AMBIENT RIVER TOW NO. 4 LEFT	AMBIENT RIVER TOW NO. 4 RIGHT
ALOSA PSEUDOHARENGUS			2	2	5	2	14		2	26
ALOSA SAPIDISSIMA							2			
ALOSA SP.		5	6	4	18	20	7	11	13	15
BREVOORTIA TYRANNUS			6							2
CYPRINUS CARPIO				2						
DOROSOMA CEPEDIANUM		5								
GOBIOSOMA BOSCI							2			
LEIOSTOMUS XANTHURUS						2				
MORONE AMERICANA			2	2	3	5	7		6	6
MORONE SAXATILIS			2	6	3	10	10	2		11
NOTROPIS HUDSONIUS					5	2		2		

NIGHT PLUME

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	THERMAL PLUME TOW NO. 1 RIGHT	THERMAL PLUME TOW NO. 2 LEFT	THERMAL PLUME TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	AMBIENT RIVER TOW NO. 3 RIGHT	AMBIENT RIVER TOW NO. 4 LEFT	AMBIENT RIVER TOW NO. 4 RIGHT
ALOSA SP.			4	2		2			9	
ANCHOA MITCHILLI			2	2	2	2	2	2		
BREVOORTIA TYRANNUS	5		4	24	4	7	16	17	3	7
DOROSOMA CEPEDIANUM		4	2		6			4		
DOROSOMA PETENENSE					2					
DOROSOMA SP.			4							2
ETHEOSTOMA OLMSTEDI			2		2					
LEIOSTOMUS XANTHURUS	10	9	10	2	4	5	9	8		5
MORONE AMERICANA			6		2			4		2
MORONE SAXATILIS			12	2		2			3	
NOTROPIS HUDSONIUS			4			5				
PERCA FLAVESCENS			2							

Table 5. (continued).

MAY 11 - 11, 1978

DAY PLUME

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	TOW NO. 1 RIGHT	TOW NO. 2 LEFT	TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	TOW NO. 3 RIGHT	TOW NO. 4 LEFT	TOW NO. 4 RIGHT
ALOSA PSEUDOHARENGUS						2	2		5	
ALOSA SP.	30	93	31	12	18	18	75	45	36	29
BREVOORTIA TYRANNUS								2		
CYPRINUS CARPIO			6	4	16	5				
DOROSOMA CEPEDIANUM								5		2
DOROSOMA PETENENSE									2	
LEIOSTOMUS XANTHURUS						2				
MENIDIA BERYLLINA					2					2
MORONE AMERICANA					2			2	10	5
MORONE SAXATILIS	4	16	4			5		2	2	14
NOTROPIS HUDSONIUS							6			

NIGHT PLUME

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	TOW NO. 1 RIGHT	TOW NO. 2 LEFT	TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	TOW NO. 3 RIGHT	TOW NO. 4 LEFT	TOW NO. 4 RIGHT
ALOSA PSEUDOHARENGUS					2					
ALOSA SP.	73	9	44	24	70	35	47	34	16	16
ANCHOA MITCHILLI			2			2				
BREVOORTIA TYRANNUS		3		2	2				5	
CYPRINUS CARPIO			9		5	6		2		
ETHEOSTOMA OLMSTEDI	3									
LEIOSTOMUS XANTHURUS	3	9	5		2	2	2	4	2	5
MORONE AMERICANA			2	2					7	7
MORONE SAXATILIS	3		5	2	5	2		2		
NOTROPIS HUDSONIUS	7	3	7	2	7	2	4		7	

Table 5. (continued).

MAY 16 - 17, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME										
ALOSA SP.		3	16	19	72	80	47	46	64	55
ANCHOA MITCHILLI				2	2				2	4
ANGUILLA ROSTRATA		6								
BREVOORTIA TYRANNUS	4		9	13	11	11	9	14	15	29
ICTALURUS PUNCTATUS			2							
LEIOSTOMUS XANTHURUS		6	4						2	2
MORONE AMERICANA				4		2	2	5	2	2
MORONE SAXATILIS			4	4						4

SPECIES			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME										
ALOSA SP.		4	7	11	28	27	17	20	2	19
BREVOORTIA TYRANNUS									2	
CYPRINUS CARPIO									2	
LEIOSTOMUS XANTHURUS						2				
MORONE AMERICANA		4					2			2
MORONE SAXATILIS			2							2
TRINECTES MACULATUS					2					

Table 5. (continued).

MAY 30 - 31, 1978

DAY PLUME

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	TOW NO. 1 RIGHT	TOW NO. 2 LEFT	TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	TOW NO. 3 RIGHT	TOW NO. 4 LEFT	TOW NO. 4 RIGHT
ALOSA AESTIVALIS				8		4				
ALOSA PSEUDOHARENGUS			6	8	4		11	14	4	2
ALOSA SP.				2	2	2	4	6	6	7
CYPRINUS CARPIO					4					
DOROSOMA CEPEDIANUM			6		4	4	7	4	4	4
GOBIOSOMA BOSCI					2					
MORONE AMERICANA			2	2	4	4	9	6		
MORONE SAXATILIS							2			

NIGHT PLUME

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	TOW NO. 1 RIGHT	TOW NO. 2 LEFT	TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	TOW NO. 3 RIGHT	TOW NO. 4 LEFT	TOW NO. 4 RIGHT
ALOSA AESTIVALIS				3			3	3	2	9
ALOSA SP.	4	4	5	5	6			8	4	2
ANCHOA MITCHILLI						3			2	
BREVOORTIA TYRANNUS								3		
CYPRINUS CARPIO						5		3		
DOROSOMA CEPEDIANUM				3				5		
FUNDULUS HETEROCLITUS						3				
ICTALURUS PUNCTATUS			2							
LEIOSTOMUS XANTHURUS	16	11	10	10	23	11	5	3		
LEPOMIS MACROCHIRUS							3			
MENIDIA BERYLLINA		8		3	3			3	2	
MORONE AMERICANA										2
MORONE SAXATILIS										2

Table 5. (continued).

JUNE 15 - 16, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME										
ALOSA PSEUDOHARENGUS		3								
ALOSA SP.				2			10		6	4
ANCHOA MITCHILLI		3	2	2					2	
DOROSOMA SP.									4	
ELOPS SAURUS	4									
GOBIOSOMA BOSCI	105	123	65	75	53	54	69	54	16	22
MEMBRAS MARTINICA			13	46	2	2	23	2	36	68
MENIDIA BERYLLINA	4	3	2	7			2		4	16
SPECIMEN MANGLED									2	
NIGHT PLUME										
ALOSA SP.			5	4	2		2	2	2	
ANCHOA MITCHILLI	14	13	7		2			4		
ANGUILLA ROSTRATA				2						
ATHERINIDAE							4		4	
BREVOORTIA TYRANNUS						2				
GOBIOSOMA BOSCI	609	429	101	135	64	41	34	39	28	8
LEIOSTOMUS XANTHURUS	7		2				10	11	2	2
MEMBRAS MARTINICA	11	3	9	31	22	15		7		26
MENIDIA BERYLLINA	21	6		2	9	7	28	22	24	4
MORONE SAXATILIS					2	4				

Table 5. (continued).

JUNE 28 - 28, 1978

NIGHT PLUME

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	THERMAL PLUME TOW NO. 1 RIGHT	THERMAL PLUME TOW NO. 2 LEFT	THERMAL PLUME TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	AMBIENT RIVER TOW NO. 3 RIGHT	AMBIENT RIVER TOW NO. 4 LEFT	AMBIENT RIVER TOW NO. 4 RIGHT
ANCHOA MITCHILLI		3	54	37	48	60	33	41	37	30
ANGUILLA ROSTRATA		3		3			2			
BREVOORTIA TYRANNUS								2		
GOBIOSOMA BOSCI	63	47	43	54	21	40	42	50	37	30
ICTALURUS PUNCTATUS										3
LEIOSTOMUS XANTHURUS	3	3		14	2		2		30	43
MEMBRAS MARTINICA					2			4		
MENIDIA BERYLLINA	3		3	3	2	2			3	3
MORONE AMERICANA			17	17			6	2	27	17
MORONE SAXATILIS			3	3			2	4	7	13
NOTROPIS HUDSONIUS									3	

DAY PLUME

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	THERMAL PLUME TOW NO. 1 RIGHT	THERMAL PLUME TOW NO. 2 LEFT	THERMAL PLUME TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	AMBIENT RIVER TOW NO. 3 RIGHT	AMBIENT RIVER TOW NO. 4 LEFT	AMBIENT RIVER TOW NO. 4 RIGHT
ANCHOA MITCHILLI	3	6	12	9	15	5	6	34	25	18
DOROSOMA PETENENSE			5	2				2	3	11
GOBIOSOMA BOSCI	9	38	5	7	96	56	26	25	22	21
MEMBRAS MARTINICA					25	3	30	5	5	
MENIDIA BERYLLINA				9	18	5	4	16		3
MORONE AMERICANA					3					

Table 5. (continued).

JULY 25 - 26, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME										
ANCHOA MITCHILLI	32	49	47	48	48	59	55	46	26	57
ATHERINICAE					2					
GOBIOSOMA BOSCI	92	37	19	12	105	18			2	
MEMBRAS MARTINICA		6	3		9	30	2	2		
MENIDIA BERYLLINA						5	7	2	4	
MENIDIA MENIDIA								2		
TRINECTES MACULATUS					9					

SPECIES			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME										
ANCHOA MITCHILLI	46	50	142	130	643	396	150	221	188	216
CYNOSCION REGALIS	4									
GOBIOSOMA BOSCI	56	53	142	199	132	86	139	120	45	75
MEMBRAS MARTINICA		3			2			2		5
MENIDIA BERYLLINA	4	3		2		5	4		5	3
MORONE AMERICANA							2			
TRINECTES MACULATUS					2					

Table 5. (continued).

AUGUST 1 - 1, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME										
ANCHCA MITCHILLI	128	123	20	30	27	53	65	83	74	92
FUNDULUS MAJALIS					5					
GOBIOSOMA BOSCI	107	144	7	12	27	36	10	11	14	19
MEMBRAS MARTINICA	6									

SPECIES			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT

NIGHT PLUME NIGHT SAMPLING ABORTED

Table 5. (continued).

AUGUST 7 - 8, 1978

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	THERMAL PLUME TOW NO. 1 RIGHT	THERMAL PLUME TOW NO. 2 LEFT	THERMAL PLUME TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	AMBIENT RIVER TOW NO. 3 RIGHT	AMBIENT RIVER TOW NO. 4 LEFT	AMBIENT RIVER TOW NO. 4 RIGHT
NIGHT PLUME										
ALOSA AESTIVALIS	3									
ANCHOA MITCHILLI	86	103	39	50	57	43	123	170	166	119
GOBIOSOMA BOSCI	131	96	25	20	19	30	82	88	73	64
ICTALURUS NEBULOSUS			2							
MEMBRAS MARTINICA					2					
MENIDIA MENIDIA										2
TRINECTES MACULATUS										2
DAY PLUME										
ANCHOA MITCHILLI	46	29	14	10	16	20	76	52	127	52
ATHERINIDAE									2	
GOBIOSOMA BOSCI	63	63	28	39	11	19	4			
MEMBRAS MARTINICA	2	2					2			
MENIDIA MENIDIA			6	2	1					

Table 5. (continued).

AUGLST 17 - 17, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME										
ANCHOA MITCHILLI	40	28	9	2	9	19	44	20	17	22
GOBIOSCMA BOSCI	142	110	48	57	24	22	2	11	2	9
MEMBRAS MARTINICA					2		4			4
MENIDIA BERYLLINA						2		11		

SPECIES			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME										
ANCHOA MITCHILLI	248	146	20	11	10	22	206	195	169	273
GOBIOSCMA BOSCI	130	117	23	30	38	50	117	135	54	60
MENIDIA MENIDIA									5	
MORONE AMERICANA			2							

Table 5. (continued).

AUGUST 21 - 22, 1978

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	THERMAL PLUME TOW NO. 1 RIGHT	THERMAL PLUME TOW NO. 2 LEFT	THERMAL PLUME TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	AMBIENT RIVER TOW NO. 3 RIGHT	AMBIENT RIVER TOW NO. 4 LEFT	AMBIENT RIVER TOW NO. 4 RIGHT
NIGHT PLUME										
ANCHOA MITCHILLI	23	52	30	40	21	29	141	230	216	248
GOBIOSOMA BOSCI	150	154	42	60	34	39	56	61	36	46
MEMBRAS MARTINICA				7	4	4	17	24	18	23
MENIDIA BERYLLINA		3	7	2	2		24	13	3	18
MORONE AMERICANA					2					
TRINECTES MACULATUS										3

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	THERMAL PLUME TOW NO. 1 RIGHT	THERMAL PLUME TOW NO. 2 LEFT	THERMAL PLUME TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	AMBIENT RIVER TOW NO. 3 RIGHT	AMBIENT RIVER TOW NO. 4 LEFT	AMBIENT RIVER TOW NO. 4 RIGHT
DAY PLUME										
ANCHOA MITCHILLI	10	8	16	26	68	58	46	36	55	34
ATHERINIDAE							2			
GOBIOSOMA BOSCI	23	18	84	66	11	20	2			
LEIOSTOMUS XANTHURUS				2						
MEMBRAS MARTINICA					23	2	28		10	4
MENIDIA BERYLLINA	3		3		7			2		
TRINECTES MACULATUS				2				2		

Table 5. (continued).

AUGUST 24 - 25, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME										
ANCHOA MITCHILLI	28	26	24	27	8	10	27	43	52	53
GOBIOSCMA BOSCI	35	26		2	6	6		2		
MEMBRAS MARTINICA				8			16		6	
MENIDIA BERYLLINA						2	10	2	9	4

SPECIES			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME										
ANCHOA MITCHILLI	34	61	34	23	39	46	52	72	23	51
GOBIOSOMA BOSCI	109	141	28	25	13	40	23	33	14	23
MEMBRAS MARTINICA							2			
MENIDIA BERYLLINA					2			2		
MORONE AMERICANA									2	

Table 5. (continued).

SEPTEMBER 11 - 12, 1978

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	THERMAL PLUME TOW NO. 1 RIGHT	THERMAL PLUME TOW NO. 2 LEFT	THERMAL PLUME TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	AMBIENT RIVER TOW NO. 3 RIGHT	AMBIENT RIVER TOW NO. 4 LEFT	AMBIENT RIVER TOW NO. 4 RIGHT
DAY PLUME										
ANCHOA MITCHILLI	16	27	2	7		3	2	2		3
GOBIOSOMA BOSCI	3	5				3				

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	THERMAL PLUME TOW NO. 1 RIGHT	THERMAL PLUME TOW NO. 2 LEFT	THERMAL PLUME TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	AMBIENT RIVER TOW NO. 3 RIGHT	AMBIENT RIVER TOW NO. 4 LEFT	AMBIENT RIVER TOW NO. 4 RIGHT
NIGHT PLUME										
ANCHOA MITCHILLI	18	22	15	16	30	33	32	33	26	40
GOBIOSOMA BOSCI		5	4	7	12	2	10	15	2	7
MEMBRAS MARTINICA						2				
MENIDIA MENIDIA								3		
MICROGOBIUS THALASSINUS				2						

Table 5. (continued).

SEPTEMBER 25 - 26, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME										
ANCHOA MITCHILLI				2	2					

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME										
ANCHOA MITCHILLI	19	19	10	20	8	9	21	20	7	24
GOBIOSOMA BOSCI				5	4	2				
MICROGOBIUS THALASSINUS	3									
MICROPOGON UNDULATUS	3	3	3						2	

Table 5. (continued).

OCTOBER 16 - 17 1978

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	THERMAL PLUME TOW NO. 1 RIGHT	THERMAL PLUME TOW NO. 2 LEFT	THERMAL PLUME TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	AMBIENT RIVER TOW NO. 3 RIGHT	AMBIENT RIVER TOW NO. 4 LEFT	AMBIENT RIVER TOW NO. 4 RIGHT
NIGHT PLUME										
ALCSA AESTIVALIS	3									
ANCHOA MITCHILLI	20	10	3	6	7	10	7			2
GOBIOSCMA BOSCI				3			5	3		
MICRCPCGCN UNCULATUS	17	10	9	12	2	3			2	
SYNGNATHUS FUSCUS				3						

SPECIES	LEFT	RIGHT	TOW NO. 1 LEFT	TOW NO. 1 RIGHT	TOW NO. 2 LEFT	TOW NO. 2 RIGHT	TOW NO. 3 LEFT	TOW NO. 3 RIGHT	TOW NO. 4 LEFT	TOW NO. 4 RIGHT
DAY PLUME										
ANCHCA MITCHILLI			14			3		7	3	4
MENIDIA MENIDIA					2					

Table 5. (continued).

NOVEMBER 13 - 14, 1978

NIGHT PLUME

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	THERMAL PLUME TOW NO. 1 RIGHT	THERMAL PLUME TOW NO. 2 LEFT	THERMAL PLUME TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	AMBIENT RIVER TOW NO. 3 RIGHT	AMBIENT RIVER TOW NO. 4 LEFT	AMBIENT RIVER TOW NO. 4 RIGHT
ALOSA AESTIVALIS		3		2						
ANCHCA MITCHILLI		5	4	2	4	2	4			
MICROPCGGN UNDULATUS	5		4				2			

DAY PLUME

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	THERMAL PLUME TOW NO. 1 RIGHT	THERMAL PLUME TOW NO. 2 LEFT	THERMAL PLUME TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	AMBIENT RIVER TOW NO. 3 RIGHT	AMBIENT RIVER TOW NO. 4 LEFT	AMBIENT RIVER TOW NO. 4 RIGHT
ANCHOA MITCHILLI			3							

Table 5. (continued).

NOVEMBER 30 - DECEMBER 1, 1978

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	TOW NO. 1 RIGHT	TOW NO. 2 LEFT	TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	TOW NO. 3 RIGHT	TOW NO. 4 LEFT	TOW NO. 4 RIGHT
NIGHT PLUME										
ANCHOA MITCHILLI			2							
MENIDIA BERYLLINA						3				
MICROPOGON UNDULATUS	10	10		5		3				

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	TOW NO. 1 RIGHT	TOW NO. 2 LEFT	TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	TOW NO. 3 RIGHT	TOW NO. 4 LEFT	TOW NO. 4 RIGHT
DAY PLUME										
ELOPS SAURUS						3				
MICROPOGON UNDULATUS	2					5				

Table 5. (continued).

DECEMBER 5 - 6, 1978

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	TOW NO. 1 RIGHT	TOW NO. 2 LEFT	TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	TOW NO. 3 RIGHT	TOW NO. 4 LEFT	TOW NO. 4 RIGHT
DAY PLUME										
ANCHOA MITCHILLI	2	2								
MICROPCGCN UNDULATUS				2						

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	TOW NO. 1 RIGHT	TOW NO. 2 LEFT	TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	TOW NO. 3 RIGHT	TOW NO. 4 LEFT	TOW NO. 4 RIGHT
NIGHT PLUME										
ALCSA AESTIVALIS							2			
ANCHOA MITCHILLI				2		2	6	2		
GOBIONELLUS BCLEOSOMA			2							
LEIOSTOMUS XANTHURUS										3
MENIDIA BERYLLINA			6						2	
MICRCPOGON UNDULATUS				2	7					
MORONE AMERICANA									2	5

Table 5. (continued).

DECEMBER 14 - 15 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME										
ANCHOA MITCHILLI		3						2		2
MENIDIA BERYLLINA			2	2		4	2		3	
MICROPOGON UNDULATUS	6	16	2			2	2		2	
DAY PLUME										
ANCHOA MITCHILLI					2	2		2	3	3

Table 6. Species and calculated number of fish eggs per 100 m^3 captured in plume entrainment samples at VEPCO Surry Nuclear Power Plant in 1978.

MARCH 13 - 14, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME	NO CATCH AT THIS TIME									

SPECIES			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME										
UNIDENTIFIED		9								

Table 6. (continued).

MARCH 27 - 27, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME										
MORONE AMERICANA			2	2		4				
UNIDENTIFIED			2							

SPECIES	DISCHARGE CANAL		TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME										
MORONE AMERICANA			2							

Table 6. (continued).

APRIL 11 - 11, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME										
ALOSA SAPIDISSIMA	3	3				2				
CYPRINUS CARPIO	87	105	42	26	3	5	4			3
DOROSOMA CEPEDIANUM		15	5							
DOROSOMA PETENENSE		3	7							
DOROSOMA SP.				13	6	3	3	2		3
MORONE AMERICANA		10	42	50	14	20				
MORONE SAXATILIS					2					2

SPECIES			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME										
ALOSA SAPIDISSIMA							2		3	
CYPRINUS CARPIO			8				2	2		
DOROSOMA CEPEDIANUM	2									
DOROSOMA SP.		5	3							
MORONE AMERICANA		5	5	36						3

Table 6. (continued).

APRIL 18 - 19, 1978

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	THERMAL PLUME TOW NO. 1 RIGHT	THERMAL PLUME TOW NO. 2 LEFT	THERMAL PLUME TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	AMBIENT RIVER TOW NO. 3 RIGHT	AMBIENT RIVER TOW NO. 4 LEFT	AMBIENT RIVER TOW NO. 4 RIGHT
DAY PLUME										
CYPRINUS CARPIO			4							
DOROSOMA SP.	5		2							
MORONE AMERICANA	3		7		14	4				

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	THERMAL PLUME TOW NO. 1 RIGHT	THERMAL PLUME TOW NO. 2 LEFT	THERMAL PLUME TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	AMBIENT RIVER TOW NO. 3 RIGHT	AMBIENT RIVER TOW NO. 4 LEFT	AMBIENT RIVER TOW NO. 4 RIGHT
NIGHT PLUME										
ALOSA SAPIDISSIMA						2				
CYPRINUS CARPIO			2	2						
DOROSOMA SP.			2	7	10	5				
MORONE AMERICANA	4	7	27	20	15	10		2		

Table 6. (continued).

APRIL 24 - 24, 1978

SPECIES	CISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
CAY PLUME										
ALCSA SP.	3	5	2							
DCRCSOMA SP.		3	4			2				
MORONE AMERICANA	10	8	12	6	2	5	2			

SPECIES										
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME										
ALCSA SAPICISSIMA					2					
DCRCSOMA SP.		3								
MCRCNE AMERICANA						2				

Table 6. (continued).

MAY 8 - 8, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME										
CYPRINUS CARPIO	15	24	41	40		2		2		
DOROSOMA SP.	10	14	2							
MORONE AMERICANA	86	106	4	2						
MORONE SAXATILIS	5					2				

SPECIES			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME										
CYPRINUS CARPIO	5			6		2				2
DOROSOMA SP.	5									
MENIDIA MENIDIA			2							
MORONE AMERICANA	5									

Table 6. (continued).

MAY 11 - 11, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME										
ALOSA SP.	9	8	4	2	7					
CYPRINUS CARPIO	4	12	46	36	7	11	4	2		5
DOROSOMA SP.	9	12	8	4	4					
MENIDIA BERYLLINA								2		
MORONE AMERICANA	22	61	17	18	11	16		2		

SPECIES			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME										
CYPRINUS CARPIO			7	7	11	8	2			

Table 6. (continued).

MAY 16 - 17, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME										
MENIDIA BERYLLINA	4									

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT

DAY PLUME NO CATCH AT THIS TIME

Table 6. (continued).

MAY 30 - 31, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME	NO CATCH AT THIS TIME									

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME										
MENIDIA BERYLLINA		4			3					

Table 6. (continued).

JUNE 15 - 16, 1978

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	THERMAL PLUME TOW NO. 1 RIGHT	THERMAL PLUME TOW NO. 2 LEFT	THERMAL PLUME TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	AMBIENT RIVER TOW NO. 3 RIGHT	AMBIENT RIVER TOW NO. 4 LEFT	AMBIENT RIVER TOW NO. 4 RIGHT
DAY PLUME										
MEMBRAS MARTINICA			2			2				

SPECIES	DISCHARGE CANAL LEFT	DISCHARGE CANAL RIGHT	THERMAL PLUME TOW NO. 1 LEFT	THERMAL PLUME TOW NO. 1 RIGHT	THERMAL PLUME TOW NO. 2 LEFT	THERMAL PLUME TOW NO. 2 RIGHT	AMBIENT RIVER TOW NO. 3 LEFT	AMBIENT RIVER TOW NO. 3 RIGHT	AMBIENT RIVER TOW NO. 4 LEFT	AMBIENT RIVER TOW NO. 4 RIGHT
NIGHT PLUME										
PEMBRAS MARTINICA			2		2	9				
MORCNE AMERICANA				2						

Table 6. (continued).

JUNE 28 - 28, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME										
ANCHCA MITCHILLI		6	6							

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
CAY PLUME										
ANCHOA MITCHILLI	13	9	7	9	3	24			8	5

Table 6. (continued).

JULY 25 - 26, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME										
ANCHOA MITCHILLI		9				2				
UNIDENTIFIED		3								

SPECIES			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT

NIGHT PLUME NO CATCH AT THIS TIME

Table 6. (continued).

AUGUST 1 - 1, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME										
ANCHOA MITCHILLI	71	67	2		12	15				

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME	NIGHT SAMPLING ABORTED									

Table 6. (continued).

AUGUST 7 - 8, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME										
GOBICSOMA BOSCI				4						
DAY PLUME										
ANCHOA MITCHILLI				3	1	1				

Table 6. (continued).

AUGUST 17 - 17, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME										
ANCHOA MITCHILLI	9		7	2	2	2				

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT

NIGHT PLUME NO CATCH AT THIS TIME

Table 6. (continued).

AUGUST 21 - 22, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME										
ANCHOA MITCHILLI		52	11	2	18	22	2		5	8

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME										
ANCHOA MITCHILLI	3		3	2	2					

Table 6. (continued).

AUGUST 24 - 25, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME										
ANCHOA MITCHILLI						4				

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME										
ANCHOA MITCHILLI	17			2	2		2	2		

Table 6. (continued).

SEPTEMBER 11 - 12, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME										
ANCHOA MITCHILLI	8					3				

SPECIES			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT

NIGHT PLUME NO CATCH AT THIS TIME

Table 6. (continued).

SEPTEMBER 25 - 26, 1978

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
DAY PLUME	NO CATCH AT THIS TIME									

SPECIES	DISCHARGE CANAL		THERMAL PLUME				AMBIENT RIVER			
			TOW NO. 1		TOW NO. 2		TOW NO. 3		TOW NO. 4	
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
NIGHT PLUME										
FUNDULUS CIAPHANUS		3								

Table 7. Salinity (°/oo) at VEPCO Surry Nuclear Power Plant during plume entrainment stations in 1978 (D = Day; N = Night).

DATE	DISCHARGE CANAL Surface	DISCHARGE CANAL Midwater	DISCHARGE CANAL Bottom	PLUME Surface	PLUME Midwater	PLUME Bottom	AMBIENT RIVER WATER Surface	AMBIENT RIVER WATER Bottom
Jan. 24 D	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Jan. 24 N	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
Feb. 23 D	2.0	2.0	2.0	1.1	1.2	1.3	0.6	0.8
Feb. 23 N	2.3	2.3	2.3	0.6	0.7	1.5	0.5	0.5
Mar. 13 D	1.0	0.9	1.0	0.8	0.6	0.2	0.1	0.3
Mar. 13 N	0.6	0.6	0.6	0.6	0.6	0.6	0.2	0.2
Mar. 27 D	0.4	0.4	0.4	0.3	0.2	0.1	0.3	0.1
Mar. 27 N	0.3	0.3	0.3	0.2	0.3	0.2	0.2	0.2
Apr. 11 D	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
Apr. 11 N	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.2
Apr. 18 D	2.9	2.9	2.8	1.6	2.2	1.7	0.9	0.8
Apr. 19 N	2.6	2.6	2.6	1.1	1.6	1.7	1.7	1.7
Apr. 24 D	2.8	2.8	2.8	2.0	2.0	2.0	1.0	0.9
Apr. 24 N	2.7	2.7	2.7	1.8	1.8	1.8	1.0	1.1
May 8 D	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.1
May 8 N	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
May 11 D	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
May 11 N	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
May 16 N	*	*	*	*	*	*	*	*
May 17 D	*	*	*	*	*	*	*	*

Table 7. (continued).

DATE	DISCHARGE CANAL Surface	DISCHARGE CANAL Midwater	DISCHARGE CANAL Bottom	PLUME Surface	PLUME Midwater	PLUME Bottom	AMBIENT RIVER WATER Surface	AMBIENT RIVER WATER Bottom
May 30 D	0.9	0.7	0.7	0.2	0.2	0.1	0.2	0.2
May 31 N	0.7	0.7	0.7	0.5	0.4	0.2	0.2	0.2
Jun. 15 D	2.1	1.7	1.7	1.0	0.6	0.5	0.7	0.8
Jun. 16 N	2.0	2.1	2.0	0.6	0.5	0.5	1.0	0.7
Jun. 28 N	3.5	3.5	3.5	2.6	2.7	2.6	2.4	1.8
Jun. 28 D	3.2	3.2	3.2	1.0	1.2	1.4	1.2	1.1
Jul. 25 D	5.2	5.2	5.2	3.5	3.8	4.2	2.0	3.6
Jul. 26 N	5.8	5.9	5.9	4.2	4.3	4.4	3.2	3.1
Aug. 1 D	6.3	6.1	6.1	2.9	3.7	4.1	3.2	3.2
Aug. 7 N	4.2	4.2	4.2	3.5	2.8	2.8	2.3	2.6
Aug. 8 D	3.6	3.6	3.6	3.1	2.7	2.5	1.0	1.4
Aug. 17 D	4.6	4.6	4.6	2.8	3.1	3.1	1.6	1.6
Aug. 17 N	4.0	4.0	4.0	3.1	1.7	1.9	1.2	1.2
Aug. 21 N	5.1	5.0	5.0	3.8	3.9	3.8	1.8	1.9
Aug. 22 D	5.0	5.1	5.0	5.0	4.6	3.8	1.6	2.6
Aug. 24 D	5.5	5.6	5.6	4.0	4.3	4.3	1.5	2.3
Aug. 25 N	5.9	5.9	5.9	4.6	4.6	4.6	3.0	2.9
Sep. 11 D	8.9	8.2	8.9	7.8	7.5	7.5	4.5	4.7
Sep. 12 N	8.2	8.2	8.2	6.9	7.2	7.2	4.1	5.3

Table 7. (concluded).

DATE	DISCHARGE CANAL Surface	DISCHARGE CANAL Midwater	DISCHARGE CANAL Bottom	PLUME Surface	PLUME Midwater	PLUME Bottom	AMBIENT RIVER WATER Surface	AMBIENT RIVER WATER Bottom
Sep. 25 D	8.5	8.4	8.5	6.5	6.3	6.6	4.4	4.5
Sep. 26 N	8.5	8.4	8.4	5.0	6.1	7.0	5.3	5.2
Oct. 16 N	5.9	6.0	6.0	2.9	5.4	5.4	2.7	2.7
Oct. 17 N	5.3	5.3	5.3	4.3	3.9	4.3	2.6	2.5
Nov. 13 N	11.1	10.9	10.9	9.9	7.5	8.9	7.5	8.4
Nov. 14 D	10.6	10.7	10.7	8.6	9.4	9.7	6.4	9.2
Nov. 30 N	10.2	10.3	10.2	6.0	6.8	9.0	5.1	6.7
Dec. 1 D	8.9	8.9	8.9	8.9	8.0	7.7	5.3	6.2
Dec. 5 D	8.9	8.5	8.5	4.3	5.6	5.7	4.9	5.6
Dec. 6 N	8.1	8.2	8.1	7.7	7.2	7.0	4.4	5.5
Dec. 14 N	4.4	4.1	4.1	2.3	2.6	2.7	2.1	2.0
Dec. 15 D	4.4	4.5	4.5	2.3	2.5	3.5	2.2	2.2

* Data misplaced by the chemistry lab.

Table 8. Water temperature (C) at VEPCO Surry Nuclear Power Plant during plume entrainment stations in 1978 (D = Day; N = Night).

DATE	DISCHARGE CANAL Surface	Midwater	Bottom	PLUME Surface	Midwater	Bottom	AMBIENT RIVER WATER Surface	Bottom
Jan. 24 D	11.0	10.2	10.2	2.0	3.0	3.1	5.7	5.1
Jan. 24 N	11.3	11.7	11.8	2.4	5.6	5.8	8.5	6.8
Feb. 23 D	11.4	10.7	10.4	5.3	5.5	6.1	0.3	0.9
Feb. 23 N	11.8	11.0	11.2	2.8	2.8	3.0	2.5	2.4
Mar. 13 D	15.9	15.4	15.3	12.3	10.0	5.4	5.3	5.5
Mar. 13 N	15.6	15.3	15.1	14.5	13.0	11.9	6.5	7.2
Mar. 27 D	16.6	16.2	16.1	13.6	12.8	12.1	13.2	12.0
Mar. 27 N	18.3	18.0	18.1	14.8	14.0	13.8	12.5	12.5
Apr. 11 D	23.5	23.2	23.2	16.8	16.0	16.0	19.0	18.0
Apr. 11 N	23.8	23.4	23.4	20.0	16.0	16.0	18.4	18.4
Apr. 18 D	21.2	20.5	20.2	17.8	18.8	18.0	16.2	*
Apr. 19 N	21.0	20.5	20.5	16.8	17.4	17.5	17.5	17.7
Apr. 24 D	19.2	18.5	18.5	17.7	17.5	17.7	16.5	16.5
Apr. 24 N	21.0	20.5	20.5	19.2	18.8	18.8	17.2	17.3
May 8 D	20.3	19.8	19.2	17.0	16.0	15.5	14.7	14.0
May 8 N	20.5	20.5	20.0	16.5	16.5	16.5	15.5	15.5
May 11 D	22.9	23.0	23.1	21.8	20.5	19.0	22.0	18.0
May 11 N	24.5	23.0	23.0	19.2	18.9	18.8	18.6	18.4
May 16 N	28.5	27.0	27.0	24.5	22.5	22.0	23.5	22.0
May 17 D	28.5	27.5	27.5	24.8	24.3	23.7	23.7	23.7

Table 8. (continued).

DATE	DISCHARGE CANAL Surface	Midwater	Bottom	PLUME Surface	Midwater	Bottom	AMBIENT RIVER WATER Surface	Bottom
May 30 D	31.2	30.0	29.0	25.0	24.0	23.5	25.0	24.0
May 31 N	29.2	28.5	27.5	26.0	25.0	24.0	23.5	23.5
Jun. 15 D	31.0	29.8	29.3	27.5	26.3	25.5	26.8	26.3
Jun. 16 N	28.5	28.5	28.0	24.0	23.5	23.5	25.2	23.5
Jun. 28 N	32.6	31.0	29.8	29.0	27.5	29.0	29.0	28.2
Jun. 28 D	35.3	34.0	33.8	29.4	29.5	29.7	29.8	29.4
Jul. 25 D	33.5	33.0	33.0	30.8	30.6	31.2	29.2	30.0
Jul. 26 N	33.0	32.2	32.3	30.2	30.2	30.2	29.5	28.8
Aug. 1 D	32.5	32.2	32.2	28.8	29.3	29.5	29.6	29.1
Aug. 7 N	37.2	36.0	36.2	33.8	31.5	31.5	30.5	30.0
Aug. 8 D	37.1	36.3	36.2	34.5	33.0	31.8	29.2	29.3
Aug. 17 D	37.5	36.5	36.5	33.5	33.0	33.2	31.0	31.0
Aug. 17 N	39.1	38.0	37.8	35.2	31.5	31.5	31.0	30.5
Aug. 21 N	36.0	35.8	35.4	33.0	32.9	32.8	29.0	28.0
Aug. 22 D	36.5	35.5	35.5	35.5	34.2	32.8	29.5	29.5
Aug. 24 D	39.0	38.9	38.4	34.3	32.4	32.6	29.5	30.1
Aug. 25 N	37.2	36.0	35.3	33.2	31.3	31.3	30.4	29.3
Sep. 11 D	36.5	35.5	35.0	33.8	32.5	32.5	28.0	28.0
Sep. 12 N	34.5	33.8	34.0	30.3	29.8	30.0	26.8	27.8

Table 8. (concluded).

DATE	DISCHARGE CANAL Surface	Midwater	Bottom	PLUME Surface	Midwater	Bottom	AMBIENT RIVER WATER Surface	Bottom
Sep. 25 D	33.5	32.8	33.0	29.0	27.9	28.5	24.3	24.1
Sep. 26 N	31.5	31.0	30.8	24.0	25.0	28.0	24.0	23.5
Oct. 16 N	27.6	27.0	26.5	21.0	24.0	25.0	18.0	18.0
Oct. 17 D	26.0	26.0	25.0	19.5	19.5	21.0	17.5	17.0
Nov. 13 N	23.0	23.0	23.0	20.0	16.3	18.0	16.4	16.4
Nov. 14 D	23.0	22.5	22.5	17.5	19.0	19.5	15.0	17.5
Nov. 30 N	19.9	19.2	20.6	12.0	13.2	16.0	10.8	12.8
Dec. 1 D	19.1	18.8	18.8	19.0	15.5	15.0	10.4	10.5
Dec. 5 D	21.0	21.0	20.6	11.8	14.0	14.2	12.3	13.8
Dec. 6 N	22.0	20.3	21.0	19.2	16.8	15.8	12.0	13.0
Dec. 14 N	14.5	14.0	14.0	8.0	7.0	*	7.5	7.5
Dec. 15 D	13.2	13.0	13.0	7.5	7.5	7.0	7.0	7.0

* Data not recorded.

Table 9. Dissolved oxygen (mg/l) at VEPCO Surry Nuclear Power Plant during plume entrainment stations in 1978 (D = Day; N = Night).

DATE	DISCHARGE CANAL Surface	DISCHARGE CANAL Midwater	DISCHARGE CANAL Bottom	PLUME Surface	PLUME Midwater	PLUME Bottom	AMBIENT RIVER WATER Surface	AMBIENT RIVER WATER Bottom
Jan. 24 D	13.0	12.1	12.2	12.5	12.1	11.9	11.7	10.1
Jan. 24 N	11.0	11.1	11.1	12.1	11.5	11.4	11.1	11.3
Feb. 23 D	11.7	11.7	11.7	12.1	11.9	11.8	12.1	12.2
Feb. 23 N	12.0	12.0	12.0	11.9	12.1	11.8	12.2	12.0
Mar. 13 D	11.0	11.0	11.0	11.2	11.2	11.3	11.2	11.2
Mar. 13 N	11.3	11.3	11.2	11.1	11.2	11.1	11.2	11.1
Mar. 27 D	9.5	9.5	9.5	9.4	9.6	9.7	9.5	9.8
Mar. 27 N	9.6	9.5	9.3	9.3	9.5	9.3	9.6	9.4
Apr. 11 D	8.5	8.2	8.3	8.8	9.4	9.0	8.5	8.6
Apr. 11 N	9.0	8.6	8.9	8.7	9.2	9.0	8.3	8.4
Apr. 18 D	8.7	8.8	8.8	9.0	8.9	8.8	8.9	9.5
Apr. 19 N	8.4	8.7	8.8	9.0	8.5	8.5	8.6	8.7
Apr. 24 D	8.6	9.0	8.5	8.6	8.3	8.4	8.8	8.6
Apr. 24 N	8.8	8.9	8.5	8.8	8.7	8.8	8.9	9.1
May 8 D	8.7	8.3	8.5	8.4	8.5	7.8	8.0	8.1
May 8 N	8.4	8.4	8.3	8.2	8.1	8.4	8.2	8.4
May 11 D	7.7	7.9	8.2	6.8	7.5	7.6	8.2	8.2
May 11 N	7.8	8.0	8.1	8.2	8.0	7.9	8.0	7.8
May 16 N	*	*	*	*	*	*	*	*
May 17 D	*	*	*	*	*	*	*	*

Table 9. (continued).

DATE	DISCHARGE CANAL Surface	DISCHARGE CANAL Midwater	DISCHARGE CANAL Bottom	PLUME Surface	PLUME Midwater	PLUME Bottom	AMBIENT RIVER WATER Surface	AMBIENT RIVER WATER Bottom
May 30 D	7.3	7.0	6.9	7.1	7.0	7.0	7.3	6.9
May 31 N	6.5	6.8	7.0	6.7	6.9	6.6	6.9	6.7
Jun. 15 D	6.8	6.8	6.7	7.5	7.4	7.4	7.6	7.5
Jun. 16 N	7.1	6.7	6.4	7.5	7.4	7.4	7.3	7.1
Jun. 28 N	6.7	6.4	8.0	5.8	6.1	5.1	5.3	5.3
Jun. 28 D	7.0	7.0	7.2	7.1	7.1	7.0	7.3	7.1
Jul. 25 D	6.3	6.5	6.5	7.1	7.0	7.0	6.9	6.2
Jul. 26 N	6.3	6.2	6.0	6.7	6.7	6.7	7.0	7.0
Aug. 1 D	6.3	6.5	6.0	6.8	6.4	5.9	6.2	6.2
Aug. 7 N	6.2	6.4	6.1	6.3	6.6	6.4	6.4	6.5
Aug. 8 D	6.4	6.3	6.3	4.1	4.8	5.0	6.7	6.6
Aug. 17 D	5.6	6.1	5.5	5.9	6.0	6.3	6.1	6.2
Aug. 17 N	6.0	5.9	5.5	6.7	6.6	6.1	6.4	6.4
Aug. 21 N	6.2	6.2	6.1	**	6.6	6.5	6.9	6.7
Aug. 22 D	6.3	6.2	6.2	6.2	6.2	6.3	6.6	6.2
Aug. 24 D	6.1	6.3	6.4	6.5	6.5	6.4	6.8	7.2
Aug. 25 N	6.6	5.9	6.3	6.7	6.3	7.0	7.0	7.2
Sep. 11 D	6.5	7.2	7.7	7.3	7.4	7.3	7.5	7.1
Sep. 12 N	6.6	6.4	6.4	6.4	6.4	6.5	6.6	6.7

Table 9. (concluded).

DATE	DISCHARGE CANAL Surface	Midwater	Bottom	PLUME Surface	Midwater	Bottom	AMBIENT RIVER WATER Surface	Bottom
Sep. 25 D	6.4	6.4	6.4	6.5	6.7	6.7	7.0	7.1
Sep. 26 N	6.7	6.5	7.0	6.9	6.8	6.2	6.5	6.7
Oct. 16 N	7.4	7.3	7.4	8.6	7.4	7.6	7.7	7.5
Oct. 17 D	7.4	7.5	7.7	7.6	7.7	7.7	***	8.0
Nov. 13 N	7.1	7.8	7.4	7.6	7.7	7.7	7.8	7.6
Nov. 14 D	7.5	7.8	7.4	7.7	7.5	7.6	6.9	6.8
Nov. 30 N	9.4	9.3	9.9	8.7	9.0	8.5	9.1	8.5
Dec. 1 D	8.9	8.8	8.8	6.4	7.1	7.1	7.4	7.3
Dec. 5 D	8.2	8.6	8.5	9.1	8.9	8.9	9.0	6.6
Dec. 6 N	8.2	8.3	8.4	8.3	8.4	8.5	8.9	8.8
Dec. 14 N	9.6	9.6	9.6	10.1	8.8	8.9	9.8	9.4
Dec. 15 D	***	9.4	9.3	9.9	10.2	10.1	10.2	10.2

* Data misplaced by the chemistry lab.
** Sample bottle not full, so discarded.
*** Data deleted because anomalous reading.

Table 10. Descriptive statistics of dependent (Y_i) and independent (X_j) variables.

Variable	January-December 1978 (N = 244) Mean	Standard Deviation	Minimum	Maximum	May-October 1978 (N = 135) Mean	Standard Deviation	Minimum	Maximum
Y_1, Total abundance of fish	3.1	2.002	0.0	7.1	-	-	-	-
Y_2, Abundance of fish species	1.1	0.666	0.0	2.5	-	-	-	-
Y_3, Fish species diversity	0.6	0.521	0.0	2.1	-	-	-	-
Y_4, Total abundance of eggs	0.8	1.316	0.0	5.6	-	-	-	-
Y_5, Abundance of egg species	0.3	0.477	0.0	1.8	-	-	-	-
Y_6, Egg species diversity	0.1	0.265	0.0	1.2	-	-	-	-
Y_7, Abundance of *A. mitchilli* fish	-	-	-	-	2.8	1.982	0.0	6.9
Y_8, Abundance of *G. bosci* fish	-	-	-	-	2.4	2.167	0.0	6.9
Y_9, Abundance of *A. mitchilli* eggs	-	-	-	-	0.5	1.032	0.0	4.9
X_1, Temperature	21.2	9.036	1.0	39.0	27.5	5.686	14.0	39.0
X_2, Salinity	2.8	2.718	0.0	11.0	2.8	2.269	0.0	9.0
X_3, Dissolved oxygen	8.0	1.775	0.1	12.5	6.9	0.744	4.7	8.5
X_4, Plume	0.4	0.491	0	1	0.4	0.492	0	1
X_5, Ambient	0.4	0.490	0	1	0.4	0.492	0	1
X_6, Period	0.5	0.501	0	1	0.5	0.502	0	1

Table 10. (continued).

Variable	January-December 1978 (N = 244) Mean	Standard Deviation	Minimum	Maximum	May-October 1978 (N = 135) Mean	Standard Deviation	Minimum	Maximum
X_7, Fall	0.2	0.401	0	1	0.1	0.263	0	1
X_8, Winter	0.2	0.371	0	1	-	-	-	-
X_9, Spring	0.3	0.470	0	1	0.4	0.485	0	1

Table 11. Summary statistics for final stepwise regression equations.

Y_i	Final Equation R^2	F_s	DF	Sig.	b_1 Temperature	b_2 Salinity	b_3 Dissolved Oxygen	b_4 Plume	b_5 Ambient	b_6 Period	b_7 Fall	b_8 Winter	b_9 Spring	b_c Constant
Y_1, Total abundance of fish	0.76	148	5,238	0.001	0.117***	-0.258***	ns	ns	ns	0.831***	-0.775**	-2.242***	ns	1.512
Y_2, Abundance of fish species	0.69	76	7,236	0.001	0.029**	-0.073***	ns	0.318***	0.169*	0.310***	ns	-0.567***	0.454***	0.327
Y_3, Fish species diversity	0.55	48	6,237	0.001	0.014**	ns	-0.037	0.336***	0.242***	0.226***	ns	ns	0.627***	0.032
Y_4, Total abundance of eggs	0.39	26	6,237	0.001	-0.036*	ns	ns	ns	-0.962***	-0.350**	-1.286***	-1.430***	0.595**	2.410
Y_5, Abundance of egg species	0.45	32	6,237	0.001	-0.020***	ns	ns	ns	-0.339***	-0.124**	-0.550***	-0.633***	0.232**	1.053
Y_6, Egg species diversity	0.35	18	7,236	0.001	-0.019***	ns	ns	-0.090*	-0.198***	-0.065*	-0.291***	-0.424***	0.097*	0.737
Y_7, Abundance of _A. mitchilli_ fish	0.68	46	6,128	0.001	0.148***	-0.246***	-0.395	ns	0.419	1.063***	ns	NA	-2.315***	2.344
Y_8, Abundance of _G. bosci_ fish	0.49	42	3,131	0.001	0.299***	-0.258***	ns	ns	ns	1.157***	ns	NA	ns	-5.659
Y_9, Abundance of _A. mitchilli_ eggs	0.20	17	2,131	0.001	0.067***	ns	ns	ns	-0.377*	ns	ns	NA	ns	-1.185

R^2, Coefficient of multiple determination
F_s, F-statistic for test of significance of regression
DF, Degrees of freedom
Sig., Significance of regression
b_i, Partial regression coefficient
*, Significant, $P<0.05$
**, Highly significant, $P<0.01$
***, Very highly significant, $P<0.001$
ns, Not significant $P>0.10$
NA, Not applicable

Table 12. Standardized partial regression coefficients with ranks of relative importance in parentheses.

Y_i	Temperature	Salinity	Dissolved Oxygen	Plume	Ambient	Period
Y_1	0.526 (1)	-0.350 (2)	ns (5)	ns (5)	ns (5)	0.208 (3)
Y_2	0.393 (1)	-0.298 (2)	ns (6)	0.234 (3)	0.124 (5)	0.233 (4)
Y_3	0.246 (2)	ns (6)	-0.126 (5)	0.317 (1)	0.228 (3)	0.217 (4)
Y_4	-0.251 (2)	ns (5)	ns (5)	ns (5)	-0.359 (1)	-0.133 (3)
Y_5	-0.373 (1)	ns (5)	ns (5)	ns (5)	-0.349 (2)	-0.130 (3)
Y_6	-0.650 (1)	ns (5.5)	ns (5.5)	-0.166 (3)	-0.365 (2)	-0.122 (4)
Y_7	0.426 (1)	-0.281 (2)	-0.148 (4)	ns (6)	0.104 (5)	0.269 (3)
Y_8	0.786 (1)	-0.271 (2)	ns (5)	ns (5)	ns (5)	0.268 (3)
Y_9	0.368 (1)	ns (4.5)	ns (4.5)	ns (4.5)	-0.180 (2)	ns (4.5)
Sum of Ranks	11	34	45	37.5	30	31.5
Overall Rank of Relative Importance	1	4	6	5	2	3

3.5.2 ICHTHYOPLANKTON ENTRAINMENT STUDY

Please refer to the following report by the Virginia Institute of Marine Science for preliminary results and conclusions.

Section II a.

PLANT ENTRAINMENT OF ICHTHYOPLANKTON AT THE VEPCO NUCLEAR POWER PLANT

by

John V. Merriner

A. Deane Estes

and

Robert K. Dias

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INTRODUCTION

Ichthyoplankton entrainment sampling at VEPCO Surry Nuclear Power Plant was initiated by the Ichthyology Department of Virginia Institute of Marine Science in April 1975. Objectives of this study were assessment of the kinds and amounts of ichthyoplankton being entrained from the James River near Hog Island and passed through the Surry facility.

VEPCO Surry is located near the fresh-saltwater transition zone of the James River. Depending upon river flow and salinity patterns in the area, ichthyofauna can range from strictly fresh-water species to marine strays. This reach of the estuary serves as spawning grounds (engraulids, gobiids), fish nursery grounds (sciaenids, Brevoortia), and migration route (Anguilla, Morone and Alosa). White (1976) reported 84 species representing 38 families in the vicinity of Hog Island and VEPCO Surry Nuclear Power Plant. Most of these species do not spawn in the vicinity of Hog Island but are found there as juvenile through adult life stages. They are not subject to entrainment.

Many eggs, prolarval, and larval fishes are pelagic, and therefore are transported by water currents. Pelagic fish eggs and larvae are potentially subject to entrainment when present in the waters surrounding the intake structure at VEPCO Surry. Intake pumps have a combined capacity to withdraw 1.68 million gallons of water per minute from the James River. Water velocity at the intake structure trash bars is approximately 1 foot/second (Applicants Environmental Report), but velocity fields have not been thoroughly mapped at distances away from the trash bars (J. White, personal communication).

Samples through December 1978 have been sorted, identified, enumerated, and stored in vials. Data from these samples have been punched and are stored on ADP cards.

Species lists and abundance of fish eggs, larvae, juveniles, and adults taken in samples from January through December 1978 are presented. Ranges of salinity, dissolved oxygen, and temperature for each 24-hour sampling station are also presented. Species composition, trends of abundance, statistical analyses of the data set (1978), and impact of entrainment upon the ichthyofauna near Hog Island are discussed.

Sampling visits for plant and thermal plume ichthyoplankton entrainment during 1978 are presented in Table 1. Sampling intensity reflects anticipated periods of greatest spawning activity (April, May).

METHODS AND MATERIALS

Ichthyoplankton entrainment studies at VEPCO Surry Nuclear Power Plant from January through December 1978 employed a 0.5 meter paired net apparatus (Fig. 1) equipped with conical Nitex nets (505 μ mesh) and General Oceanics Digital Flowmeters (Model 2030). Flowmeters were periodically calibrated in the VIMS flume.

Sampling sites for the 24-hour stations were: (1) intake structure forebay directly in front of the trash bars, and (2) mid-channel in the discharge canal at the roadway bridge. Samples were made at surface, midwater, and bottom depths at sample times of 1000, 1400, 1800, 2200, 0200, and 0600 hours. Tow time at the intake was 10 minutes and at the discharge was 5 minutes. Temperature, salinity, and dissolved oxygen data were recorded for each sample at each sample time.

Tow times at the intake and discharge reflect a compromise between sampling equal water volumes and sampling the same water mass at each site. Time of passage through the facility (intake to discharge) is approximately one hour (J. White, personal communication). Transportation time between sites was approximately 15 minutes and occasionally, sampling in the discharge was delayed.

Dissolved oxygen samples were fixed on station for laboratory analysis by Winkler Titration Method. Salinity samples were returned to VIMS for analysis with a Beckman RS-7 induction salinometer. Water temperature was measured with a stem thermometer (-35 to 50 C, 1 C interval) and recorded in the field sample log. Sea state, weather, tidal stage, turbidity, air temperature, and wind were recorded on the log sheet at the time of sampling.

Samples were preserved in approximately 5% formalin in the field and returned to the lab for sorting, enumeration, and identification. Data are stored on ADP cards. Specimens are retained in vials with 5% buffered formalin for further study or reference.

The manual by Lippson and Moran (1974) has been most useful in identification of specimens. Myomere counts of small larvae were facilitated by clearing and staining (Mook and Wilcox, 1974).

Vessels and operators for 24-hour stations were provided by VEPCO. Two VIMS project personnel were required on each of two 12-hour shifts.

All calculations and conclusions presented in this report are based on number of organisms per 100 cubic meters of water strained unless otherwise stated.

Statistical methods

Catch data were subjected to statistical analysis (a) to determine the significant spatial and temporal trends in the ichthyoplanktonic community, (b) to develop regression models which identify the major environmental factors of importance to community structure, and (c) to assess significant patterns in two dominant fish populations (Anchoa mitchilli and Gobiosoma bosci).

Six dependent or response variables (Y_i) which reflect overall community structure were included in the analysis these were total abundance of fish, abundance of fish species, fish species diversity (Shannon index), total abundance of eggs, abundance of egg species, and egg species diversity. The abundance of A. mitchilli eggs, and G. bosci fish were also included as dependent variables. [NOTE: For simplicity throughout this report, the species abundance and species diversity of the egg stage are referred to as egg species abundance and egg species diversity, respectively.]

Measures of abundance were computed as $Y_i = \log_e (C_i + 1)$, where Y_i is abundance and C_i is standardized catch of collection i (i.e., number captured per 100 cubic meters of water strained per collection). Logarithmic transformation of the catch data was necessary to convert discrete variables to continuous form and to remove heterogeneity and non-normality from the data. Measures of species diversity were not log-transformed, but were analyzed in their original scale.

Ten independent variables (X_j) were chosen for analysis: sample depth, water temperature, salinity, dissolved oxygen, tide and dummy variables for sampling location, period, and seasons (fall, winter and spring). Table 2 summarizes notation and defines the dependent and independent variables.

Multiple regression was selected as the major method to analyze trends in the response variables for the following reasons:

(a) Complex multivariate relationships exist between the abundance of fish and eggs and environmental variables; as a descriptive tool, multiple regression can give a concise summary of these relationships.

(b) Field survey data are confounded by numerous factors since such surveys are observational in nature rather than controlled; multiple regression allows for control of some of these confounding factors by the use of "dummy" (categorical) variables. Also, each partial regression coefficient is computed as if the other variables in the equation are held constant, thereby removing their confounding effects.

(c) The ability to accurately predict the effects of environmental change or modification upon living resources is an ultimate goal; multiple regression techniques can be used to develop empirical models with predicitive capabilities.

Stepwise regression techniques (Draper and Smith, 1966) were used to develop the "best" regression equation for each Y_i in the following manner:

(a) The dependent variables were plotted against environmental (independent) variables and the data were transformed where necessary.

(b) Matrices of simple correlation coefficients of dependent and independent variables and selected transformations were computed.

(c) Using the multiple regression model

$$Y_i = B_0 + B_1X_1 + B_2X_2 + \ldots + B_pX_p + \varepsilon$$

where Y_i is abundance or species diversity, X_j is some function of one of the selected environmental variables, and B_j is a partial regression coefficient, a stepwise regression was performed to identify those parameters which explain a significant portion of the variation in the model.

(d) For each final regression equation residuals were analyzed to detect possible violations of the basic assumptions that the errors were independent, had zero mean, constant variance and followed a normal distribution.

Computations were made using SPSS version 6.02 (Nie, et al., 1975). Independent variables were retained in the equations if their partial regression coefficients (b_j) could be declared significantly different from zero at $P<0.10$. Equations for the community structure variables (Y_1 through Y_6, Table 2) were based upon data from January through December 1978. Equations for _A. mitchilli_ and _G. bosci_ (Y_7 through Y_9) were based on data from May through October 1978, the time period in which eggs and larvae of these species are known to occur.

RESULTS AND DISCUSSION

Seasonal trends in species composition and abundance

Number of species (fish) decreased from January to March when lowest numbers were recorded (Table 3; Fig. 2). Number of species increased in April and remained relatively stable through mid-June. A slight decrease was recorded in mid-June and afterward remained stable through September. A decrease was recorded in October and little fluctuation occurred through December. Highest number of species was recorded on 18-19 May.

Fish eggs were taken from January through September (Table 3; Fig. 3). January, February, and March samples each yielded one egg in the discharge canal which remains unidentified at present. Number of species increased through late April when a slight decrease was recorded. Number of species again increased in May and highest numbers were recorded on 18-19 May. Number of species then declined in late May and fluctuated at lower numbers through September. Discharge canal samples consistently captured more species of eggs than intake samples, indicating spawning activity in either the high level intake canal or the discharge canal.

Calculated number of fish per 100 m^3 was less than one fish per 100 m^3 from January through March (Fig. 4). Slight increases were recorded in early April but numbers fell again in late April and early May. Number of fish again increased in mid-May but fell in late May. Sharp increases were recorded in June and a slight decline was recorded in July. Another increase was recorded in August when highest numbers were reached. A drastic decline was recorded in September and numbers remained very low through December.

Increased fish abundance during mid-April (Fig. 4) was due to catches of larval white perch, Morone americana and striped bass, Morone saxatilis. Again in mid-May, white perch and striped bass contributed to increased abundances (Table 4). Larval river herring, Alosa species also contributed greatly to the increased abundance in May. Peak abundances in summer reflect the spawning activity of bay anchovy, Anchoa mitchilli and naked goby, Gobiosoma bosci.

Abundance of fish eggs (Fig. 5) was relatively low through mid-June when increases were recorded with the onset of bay anchovy spawning. Bay anchovy spawning continued through August but ceased in September (Table 5). Eggs were captured during April and May, with most being captured in the discharge canal. White perch, carp (Cyprinus carpio) and threadfin or gizzard shad (Dorosoma species) comprised the bulk of April and May catches. No eggs were captured past September. Highest abundance of eggs was recorded on 22-23 June (1.561/100 m^3).

Average catch of fish per sample (100 m^3; all samples) was constant at the surface, decreased at midwater, and increased at the bottom (Table 6). Average catch per sample was stratified with depth (greatest catch at bottom) at both the intake and discharge.

Average catch of fish eggs per sample (100 m^3; all samples) increased at the surface and decreased at midwater and bottom (Table 6). Fish eggs were also stratified with depth at both the intake and discharge. The increased catch of eggs in surface discharge waters is presumably due to increased turbulence in the discharge canal.

Bay anchovy and naked goby were the dominant species captured during 1978 as in previous years (Jordan et. al., 1978) (Tables 4,5 &7). All life stages of bay anchovy were captured; gobies were primarily the larval and post-larval stages. Eggs, larvae, and postlarvae of both species were commonly taken from April through September. Juvenile and adult anchovies were taken all year. These two species comprised 89.6 percent of the total yearly calculated catch for both fish and eggs [bay anchovy = 66.0% (fish = 7.5%; eggs = 58.5%); naked goby = 23.6%]. From April-September, the period of larval goby and anchovy spawning, bay anchovy comprised 66.0 percent of the total catch (fish = 7.3%; eggs = 58.7%) and naked goby comprised 23.7 percent of the total calculated catch for that time period. Naked goby was the most abundant fish captured reaching concentrations of 15/m^3 on 17 August (Table 4). Bay anchovy concentrations of $5/m^3$ were recorded on 17 August. Bay anchovy eggs were the single most abundant organism captured, reaching concentrations of $95/m^3$ in one tow on 22 June (Table 5).

Total yearly calculated catch (100 m^3) of bay anchovy (fish and eggs) was down by 38 percent from the catch in 1977 (approximately 88,400 versus 143,000). Bay anchovy rose slightly as a percent of total catch over 1977 (66.0% versus 65.5%) while total catch of all fish and eggs decreased (134,000 versus 209,000 or 35.9%) (Jordan et. al., 1978). Average catch (yearly) of bay anchovy per sample ($100/m^3$) decreased from 107/sample to 63/sample.

Total yearly calculated catch of naked goby decreased by 35.5 percent from 1977 (31,600 versus 49,000). Percentage of total catch rose slightly (23.6% versus 23.0%) (Jordan et. al., 1978) while average catch per sample (100 m^3) decreased from 36/sample to 22/sample.

Atlantic silverside (<u>Menidia menidia</u>), tidewater silverside (<u>Menidia beryllina</u>) and rough silverside (<u>Membras martinica</u>) were captured in all life stages (Tables 4 and 5). Eggs, larvae, and juveniles were taken in spring and summer ($<1/m^3$). Only juveniles and adults of these species were taken in fall and winter. The tidewater silverside was the most common species of the silverside group. Silverside eggs are normally attached to submerged objects, thus eggs in our samples presumably had been dislodged by wave action and water currents.

Striped bass larvae and white perch eggs and larvae were common in April and May samples (Tables 4 and 7). Though concentrations never exceeded $1/m^3$ both species were more abundant than in 1976 or 1977.

Postlarval and juvenile Atlantic croaker (*Micropogon undulatus*) and spot (*Leiostomus xanthurus*) were captured seasonally (Tables 4 and 7). Croaker were captured during fall and early-winter in concentrations of less than $1/m^3$. Spot were captured during spring in concentrations of less than $1/m^3$. Sciaenids as a group spawn in offshore waters but postlarvae and juveniles move into the estuaries (such as the James) which serve as nursery areas for these species.

Atlantic menhaden (*Brevoortia tyrannus*) also utilize the James River estuary as a nursery area in the postlarval and juvenile stages. During late winter-early spring, menhaden were captured in concentrations of less than $1/m^3$ at VEPCO Surry Nuclear Power Plant (Tables 4 and 7).

Carp eggs were taken in low numbers during April and May (Table 5). Carp eggs were taken primarily in the discharge canal indicating a resident population spawning in the high level intake canal or in the discharge canal.

Other species were captured in low abundance (Tables 4 and 5).

Hydrographic data

Ranges of salinity, water temperature, and dissolved oxygen taken during 24 hour stations are presented in Tables 8, 9, and 10, and intake data are shown in Figures 6, 7, and 8.

Salinities during 1978 remained relatively low until fall when a prolonged dry spell elevated salinities (Table 8; Fig. 6). During the spawning season (April, May), salinites remained below 1 $^0/_{00}$ except for the last half of April.

Water temperature at the intake was at a minimum of 1 C on 16-17 February and a maximum of 32 C on 17-18 August (Table 10; Fig. 7). Water temperature at the discharge usually exceeded intake temperatures by 4-9 C unless one or both generation units were inoperative.

Dissolved oxygen data show no oxygen dificiencies (4 mg/l) at either the intake or discharge though readings were between 4 mg/l and 5 mg/l in late June and August (Table 10; Fig. 8).

Statistical Results

An examination of simple correlation matrices of potential regression variables in original and log-transformed scales was made to identity the final form of variables. In general, correlations were higher between transformed dependent variables (Y_i) and independent variables (X_j) in their original scale, except for fish and egg species diversities. Little or no improvement in correlations were found by transforming either species diversity or the independent variables.

Although many simple correlation coefficients (r) between the dependent and independent variables were declared highly significant ($P<0.001$), most correlations were not high (maximum r = 0.67). All independent variables, except depth, period, and tide, were significantly correlated ($P<0.05$ or better) with five or more of the dependent variables.

Descriptive statistics of the dependent and independent variables, are shown in Table 11 and the results of the regression analysis appear in Table 12. Each final regression equation is discussed separately, then overall patterns are summarized.

The regression coefficients (b_j's) are partial coefficients which estimate the effects of a particular variables while holding constant or controlling for other varialbes

Total Abundance of Fish (Y_1):

All independent variables except tide and the dummy seasons were retained in the final regression equation as significant predictors of total abundance of fish (Y_1). The equation for Y_1 was highly significant ($P<0.001$) and about two-thirds of the variation in total abundance of fish was accounted for by the regression ($R^2 = 0.64$).

Depth, temperature and period had positive b_j's; i.e., their partial effects on fish abundance were positive. The remaining variables had negative b_j's.

Within the ranges of values observed, the equation predicts an increasing total abundance of fish with an increasing depth or temperature, or with a decreasing salinity or dissolved oxygen, holding other variables constant. Y_1 was significantly higher at the mouth of the intake canal than in the discharge canal (recall location was coded as 0 = intake, 1 = discharge). A significantly higher fish abundance was found at night than day (period was coded as 0 = day, 1 = night).

Abundance of Fish Species (Y_2):

Depth, temperature, salinity, period, winter and spring were retained in the equation for Y_2. The highly significant regression explained over half of the variation in abundance of fish species ($R^2 = 0.55$). The partial regression coefficients for salinity and winter were negative; the others were positive. The equation predicts Y_2 will increase as temperature and sampling depth increase and as salinity decreases. A significantly higher abundance of fish species was found at night than day. No significant difference in fish species abundance was detected between the two sampling locations.

Dummy seasons were included in the analysis to mathematically reduce the unexplained variation in the model and to remove factors which could confound the analysis. After allowing for the effects of other variables in the equation, spring had a significantly higher abundance of fish species than the reference season summer; for winter, the converse was true. This suggests that other seasonal effects (in addition to those accounted for by variables in the equation) tend to decrease fish abundance in winter and increase it in spring. Factors which may be reflected in the season variables include time and duration of migrations of parent populations, recruitment, wind direction, currents, fishing efficiency of gear, and other unmeasured factors. For example, the high abundance of ctenophores during the summer would decrease the gear efficiency by clogging nets and would lead to lower abundance estimates in this season.

Fish Species Diversity (Y_3):

The equation for Y_3, significant at $P<0.001$, explained 35 percent of the variation in fish species diversity. All independent variables except dissolved oxygen, tide and spring were significant. Fish species diversity will increase as depth and temperature increase and as salinity decreases. Holding other variables constant, diversity was significantly higher ($P<0.01$) in the discharge canal than at the power plant intake structure. Two plausible explanations for this unusual pattern are (a) additional species which were not present in samples taken at the intake inhabit and reproduce in the high level intake canal, and (b) the efficiency and selectivity of the sampling gear differed between the two locations. Samples at night had a higher fish species diversity than samples during daylight. Unmeasured seasonal factors collectively represented by the seasons fall and winter tended to decrease the diversity in these seasons.

Total Abundance of Eggs (Y_4):

The regression of Y_4 on all independent variables, except depth, dissolved oxygen and location, was highly significant and explained 30 percent of the variation in egg abundance. The partial effects of temperature, salinity, tide, winter and spring were positive, while those for period and fall were negative. The equation predicts a higher temperature or salinity. Significantly more eggs were collected at high tide and during the day. Unmeasured seasonal factors in winter and spring tended to increase egg abundance during these seasons compared to summer. The converse was true for fall. There was no significant difference in egg abundance between intake and discharge samples.

Abundance of Egg Species (Y_5):

The highly significant regression equation for Y_5 explained 36 percent of the variation in egg species abundance. Temperature, location and spring had positive b_j's; fall had a negative b_j. The remaining independent variables were not selected as significant predictors of egg species abundance. Abundance of egg species was significantly higher in the discharge canal.

Egg Species Diversity (Y_6):

Although the final equation for Y_6 was highly significant, only 23 percent of the variation in egg diversity was explained by the regression. Since the primary objective of the analysis was to assess the effects of the independent variables and not to predict diversity, a low R^2 does not hinder the analysis.

Dissolved oxygen, location and spring were selected as positive predictors of egg diversity and winter was selected as a negative predictor. Other independent variables were not found to be significant. The discharge canal had a higher egg diversity than the intake.

Abundance of Anchoa mitchilli Fish (Y_7):

Fifty-nine percent of the variation in Y_7 was explained by the highly significant regression of anchovy abundance on all independent variables except salinity, location and fall. Depth, temperature, period and tide had a positive relationship with anchovy abundance but dissolved oxygen and spring had a negative relationship. A higher anchovy abundance is predicted at night and at high slack water. The partial effect of spring on Y_7 was negative. No difference in anchovy abundance was found between the two sampling locations.

Abundance of Gobiosoma bosci Fish (Y_8):

The highly significant equation for goby abundance explained 56 percent of the variation in Y_8 and retained all independent variables except salinity, period and tide. Depth, temperature, fall and spring had positive partial regression coefficients. Dissolved oxygen and location had negative coefficients. Goby abundance was significantly higher at the mouth of the intake canal and in fall and spring.

Abundance of Anchoa mitchilli Eggs (Y_9):

The highly significant equation for anchovy egg abundance explained 37 percent of the variation in Y_9. All independent variables except dissolved oxygen and fall were retained as significant predictors of anchovy egg abundance. Independent variables with significant positive partial regression coefficients were depth, temperature, salinity, tide and spring. Location and period had negative partial regression coefficients. Intake and day collections had a higher anchovy egg abundance.

Summary of Regression Analysis:

A nonparametric ranking procedure was developed to assess the relative importance of the independent variables. Direct comparisons of partial regression coefficients are not useful since the independent variables were measured in different units. However, comparisons between standardized coefficients (dependent and independent variables standardized to unit variance) can be used to determine the relative effect of each independent variable on the dependent variables. The procedure consisted of ranking the absolute values of the standardized b_j's in each equation, summing the individual ranks for each variable across all equations, and ranking these sums to give an overall measure of relative importance (Table 13). Ties were assigned average ranks, and seasons were not included in the analysis.

Overall, temperature ranked first in relative importance and was retained in all but one of the regression equations as a highly significant ($P<0.01$ or better) predictor of fish and egg abundances and diversities. The relationship between temperature and the dependent variables was positive;

within the range of temperatures encountered during the study, abundance and diversity will increase as temperature increases.

Salinity was the second most important independent variable and was retained in five equations. The relationship between fish abundance, fish species abundance and fish species diversity was negative; i.e., these dependent variables increased as salinity decreased. For total abundance of eggs and abundance of anchovy eggs, the converse was true.

Location was third in relative importance and was a significant variable in six equations. The pattern of its effect was mixed. Significantly higher total abundance of fish, goby abundance, and anchovy egg abundance were found at the mouth of the intake canal. On the other hand, fish species diversity, abundance of egg species and egg species diversity were higher in the discharge canal. The presence of resident populations of fishes within the intake canal proper is a complicating factor. The location variable is a net measure of the mechanical removal of fish and eggs as the water passes through the plant. Additional fishes inhabiting the intake or discharge canal could account for the unexpected gain in fish and egg species diversities. Also, the stresses of passage through the plant could make some species more susceptible to capture in the discharge canal and would result in inflated estimates.

Depth was fourth in importance and was retained in six equations. Depth had no significant effect on total egg abundance, egg species abundance and egg species diversity but was positively related to the other dependent variables. Fish abundance, fish species abundance, fish species diversity, anchovy abundance, goby abundance and anchovy egg abundance increased as sampling depth increased. If samples contained a majority of negatively buoyant larvae this pattern would be explained. Also, surface effects (e.g., wind, currents, turbulence, and velocity) may have resulted in a decreased gear efficiency for surface samples.

Period was fifth in relative importance and was retained in six regression equations as a highly signficant independent variable. The relationship between period and all fish abundance and diversity variables except goby abundance was positive; fish abundance and fish species diversity were significantly higher at night than during the day. If net avoidance was greater during the day because of increased visibility, this pattern could result from diurnal differences in the catch efficiency of the sampling gear. The opposite pattern was observed for total egg abundance and anchovy egg abundance which were significantly higher during the day. No explanation for this pattern can be offered at this time.

Dissolved oxygen ranked sixth in overall importance. Egg species diversity increased as dissolved oxygen increased. Total abundance of fish, anchovy abundance and goby abundance increased with a decreasing dissolved oxygen. Apparently, levels of dissolved oxygen were not low enough to result in a decreased fish abundance.

Tide was the least important independent variable and was retained in only three equations. Tide had little or no effect upon the overall fish community structure. It was a significant factor, however, in the total abundance of eggs and the abundance of anchovy fish and eggs; these dependent variables increased as tide increased, i.e., abundance was greater at late flood, high slack and early ebb than at other tide stages.

CONCLUSIONS

VIMS ichthyoplankton data collected at VEPCO Surry Nuclear Power Plant since 1976 reveal a decrease in the overall catch of fish eggs and larvae in our samples. The two dominant species, bay anchovy and naked goby have each decreased by forty percent or more. While this decrease may seem great, in actuality it may not be, and it cannot be directly attributed to mortality inflicted by the power plant. Natural fluctuations of considerable magnitude do occur in fish populations and these fluctuations reflect changes in natural mortality. Natural mortality from the egg to juvenile stage is 99 percent or more (Pearcy, 1962; Ahlstrom, 1954). Success of a given yearclass is correlated with natural mortality and conditions on the spawning and nursery grounds. Thus, from year to year there may be natural fluctuations in species abundance of one or more orders of magnitude similar to those we have observed at VEPCO Surry.

The decrease in catch of ichthyoplankton at VEPCO Surry is attributable to variations in salinity patterns more than to other factors. Salinity at VEPCO may vary from 0‰ to 14‰ depending on meteorological conditions and seasons. Since anchovies constitute nearly 60 percent of the catch (as eggs and larvae) and anchovies prefer higher salinities for spawning (Lippson and Moran, 1974), lower river salinities near Hog Island in 1978 caused the decreased catches of anchovy.

The decline in catch of gobies is unexplainable at this point. If salinity were the major factor influencing gobies, they should have increased slightly in 1977 (as did anchovies) and decreased in 1978. However, they have declined each year since the inception of this sampling program. Naked goby are seldom captured in trawl or seine surveys. They inhabit oyster bar communities and other areas where crevices, etc. afford shelter. It is impossible to obtain a realistic estimate of their adult population from present data. We have no estimates of concentrations of larvae in mainstream either; therefore, effect of the plant on adult population levels cannot be determined.

Bay anchovy and naked goby are not important commercially, but are principal forage species for commercially important species such as weakfish (Cynoscion regalis), bluefish (Pomatomus saltatrix), striped bass (Morone saxatilis), and catfishes (Ictalurus spp.), etc. (Hildebrand and Schroeder, 1928). Even though they constitute the major portion of our catches, their centers of abundance are not located near the VEPCO Surry Nuclear Power Plant since each species prefers slightly higher salinities.

The James River has been subjected to numerous stresses in recent years, i.e., organic and inorganic pollutants, siltation, flooding, etc. To extract any one stress (e.g., VEPCO Surry) from such a combination is extremely difficult, especially when the effects of other stresses have not been analyzed. Coupled with sampling variability, natural population fluctuations, biological attributes of ichthyoplankton, environmental factors, and other sources of variability inherent in any sampling program, any changes other than those of catastrophic proportions are difficult to assess.

Multiple regression techniques explained some of the complex relationships between environmental factors and the abundance and diversity of fish and eggs, and isolated factors which tend to confound the analysis of data from general field surveys. These techniques were successful in identifying the dominant environmental factors and assessing their relative importance.

This study was designed to identify and enumerate ichthyoplankton entering and leaving VEPCO Surry Nuclear Power Station. This objective has been satisfied. The impact of the plant upon the adult populations cannot be determined from these data alone. Without larval fish concentrations from the mainstream and continual monitoring of population levels, biological impact assessment is impossible. Even with these data, other stresses (i.e., Kepone, chlorination, dredging etc.) would have to be eliminated before any direct impact could be shown.

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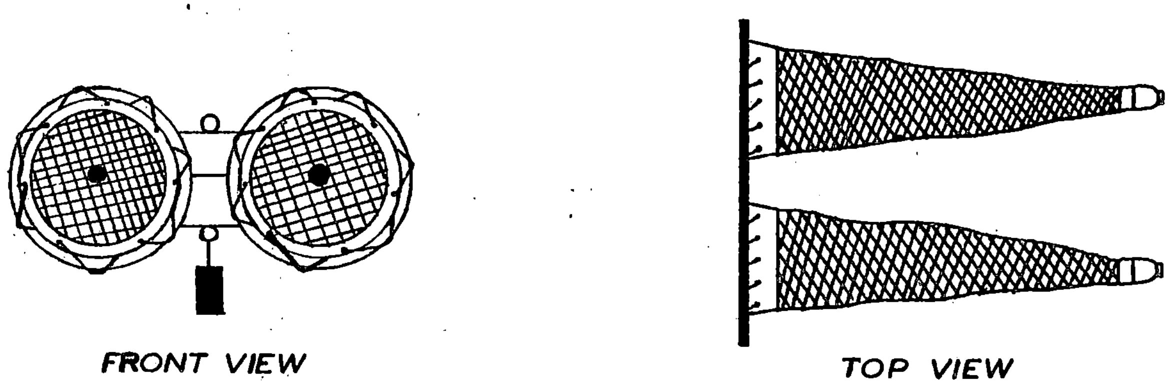

Figure 1. Paired net apparatus used at VEPCO Surry Nuclear Power Plant for ichthyoplankton collections.

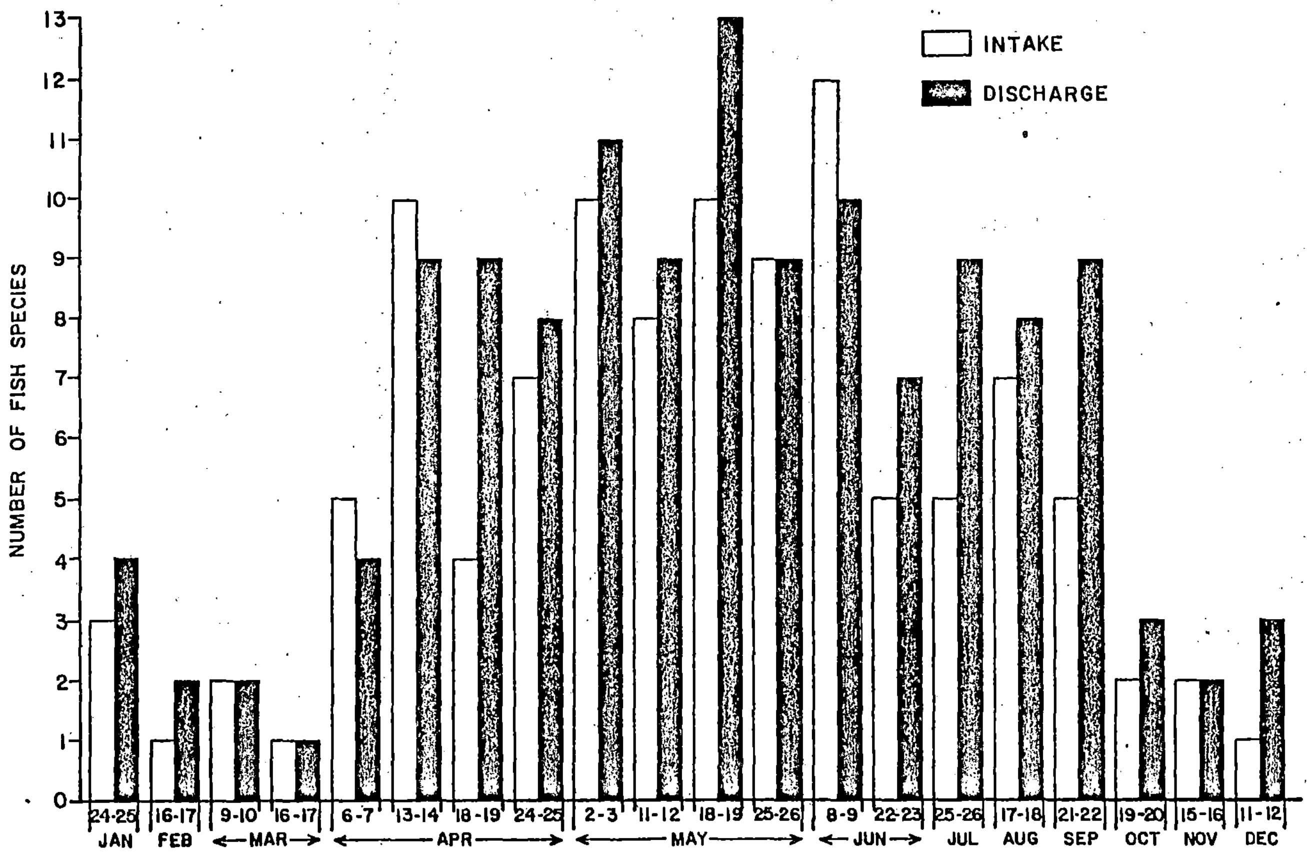

Figure 2. Number of fish species captured during plant entrainment stations at VEPCO Surry Nuclear Power Plant in 1978.

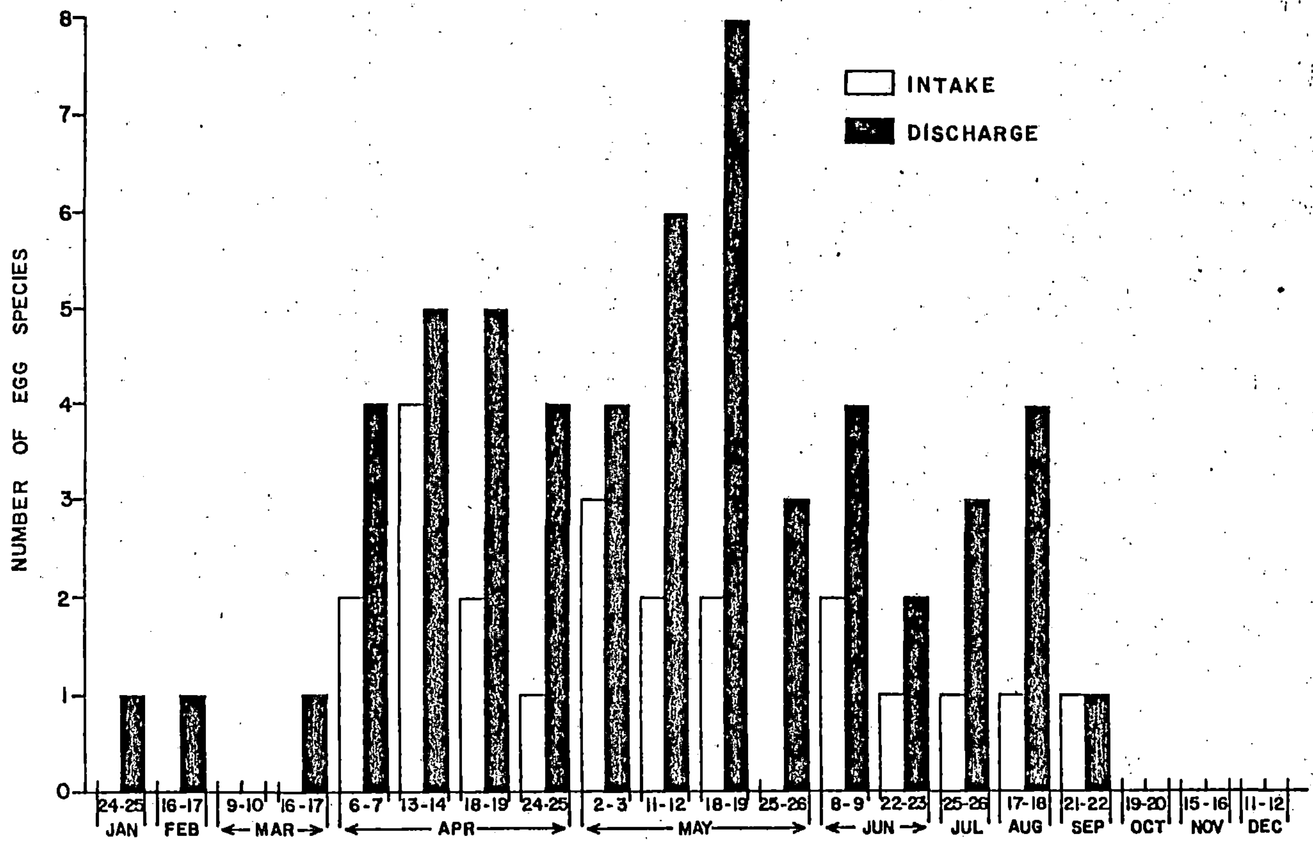

Figure 3. Number of egg species captured during plant entrainment stations at VEPCO Surry Nuclear Power Plant in 1978.

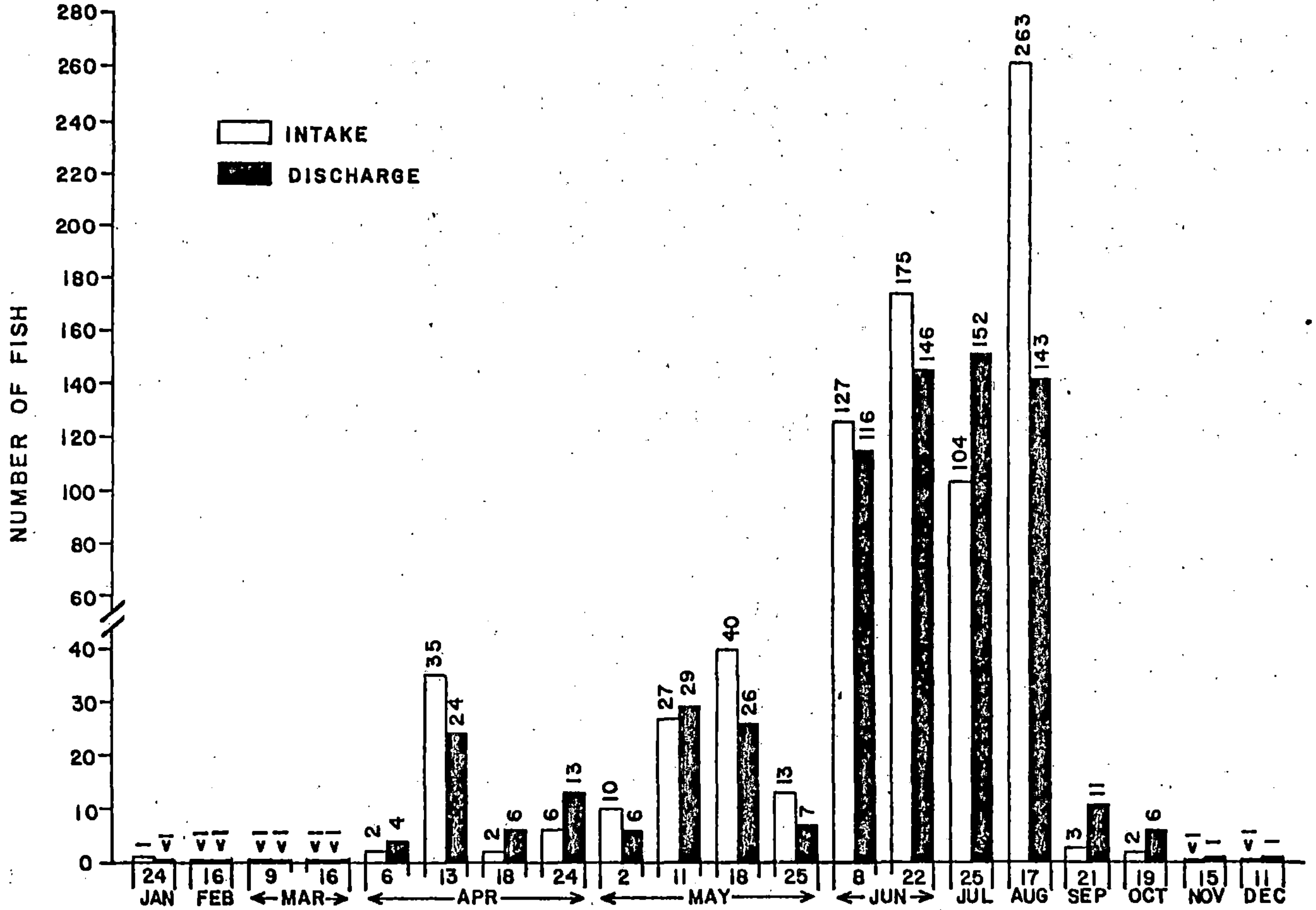

Figure 4. Average number of fish per sample (100 m^3) captured during plant entrainment stations at VEPCO Surry Nuclear Power Plant in 1978.

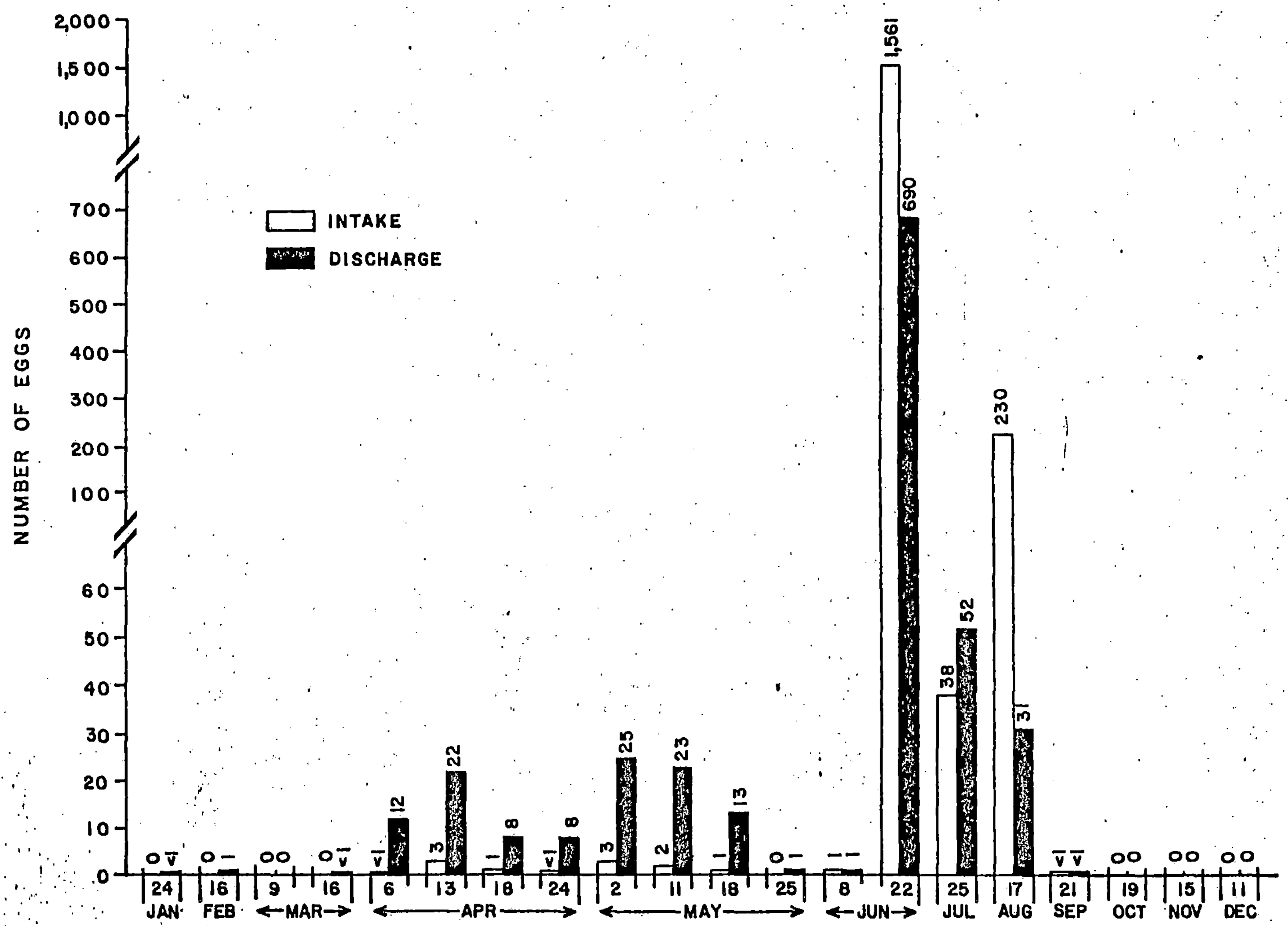

Figure 5. Average number of eggs per sample (100 m^3) captured during plant entrainment stations at VEPCO Surry Nuclear Power Plant in 1978.

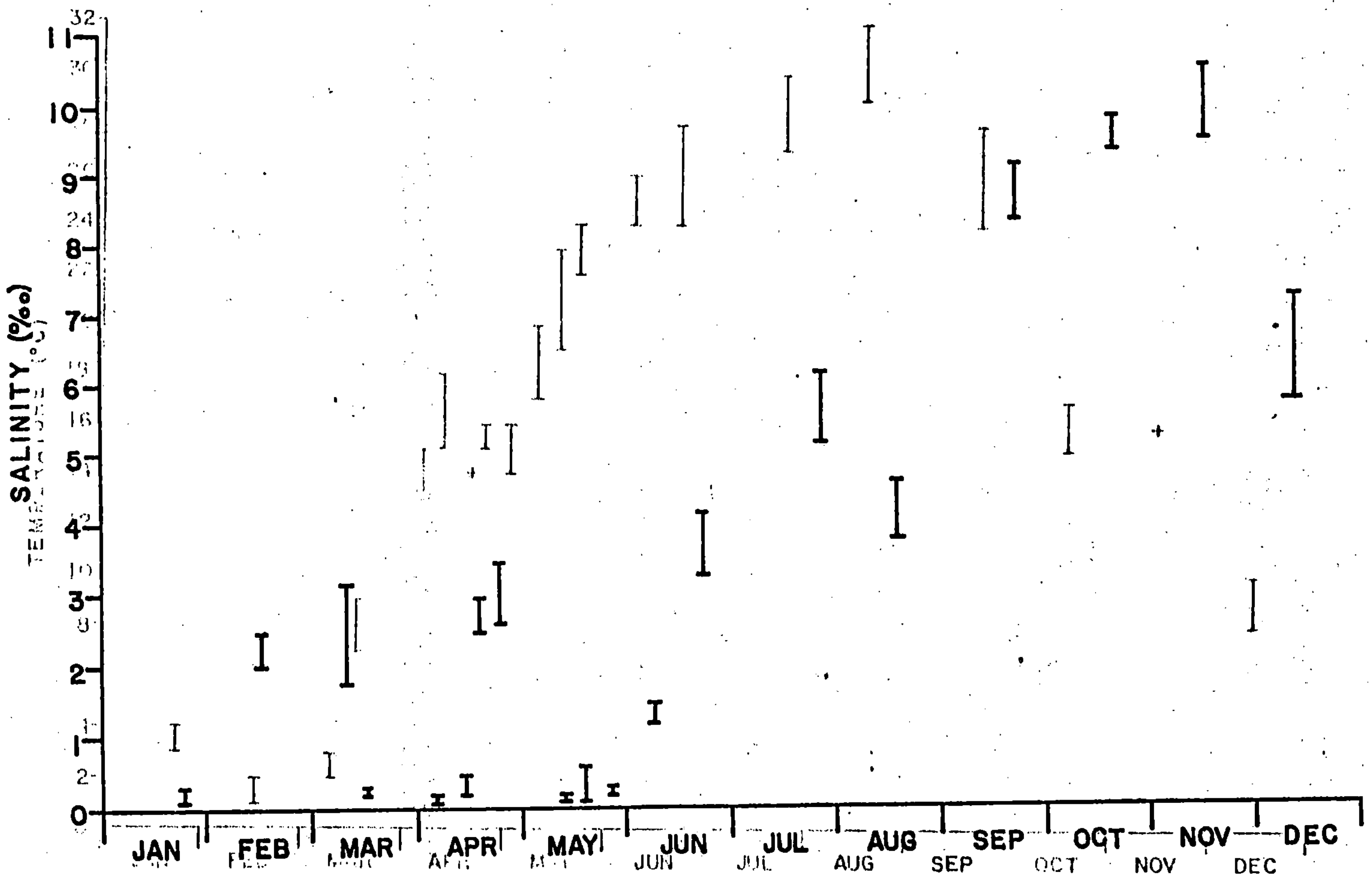

Figure 6. Ranges of salinity (⁰/oo) at the intake during plant entrainment stations at VEPCO Surry Nuclear Power Plant in 1978.

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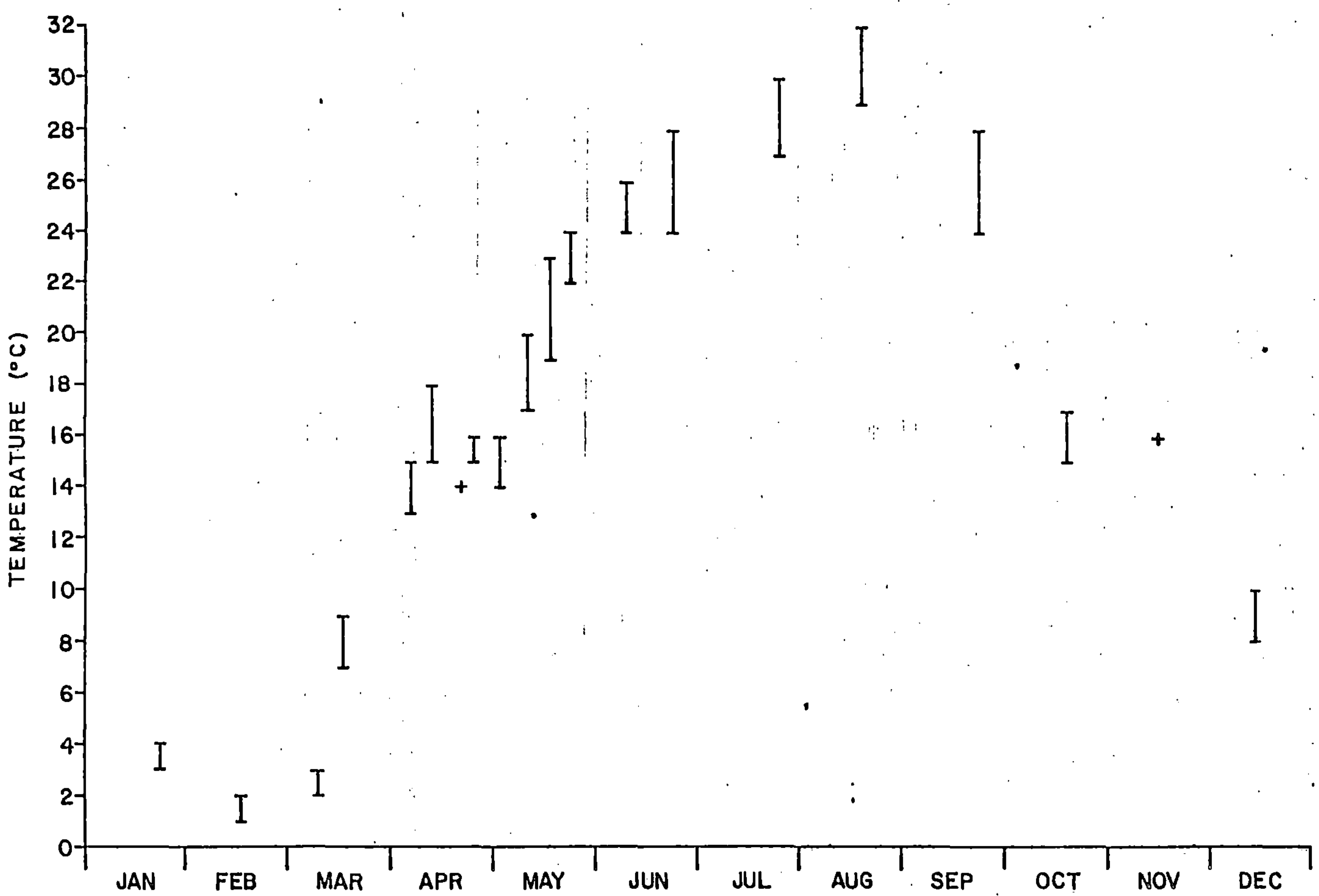

Figure 7. Ranges of water temperature (C) at the intake during plant entrainment stations at VEPCO Surry Nuclear Power Plant in 1978.

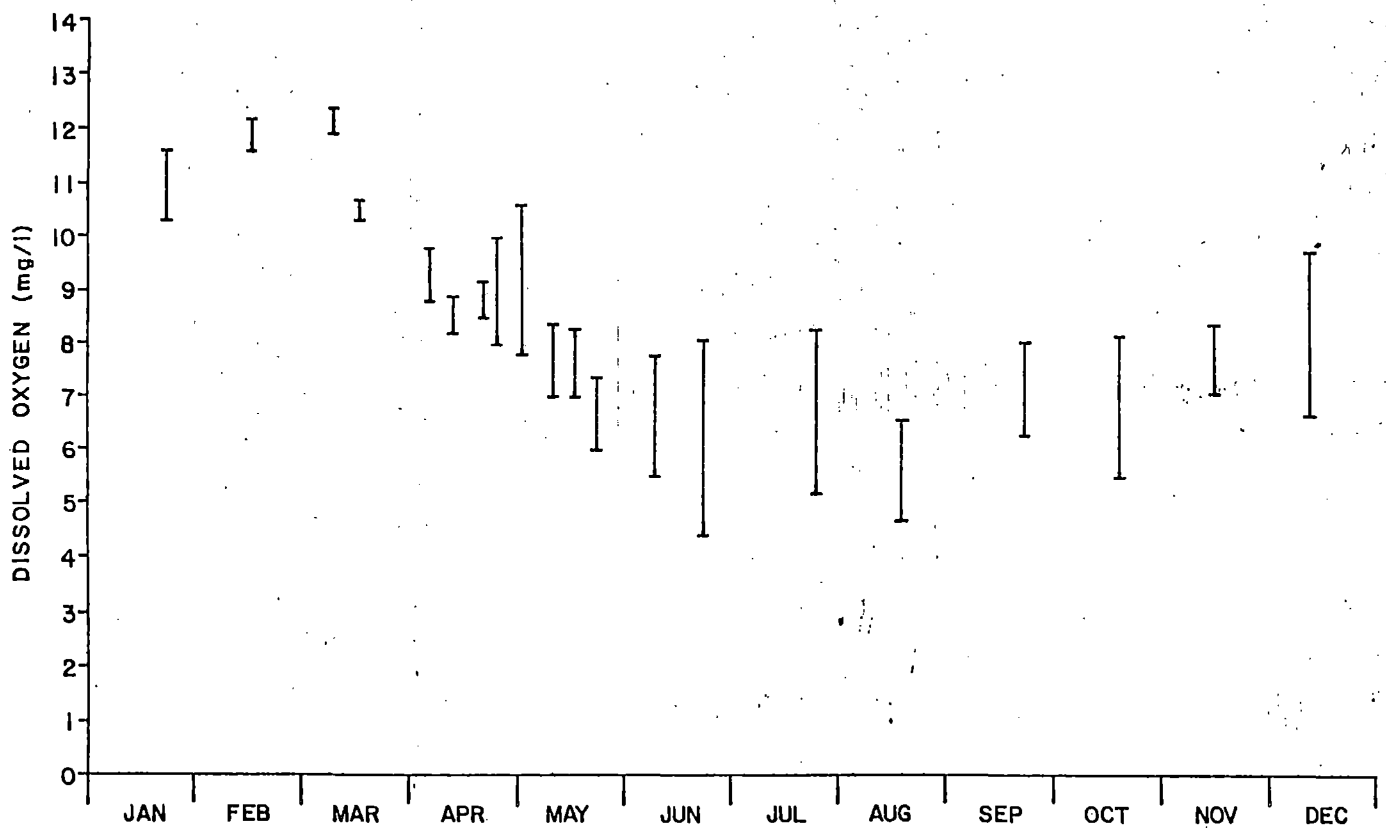

Figure 8. Ranges of dissolved oxygen (mg/l) at the intake during plant entrainment stations at VEPCO Surry Nuclear Power Plant in 1978.

Table 1. Ichthyoplankton sampling schedule for plant and plume entrainment studies at VEPCO Surry Nuclear Power Plant (January through December 1978).

Study	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Plant Entrainment	X	X	XX	XXXX	XXXX	XX	X	X	X	X	X	X
Plume Entrainment	X	X	XX	XXXX	XXXX	XX	XX	XXXX	XX	X	XX	XX

Table 2. Dependent (Y_i) and independent (X_j) variables for statistical analysis (standardized catch is number collected per 100 cubic meters of water strained per collection).

Variable	Definition
Y_1, Total abundance of fish	$Y_1 = \log_e (C_1 + 1)$, where C_1 = standardized catch of fish
Y_2, Abundance of fish species	$Y_2 = \log_e (C_2 + 1)$, where C_2 = number of fish species
Y_3, Fish species diversity	$Y_3 = -\Sigma p_k \log_e p_k$, where $p_k = \frac{n_k}{N}$, n_k = number of fish of the k^{th} species, and N = total number of fish
Y_4, Total abundance of eggs	$Y_4 = \log_e (C_4 + 1)$, where C_4 = standardized catch of eggs
Y_5, Abundance of egg species	$Y_5 = \log_e (C_5 + 1)$, where C_5 = number of egg species
Y_6, Egg species diversity	$Y_6 = -\Sigma p_k \log_e p_k$, where $p_k = \frac{n_k}{N}$, n_k = number of eggs of the k^{th} species, and N = total number of eggs
Y_7, Abundance of *A. mitchilli* fish	$Y_7 = \log_e (C_7 + 1)$, where C_7 = standardized catch of *A. mitchilli* fish
Y_8, Abundance of *G. bosci* fish	$Y_8 = \log_e (C_8 + 1)$, where C_8 = standardized catch of *G. bosci* fish
Y_9, Abundance of *A. mitchilli* eggs	$Y_9 = \log_e (C_9 + 1)$, where C_9 = standardized catch of *A. mitchilli* eggs
X_1, Collection depth	Meters
X_2, Water temperature	°C
X_3, Salinity	ppt
X_4, Dissolved oxygen	mg/l
X_5, Location dummy variable	0 = intake, 1 = discharge

Table 2. (continued).

Variable	Definition
X_6, Period dummy variable	0 = day (5 to 16.9 h EST), 1 = night (17.0 to 4.9 h EST)
X_7, Tide	Represented by a cosine function: +1.0 = slack before ebb -1.0 = slack before flood
X_8, X_9, X_{10}, Season dummy variables	

Season	X_8, Fall =	X_9, Winter =	X_{10}, Spring =
Summer (July, Aug., Sept.)	0	0	0
Fall (Oct., Nov., Dec.)	1	0	0
Winter (Jan., Feb., March)	0	1	0
Spring (April, May, June)	0	0	1

Table 3. Number of species captured during 24-hour stations at VEPCO Surry Nuclear Power Station in 1978.

NUMBER OF SPECIES

	INTAKE			DISCHARGE			Species occurring at both intake and discharge	
DATE	Fish	Eggs	Both*	Fish	Eggs	Both*	Fish	Eggs
Jan. 24-25	3	0	0	4	1	0	3	0
Feb. 16-17	1	0	0	2	1	0	0	0
Mar. 09-10	2	0	0	2	0	0	1	0
Mar. 16-17	1	0	0	1	1	0	0	0
Apr. 06-07	5	2	1	4	4	1	3	2
Apr. 13-14	10	4	2	9	5	4	7	4
Apr. 18-19	4	2	1	9	5	3	3	2
Apr. 24-25	7	1	1	8	4	2	6	1
May 02-03	10	3	2	11	4	3	9	3
May 11-12	8	2	1	9	6	3	5	2
May 18-19	10	2	1	13	8	4	7	2
May 25-26	9	0	0	9	3	1	4	0
June 08-09	12	2	2	10	4	2	9	2
June 22-23	5	1	1	7	2	2	4	1
July 25-26	5	1	1	9	3	1	4	1
Aug. 17-18	7	1	1	8	4	2	7	1
Sep. 21-22	5	1	1	9	1	0	5	0
Oct. 19-20	2	0	0	3	0	0	2	0
Nov. 15-16	2	0	0	2	0	0	2	0
Dec. 11-12	1	0	0	3	0	0	1	0

* Species occurring as both fish and eggs

Table 4. Species and calculated number of fish per 100 m^3 captured during 24-hour stations at VEPCO Surry Nuclear Power Plant in 1978.

JANUARY 24 - 25, 1978

SPECIES	STATION TIME	INTAKE						DISCHARGE					
		SURFACE		MIDWATER		BOTTOM		SURFACE		MIDWATER		BOTTOM	
		LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
	10:00												
MENIDIA BERYLLINA			5										
	14:00												
MENIDIA BERYLLINA				3				6					
	18:00												
ALOSA AESTIVALIS												3	
MENIDIA BERYLLINA			4										
	22:00												
ANGUILLA ROSTRATA						4			3				
MORONE AMERICANA							5						
	2:00												
MORONE AMERICANA					3			3					
	6:00												
MENIDIA BERYLLINA		3											

Table 4. (continued).

FEBRUARY 16 - 17, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
MENIDIA BERYLLINA			5										
	14:00												
MENIDIA MENIDIA								2					
	18:00												
MENIDIA BERYLLINA		4											
	6:00												
ANGUILLA ROSTRATA											3	3	

Table 4. (continued).

MARCH 9 - 10, 1978

SPECIES	STATION TIME	INTAKE						DISCHARGE					
		SURFACE		MIDWATER		BOTTOM		SURFACE		MIDWATER		BOTTOM	
		LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
	10:00												
ANGUILLA RCSTRATA					5								
	18:00												
MENIDIA BERYLLINA									3				
	22:00												
ANGUILLA ROSTRATA									3				
MCRCNE AMERICANA					4								

Table 4. (continued).

MARCH 16 - 17, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
ANGUILLA ROSTRATA							3						
	22:00												
ALOSA AESTIVALIS											3		

Table 4. (continued).

APRIL 6 - 7, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
BREVOORTIA TYRANNUS									10				
MORONE AMERICANA											5		
	14:00												
BREVOORTIA TYRANNUS		4						4		4			
	18:00												
ANGUILLA ROSTRATA		5							8	5	4		
BREVOORTIA TYRANNUS													4
	22:00												
ANGUILLA ROSTRATA													5
BREVOORTIA TYRANNUS							4					14	5
	2:00												
ANGUILLA ROSTRATA		4						4					
BREVOORTIA TYRANNUS			5	9	8	4	7		4	8	4	10	10
MENIDIA BERYLLINA												3	
MORONE AMERICANA						12	3						
TRINECTES MACULATUS						4							

Table 4. (continued).

SPECIES	STATION TIME	INTAKE						DISCHARGE					
		SURFACE		MIDWATER		BOTTOM		SURFACE		MIDWATER		BOTTOM	
		LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
	6:00												
BREVOORTIA TYRANNUS									4		3	3	6
MORONE AMERICANA			4	4		4							
MORONE SAXATILIS					4								

Table 4. (continued).

APRIL 13 - 14, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
ALCSA SP.			5										
BREVOORTIA TYRANNUS				8	4			5	5		11	4	19
CYPRINUS CARPIO												2	2
DORCSOMA CEPEDIANUM											4		2
MORONE AMERICANA		14		8	7	15	10	5	13	4	26	9	6
MORONE SAXATILIS		5		4	4					2			
SPECIMEN MANGLED									3				
	14:00												
ALOSA SAPIDISSIMA							4						
BREVOORTIA TYRANNUS		12	6	4			4			11	9	9	
DORCSOMA SP.										2			
LEIOSTOMUS XANTHURUS												2	
MORONE AMERICANA		42	35	35	64	54	15		16	23	22	17	55
MORONE SAXATILIS		12	6		21					7	2	7	5
SPECIMEN MANGLED							4						
	18:00												
BREVOORTIA TYRANNUS										2	6	6	4
CYPRINUS CARPIO									3	2			2
MORONE AMERICANA		87	38	26	12	17	5	3	28	7	13	25	34
MORONE SAXATILIS		8	17	10	12	6	5		5	2	4	2	4
SPECIMEN MANGLED									3				

Table 4. (continued).

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	22:00												
ALOSA SP.													2
ANGUILLA ROSTRATA		3	3		3								
BREVOORTIA TYRANNUS		3		3		17	6	3				13	20
CYPRINUS CARPIO											2		
DOROSOMA CEPEDIANUM										2	2	4	2
MENIDIA BERYLLINA		3											
MORONE AMERICANA		7		6	3	3	6			12	9	11	4
MORONE SAXATILIS				3	3	7			3	2			2
	2:00												
ANGUILLA ROSTRATA							5			2	2		
BREVOORTIA TYRANNUS				11	12	5	20				5	15	14
CYPRINIDAE		6											
CYPRINUS CARPIO				5				3					5
LEIOSTOMUS XANTHURUS					4					2	2		2
MORONE AMERICANA		18	23	32	19	82	92	9	9	10	19	12	45
MORONE SAXATILIS		36	17		27	24	15		3	12	12	7	5
	6:00												
BREVOORTIA TYRANNUS		14	10			3		3		4	4	7	2
CYPRINUS CARPIO									3	2			2
DOROSOMA CEPEDIANUM										2			
MORONE AMERICANA		10	3	6	5	6	14		3	11	24	13	17
MORONE SAXATILIS		3		3			3			2	2		11

Table 4. (continued).

APRIL 18 - 19, 1978

SPECIES / STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
10:00												
ANCHOA MITCHILLI								3				
BREVOORTIA TYRANNUS							3					
MORONE AMERICANA		4									2	
14:00												
ANCHOA MITCHILLI						7			5	5	3	5
BREVOORTIA TYRANNUS										5	8	10
DOROSOMA CEPEDIANUM											5	
MORONE AMERICANA								3	3		3	
MORONE SAXATILIS		3		3							5	
18:00												
ANCHOA MITCHILLI	5								3	3	11	8
ANGUILLA ROSTRATA								3				
BREVOORTIA TYRANNUS											5	
LEIOSTOMUS XANTHURUS									3	3		
MENIDIA BERYLLINA	5											
MORONE SAXATILIS												3
22:00												
ANCHOA MITCHILLI			5	8					5		8	8
ANGUILLA ROSTRATA							3	3		3	8	
BREVOORTIA TYRANNUS								3	3	3	8	3
MENIDIA BERYLLINA		5		4								
MORONE AMERICANA										3		

Table 4. (continued).

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	2:00												
ALOSA SP.										2			
ANCHOA MITCHILLI											2	7	
ANGUILLA ROSTRATA		0200 INTAKE SAMPLING ABORTED							3	2	2		
BREVOORTIA TYRANNUS										12			5
DOROSOMA CEPEDIANUM											2		
	6:00												
BREVOORTIA TYRANNUS												3	
CYPRINUS CARPIO												3	
MORONE AMERICANA												5	

Table 4. (continued).

APRIL 24 - 25, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
BREVOORTIA TYRANNUS										6	3	6	9
LEIOSTOMUS XANTHURUS							4						
MORONE AMERICANA						4							
	14:00												
ANCHOA MITCHILLI										3		9	4
BREVOORTIA TYRANNUS							4			5		2	4
LEIOSTOMUS XANTHURUS													2
MORONE SAXATILIS													2
	18:00												
ALOSA PSEUDOHARENGUS											3		
ALOSA SP.												2	
ANCHOA MITCHILLI				6		4	4	3	3	14	8	25	15
ANGUILLA ROSTRATA										3			2
BREVOORTIA TYRANNUS					4	4	4	3		16	11	8	13
DOROSOMA SP.		11											
MORONE AMERICANA									3				
MORONE SAXATILIS		11											
	22:00												
ANCHOA MITCHILLI		7		14	24	9	10			13	6	9	20
ANGUILLA ROSTRATA							5						3
BREVOORTIA TYRANNUS				9	5	9	5			6	12	3	3
LEIOSTOMUS XANTHURUS							5				6		3
MORONE AMERICANA									3				

Table 4. (continued).

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	2:00												
ANCHOA MITCHILLI				8		8	4			24	6	10	18
BREVOORTIA TYRANNUS						4		6		12	3	10	18
LEIOSTOMUS XANTHURUS				4						6	18	6	
MORONE AMERICANA												3	
	6:00												
ANCHOA MITCHILLI				5			3			3	3	7	12
BREVOORTIA TYRANNUS						3	5	3		6	9	2	15
LEIOSTOMUS XANTHURUS												2	
MORONE SAXATILIS											3		

Table 4. (continued).

MAY 2 - 3, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
ALOSA SP.		18			10								6
BREVOORTIA TYRANNUS												7	
LEIOSTOMUS XANTHURUS								4					
MORONE SAXATILIS						5	6						
POMOXIS NIGROMACULATUS												3	
	14:00												
ALOSA PSEUDOHARENGUS			5	18	9								
ALOSA SP.							12						
BREVOORTIA TYRANNUS										7			
DOROSOMA CEPEDIANUM					5								
DOROSOMA SP.								4				3	
	18:00												
ALOSA PSEUDOHARENGUS					7								
ALOSA SP.			23								4	4	
BREVOORTIA TYRANNUS				5									
DOROSOMA CEPEDIANUM											4		
DOROSOMA PETENENSE												4	
DOROSOMA SP.				16									
LEIOSTOMUS XANTHURUS							8					4	11

Table 4. (continued).

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	22:00												
ALOSA SP.		7	6								3		
ANCHOA MITCHILLI												7	
DOROSOMA CEPEDIANUM												3	
DOROSOMA PETENENSE					6							3	
ICTALURUS PUNCTATUS													6
LEIOSTOMUS XANTHURUS				6						3	3	3	16
MORONE AMERICANA		7			6							3	
MORONE SAXATILIS					6	12						3	
NOTROPIS HUDSONIUS		7	19	13			14				3	3	
	2:00												
ALOSA PSEUDOHARENGUS					4								
ALOSA SP.							9						
ANCHOA MITCHILLI						6		4	10	6		3	6
BREVOORTIA TYRANNUS							9			3			
DOROSOMA CEPEDIANUM			4								3		
DOROSOMA PETENENSE										3			
DOROSOMA SP.		8											
LEIOSTOMUS XANTHURUS						6				3			9
MORONE AMERICANA						6						6	
MORONE SAXATILIS					4							3	3
NOTROPIS HUDSONIUS		24	7						3	3			3
	6:00												
ALOSA SP.		6											4
ANCHOA MITCHILLI													4
DOROSOMA PETENENSE				7				4					
DOROSOMA SP.		13											
MORONE AMERICANA													4
NOTROPIS HUDSONIUS													11
SPECIMEN MANGLED			5										

Table 4. (continued).

MAY 11 - 12, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
ALOSA PSEUDOHARENGUS			14										
ALOSA SP.		34		18	31	28	34	27	10	14	19	45	39
BREVOORTIA TYRANNUS												8	
LEIOSTOMUS XANTHURUS											3	4	
MENIDIA BERYLLINA			5										
MORONE AMERICANA		4											4
MORONE SAXATILIS		9		6	23	9	11	4	7		3	4	4
	14:00												
ALOSA AESTIVALIS		8											
ALOSA PSEUDOHARENGUS													8
ALOSA SP.		8	56	35	7	7	5	46	53	30	34	43	19
BREVOORTIA TYRANNUS							5						
CYPRINUS CARPIO											4		
ETHEOSTOMA OLMSTEDI										4			
MORONE AMERICANA				7									4
MORONE SAXATILIS						7							
NOTROPIS HUDSONIUS		8	19					4			4	4	
	18:00												
ALOSA PSEUDOHARENGUS			10										
ALOSA SP.		78	57	9		4	4	11		7	38	28	37
BREVOORTIA TYRANNUS					11	4	4				3		
MORONE AMERICANA											3		
NOTROPIS HUDSONIUS				9						3			4

Table 4. (continued).

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	22:00												
ALOSA SP.					6		28	16	3	23	10	65	12
BREVOORTIA TYRANNUS				15				6					
LEIOSTOMUS XANTHURUS								6	25	4		4	4
MORONE SAXATILIS								6	3	8		4	
NOTROPIS HUDSONIUS							7	10	3		3	9	
	2:00												
ALOSA PSEUDOHARENGUS		10											
ALOSA SP.			30	26	13	74	20			4	16	16	14
BREVOORTIA TYRANNUS					6								
DOROSOMA CEPEDIANUM					6								
LEIOSTOMUS XANTHURUS								6	3	11	6		11
NOTROPIS HUDSONIUS			8				7	3	3			8	4
	6:00												
ALOSA PSEUDOHARENGUS		5											
ALOSA SP.		36	4			9	17	3	3	8	10	18	11
BREVOORTIA TYRANNUS												5	7
CYPRINUS CARPIO										4			
LEIOSTOMUS XANTHURUS											3		
MORONE SAXATILIS				9			26	3		4		9	
NOTROPIS HUDSONIUS				5		4	4		3	4	10		7

Table 4. (continued).

MAY 18 - 19, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
ALOSA PSEUDOHARENGUS													4
ALOSA SP.		9	14	9	23	8	7		4	4	3	8	
BREVOORTIA TYRANNUS							3		4				
CYPRINUS CARPIO											3		4
GOBIOSOMA BOSCI				9		19						16	8
LEIOSTOMUS XANTHURUS							7						
MORONE AMERICANA						8	27		7	4	3		15
MORONE SAXATILIS		9	5	41	14	89	120	8	7	7	3	28	83
	14:00												
ALOSA AESTIVALIS		6											
ALOSA PSEUDOHARENGUS		6											
ALOSA SP.		6	4	10						3		3	7
BREVOORTIA TYRANNUS						5							
CYPRINUS CARPIO													3
DOROSOMA CEPEDIANUM				5	21	5					9	10	
GOBIOSOMA BOSCI								4	3		3		
LEIOSTOMUS XANTHURUS								4		3			
MORONE AMERICANA						9	4					7	
MORONE SAXATILIS				10	16	9	8	4		7	12	3	3
	18:00												
ALOSA SP.		7		5			4					5	4
BREVOORTIA TYRANNUS							4						
CYPRINUS CARPIO										4		9	
GOBIOSOMA BOSCI						9	12		3		3	5	
MORONE AMERICANA				5		9			3				
MORONE SAXATILIS				10	5	30	31	3	3	7	10	5	16
NOTROPIS HUDSONIUS						4							

Table 4. (continued).

SPECIES / STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
22:00												
ALOSA AESTIVALIS												4
ALOSA SP.			6									4
ANCHOA MITCHILLI	8				4							
BREVOORTIA TYRANNUS			6		4	4				4		
CYPRINUS CARPIO										4		
GOBIOSOMA BOSCI									4			4
ICTALURUS PUNCTATUS										4		
LEIOSTOMUS XANTHURUS				4						11		
MORONE AMERICANA					9				4			
MORONE SAXATILIS	25	5	39	37	17	12	18	6	24	14	10	25
NOTROPIS HUDSONIUS				4				3			5	
2:00												
ALOSA PSEUDOHARENGUS		4	5									
ALOSA SP.			10	3	4	10				13		4
ANCHOA MITCHILLI				3								
ATHERINIDAE										3		
BREVOORTIA TYRANNUS			5	3	35	20	4		7	16	4	4
DOROSOMA CEPEDIANUM	7	22	5			3			3			
GOBIOSOMA BOSCI	7	9	5				8				13	
LEIOSTOMUS XANTHURUS				10	12	10	8	4	10	25	13	8
MORONE AMERICANA				13	23	3	4			3		4
MORONE SAXATILIS			36	30	88	63	12	11	7	6	35	12
NOTROPIS HUDSONIUS								4				
SPECIMEN MANGLED					4							
6:00												
ALOSA PSEUDOHARENGUS									4			
ALOSA SP.	20	5	5	7			4	4	8		4	
ANGUILLA ROSTRATA								4				
BREVOORTIA TYRANNUS				4								
GOBIOSOMA BOSCI			5						4			
MORONE AMERICANA				4							9	
MORONE SAXATILIS	15		30	7	9	4	12	4	23	25	17	12
NOTROPIS HUDSONIUS								4			4	4

Table 4. (continued).

MAY 25 - 26, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
ALOSA SP.		6	17			4				2	2		
DOROSOMA CEPEDIANUM			4										
MORONE SAXATILIS													4
	14:00												
ALOSA SP.		9	4	4							3		
BREVOORTIA TYRANNUS						4							
LEIOSTOMUS XANTHURUS											3	4	4
MORONE SAXATILIS						4							
	18:00												
ALOSA AESTIVALIS					4								
ALOSA SP.		4	26								3	3	3
BREVOORTIA TYRANNUS												3	
LEIOSTOMUS XANTHURUS				5		18	22			3			9
MENIDIA BERYLLINA									3				
MORONE SAXATILIS						4						6	
	22:00												
ALOSA PSEUDOHARENGUS				4									
ALOSA SP.					10			4					7
ANGUILLA ROSTRATA											3		
BREVOORTIA TYRANNUS		9		4									
FUNDULUS HETEROCLITUS										4			
ICTALURUS PUNCTATUS										4			
LEIOSTOMUS XANTHURUS				76	59	52	18	4		25	10	4	23
MENIDIA BERYLLINA								4					
NOTROPIS HUDSONIUS			4				4						
TRINECTES MACULATUS					3								

Table 4. (continued).

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	2:00												
ALOSA SP.					5	4			4				7
ANCHOA MITCHILLI							4						
BREVOORTIA TYRANNUS					5		4						
LEIOSTOMUS XANTHURUS					5	22						4	
MORONE SAXATILIS		5								4			
NOTROPIS HUDSONIUS											4		
	6:00												
ALOSA SP.			5										
BREVOORTIA TYRANNUS			5										
LEIOSTOMUS XANTHURUS					16		7			7	12	25	34

Table 4. (continued).

JUNE 8 - 9, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
ALCSA SP.		4		9									
ANCHCA MITCHILLI						4					6		
GOBIOSCMA BCSCI				172	152	74	80	17	19	55	51	82	
MEMBRAS MARTINICA									3	6	6	3	
	14:00												
ANCHCA MITCHILLI													3
GOBICSCMA BCSCI		5	5	127	98	124	94	10	26	85	104	192	185
MEMBRAS MARTINICA		5								6			
MENIDIA BERYLLINA								3				12	3
	18:00												
ALOSA SP.			4										
ANCHCA MITCHILLI							3		3				
DCROSOMA CEPEDIANUM			4										
DOROSOMA PETENENSE									3	3	3		
GCBIOSCMA BCSCI		76	84	73	56	100	109	25	6	81	74	106	93
ICTALURUS PUNCTATUS										3			
LEIOSTCMUS XANTHURUS					3					3	6	3	
MEMBRAS MARTINICA						4		3					
MENIDIA BERYLLINA								3		3	3		
MENIDIA MENIDIA						4							
	22:00												
ANCHCA MITCHILLI		5			8								
BREVCORTIA TYRANNUS					4			3					
GOBICSCMA BCSCI		42	12	235	111	218	236		37	117	130	240	150
LEIOSTCMUS XANTHURUS					4	8		3	3	13	3	3	3
MENIDIA BERYLLINA					8	17	4				3	3	3
MORCNE SAXATILIS							4			3			
TRINECTES MACULATUS						4							

Table 4. (continued).

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	2:00												
ANCHOA MITCHILLI					7		8						3
BREVOORTIA TYRANNUS		10	5										
DORCSOMA PETENENSE				9							3		
GOBIOSOMA BOSCI		19	52	511	382	306	213	60	27	344	210	565	470
LEIOSTOMUS XANTHURUS										14			
MEMBRAS MARTINICA				14									
MENIDIA BERYLLINA				9		10					3		
MENIDIA MENIDIA								4					
MORONE SAXATILIS										3			
	6:00												
ANCHOA MITCHILLI			7	4		4	3						
DORCSOMA PETENENSE						4			3				
GOBIOSOMA BOSCI		122	147	65	71	100	88	24	29	58	66	71	74
LEIOSTOMUS XANTHURUS						4							
MENIDIA BERYLLINA				4						3			3
MENIDIA MENIDIA									3				

Table 4. (continued).

JUNE 22 - 23, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
ANCHOA MITCHILLI				75	7		107	3		20	16	15	27
GOBIOSOMA BOSCI		35	32	509	248	53	71	10	14	56	69	178	120
MEMBRAS MARTINICA										3			
	14:00												
ANCHOA MITCHILLI				83		50	49			3		49	31
GOBIOSOMA BOSCI				167		212	249		6	41	16	423	497
	18:00												
ANCHOA MITCHILLI						4			3	6	3	17	7
CYNOSCION REGALIS												4	
FUNDULUS HETEROCLITUS			19										
GOBIOSOMA BOSCI			38	22	27	109	123	21	29	66	50	82	83
	22:00												
ENTIRE 2200 SAMPLING ABORTED													
	2:00												
ANCHOA MITCHILLI				43	37	101	81	16	3	37	13	31	23
GOBIOSOMA BOSCI			19	296	232	1067	550	22	30	351	269	295	316
LEIOSTOMUS XANTHURUS										4		4	
MEMBRAS MARTINICA								6	3				
MENIDIA BERYLLINA						59	10				3	4	

Table 4. (continued).

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	6:00												
ANCHOA MITCHILLI		8		17	21	13	8	7		24	13	32	24
CYNOSCION REGALIS					4								4
GOBIOSOMA BOSCI		8	9	67	74	31	25		3	87	114	410	263
MORONE SAXATILIS													4

Table 4. (continued).

JULY 25 - 26, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
ANCHOA MITCHILLI		5		46	27	7	7	13	9	12	3	42	33
GOBIOSOMA BOSCI				63	27	286	255	28	9	15	21	61	47
MEMBRAS MARTINICA		34										3	3
MENIDIA BERYLLINA									3				
	14:00												
ANCHOA MITCHILLI				43	15	86	73	7	10	41	20	72	80
CYNOSCION REGALIS												3	
FUNDULUS HETEROCLITUS			4	6									
GOBIOSOMA BOSCI				68	44	111	105	7		7	7	34	37
MEMBRAS MARTINICA		18		6									
MENIDIA BERYLLINA		18											
	18:00												
ANCHOA MITCHILLI			5	4	8	170	189	22	27	81	38	117	168
GOBIOSOMA BOSCI						44	64		7	66	84	203	262
HYPSOBLENNIUS HENTZI												3	
MEMBRAS MARTINICA				4	8	24	15						9
MENIDIA MENIDIA								4					
SYNGNATHUS FUSCUS										3			
	22:00												
ANCHOA MITCHILLI				65	31	56	29	39	17	18	17	53	40
GOBIOSOMA BOSCI			4	52	21	11	29	6		88	52	67	99
MENIDIA BERYLLINA				4									
MICROPOGON UNDULATUS										3			

Table 4. (continued).

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	2:00												
ANCHOA MITCHILLI								3	6	89	90	102	164
CYNOSCION REGALIS											3		6
GOBIOSOMA BOSCI								14		38	93	119	155
MEMBRAS MARTINICA											3	3	
MENIDIA MENIDIA										5			
	6:00												
ANCHOA MITCHILLI		27			12		86	41	45	75	107	243	221
GOBIOSOMA BOSCI		13		69	81		522	25	139	158	148	615	526
MEMBRAS MARTINICA			6							3			3

Table 4. (continued).

AUGUST 17 - 18, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
ANCHOA MITCHILLI		5		500		133	327	3	6	25	40	74	94
ATHERINIDAE		5											
GOBIOSOMA BOSCI				1500	1000	385	1551	68	113	137	86	101	184
MEMBRAS MARTINICA		15											
MENIDIA BERYLLINA		15											3
	14:00												
ANCHOA MITCHILLI				42	43	17	17	25	19	31	33	183	147
CYNOSCION REGALIS						3				2			
GOBIOSOMA BOSCI				472	355	98	121	113	89	233	213	430	343
	18:00												
ANCHOA MITCHILLI		34	24	27	11	8	12	5	3	46	55	208	167
GOBIOSOMA BOSCI				46	54	113	113	30	44	61	35	126	104
MENIDIA BERYLLINA											3		
	22:00												
ANCHOA MITCHILLI		23	30	159	95	144	109	32	42	62	72	39	63
CYNOSCION REGALIS												2	
GOBIOSOMA BOSCI				17	37	58	59	41	54	51	55	56	27
MEMBRAS MARTINICA		23				14	8						
MENIDIA BERYLLINA		11		11	11		4					2	
MENIDIA MENIDIA				6									
TRINECTES MACULATUS							4						
SPECIMEN MANGLED							4						

Table 4. (continued).

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	2:00												
ANCHOA MITCHILLI		5	23	78	80	195	163	11	40	58	50	83	60
GOBIOSOMA BOSCI		13	34	53	31	78	89	37	30	23	62	63	60
MEMBRAS MARTINICA		4						5			2		5
MENIDIA BERYLLINA		4				8	14					5	
MENIDIA MENIDIA				5	4							2	
TRINECTES MACULATUS								3					
	6:00												
ANCHOA MITCHILLI		8		129	150	60	33	10	22	32	29	21	32
GOBIOSOMA BOSCI		38	39	42	16	80	104	7	30	10	32	21	23
MEMBRAS MARTINICA				3									
SYNGNATHUS FUSCUS											2		

Table 4. (continued).

SEPTEMBER 21 - 22, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
ANCHOA MITCHILLI							4				5	9	6
GOBIOSOMA BOSCI													3
	14:00												
ANCHOA MITCHILLI												8	11
GOBIOSOMA BOSCI							3						
SYNGNATHUS FUSCUS							3						
	18:00												
ANCHOA MITCHILLI							3	5		12	12	10	7
GOBIOSOMA BOSCI								2					5
	22:00												
ANCHOA MITCHILLI				4			6	14	11	8	12	7	20
ANGUILLA ROSTRATA											3		
GOBIOSOMA BOSCI				4			3	3		2		18	16
MEMBRAS MARTINICA													3
MICROGOBIUS THALASSINUS											3		
MICROPOGON UNDULATUS									8	2			3
SYMPHURUS PLAGIUSA													3
SYNGNATHUS FUSCUS											3		
	2:00												
ANCHOA MITCHILLI				13		4	7	20	11	3	8	13	17
GOBIOSOMA BOSCI				3	6	8	4			3		5	5
MEMBRAS MARTINICA											3		2
MICROGOBIUS THALASSINUS				3									
MICROPOGON UNDULATUS								6				3	2
MORONE AMERICANA													2
SYNGNATHUS FUSCUS													2

Table 4. (continued).

SPECIES	STATION TIME	INTAKE						DISCHARGE					
		SURFACE		MIDWATER		BOTTOM		SURFACE		MIDWATER		BOTTOM	
		LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
	6:00												
ANCHOA MITCHILLI						13	13	6	6	3	3	10	12
GOBIOSOMA BOSCI						4					3		
MICROPOGON UNDULATUS						4					3		

Table 4. (continued).

OCTOBER 19 - 20 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
ANCHOA MITCHILLI							4						
	14:00												
ANCHOA MITCHILLI				5		3	8			3		6	6
	18:00												
ANCHOA MITCHILLI				3		3	7	5		5	3	22	5
MICROPOGON UNDULATUS													3
	22:00												
ANCHOA MITCHILLI					5	5		6	7	3	12	25	19
GOBIOSOMA BOSCI									4				
MICROPOGON UNDULATUS						5			4		6	6	13
	2:00												
ANCHOA MITCHILLI				4	10	4	6						
	6:00												
ANCHOA MITCHILLI				4	4	5	5		3	3		2	
MICROPOGON UNDULATUS													2

Table 4. (continued).

NOVEMBER 15 - 16, 1978

SPECIES	STATION TIME	INTAKE						DISCHARGE					
		SURFACE		MIDWATER		BOTTOM		SURFACE		MIDWATER		BOTTOM	
		LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
	10:00												
ANCHOA MITCHILLI											3		
	14:00												
ANCHOA MITCHILLI									3				4
	18:00												
ANCHOA MITCHILLI							3						
MICROPOGON UNDULATUS						3					5	7	12
	22:00												
ANCHOA MITCHILLI			5										
MICROPOGON UNDULATUS												2	

Table 4. (continued).

DECEMBER 11 - 12, 1978

SPECIES	STATION TIME	INTAKE						DISCHARGE					
		SURFACE		MIDWATER		BOTTOM		SURFACE		MIDWATER		BOTTOM	
		LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
	14:00												
ANCHOA MITCHILLI												2	2
	18:00												
ANCHOA MITCHILLI				4	5							4	2
MICROPOGON UNCULATUS										3	3	4	
	22:00												
MICRCPCGON UNDULATUS													2
	2:00												
ALCSA AESTIVALIS												2	
ANCHOA MITCHILLI													2
MICROPOGON UNCULATUS													4

Table 5. Species and calculated number of fish eggs per 100 m^3 captured during 24-hour stations at VEPCO Surry Nuclear Power Plant in 1978.

JANUARY 24 - 25, 1978

SPECIES	STATION TIME	INTAKE						DISCHARGE					
		SURFACE		MIDWATER		BOTTOM		SURFACE		MIDWATER		BOTTOM	
		LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
	18:00												
UNICENTIFIEC													.3

Table 5. (continued).

FEBRUARY 16 - 17, 1978

SPECIES	STATION TIME	INTAKE						DISCHARGE					
		SURFACE		MIDWATER		BOTTOM		SURFACE		MIDWATER		BOTTOM	
		LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
	2:00												
UNICENTIFIEC										19		3	

Table 5. (continued).

MARCH 16 - 17, 1978

SPECIES	STATION TIME	INTAKE						DISCHARGE					
		SURFACE		MIDWATER		BOTTOM		SURFACE		MIDWATER		BOTTOM	
		LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
	14:00												
UNIDENTIFIED									10				

Table 5. (continued).

APRIL 6 - 7, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
CYPRINUS CARPIO										30	33	20	9
DOROSOMA SP.												5	
MORONE AMERICANA						4					14		9
	14:00												
CYPRINUS CARPIO									4				12
MORONE AMERICANA											7	8	
	18:00												
MORONE AMERICANA								4	8				
UNIDENTIFIED								4					
	22:00												
DOROSOMA SP.		6						26	5	5			14
MORONE AMERICANA								5					5
	2:00												
CYPRINUS CARPIO												3	3
MORONE AMERICANA												3	3
	6:00												
CYPRINUS CARPIO								4					
DOROSOMA SP.								27	17	21	17	3	46
MORONE AMERICANA										7	3	7	25
UNIDENTIFIED									4	7		3	6

Table 5. (continued).

APRIL 13 - 14, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
CYPRINUS CARPIO								8	10	56	73	76	56
DOROSOMA SP.								5	8			2	
MORONE AMERICANA								3				4	
	14:00												
ALOSA SP.						4						2	
CYPRINUS CARPIO		24	12		7			3					2
DOROSOMA SP.										14	4		7
MORONE AMERICANA								3	3		4	2	
UNIDENTIFIED									3				2
	18:00												
ALOSA SP.												6	4
CYPRINUS CARPIO			3			6	10		3				2
DOROSOMA SP.									3		2	23	15
MORONE AMERICANA												2	4
UNIDENTIFIED							5						
	22:00												
ALOSA SP.										2		4	
CYPRINUS CARPIO		3								2			
DOROSOMA SP.										5	2	2	2
MORONE AMERICANA												2	
	2:00												
CYPRINUS CARPIO							5			5	9	56	83
DOROSOMA SP.										5		5	21
MORONE AMERICANA								3	3	2	7	7	17

Table 5. (Continued).

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	6:00												
ALOSA SP.								3			2	2	
CYPRINUS CARPIO		7			3		6	8	5	18	9	30	25
DOROSOMA SP.			3								11		
MORONE AMERICANA								5		11	6	4	4

Table 5. (continued).

APRIL 18 - 19, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
ALOSA SP.											3		
CYPRINUS CARPIO		11					3						
DOROSOMA SP.								6	3		3		2
MORONE AMERICANA									8		13	5	9
	14:00												
CYPRINUS CARPIO		3		4								3	
DOROSOMA SP.								6				8	
MORONE AMERICANA											5		
	18:00												
DOROSOMA SP.								3		13	9		3
	22:00												
DOROSOMA SP.								9					3
MORONE AMERICANA										3	3		
	2:00												
ALOSA SP.								5	8				
DOROSOMA SP.		0200 INTAKE SAMPLING ABORTED								7	2	2	
MORONE AMERICANA											7	5	8
	6:00												
DOROSOMA SP.										15	15	18	10
MORONE AMERICANA			5								10	10	5
UNIDENTIFIED											15	16	

Table 5. (continued).

APRIL 24 - 25, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
ALOSA SP.										3			3
DOROSOMA SP.								3	6		3		
MORONE AMERICANA									3		6		
	14:00												
DOROSOMA SP.										3	5	2	
MORONE AMERICANA									3		2	2	2
	18:00												
ALOSA SP.								3					
DOROSOMA SP.										5	5	10	
MORONE AMERICANA									3		3	2	4
	22:00												
DOROSOMA SP.								2	3	3	12	3	7
MORONE AMERICANA								6	7	3			3
UNIDENTIFIED									3				
	2:00												
DOROSOMA SP.								19	13	49	33		3
MORONE AMERICANA					4		4		3	3	3	3	3
	6:00												
DOROSOMA SP.													7
MORONE AMERICANA								6			12	2	10
UNIDENTIFIED													2

Table 5. (continued).

MAY 2 - 3, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
CYPRINUS CARPIO									4	7	7	10	45
DOROSOMA SP.													10
MORONE AMERICANA								4		3	3	31	55
	14:00												
CYPRINUS CARPIO		4							4	7	3	14	22
DOROSOMA SP.					9			4	4			3	
MORONE AMERICANA									7		3	14	22
	18:00												
CYPRINUS CARPIO			8										
DOROSOMA SP.		6										4	4
MORONE AMERICANA										4	16	8	
	22:00												
CYPRINUS CARPIO										3			
DOROSOMA SP.									3	7		7	
MORONE AMERICANA				6				25	3	10	3	13	16
	2:00												
DOROSOMA SP.												3	
MORONE AMERICANA		4		9				29	21	26	15	80	45
	6:00												
ALOSA SP.												4	
CYPRINUS CARPIO								4		4	8	8	29
DOROSOMA SP.					18			8			23		4
MORONE AMERICANA		19	5	20			11	25	20	20	42	16	51

Table 5. (continued).

MAY 11 - 12, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
ALOSA SP.												26	
CYPRINUS CARPIO								8		25	36	23	14
DOROSOMA CEPEDIANUM									3	4			
MORONE AMERICANA									3	7	16	49	14
	14:00												
CYPRINUS CARPIO			28	7		7	5	4				4	
DOROSOMA SP.												4	
MORONE AMERICANA										4		22	4
	18:00												
ALOSA SP.												9	
DOROSOMA SP.								7			3		
MORONE AMERICANA												9	4
	22:00												
ALOSA SP.										4			4
MORONE AMERICANA										8		9	4
	2:00												
CYPRINUS CARPIO							7				3		7
DOROSOMA SP.									6				
MENIDIA BERYLLINA													4
MORONE AMERICANA								10				24	7

Table 5. (continued).

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	6:00												
ALOSA SP.											14	18	33
CYPRINUS CARPIO		5							3	53	28	37	22
DOROSOMA SP.									9				
MORONE AMERICANA					5	4		18	12	38	35	73	45

Table 5. (continued).

MAY 18 - 19, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
ALCSA SP.												4	4
CYPRINUS CARPIO								4		7	10	28	26
MCRCNE AMERICANA			5					8	4	15	7	33	30
	14:00												
CYPRINUS CARPIO			8		5			4	3				
CCRCSOMA SP.								4				3	7
MORCNE AMERICANA										3			
	18:00												
CYPRINUS CARPIO										4			4
MENIDIA BERYLLINA											3		
MENIDIA MENIDIA													4
MORCNE AMERICANA										4			
	22:00												
ALCSA SP.												5	4
CYPRINUS CARPIO												5	
CCRCSOMA SP.									6				
MCRCNE AMERICANA											4	5	
UNICENTIFIEC													4
	2:00												
ALCSA SP.													8
CYPRINUS CARPIO								4	4	14	13	18	8
CCRCSCMA CEPEDIANUM													4
MORCNE AMERICANA						4					6	35	20

Table 5. (continued).

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	6:00												
CYPRINUS CARPIO										4			
MORONE AMERICANA					4				11		4	13	23
UNIDENTIFIED													8

Table 5. (continued).

MAY 25 - 26, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
ALCSA SP.								4					
	14:00												
MORCNE AMERICANA													4
	6:00												
CYPRINUS CARPIO								4		7	3	16	

Table 5. (continued).

JUNE 8 - 9, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	14:00												
ANCHOA MITCHILLI		5											
UNIDENTIFIED													3
	18:00												
ANCHOA MITCHILLI													3
	22:00												
ANCHOA MITCHILLI				5		4	4						
DOROSOMA SP.													3
MENIDIA BERYLLINA				5		4							
	2:00												
ANCHOA MITCHILLI				5	7	5		4					
DOROSOMA SP.											3		
MENIDIA BERYLLINA													3
	6:00												
ANCHOA MITCHILLI							3		12				

Table 5. (continued).

JUNE 22 - 23, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
ANCHOA MITCHILLI		752	617	4000	1628	9579	7107	197	90	436	548	629	371
	14:00												
ANCHOA MITCHILLI						70	46	178	212	428	239	318	317
	18:00												
ANCHOA MITCHILLI		162	132	315	164	134	138	80	32	164	171	172	33
	2:00												
ANCHOA MITCHILLI		170	123	1022	849	7647	4569	202	280	317	188	372	323
	6:00												
ANCHOA MITCHILLI		904	435	1346	730	1430	1197	2231	1556	2425	2059	3336	2781
MEMBRAS MARTINICA												5	

ENTIRE 2200 SAMPLING ABORTED

Table 5. (continued).

JULY 25 - 26, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
ANCHOA MITCHILLI								9	6	6	3	6	
	14:00												
ANCHOA MITCHILLI				80	15	157	251	25	3	4	10	14	6
	18:00												
ANCHOA MITCHILLI		6	15	4	4	5	19			6	40	3	
UNIDENTIFIED									3				
	22:00												
ANCHOA MITCHILLI		4	4	9		46	15	12				6	27
UNIDENTIFIED													3
	2:00												
ANCHOA MITCHILLI									3		6		
CYPRINODON VARIEGATUS											3		
	6:00												
ANCHOA MITCHILLI		13	12	216	101		113	222	317	301	211	230	385

Table 5. (continued).

AUGUST 17 - 18, 1978

SPECIES	STATION TIME	INTAKE SURFACE LEFT	INTAKE SURFACE RIGHT	INTAKE MIDWATER LEFT	INTAKE MIDWATER RIGHT	INTAKE BOTTOM LEFT	INTAKE BOTTOM RIGHT	DISCHARGE SURFACE LEFT	DISCHARGE SURFACE RIGHT	DISCHARGE MIDWATER LEFT	DISCHARGE MIDWATER RIGHT	DISCHARGE BOTTOM LEFT	DISCHARGE BOTTOM RIGHT
	10:00												
ANCHOA MITCHILLI		30	88	2000	5500	70	245	174	226	161	205	69	160
	14:00												
ANCHOA MITCHILLI		15	4	63	49	73	107	29		10	2	9	14
	18:00												
ANCHOA MITCHILLI		3			7	12			5				5
	2:00												
ANCHOA MITCHILLI											12	2	2
CYPRINODON VARIEGATUS													2
GOBIOSOMA BOSCI													10
	6:00												
ANCHOA MITCHILLI									2				
FUNDULUS DIAPHANUS										2			

Table 5. (continued).

SEPTEMBER 21 - 22, 1976

SPECIES	STATION TIME	INTAKE						DISCHARGE					
		SURFACE		MIDWATER		BOTTOM		SURFACE		MIDWATER		BOTTOM	
		LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
	10:00												
FUNDULUS DIAPHANUS								3					
	22:00												
ANCHOA MITCHILLI							3						

Table 6. Average (yearly) number of fish and fish eggs captured per sample (by depth) during 24-hour stations at VEPCO Surry Nuclear Power Station in 1978.

	Intake Surface	Discharge Surface	Intake Midwater	Discharge Midwater	Intake Bottom	Discharge Bottom
Fish	11	11	49	30	57	59
% Change	0%		-39%		4%	
Eggs	16	29	78	39	142	50
% Change	81%		-50%		-65%	

Table 7. Average number per sample of dominant species (fish and fish eggs) captured during 24-hour stations at VEPCO Surry Nuclear Power Plant in 1978.

1978	INTAKE							DISCHARGE						
Date	*Anchoa mitchilli*	*Anchoa mitchilli* (eggs)	*Gobiosoma bosci*	*Micropogon undulatus*	*Brevoortia tyrannus*	*Morone saxatilis*	*Morone americana*	*Anchoa mitchilli*	*Anchoa mitchilli* (eggs)	*Gobiosoma bosci*	*Micropogon undulatus*	*Brevoortia tyrannus*	*Morone saxatilis*	*Morone americana*
Jan. 24-25	0	0	0	0	0	0	<1	0	0	0	0	0	0	<1
Feb. 16-17	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar. 09-10	0	0	0	0	0	0	<1	0	0	0	0	0	0	0
Mar. 16-17	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apr. 06-07	0	0	0	0	1	<1	1	0	0	0	0	3	0	<1
Apr. 13-14	0	0	0	0	4	7	23	0	0	0	0	5	3	14
Apr. 18-19	1	0	0	0	0	<1	<1	2	0	0	0	2	<1	<1
Apr. 24-25	3	0	0	0	2	<1	<1	6	0	0	0	6	<1	<1
May 02-03	<1	0	0	0	<1	1	1	1	0	0	0	<1	<1	<1
May 11-12	0	0	0	0	1	3	<1	0	0	0	0	1	2	<1
May 18-19	<1	0	2	0	3	23	3	0	0	2	0	1	13	2
May 25-26	<1	0	0	0	1	<1	0	0	0	0	0	<1	<1	0
Jun. 08-09	1	1	121	0	1	<1	0	<1	1	111	0	<1	<1	0
Jun. 22-23	24	1,561	147	0	0	0	0	14	690	131	0	0	<1	0
Jul. 25-26	34	38	64	0	0	0	0	60	52	90	<1	0	0	0
Aug. 17-18	75	230	183	0	0	0	0	53	30	89	0	0	0	0
Sep. 21-22	2	<1	1	<1	0	0	0	7	0	2	1	0	0	<1
Oct. 19-20	2	0	0	<1	0	0	0	4	0	<1	1	0	0	0
Nov. 15-16	<1	0	0	<1	0	0	0	<1	0	0	1	0	0	0
Dec. 11-12	<1	0	0	0	0	0	0	<1	0	0	<1	0	0	0

Table 8. Ranges of salinity (^{o}/oo) during 24-hour stations at VEPCO Surry Nuclear Power Plant in 1978.

DATE			INTAKE Surface	INTAKE Midwater	INTAKE Bottom	DISCHARGE Surface	DISCHARGE Midwater	DISCHARGE Bottom
Jan.	24-25	High	0.2	0.2	0.3	0.2	0.2	0.2
		Low	0.1	0.1	0.1	0.1	0.1	0.1
Feb.	16-17	High	2.2	2.5	2.5	2.5	2.4	2.4
		Low	2.0	2.0	2.0	2.1	2.1	2.1
Mar.	09-10	High	3.1	3.2	3.2	3.2	3.2	3.2
		Low	1.8	1.8	2.3	2.1	2.2	2.3
Mar.	16-17	High	0.3	0.3	0.3	0.3	0.3	0.3
		Low	0.2	0.2	0.2	0.2	0.2	0.2
Apr.	06-07	High	0.2	0.2	0.2	1.6	0.5	0.2
		Low	0.1	0.1	0.1	0.1	0.1	0.1
Apr.	13-14	High	0.4	0.4	0.5	0.4	0.4	0.4
		Low	0.2	0.3	0.2	0.3	0.3	0.3
Apr.	18-19	High	2.8	2.8	3.0	3.0	3.1	3.0
		Low	2.5	2.6	2.5	2.6	2.6	2.6
Apr.	24-25	High	3.2	3.3	3.5	3.3	3.3	3.3
		Low	2.6	2.6	2.6	2.6	2.6	2.5
May	02-03	High	Data misplaced			0.5	0.5	0.5
		Low				0.3	0.3	0.3
May	11-12	High	0.2	0.1	0.1	0.1	0.1	0.1
		Low	0.1	0.1	0.1	0.1	0.1	0.1

Table 8. (Continued)

DATE			INTAKE Surface	INTAKE Midwater	INTAKE Bottom	DISCHARGE Surface	DISCHARGE Midwater	DISCHARGE Bottom
May	18-19	High	0.6	0.3	0.4	0.3	0.3	0.3
		Low	0.1	0.1	0.1	0.1	0.1	0.1
May	25-26	High	0.3	0.3	0.3	0.4	0.4	0.4
		Low	0.2	0.2	0.2	0.2	0.2	0.2
June	08-09	High	1.5	1.5	1.4	1.9	1.5	1.5
		Low	1.2	1.3	1.3	1.3	1.2	1.2
June	22-23	High	4.1	4.1	4.2	4.0	4.0	4.0
		Low	3.3	3.5	3.7	3.4	3.4	3.4
July	25-26	High	6.0	6.0	6.2	6.0	6.0	6.0
		Low	5.2	5.2	5.3	4.0	5.3	5.3
Aug.	17-18	High	4.6	4.6	4.6	4.7	4.7	4.7
		Low	3.8	3.8	3.9	3.8	3.9	3.9
Sept.	21-22	High	9.2	9.2	9.2	9.2	9.2	9.2
		Low	8.4	8.5	8.5	8.5	8.5	8.4
Oct.	19-20	High	9.8	9.6	9.9	9.7	9.7	9.7
		Low	9.4	9.4	9.4	9.4	9.4	9.4
Nov.	15-16	High	10.5	10.6	10.6	10.6	10.6	10.6
		Low	9.6	9.6	9.6	9.7	9.7	9.7
Dec.	11-12	High	7.3	7.2	7.2	7.1	7.0	7.0
		Low	5.7	5.7	5.8	5.7	5.7	5.7

Table 9. Ranges of water temperature (C) during 24-hour stations at VEPCO Surry Nuclear Power Plant in 1978.

DATE			INTAKE Surface	INTAKE Midwater	INTAKE Bottom	DISCHARGE Surface	DISCHARGE Midwater	DISCHARGE Bottom
Jan.	24-25	High	4	4	4	12	12	12
		Low	3	3	3	11	11	11
Feb.	16-17	High	2	2	2	10	10	10
		Low	1	1	1	9	9	9
Mar.	09-10	High	3	3	3	12	11	11
		Low	2	2	2	11	10	11
Mar.	16-17	High	9	9	9	18	18	18
		Low	7	7	7	15	16	16
Apr.	06-07	High	15	15	14	20	20	20
		Low	13	13	13	19	19	18
Apr.	13-14	High	18	17	17	24	24	24
		Low	15	15	15	22	22	21
Apr.	18-19	High	14	14	14	21	21	21
		Low	14	14	14	21	20	20
Apr.	24-25	High	16	16	16	22	22	21
		Low	15	15	15	19	19	19
May	02-03	High	16	16	16	22	22	20
		Low	14	14	14	20	19	20
May	11-12	High	20	20	19	25	24	24
		Low	17	17	17	23	22	22

Table 9. (Continued)

DATE			INTAKE Surface	Midwater	Bottom	DISCHARGE Surface	Midwater	Bottom
May	18-19	High	23	22	21	28	28	27
		Low	20	20	19	25	25	24
May	25-26	High	24	24	23	24	24	24
		Low	22	22	22	22	22	22
June	08-09	High	26	26	26	31	30	30
		Low	24	24	24	29	28	28
June	22-23	High	28	28	27	35	32	32
		Low	24	24	24	31	30	30
July	25-26	High	30	30	30	35	34	34
		Low	27	27	27	32	32	32
Aug.	17-18	High	32	31	31	39	38	38
		Low	29	29	29	37	35	37
Sept.	21-22	High	28	27	27	35	34	34
		Low	24	24	24	33	32	32
Oct.	19-20	High	17	17	17	27	26	26
		Low	15	15	15	26	25	24
Nov.	15-16	High	16	16	16	25	24	23
		Low	16	16	16	23	23	25
Dec.	11-12	High	10	10	10	18	17	18
		Low	8	9	9	14	13	13

Table 10. Ranges of dissolved oxygen (mg/l) during 24-hour stations at VEPCO Surry Power Plant in 1978.

DATE			INTAKE Surface	INTAKE Midwater	INTAKE Bottom	DISCHARGE Surface	DISCHARGE Midwater	DISCHARGE Bottom
Jan.	24-25	High	11.6	11.6	11.6	11.2	11.6	11.3
		Low	10.3	11.2	11.2	10.2	9.2	9.8
Feb.	16-17	High	12.1	12.1	12.2	14.9	12.1	12.0
		Low	11.8	11.6	11.8	11.5	11.4	11.4
Mar.	09-10	High	12.4	12.4	12.4	12.3	12.3	12.4
		Low	12.0	12.0	11.9	11.3	11.4	11.4
Mar.	16-17	High	10.6	10.7	10.7	10.6	10.4	10.5
		Low	10.4	10.3	10.4	10.3	10.0	10.2
Apr.	06-07	High	9.8	9.8	9.6	9.2	9.3	9.3
		Low	8.9	9.0	8.8	8.9	8.7	8.4
Apr.	13-14	High	8.9	8.7	8.9	8.7	9.5	8.6
		Low	8.2	8.3	8.3	8.1	8.3	8.3
Apr.	18-19	High	9.1	8.9	9.2	9.0	9.0	9.0
		Low	8.5	8.6	8.7	8.3	8.5	8.5
Apr.	24-25	High	9.6	10.0	9.8	9.0	9.2	9.2
		Low	8.0	8.2	8.3	8.3	8.5	8.3
May	02-03	High	9.2	9.1	10.6	8.4	8.7	8.3
		Low	8.0	7.8	7.9	7.7	8.0	8.0
May	11-12	High	8.0	8.4	7.9	8.0	8.0	8.2
		Low	7.0	7.8	7.1	7.5	7.6	7.5

Table 10. (Continued)

DATE			INTAKE Surface	Midwater	Bottom	DISCHARGE Surface	Midwater	Bottom
May	18-19	High	7.6	8.2	8.3	7.5	9.2	7.7
		Low	7.2	7.0	7.4	6.3	6.9	6.6
May	25-26	High	7.4	7.3	7.3	7.3	7.1	7.2
		Low	6.9	6.0	6.4	6.6	6.7	7.0
June	08-09	High	7.8	6.7	6.7	6.6	7.1	6.5
		Low	5.7	5.8	5.5	5.3	5.7	6.0
June	22-23	High	7.1	7.3	8.1	6.6	6.7	6.6
		Low	4.5	4.4	5.1	4.3	5.5	5.9
July	25-26	High	8.1	8.0	8.3	6.9	6.9	7.0
		Low	5.2	6.1	6.4	6.2	6.1	6.0
Aug.	17-18	High	6.3	6.3	6.6	6.1	6.2	6.2
		Low	4.8	4.7	5.5	4.7	4.6	5.3
Sept.	21-22	High	7.8	7.9	8.1	6.7	6.5	6.5
		Low	6.4	6.6	6.3	5.6	5.9	5.2
Oct.	19-20	High	8.1	8.2	8.1	7.8	7.9	7.8
		Low	6.5	6.5	5.5	6.9	7.1	5.4
Nov.	15-16	High	7.9	8.0	8.4	11.5	7.6	7.9
		Low	7.5	7.1	7.4	6.5	6.9	7.1
Dec.	11-12	High	9.8	9.5	9.7	9.9	9.7	9.7
		Low	7.1	7.4	6.7	7.8	8.0	8.7

Table 11. Descriptive statistics of dependent (Y_i) and independent (X_j) variables.

Variable	January-December 1978 (N = 656) Mean	Standard Deviation	Minimum	Maximum	May-October 1978 (N = 316) Mean	Standard Deviation	Minimum	Maximum
Y_1, Total abundance of fish	2.3	2.10	0.0	8.01	-	-	-	-
Y_2, Abundance of fish species	0.8	0.64	0.0	2.30	-	-	-	-
Y_3, Fish species diversity	0.3	0.44	0.0	1.8	-	-	-	-
Y_4, Total abundance of eggs	1.2	1.94	0.0	9.7	-	-	-	-
Y_5, Abundance of egg species	0.3	0.45	0.0	1.6	-	-	-	-
Y_6, Egg species diversity	0.1	0.24	0.0	1.2	-	-	-	-
Y_7, Abundance of *A. mitchilli* fish	-	-	-	-	1.6	1.86	0.0	6.2
Y_8, Abundance of *G. bosci* fish	-	-	-	-	2.1	2.40	0.0	7.8
Y_9, Abundance of *A. mitchilli* eggs	-	-	-	-	1.2	2.31	0.0	9.7
X_1, Depth	3.1	2.09	1.0	7.0	3.1	2.06	1.0	7.0
X_2, Temperature	19.7	8.70	1.0	39.0	26.2	5.57	15.0	39.0
X_3, Salinity	3.0	3.34	0.0	11.0	3.5	3.52	0.0	10.0
X_4, Dissolved oxygen	8.4	1.92	4.3	14.9	6.9	0.87	4.3	9.2
X_5, Location	0.5	0.50	0	1	0.5	0.50	0	1
X_6, Period	0.5	0.50	0	1	0.5	0.50	0	1

Table 11. (continued).

Variable	January-December 1978 (N = 656) Mean	Standard Deviation	Minimum	Maximum	May-October 1978 (N = 316) Mean	Standard Deviation	Minimum	Maximum
X_7, Tide	0.0	0.70	-1	1	0.1	0.70	-1	1
X_8, Fall	0.1	0.35	0	1	0.1	0.30	0	1
X_9, Winter	0.2	0.41	0	1	-	-	-	-
X_{10}, Spring	0.5	0.50	0	1	0.6	0.50	0	1

Table 12. Summary statistics for final stepwise regression equations.

Y_i	Final Equation R^2	F_s	DF	Sig.	b_1 Depth	b_2 Temp.	b_3 Salinity	b_4 Dissolved Oxygen	b_5 Location	b_6 Period	b_7 Tide	b_8 Fall	b_9 Winter	b_{10} Spring	b_0 Constant
Y_1, Total abundance of fish	0.64	191	6,649	0.001	0.201***	0.176***	-0.225***	-0.159*	-0.542***	0.338***	ns	ns	ns	ns	0.345
Y_2, Abundance of fish species	0.55	135	6,649	0.001	0.046***	0.040***	-0.062***	ns	ns	0.173***	ns	ns	-0.29[illegible]**	0.142	-0.074
Y_3, Fish species diversity	0.35	51	7,648	0.001	0.024***	0.008**	-0.028***	ns	0.095**	0.127***	ns	-0.236***	-0.410***	ns	0.192
Y_4, Total abundance of eggs	0.30	40	7,648	0.001	ns	0.095***	0.110**	ns	ns	-0.462***	0.260**	-0.604	1.130**	1.731***	-1.792
Y_5, Abundance of egg species	0.36	91	4,651	0.001	ns	0.009***	ns	ns	0.230***	ns	ns	-0.144***	ns	0.346***	-2.126
Y_6, Egg species diversity	0.23	49	4,651	0.001	ns	ns	ns	0.034***	0.152***	ns	ns	ns	-0.149***	0.133***	-0.314
Y_7, Abundance of *A. mitchilli* fish	0.59	74	6,309	0.001	0.274***	0.126***	ns	-0.450***	ns	0.387**	0.193*	ns	NA	-1.303***	1.051
Y_8, Abundance of *G. bosci* fish	0.56	65	6,309	0.001	0.326***	0.401***	ns	-0.459**	-1.455***	ns	ns	1.724***	NA	2.194***	-6.970
Y_9, Abundance of *A. mitchilli* eggs	0.37	26	7,308	0.001	0.106	0.292***	0.402***	ns	-1.420***	-0.669**	0.358*	ns	NA	3.748***	-9.236

R^2, Coefficient of multiple determination
F_s, F-statistic for test of significance
DF, Degrees of freedom
Sig., Significance of regression
b_i, Partial regression coefficient
*, Significant, $P<0.05$
**, Highly significant, $P<0.01$
***, Very highly significant, $P<0.001$
ns, Not significant, $P>0.10$
NA, Not applicable

Table 13. Standardized partial regression coefficients with ranks of relative importance in parentheses.

Y_i	Depth	Temperature	Salinity	Dissolved Oxygen	Location	Period	Tide
Y_1	0.200 (3)	0.727 (1)	-0.358 (2)	-0.145 (4)	-0.129 (5)	0.080 (6)	ns (7)
Y_2	0.150 (3)	0.542 (1)	-0.326 (2)	ns (6)	ns (6)	0.136 (4)	ns (6)
Y_3	0.116 (4)	0.168 (2)	-0.212 (1)	ns (6.5)	0.109 (5)	0.146 (3)	ns (6.5)
Y_4	ns (6)	0.427 (1)	0.189 (2)	ns (6)	ns (6)	-0.119 (3)	0.094 (4)
Y_5	ns (5)	0.167 (2)	ns (5)	ns (5)	0.257 (1)	ns (5)	ns (5)
Y_6	ns (5)	ns (5)	ns (5)	0.276 (2)	0.318 (1)	ns (5)	ns (5)
Y_7	0.304 (2)	0.376 (1)	ns (6.5)	-0.210 (3)	ns (6.5)	0.104 (4)	0.073 (5)
Y_8	0.279 (3)	0.929 (1)	ns (6)	-0.166 (4)	-0.302 (2)	ns (6)	ns (6)
Y_9	0.094 (6)	0.703 (1)	0.611 (2)	ns (7)	-0.307 (3)	-0.145 (4)	0.109 (5)
Sum of Ranks	37	15	31.5	43.5	35.5	40	49.5
Overall Rank of Relative Importance	4	1	2	6	3	5	7

3.6 FISH MORTALITIES

Fish impingement estimates for the low-level screens for the time period of January 1, 1978 to December 30, 1978 are reported. Due to ice damage to the screens, samples were not taken during the period from February 5 through March 4. These estimates are based on two five-minute replicates taken daily Monday through Friday and extrapolated to reflect weekly values.

The low-level screens, which were specifically designed to reduce fish impingement mortality, stopped an estimated 4,043,054 fish from entering the high level canal during this time period. Of this total, an estimated 3,796,682 individuals were returned to the river alive. The average eleven-month survival was 94% with a range of 83% to 99%.

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of January 1 Through January 7, 1978

Ave. No. Circ. Pumps: 8
Temperature Min-Max: 3.1 - 4.4
Salinity Min-Max: 1.6 - 2.9
Survival Percentage: 99.5 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus			
039	White catfish	Ictalurus catus	200-299	288	0
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	300-399	576	0
051	Gizzard shad	Dorosoma cepedianum	140-199	23,112	0
275	Threadfin shad	Dorosoma petenense	60-79	4,968	0
026	Alewife	Alosa pseudoharengus	100-119,120-139	864	0
027	Blueback herring	Alosa aestivalis	60-79	30,528	144
037	Atlantic menhaden	Brevoortia tyrannus	80-99	6,048	0
103	Bay anchovy	Anchoa mitchilli			
149	Tidewater silverside	Menidia beryllina	60-79	504	0
150	Atlantic silverside	Menidia menidia	80-99	2,232	0
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	80-99	91,800	648
033	Spot	Leiostomus xanthurus	80-99	648	0
005	Atlantic croaker	Micropogon undulatus	40-59	1,224	72
151	Hogchoker	Trinectes maculatus	80-99	360	0
107	Silvery minnow	Hybognathus nuchalis	120-139	144	0
231	Striped mullet	Mugil cephalus	140-199	144	0
			TOTAL	163,440	864

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Ave. No. Circ. Pumps: 8
Temperature Min-Max: 0.7 - 6.0
Salinity Min-Max: 0.0 - 4.9
Survival Percentage: 99 %

[We]ek Of January 8 Through January 14, 1978

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	576	0
039	White catfish	Ictalurus catus	140-199,200-299	3,240	0
116	Brown bullhead	Ictalurus nebulosus	200-299	216	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	300-399	360	0
051	Gizzard shad	Dorosoma cepedianum	140-199	28,368	288
275	Threadfin shad	Dorosoma petenense	60-79,80-99	3,096	144
026	Alewife	Alosa pseudoharengus	120-139	936	0
027	Blueback herring	Alosa aestivalis	60-79	22,536	72
037	Atlantic menhaden	Brevoortia tyrannus	80-99	22,320	216
103	Bay anchovy	Anchoa mitchilli	60-79	1,080	144
149	Tidewater silverside	Menidia beryllina	60-79	360	144
150	Atlantic silverside	Menidia menidia	80-99	3,888	288
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	80-99	135,720	1,224
033	Spot	Leiostomus xanthurus	80-99	144	0
005	Atlantic croaker	Micropogon undulatus	40-59	2,520	72
151	Hogchoker	Trinectes maculatus	60-79,100-119	216	0
052	Carp	Cyprinus carpio	400-499	432	0
122	Mummichog	Fundulus heteroclitus	80-99	72	0
031	Striped bass	Morone saxatilis	200-299	216	0
231	Striped mullet	Mugil cephalus	140-199	360	0
030	American shad	Alosa sapidissima	80-99,120-139	288	0
			TOTAL	226,944	2,592

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of January 15 Through January 21, 1978

Ave. No. Circ. Pumps: 8
Temperature Min-Max: 3.1 - 5.4
Salinity Min-Max: 0.3 - 0.0
Survival Percentage: 98 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	72	0
039	White catfish	Ictalurus catus	200-299	2,304	0
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	400-499,500+	216	0
051	Gizzard shad	Dorosoma cepedianum	140-199	35,928	288
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	100-119	576	0
027	Blueback herring	Alosa aestivalis	60-79	69,408	2,088
037	Atlantic menhaden	Brevoortia tyrannus			
103	Bay anchovy	Anchoa mitchilli			
149	Tidewater silverside	Menidia beryllina	60-79	1,152	72
150	Atlantic silverside	Menidia menidia	100-119	72	0
135	Pumpkinseed	Lepomis gibbosus	80-99	72	0
032	White perch	Morone americana	80-99	43,272	936
033	Spot	Leiostomus xanthurus			
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus			
122	Mummichog	Fundulus heteroclitus	80-99	144	0
031	Striped bass	Morone saxatilis	140-199	144	0
231	Striped mullet	Mugil cephalus	140-199	576	0
			TOTAL	153,936	3,384

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of January 22 Through January 28, 1978

Ave. No. Circ. Pumps: 7
Temperature Min-Max: 2.7 - 6.0
Salinity Min-Max: 0.0 - 0.4
Survival Percentage: 99 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299,300-399	288	0
039	White catfish	Ictalurus catus	140-199	47,304	0
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	200-299	576	0
051	Gizzard shad	Dorosoma cepedianum	140-199	161,352	648
275	Threadfin shad	Dorosoma petenense	80-99	144	0
026	Alewife	Alosa pseudoharengus	80-99,100-119	576	0
027	Blueback herring	Alosa aestivalis	60-79	103,824	1,872
037	Atlantic menhaden	Brevoortia tyrannus	140-199	72	0
103	Bay anchovy	Anchoa mitchilli			
149	Tidewater silverside	Menidia beryllina	60-79	792	72
150	Atlantic silverside	Menidia menidia			
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	80-99	163,296	2,520
033	Spot	Leiostomus xanthurus			
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus	40-59	72	0
030	American shad	Alosa sapidissima	100-119	72	0
122	Mummichog	Fundulus heteroclitus	60-79	216	0
231	Striped mullet	Mugil cephalus	140-199	288	0
031	Striped bass	Morone saxatilis	140-199	1,368	0
052	Carp	Cyprinus carpio	500 +	288	0
			TOTAL	480,528	5,112

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of January 29 Through February 4,1978

Ave. No. Circ. Pumps: 7
Temperature Min-Max: 0.4 - 2.6
Salinity Min-Max: 0.0 - 0.3
Survival Percentage: 99 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	300-399	360	0
039	White catfish	Ictalurus catus	140-199	61,632	72
116	Brown bullhead	Ictalurus nebulosus	200-299	144	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	300-399	288	0
051	Gizzard shad	Dorosoma cepedianum	140-199	18,144	432
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus			
027	Blueback herring	Alosa aestivalis	60-79	1,440	72
037	Atlantic menhaden	Brevoortia tyrannus			
103	Bay anchovy	Anchoa mitchilli			
149	Tidewater silverside	Menidia beryllina	60-79	936	0
150	Atlantic silverside	Menidia menidia	80-99	144	0
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	80-99	39,456	1,296
033	Spot	Leiostomus xanthurus			
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus			
100	Sea lamprey	Petromyzon marinus	500 +	72	0
052	Carp	Cyprinus carpio	300-399	288	0
122	Mummichog	Fundulus heteroclitus	80-99	504	0
231	Striped mullet	Mugil cephalus	140-199	288	0
031	Striped bass	Morone saxatilis	140-199,200-299	216	0
			TOTAL	123,912	1,872

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of March 5 Through March 11, 1978

Ave. No. Circ. Pumps: 7 *
Temperature Min-Max: 2.2 - 3.3
Salinity Min-Max: 1.4 - 3.3
Survival Percentage: 100 %
* 7 pumps with 1 screen operating

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus			
039	White catfish	Ictalurus catus			
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata			
051	Gizzard shad	Dorosoma cepedianum	100-119, 140-199	720	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	100-119	432	0
027	Blueback herring	Alosa aestivalis	60-79	19,296	0
037	Atlantic menhaden	Brevoortia tyrannus			
103	Bay anchovy	Anchoa mitchilli			
149	Tidewater silverside	Menidia beryllina	80-99	144	0
150	Atlantic silverside	Menidia menidia	80-99	5,760	0
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	80-99	2,592	0
033	Spot	Leiostomus xanthurus			
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus			
101	Longnose gar	Lepisosteus osseus	300-399	288	0
030	American shad	Alosa sapidissima	100-119	144	0
			TOTAL	29,376	0

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Ave. No. Circ. Pumps: 7 *
Temperature Min-Max: 6.3 - 9.5
Salinity Min-Max: 0.7 - 0.2
Survival Percentage: 99 %
* 7 pumps with 1 screen operating

Week Of March 12 Through March 18, 1978

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus			
039	White catfish	Ictalurus catus			
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata			
051	Gizzard shad	Dorosoma cepedianum	140-199	1,728	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	100-119	432	0
027	Blueback herring	Alosa aestivalis	60-79	9,072	144
037	Atlantic menhaden	Brevoortia tyrannus			
103	Bay anchovy	Anchoa mitchilli			
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	120-139	3,312	0
033	Spot	Leiostomus xanthurus			
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus			
122	Mummichog	Fundulus heteroclitus	60-79	288	0
			TOTAL	14,832	144

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of March 19 Through March 25, 1978

Ave. No. Circ. Pumps: 7 *
Temperature Min-Max: 8.0 - 11.2
Salinity Min-Max: 0.0 - 0.2
Survival Percentage: 99.6 %

* 7 pumps with 1 screen operating

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus			
039	White catfish	Ictalurus catus			
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata			
051	Gizzard shad	Dorosoma cepedianum	120-139, 300-399	576	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	100-119, 120-139	288	0
027	Blueback herring	Alosa aestivalis	60-79	33,840	0
037	Atlantic menhaden	Brevoortia tyrannus			
103	Bay anchovy	Anchoa mitchilli			
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	80-99	288	0
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	80-99	3,312	144
033	Spot	Leiostomus xanthurus			
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus			
107	Silvery minnow	Hybognathus nuchalis	100-119	288	0
122	Mummichog	Fundulus heteroclitus	60-79	3,456	0
			TOTAL	42,048	144

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of March 26 Through April 1, 1978

Ave. No. Circ. Pumps: 5 *
Temperature Min-Max: 10.2 - 13.5
Salinity Min-Max: 0.0 - 0.4
Survival Percentage: 98 %
* 5 pumps with 1 screen operating

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus			
039	White catfish	Ictalurus catus			
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas	60-79	432	0
110	Spottail shiner	Notropis hudsonius	80-99	144	0
060	American eel	Anguilla rostrata			
051	Gizzard shad	Dorosoma cepedianum	140-199	576	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	80-99, 100-119	432	0
027	Blueback herring	Alosa aestivalis	80-99	9,504	0
037	Atlantic menhaden	Brevoortia tyrannus	140-199	576	0
103	Bay anchovy	Anchoa mitchilli			
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	100-119	288	0
135	Pumpkinseed	Lepomis gibbosus	120-139, 140-199	576	288
032	White perch	Morone americana	60-79, 80-99	864	0
033	Spot	Leiostomus xanthurus			
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus			
122	Mummichog	Fundulus heteroclitus	60-79	2,736	0
137	Largemouth bass	Micropterus salmoides	300-399	288	0
142	Yellow perch	Perca flavescens	100-119	144	0
031	Striped bass	Morone saxatilis	80-99	144	0
			TOTAL	16,704	288

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of April 2 Through April 8, 1978

Ave. No. Circ. Pumps: 5 *
Temperature Min-Max: 12.8 - 14.7
Salinity Min-Max: 0.0 - 0.0
Survival Percentage: 100 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus			
039	White catfish	Ictalurus catus			
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius	80-99, 100-119	864	0
060	American eel	Anguilla rostrata			
051	Gizzard shad	Dorosoma cepedianum			
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus			
027	Blueback herring	Alosa aestivalis	80-99	5,040	0
037	Atlantic menhaden	Brevoortia tyrannus	60-79, 120-139	288	0
103	Bay anchovy	Anchoa mitchilli			
149	Tidewater silverside	Menidia beryllina	60-79	288	0
150	Atlantic silverside	Menidia menidia			
135	Pumpkinseed	Lepomis gibbosus	100-119, 140-199	288	0
032	White perch	Morone americana	80-99	2,880	0
033	Spot	Leiostomus xanthurus			
005	Atlantic croaker	Micropogon undulatus	40-59	288	0
151	Hogchoker	Trinectes maculatus	60-79, 80-99	2,448	0
122	Mummichog	Fundulus heteroclitus	40-59	3,456	0
138	Black crappie	Pomoxis nigromaculatus	200-299	144	0
			TOTAL	15,984	0

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Ave. No. Circ. Pumps: 8 *
Temperature Min-Max: 15.1 - 16.9
Salinity Min-Max: 0.0 - 0.2
Survival Percentage: 99 %

ek Of April 9 Through April 15, 1978

* 8 pumps with 4 screens operating

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus			
039	White catfish	Ictalurus catus	140-199	576	0
116	Brown bullhead	Ictalurus nebulosus	140-199	288	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius	80-99	144	0
060	American eel	Anguilla rostrata	200-299	144	0
051	Gizzard shad	Dorosoma cepedianum	140-199, 400-499	576	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	200-299	720	0
027	Blueback herring	Alosa aestivalis	60-79	4,032	0
037	Atlantic menhaden	Brevoortia tyrannus	140-199	4,464	0
103	Bay anchovy	Anchoa mitchilli	60-79	432	432
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
135	Pumpkinseed	Lepomis gibbosus	100-119, 140-199	1,008	0
032	White perch	Morone americana	80-99	7,920	0
033	Spot	Leiostomus xanthurus	100-119	8,784	0
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus	60-79	2,304	0
122	Mummichog	Fundulus heteroclitus	60-79	2,592	0
136	Bluegill	Lepomis macrochirus	200-299	288	0
			TOTAL	34,272	432

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of April 16 Through April 22, 1978

Ave. No. Circ. Pumps: 8 *
Temperature Min-Max: 13.9 - 14.9
Salinity Min-Max: 1.6 - 3.3
Survival Percentage: 96 %
* 8 pumps with 6 screens operating

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus			
039	White catfish	Ictalurus catus			
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas	60-79	144	0
110	Spottail shiner	Notropis hudsonius	80-99	720	0
060	American eel	Anguilla rostrata	200-299,300-399	432	0
051	Gizzard shad	Dorosoma cepedianum	140-199	144	144
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	200-299	1,584	0
027	Blueback herring	Alosa aestivalis	200-299	4,608	288
037	Atlantic menhaden	Brevoortia tyrannus	100-119	9,936	0
103	Bay anchovy	Anchoa mitchilli	60-79	38,016	2,880
149	Tidewater silverside	Menidia beryllina	40-59	432	288
150	Atlantic silverside	Menidia menidia			
135	Pumpkinseed	Lepomis gibbosus	120-139	432	0
032	White perch	Morone americana	80-99	14,544	0
033	Spot	Leiostomus xanthurus	100-119	9,936	0
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus	60-79	4,464	0
122	Mummichog	Fundulus heteroclitus	40-59	288	0
148	Rough silverside	Membras martinica	100-119	288	0
031	Striped bass	Morone saxatilis	120-139	288	0
			TOTAL	86,256	3,600

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of April 23, 1978 Through April 29, 1978

Ave. No. Circ. Pumps: 5
Temperature Min-Max: 10.6 - 15.6
Salinity Min-Max: 2.7 - 7.0
Survival Percentage: 81 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus			
039	White catfish	Ictalurus catus			
116	Brown bullhead	Ictalurus nebulosus	140-199	144	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	200-299	720	0
051	Gizzard shad	Dorosoma cepedianum	200-299	432	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	100-119	720	0
027	Blueback herring	Alosa aestivalis	200-299	5,904	288
037	Atlantic menhaden	Brevoortia tyrannus	80-99	9,216	864
103	Bay anchovy	Anchoa mitchilli	60-79	26,640	15,552
149	Tidewater silverside	Menidia beryllina	60-79	288	0
150	Atlantic silverside	Menidia menidia	80-99	432	0
135	Pumpkinseed	Lepomis gibbosus	140-199	576	0
032	White perch	Morone americana	80-99	19,584	0
033	Spot	Leiostomus xanthurus	100-119	6,624	0
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus	60-79	864	0
052	Carp	Cyprinus carpio	200-299,300-399	288	0
122	Mummichog	Fundulus heteroclitus	40-59,60-79	576	0
031	Striped bass	Morone saxatilis	100-119	288	0
007	Weakfish	Cynoscion regalis	140-199	144	0
			TOTAL	73,440	16,704

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

ek Of April 30 Through May 6, 1978

Ave. No. Circ. Pumps: 5
Temperature Min-Max: 13.4 - 15.6
Salinity Min-Max: 0.0 - 0.8
Survival Percentage: 99 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	120-139,200-299	576	0
039	White catfish	Ictalurus catus	200-299	144	0
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	200-299	1,584	0
051	Gizzard shad	Dorosoma cepedianum	140-199	432	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus			
027	Blueback herring	Alosa aestivalis	80-99,140-199	432	0
037	Atlantic menhaden	Brevoortia tyrannus	80-99,120-139	3,024	0
103	Bay anchovy	Anchoa mitchilli	40-59	2,448	144
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
35	Pumpkinseed	Lepomis gibbosus	140-199	576	0
032	White perch	Morone americana	80-99	7,776	144
033	Spot	Leiostomus xanthurus	100-119	9,072	144
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus	60-79	2,304	0
030	American shad	Alosa sapidissima	120-139	288	0
122	Mummichog	Fundulus heteroclitus	60-79	288	0
188	Redbreast sunfish	Lepomis auritus	120-139,140-199	432	0
031	Striped bass	Morone saxatilis	200-299	288	0
			TOTAL	29,664	432

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of May 7 Through May 13, 1978

Ave. No. Circ. Pumps: 5
Temperature Min-Max: 14.0 - 18.3
Salinity Min-Max: 0.0 - 0.1
Survival Percentage: 97 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	288	0
039	White catfish	Ictalurus catus			
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	400-499	720	0
051	Gizzard shad	Dorosoma cepedianum			
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus			
027	Blueback herring	Alosa aestivalis	200-299	144	0
037	Atlantic menhaden	Brevoortia tyrannus	80-99	864	288
103	Bay anchovy	Anchoa mitchilli			
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
35	Pumpkinseed	Lepomis gibbosus	120-139	720	0
032	White perch	Morone americana	80-99	4,176	144
033	Spot	Leiostomus xanthurus	100-119	6,624	0
005	Atlantic croaker	Micropogon undulatus	120-139	144	0
151	Hogchoker	Trinectes maculatus	60-79	1,440	0
122	Mummichog	Fundulus heteroclitus	60-79	144	0
148	Rough silverside	Membras martinica	100-119	288	0
136	Bluegill	Lepomis macrochirus	80-99	432	0
031	Striped bass	Morone saxatilis	100-119,120-139	432	0
			TOTAL	16,416	432

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

k Of May 14 Through May 20, 1978

Ave. No. Circ. Pumps: 5
Temperature Min-Max: 17.6 - 21.3
Salinity Min-Max: 0.0 - 0.1
Survival Percentage: 99 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	432	0
039	White catfish	Ictalurus catus	200-299	288	0
116	Brown bullhead	Ictalurus nebulosus	80-99	288	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius	80-99	144	0
060	American eel	Anguilla rostrata	200-299	1,008	0
051	Gizzard shad	Dorosoma cepedianum			
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	200-299	144	0
027	Blueback herring	Alosa aestivalis			
037	Atlantic menhaden	Brevoortia tyrannus =	120-139	2,592	0
103	Bay anchovy	Anchoa mitchilli			
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
35	Pumpkinseed	Lepomis gibbosus	120-139,140-199	1,584	0
032	White perch	Morone americana	80-99	2,304	0
033	Spot	Leiostomus xanthurus	120-139	3,168	288
005	Atlantic croaker	Micropogon undulatus	80-99	144	0
151	Hogchoker	Trinectes maculatus	40-59	34,272	288
122	Mummichog	Fundulus heteroclitus	80-99	288	0
136	Bluegill	Lepomis macrochirus	120-139	1,008	0
137	Largemouth bass	Micropterus salmoides	300-399	288	0
			TOTAL	47,952	576

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Ave. No. Circ. Pumps: 5
Temperature Min-Max: 20.7 - 22.9
Salinity Min-Max: 0.1 - 0.4
Survival Percentage: 96 %

Week Of May 21 Through May 27, 1978

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	720	0
039	White catfish	Ictalurus catus	140-199,200-299	288	0
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	200-299	1,872	0
051	Gizzard shad	Dorosoma cepedianum	300-399	144	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus			
027	Blueback herring	Alosa aestivalis	200-299	288	0
037	Atlantic menhaden	Brevoortia tyrannus	40-59	3,168	432
103	Bay anchovy	Anchoa mitchilli	60-79	144	0
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	80-99	3,456	0
033	Spot	Leiostomus xanthurus	120-139	7,632	576
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus	40-59	3,888	0
122	Mummichog	Fundulus heteroclitus	40-59,60-79	432	0
138	Redbreast sunfish	Lepomis auritus	140-199	432	0
136	Bluegill	Lepomis macrochirus	40-59,100-119	432	0
031	Striped bass	Morone saxatilis	200-299	144	0
			TOTAL	23,040	1,008

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Ave. No. Circ. Pumps: 4
Temperature Min-Max: 22.7 - 23.6
Salinity Min-Max: 0.6 - 1.0
Survival Percentage: 91 %

Week Of May 28 Through June 3, 1978

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	1,440	0
039	White catfish	Ictalurus catus			
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	200-299	1,296	0
051	Gizzard shad	Dorosoma cepedianum	200-299	432	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus			
027	Blueback herring	Alosa aestivalis			
037	Atlantic menhaden	Brevoortia tyrannus	100-119	4,896	864
103	Bay anchovy	Anchoa mitchilli	60-79	432	0
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
135	Pumpkinseed	Lepomis gibbosus	140-199	288	0
032	White perch	Morone americana	100-119	2,880	0
033	Spot	Leiostomus xanthurus	40-59	18,000	2,448
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus	40-59	7,776	144
148	Rough silverside	Membras martinica	60-79	0	144
031	Striped bass	Morone saxatilis	140-199	432	0
003	Summer flounder	Paralichthys dentatus	20-39	288	0
			TOTAL	38,160	3,600

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Ave. No. Circ. Pumps: 5
Temperature Min-Max: 21.9 - 25.5
Salinity Min-Max: 0.9 - 1.3
Survival Percentage: 96 %

ek Of June 4 Through June 10, 1978

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	1,296	0
039	White catfish	Ictalurus catus	140-199	432	0
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	200-299	864	0
051	Gizzard shad	Dorosoma cepedianum	140-199	144	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus			
027	Blueback herring	Alosa aestivalis			
037	Atlantic menhaden	Brevoortia tyrannus	100-119	23,040	1,584
103	Bay anchovy	Anchoa mitchilli	60-79	1,440	720
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	140-199	4,320	0
033	Spot	Leiostomus xanthurus	40-59	36,288	720
005	Atlantic croaker	Micropogon undulatus	80-99	144	0
151	Hogchoker	Trinectes maculatus	40-59	4,752	0
031	Striped Bass	Morone saxatilis	20-39, 140-199	1,008	0
			TOTAL	73,728	3,024

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Ave. No. Circ. Pumps: 5
Temperature Min-Max: 21.9 - 25.2
Salinity Min-Max: 1.0 - 2.4
Survival Percentage: 96 %

[illegible]ek Of June 11 Through June 17, 1978

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299, 300-399	864	144
039	White catfish	Ictalurus catus	140-199	864	0
116	Brown bullhead	Ictalurus nebulosus	200-299	144	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	200-299	432	0
051	Gizzard shad	Dorosoma cepedianum			
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	200-299	144	0
027	Blueback herring	Alosa aestivalis	300-399	144	0
037	Atlantic menhaden	Brevoortia tyrannus	100-119	28,368	1,728
103	Bay anchovy	Anchoa mitchilli	60-79	576	144
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
[illegible]35	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	100-119	1,872	0
033	Spot	Leiostomus xanthurus	60-79	40,896	1,728
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus	40-59	27,936	0
052	Carp	Cyprinus carpio	120-139	144	0
009	Bluefish	Pomatomus saltatrix	200-299	144	0
031	Striped bass	Morone saxatilis	40-59, 120-139	432	288
			TOTAL	102,960	4,032

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Ave. No. Circ. Pumps: 5
Temperature Min-Max: 24.8 - 26.1
Salinity Min-Max: 3.0 4.2
Survival Percentage: 95 %

k Of June 18 Through June 24, 1978

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	400-499	144	0
039	White catfish	Ictalurus catus			
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	200-299	1,152	0
051	Gizzard shad	Dorosoma cepedianum			
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus			
027	Blueback herring	Alosa aestivalis			
037	Atlantic menhaden	Brevoortia tyrannus	100-119	25,632	1,140
103	Bay anchovy	Anchoa mitchilli	60-79	1,008	864
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
35	Pumpkinseed	Lepomis gibbosus	120-139	288	0
032	White perch	Morone americana	100-119	4,032	0
033	Spot	Leiostomus xanthurus	120-139	50,112	2,160
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus	40-59	7,920	576
052	Carp	Cyprinus carpio	140-199	432	144
009	Bluefish	Pomatomus saltatrix	60-79	432	144
136	Bluegill	Lepomis macrochirus	100-119	144	0
031	Striped bass	Morone saxatilis	40-59	1,584	0
003	Summer flounder	Paralichthys dentatus	200-299	288	0
			TOTAL	93,168	5,328

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of June 25 Through July 1, 1978

Ave. No. Circ. Pumps: 5
Temperature Min-Max: 25.0 - 26.8
Salinity Min-Max: 3.4 - 3.9
Survival Percentage: 95 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	288	0
039	White catfish	Ictalurus catus			
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	200-299	576	0
051	Gizzard shad	Dorosoma cepedianum			
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus			
027	Blueback herring	Alosa aestivalis			
037	Atlantic menhaden	Brevoortia tyrannus	100-119	20,592	1,584
103	Bay anchovy	Anchoa mitchilli	60-79	2,016	720
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
35	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	120-139	3,024	0
033	Spot	Leiostomus xanthurus	60-79	56,736	3,024
005	Atlantic croaker	Micropogon undulatus	100-119,140-199	720	0
151	Hogchoker	Trinectes maculatus	40-59	33,408	432
122	Mummichog	Fundulus heteroclitus	80-99	144	0
			TOTAL	117,504	5,760

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

[illegible]k Of July 2 Through July 8, 1978

Ave. No. Circ. Pumps: 6
Temperature Min-Max: 24.3 - 25.4
Salinity Min-Max: 5.2 - 6.4
Survival Percentage: 97 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	576	0
039	White catfish	Ictalurus catus	40-59,140-199	1,440	0
116	Brown bullhead	Ictalurus nebulosus	40-59	288	0
108	Golden shiner	Notemigonus crysoleucas	100-119	288	0
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	200-299	1,440	0
051	Gizzard shad	Dorosoma cepedianum	300-399	144	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	60-79	1,008	0
027	Blueback herring	Alosa aestivalis			
037	Atlantic menhaden	Brevoortia tyrannus	100-119	21,744	720
103	Bay anchovy	Anchoa mitchilli	60-79	288	288
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
[illegible]35	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	40-59,120-139	2,448	0
033	Spot	Leiostomus xanthurus	60-79	63,072	2,016
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus	40-59	8,928	576
009	Bluefish	Pomatomus saltatrix	200-299	576	0
031	Striped bass	Morone saxatilis	40-59	288	0
			TOTAL	105,528	3,600

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

[illegible]ek Of July 9 Through July 15

Ave. No. Circ. Pumps: 5
Temperature Min-Max: 23.7 - 27.1
Salinity Min-Max: 4.4 - 5.9
Survival Percentage: 98 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	720	0
039	White catfish	Ictalurus catus	200-299	864	0
116	Brown bullhead	Ictalurus nebulosus	40-59	14,400	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	200-299	720	0
051	Gizzard shad	Dorosoma cepedianum			
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	60-79	144	0
027	Blueback herring	Alosa aestivalis			
037	Atlantic menhaden	Brevoortia tyrannus	100-119	49,536	720
103	Bay anchovy	Anchoa mitchilli	60-79	432	720
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
[illegible]35	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	120-139	576	0
033	Spot	Leiostomus xanthurus	80-99	94,320	864
005	Atlantic croaker	Micropogon undulatus	100-119	144	0
151	Hogchoker	Trinectes maculatus	40-59	4,752	288
052	Carp	Cyprinus carpio	300-399	144	0
009	Bluefish	Pomatomus saltatrix	100-119	144	0
007	Weakfish	Cynoscion regalis	40-59	144	0
			TOTAL	167,040	2,592

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of July 16 Through July 22, 1978

Ave. No. Circ. Pumps: 5
Temperature Min-Max: 26.0 - 27.2
Salinity Min-Max: 5.3 - 7.4
Survival Percentage: 95 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus			
039	White catfish	Ictalurus catus	200-299	288	0
116	Brown bullhead	Ictalurus nebulosus	40-59	1,584	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	200-299	288	0
051	Gizzard shad	Dorosoma cepedianum			
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus			
027	Blueback herring	Alosa aestivalis			
037	Atlantic menhaden	Brevoortia tyrannus	100-119	3,024	0
103	Bay anchovy	Anchoa mitchilli	60-79	288	288
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	40-59	1,152	0
033	Spot	Leiostomus xanthurus	60-79	33,696	2,160
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus	40-59	720	0
148	Rough silverside	Membras martinica	40-59	144	0
031	Striped bass	Morone saxatilis	40-59	864	0
007	Weakfish	Cynoscion regalis	140-199	144	0
003	Summer flounder	Paralichthys dentatus	200-299	288	0
			TOTAL	42,480	2,448

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of July 23 Through July 29, 1978

Ave. No. Circ. Pumps: 6
Temperature Min-Max: 27.8 - 30.4
Salinity Min-Max: 5.5 - 6.9
Survival Percentage: 99 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus			
039	White catfish	Ictalurus catus	200-299	144	0
116	Brown bullhead	Ictalurus nebulosus	40-59	16,992	288
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	200-299	720	0
051	Gizzard shad	Dorosoma cepedianum			
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	60-79	288	0
027	Blueback herring	Alosa aestivalis			
037	Atlantic menhaden	Brevoortia tyrannus	120-139	8,208	288
103	Bay anchovy	Anchoa mitchilli	60-79	3,024	288
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	40-59	3,744	0
033	Spot	Leiostomus xanthurus	80-99	68,256	864
005	Atlantic croaker	Micropogon undulatus	80-99	144	0
151	Hogchoker	Trinectes maculatus	40-59	1,296	0
009	Bluefish	Pomatomus saltatrix	140-199	144	0
031	Striped bass	Morone saxatilis	40-59,60-79	576	0
007	Weakfish	Cynoscion regalis	40-59	1,008	0
			TOTAL	104,544	1,728

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Ave. No. Circ. Pumps: 6
Temperature Min-Max: 27.3 - 28.4
Salinity Min-Max: 5.4 - 6.9
Survival Percentage: 98 %

Week Of July 30 Through Aug. 5, 1978

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	0	288
039	White catfish	Ictalurus catus	40-59	1,152	0
116	Brown bullhead	Ictalurus nebulosus	40-59	18,288	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	200-299	288	0
051	Gizzard shad	Dorosoma cepedianum	120-139	3,744	144
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	60-79	288	0
027	Blueback herring	Alosa aestivalis	40-59	720	0
037	Atlantic menhaden	Brevoortia tyrannus	120-139	14,976	432
103	Bay anchovy	Anchoa mitchilli	60-79	2,304	288
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	40-59	144	144
135	Pumpkinseed	Lepomis gibbosus	140-199	144	0
032	White perch	Morone americana	140-199	1,152	0
033	Spot	Leiostomus xanthurus	80-99	39,888	288
005	Atlantic croaker	Micropogon undulatus	120-139	144	0
151	Hogchoker	Trinectes maculatus	40-59	1,008	0
122	Mummichog	Fundulus heteroclitus	60-79	144	0
196	Atlantic needlefish	Strongylura marina	200-299	288	0
148	Rough silverside	Membras martinica	40-59	288	0
009	Bluefish	Pomatomus saltatrix	120-139	1,296	0
031	Striped bass	Morone saxatilis	80-99	144	0
003	Summer flounder	Paralichthys dentatus	300-399	144	0
185	Cownose ray	Rhinoptera bonasus	200-299	288	0
			TOTAL	86,832	1,584

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Ave. No. Circ. Pumps: 7 *
Temperature Min-Max: 27.2 - 28.4
Salinity Min-Max: 3.2 - 4.5
Survival Percentage: 96 %
* 7 pumps with 6 screens operating

Week Of Aug. 6 Through Aug. 12, 1978

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	300-399	288	0
039	White catfish	Ictalurus catus	60-79	1,728	0
116	Brown bullhead	Ictalurus nebulosus	60-79	55,440	1,296
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata			
051	Gizzard shad	Dorosoma cepedianum	100-119	432	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	60-79	0	144
027	Blueback herring	Alosa aestivalis	300-399	288	0
037	Atlantic menhaden	Brevoortia tyrannus	120-139	50,400	1,296
103	Bay anchovy	Anchoa mitchilli	60-79	1,440	864
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
135	Pumpkinseed	Lepomis gibbosus	40-59, 140-199	288	0
032	White perch	Morone americana	40-59	5,184	144
033	Spot	Leiostomus xanthurus	60-79	70,704	3,168
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus			
030	American shad	Alosa sapidissima	60-79	288	0
009	Bluefish	Pomatomus saltatrix	120-139	576	0
136	Bluegill	Lepomis macrochirus	40-59	1,008	0
142	Yellow perch	Perca flavescens	60-79	144	0
031	Striped bass	Morone saxatilis	140-199	288	0
007	Weakfish	Cynoscion regalis	40-59	864	720
023	Searobin	Prionotus sp.	40-59	288	0
			TOTAL	189,648	7,632

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of August 13 Through August 19, 1978

Ave. No. Circ. Pumps: 7 *
Temperature Min-Max: 28.3 - 29.9
Salinity Min-Max: 3.9 - 4.8
Survival Percentage: 97 %
* 7 Pumps with 6 Screens Operating

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus			
039	White catfish	Ictalurus catus	60-79	2,880	0
116	Brown bullhead	Ictalurus nebulosus	60-79	1,728	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	200-299	432	0
051	Gizzard shad	Dorosoma cepedianum	120-139	1,728	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	60-79	576	0
027	Blueback herring	Alosa aestivalis	200-299	144	0
037	Atlantic menhaden	Brevoortia tyrannus	120-139	21,168	288
103	Bay anchovy	Anchoa mitchilli	20-39	1,296	144
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
135	Pumpkinseed	Lepomis gibbosus	140-199	144	0
032	White perch	Morone americana	40-59	13,392	864
033	Spot	Leiostomus xanthurus	80-99	23,760	864
005	Atlantic croaker	Micropogon undulatus	100-119	1,152	0
151	Hogchoker	Trinectes maculatus			
122	Mummichog	Fundulus heteroclitus	80-99	288	0
009	Bluefish	Pomatomus saltatrix	120-139	2,448	0
031	Striped bass	Morone saxatilis	60-79	576	0
007	Weakfish	Cynoscion regalis	40-59, 60-79	432	0
003	Summer flounder	Paralichthys dentatus	200-299	144	0
			TOTAL	72,288	2,160

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of August 20 Through August 26

Ave. No. Circ. Pumps: 7 *
Temperature Min-Max: 24.3 - 27.6
Salinity Min-Max: 4.2 - 6.3
Survival Percentage: 92 %
* 7 Pumps with 6 Screens operating.

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus			
039	White catfish	Ictalurus catus	60-79	1,440	0
116	Brown bullhead	Ictalurus nebulosus	60-79	576	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	200-299,300-399	288	0
051	Gizzard shad	Dorosoma cepedianum	120-139	1,440	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	60-79	576	288
027	Blueback herring	Alosa aestivalis			
037	Atlantic menhaden	Brevoortia tyrannus	120-139	26,928	1,296
103	Bay anchovy	Anchoa mitchilli	60-79	3,024	1,152
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	40-59	288	0
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	140-199	2,592	0
033	Spot	Leiostomus xanthurus	60-79	32,400	3,312
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus			
009	Bluefish	Pomatomus saltatrix	140-199	144	0
011	Harvestfish	Peprilus alepidotus	40-59	432	144
007	Weakfish	Cynoscion regalis	60-79,200-299	288	0
			TOTAL	70,416	6,192

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of Aug. 27 Through Sept. 2, 1978

Ave. No. Circ. Pumps: 7 *
Temperature Min-Max: 27.5 - 28.4
Salinity Min-Max: 6.0 - 7.0
Survival Percentage: 95 %
* 7 pumps with 6 screens operating

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus			
039	White catfish	Ictalurus catus	200-299	288	0
116	Brown bullhead	Ictalurus nebulosus	80-99	144	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	200-299,400-499	432	0
051	Gizzard shad	Dorosoma cepedianum	120-139	2,736	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	60-79	288	0
027	Blueback herring	Alosa aestivalis			
037	Atlantic menhaden	Brevoortia tyrannus	120-139	13,392	144
103	Bay anchovy	Anchoa mitchilli	80-99	1,008	288
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	60-79	0	288
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	140-199	1,296	0
033	Spot	Leiostomus xanthurus	80-99	8,496	144
005	Atlantic croaker	Micropogon undulatus	60-79	288	0
151	Hogchoker	Trinectes maculatus	140-199	144	0
011	Harvestfish	Peprilus alepidotus	60-79	2,160	576
007	Weakfish	Cynoscion regalis	60-79	0	288
204	Crevalle jack	Caranx hippos	80-99	144	0
009	Bluefish	Pomatomus saltatrix	140-199	432	0
003	Summer flounder	Paralichthys dentatus	200-299	288	0
			TOTAL	31,536	1,728

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of Sept. 3 Through Sept. 9, 1978

Ave. No. Circ. Pumps: 7*
Temperature Min-Max: 26.3 - 27.4
Salinity Min-Max: 6.9 - 7.4
Survival Percentage: 96 %
* 7 Pumps with 6 Screens operating

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	500+	288	0
039	White catfish	Ictalurus catus	80-99	1,296	144
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata			
051	Gizzard shad	Dorosoma cepedianum	140-199	1,152	144
275	Threadfin shad	Dorosoma petenense		-	
026	Alewife	Alosa pseudoharengus	60-79	288	0
027	Blueback herring	Alosa aestivalis			
037	Atlantic menhaden	Brevoortia tyrannus	120-139	3,312	0
103	Bay anchovy	Anchoa mitchilli	40-59,80-99	2.448	288
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	60-79,80-99	720	0
135	Pumpkinseed	Lepomis gibbosus	140-199	144	0
032	White perch	Morone americana	120-139,140-199	432	0
033	Spot	Leiostomus xanthurus	60-79	15,552	432
005	Atlantic croaker	Micropogon undulatus	60-79	432	0
151	Hogchoker	Trinectes maculatus	100-119	288	0
196	Atlantic needlefish	Strongylura marina	200-299	288	0
148	Rough silverside	Membras martinica	60-79, 80-99	144	288
011	Harvestfish	Peprilus alepidotus	80-99	4,320	0
			TOTAL	31,104	1,296

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3.6-33

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of Sept. 10 Through Sept. 16, 1978

Ave. No. Circ. Pumps: 7
Temperature Min-Max: 24.0 - 26.5
Salinity Min-Max: 6.7 - 9.3
Survival Percentage: 95 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus			
039	White catfish	Ictalurus catus	80-99	720	288
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas	100-119	144	0
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	500+	144	0
051	Gizzard shad	Dorosoma cepedianum	140-199	1,296	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus			
027	Blueback herring	Alosa aestivalis			
037	Atlantic menhaden	Brevoortia tyrannus	140-199	7,056	0
103	Bay anchovy	Anchoa mitchilli	40-59	1,728	576
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
135	Pumpkinseed	Lepomis gibbosus	60-79	288	0
032	White perch	Morone americana	60-79	720	0
033	Spot	Leiostomus xanthurus	80-99	10,080	576
005	Atlantic croaker	Micropogon undulatus	80-99	1,152	0
151	Hogchoker	Trinectes maculatus	80-99, 100-119	576	0
122	Mummichog	Fundulus heteroclitus	60-79	144	0
011	Harvestfish	Peprilus alepidotus	60-79	4,896	144
007	Weakfish	Cynoscion regalis	60-79	144	0
			TOTAL	29,088	1,584

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of Sept. 17 Through Sept. 23, 1978

Ave. No. Circ. Pumps: 6 *
Temperature Min-Max: 25.4 - 27.3
Salinity Min-Max: 7.0 - 8.3
Survival Percentage: 98 %
* 6 Pumps with 5 Screens operating

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	1,296	144
039	White catfish	Ictalurus catus	140-199	144	0
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata			
051	Gizzard shad	Dorosoma cepedianum	140-199	1,440	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus			
027	Blueback herring	Alosa aestivalis			
037	Atlantic menhaden	Brevoortia tyrannus	120-139	1,584	0
103	Bay anchovy	Anchoa mitchilli	40-59	144	0
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	80-99	720	0
033	Spot	Leiostomus xanthurus	80-99	22,176	576
005	Atlantic croaker	Micropogon undulatus	80-99	144	0
151	Hogchoker	Trinectes maculatus			
052	Carp	Cyprinus carpio	140-199	288	0
122	Mummichog	Fundulus heteroclitus	60-79	144	0
011	Harvestfish	Peprilus alepidotus	60-79	1,728	0
031	Striped Bass	Morone saxatilis	60-79, 80-99	432	0
			TOTAL	30,240	720

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of Sept. 24 Through Sept. 30, 1978

Ave. No. Circ. Pumps: 7 *
Temperature Min-Max: 21.9 - 23.1
Salinity Min-Max: 7.4 - 9.4
Survival Percentage: 98 %
* 7 Pumps with 5 screens operating

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	0	144
039	White catfish	Ictalurus catus			
116	Brown bullhead	Ictalurus nebulosus	60-79	432	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata			
051	Gizzard shad	Dorosoma cepedianum	140-199	2,304	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus			
027	Blueback herring	Alosa aestivalis			
037	Atlantic menhaden	Brevoortia tyrannus	100-119	4,464	0
103	Bay anchovy	Anchoa mitchilli	60-79	1,008	0
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	60-79	0	288
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	120-139, 200-299	576	0
033	Spot	Leiostomus xanthurus	80-99	10,368	0
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus	80-99, 100-119	720	0
148	Rough silverside	Membras martinica	80-99	288	0
011	Harvestfish	Peprilus alepidotus	80-99	1,296	0
031	Striped bass	Morone saxatilis	60-79	288	0
003	Summer flounder	Paralichthys dentatus	140-199	144	0
			TOTAL	21,888	432

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of Oct. 1 Through Oct. 7, 1978

Ave. No. Circ. Pumps: 6
Temperature Min-Max: 20.7 - 21.8
Salinity Min-Max: 8.3 - 10.1
Survival Percentage: 98 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	144	0
039	White catfish	Ictalurus catus	100-119, 140-199	432	0
116	Brown bullhead	Ictalurus nebulosus	80-99	288	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	500+	144	0
051	Gizzard shad	Dorosoma cepedianum	140-199	720	576
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus			
027	Blueback herring	Alosa aestivalis			
037	Atlantic menhaden	Brevoortia tyrannus	120-139	17,856	0
103	Bay anchovy	Anchoa mitchilli	60-79	1,872	0
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana			
033	Spot	Leiostomus xanthurus	80-99	21,168	288
005	Atlantic croaker	Micropogon undulatus	100-119	288	0
151	Hogchoker	Trinectes maculatus	80-99	2,160	0
148	Rough silverside	Membras martinica	80-99	144	0
011	Harvestfish	Peprilus alepidotus	80-99	2,448	0
152	Blackcheek tonguefish	Symphurus plagiusa	80-99	288	0
			TOTAL	47,952	864

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Ave. No. Circ. Pumps: 5
Temperature Min-Max: 15.9 - 20.3
Salinity Min-Max: 8.2 - 9.3
Survival Percentage: 99 %

Week Of Oct. 8 Through Oct. 14, 1978

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	1,152	0
039	White catfish	Ictalurus catus	80-99	9,072	0
116	Brown bullhead	Ictalurus nebulosus	60-79	3,456	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	140-199	576	0
051	Gizzard shad	Dorosoma cepedianum			
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	60-79	576	0
027	Blueback herring	Alosa aestivalis			
037	Atlantic menhaden	Brevoortia tyrannus	140-199	19,152	144
103	Bay anchovy	Anchoa mitchilli	80-99	1,152	864
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	100-119	288	0
[illegible]35	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	140-199	11,664	0
033	Spot	Leiostomus xanthurus	100-119	58,032	576
005	Atlantic croaker	Micropogon undulatus	140-199	288	0
151	Hogchoker	Trinectes maculatus	80-99	2,304	0
122	Mummichog	Fundulus heteroclitus	60-79,80-99	432	0
231	Striped mullet	Mugil cephalus	200-299	288	0
011	Harvestfish	Peprilus alepidotus	80-99	2,160	0
031	Striped bass	Morone saxatilis	140-199	2,448	0
			TOTAL	113,040	1,584

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Ave. No. Circ. Pumps: 6*
Temperature Min-Max: 16.4 - 17.6
Salinity Min-Max: 8.9 - 10.4
Survival Percentage: 98 %

ek Of Oct. 15 Through Oct. 21, 1978

* 6 Pumps with 5 Screens operating

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	864	0
039	White catfish	Ictalurus catus	80-99, 100-119	1,440	0
116	Brown bullhead	Ictalurus nebulosus	60-79	1,152	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	200-299	864	0
051	Gizzard shad	Dorosoma cepedianum	140-199	288	288
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	60-79	11,232	432
027	Blueback herring	Alosa aestivalis	40-59	4,464	576
037	Atlantic menhaden	Brevoortia tyrannus	100-119	69,120	576
103	Bay anchovy	Anchoa mitchilli	40-59, 80-99	4,464	1,008
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	60-79, 80-99	1,584	144
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	140-199	288	0
033	Spot	Leiostomus xanthurus	100-119	31,392	0
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus	80-99	576	0
231	Striped mullet	Mugil cephalus	200-299	144	0
011	Harvestfish	Peprilus alepidotus	60-79	288	0
007	Weakfish	Cynoscion regalis	80-99	720	0
213	Silver perch	Bairdiella chrysura	140-199	144	0
003	Summer flounder	Paralichthys dentatus	300-399	288	0
			TOTAL	129,312	3,024

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Ave. No. Circ. Pumps: 6 *
Temperature Min-Max: 15.8 - 17.9
Salinity Min-Max: 8.2 - 10.8
Survival Percentage: 95 %

●ek Of Oct. 22 Through Oct. 28, 1978

*6 Pumps with 5 Screens operating

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus			
039	White catfish	Ictalurus catus	300-399	144	0
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata			
051	Gizzard shad	Dorosoma cepedianum	140-199	432	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	60-79	1,728	288
027	Blueback herring	Alosa aestivalis	40-59	1,584	0
037	Atlantic menhaden	Brevoortia tyrannus	100-119	10,512	0
103	Bay anchovy	Anchoa mitchilli	80-99	6,192	1,152
149	Tidewater silverside	Menidia beryllina	40-59	144	0
150	Atlantic silverside	Menidia menidia			
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana			
033	Spot	Leiostomus xanthurus	100-119	2,448	0
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus	80-99	6,624	0
031	Striped bass	Morone saxatilis	100-119	144	0
144	Naked goby	Gobiosoma bosci	40-59	288	0
			TOTAL	30,240	1,440

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3.6-40

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of Oct. 29 Through Nov. 4, 1978

Ave. No. Circ. Pumps: 6 *
Temperature Min-Max: 14.1 - 16.4
Salinity Min-Max: 10.3 - 11.1
Survival Percentage: 93 %
* 6 pumps with 5 screens operating.

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	300-399	432	0
039	White catfish	Ictalurus catus			
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata			
051	Gizzard shad	Dorosoma cepedianum			
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	80-99	3,744	0
027	Blueback herring	Alosa aestivalis	40-59	13,248	720
037	Atlantic menhaden	Brevoortia tyrannus	100-119	16,848	0
103	Bay anchovy	Anchoa mitchilli	60-79	271,296	22,032
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	60-79	432	0
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	140-199	288	0
033	Spot	Leiostomus xanthurus	80-99	4,752	0
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus	80-99	2,304	0
122	Mummichog	Fundulus heteroclitus	60-79	144	0
148	Rough silverside	Membras martinica	40-59, 80-99	432	0
009	Bluefish	Pomatomus saltatrix	200-299	288	0
011	Harvestfish	Peprilus alepidotus	80-99	144	0
007	Weakfish	Cynoscion regalis	100-119,120-139	576	0
003	Summer flounder	Paralichthys dentatus	300-399	144	0
			TOTAL	315,072	22,752

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

ek Of Nov. 5 Through Nov. 11, 1978

Ave. No. Circ. Pumps: 6
Temperature Min-Max: 15.0 - 16.0
Salinity Min-Max: 10.7 - 11.4
Survival Percentage: 98 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	576	0
039	White catfish	Ictalurus catus			
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata			
051	Gizzard shad	Dorosoma cepedianum			
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	60-79	4,752	144
027	Blueback herring	Alosa aestivalis	60-79	37,296	576
037	Atlantic menhaden	Brevoortia tyrannus	100-119	9,072	0
103	Bay anchovy	Anchoa mitchilli	60-79	7,632	720
149	Tidewater silverside	Menidia beryllina	60-79	720	0
150	Atlantic silverside	Menidia menidia	80-99	288	0
35	Pumpkinseed	Lepomis gibbosus	60-79	2,592	0
032	White perch	Morone americana	120-139	720	0
033	Spot	Leiostomus xanthurus	100-119	6,768	0
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus	80-99	1,008	0
122	Mummichog	Fundulus heteroclitus	80-99	1,440	0
148	Rough silverside	Membras martinica	60-99	144	0
011	Harvestfish	Peprilus alepidotus	80-99	144	0
			TOTAL	73,152	1,440

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of Nov. 12 Through Nov. 18, 1978

Ave. No. Circ. Pumps: 7 *
Temperature Min-Max: 14.7 - 15.8
Salinity Min-Max: 10.4 - 11.8
Survival Percentage: 93 %
* 7 pumps with 6 screens operating

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus			
039	White catfish	Ictalurus catus			
116	Brown bullhead	Ictalurus nebulosus	40-59	288	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata			
051	Gizzard shad	Dorosoma cepedianum	140-199	2,592	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	60-79	2,160	144
027	Blueback herring	Alosa aestivalis	40-59	119,232	9,360
037	Atlantic menhaden	Brevoortia tyrannus	100-119	8,352	0
103	Bay anchovy	Anchoa mitchilli	60-79	3,456	2,304
149	Tidewater silverside	Menidia beryllina	40-59, 60-79	576	0
150	Atlantic silverside	Menidia menidia			
135	Pumpkinseed	Lepomis gibbosus	60-79	1,152	0
032	White perch	Morone americana	60-79	2,592	288
033	Spot	Leiostomus xanthurus	100-119	14,256	0
005	Atlantic croaker	Micropogon undulatus	120-139	144	0
151	Hogchoker	Trinectes maculatus	60-79, 80-99	576	0
148	Rough silverside	Membras martinica	60-79	1,152	288
122	Mummichog	Fundulus heteroclitus	60-79	9,792	0
120	Sheepshead minnow	Cyprinodon variegatus	40-59	288	0
007	Weakfish	Cynoscion regalis	140-199	288	0
			TOTAL	166,896	12,384

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Ave. No. Circ. Pumps: 6
Temperature Min-Max: 13.6 - 14.1
Salinity Min-Max: 8.7 - 10.2
Survival Percentage: 89 %

ek Of Nov. 19 Through Nov. 25, 1978

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus			
039	White catfish	Ictalurus catus	60-79, 100-119	720	0
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata			
051	Gizzard shad	Dorosoma cepedianum	140-199	288	288
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	60-79	9,360	576
027	Blueback herring	Alosa aestivalis	60-79	338,256	31,680
037	Atlantic menhaden	Brevoortia tyrannus	100-119	4,896	0
103	Bay anchovy	Anchoa mitchilli	40-59	12,960	13,536
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	60-79	864	0
135	Pumpkinseed	Lepomis gibbosus	40-59	5,184	576
032	White perch	Morone americana	60-79	2,880	0
033	Spot	Leiostomus xanthurus	100-119	2,448	0
005	Atlantic croaker	Micropogon undulatus	120-139	2,016	0
151	Hogchoker	Trinectes maculatus			
030	American shad	Alosa sapidissima	100-119	576	0
122	Mummichog	Fundulus heteroclitus	40-59	4,896	0
231	Striped mullet	Mugil cephalus	200-299	144	0
136	Bluegill	Lepomis macrochirus	140-199	288	0
031	Striped bass	Morone saxatilis	100-119	288	0
213	Silver perch	Bairdiella chrysura	120-139	144	0
144	Naked goby	Gobiosoma bosci	40-59	144	0
			TOTAL	386,352	46,656

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

W[illegible] Of November 26,1978 Through December 2, 1978

Ave. No. Circ. Pumps: 7*
Temperature Min-Max: 10.5 - 11.3
Salinity Min-Max: 9.8 - 11.2
Survival Percentage: 95 %
* 7 pumps with 6 screens operating

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus			
039	White catfish	Ictalurus catus	80-99	288	0
116	Brown bullhead	Ictalurus nebulosus	40-59, 60-79	576	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	200-299	288	0
051	Gizzard shad	Dorosoma cepedianum	140-199	144	0
275	Threadfin shad	Dorosoma petenense	100-119	144	0
026	Alewife	Alosa pseudoharengus	60-79	1,440	144
027	Blueback herring	Alosa aestivalis	40-59	281,376	15,696
037	Atlantic menhaden	Brevoortia tyrannus	140-199	2,448	0
103	Bay anchovy	Anchoa mitchilli	60-79	288.	288
149	Tidewater silverside	Menidia beryllina	60-79	576	0
150	Atlantic silverside	Menidia menidia	80-99	864	0
135	Pumpkinseed	Lepomis gibbosus	60-79	10,512	144
032	White perch	Morone americana	60-79	10,080	288
033	Spot	Leiostomus xanthurus	80-99	9,648	144
005	Atlantic croaker	Micropogon undulatus	120-139	288	0
151	Hogchoker	Trinectes maculatus	80-99	1,872	0
052	Carp	Cyprinus Carpio	140-199	288	0
030	American Shad	Alosa sapidissima	120-139	288	0
122	Mummichog	Fundulus heteroclitus	40-59	27,648	288
148	Rough silverside	Membras martinica	60-79	144	0
031	Striped bass	Moron saxatilis	100-119	288	0
003	Summer flounder	Paralichthys dentatus	200-299	288	0
152	Blackcheek tonguefish	Symphurus plagiusa	60-79, 80-99	288	144
			TOTAL	350,064	17,136

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Ave. No. Circ. Pumps: 6
Temperature Min-Max: 11.6 - 13.2
Salinity Min-Max: 7.3 - 9.7
Survival Percentage: 94 %

ek Of Dec. 3 Through Dec. 9, 1978

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	432	0
039	White catfish	Ictalurus catus	100-119	288	0
116	Brown bullhead	Ictalurus nebulosus	60-79	7,776	576
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata			
051	Gizzard shad	Dorosoma cepedianum	140-199	3,744	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	60-79	4,896	144
027	Blueback herring	Alosa aestivalis	60-79	106,704	8,928
037	Atlantic menhaden	Brevoortia tyrannus	100-119	6,048	0
103	Bay anchovy	Anchoa mitchilli	40-59	2,016	144
149	Tidewater silverside	Menidia beryllina	40-59	720	0
150	Atlantic silverside	Menidia menidia	100-119	288	0
135	Pumpkinseed	Lepomis gibbosus	40-59	7,488	0
032	White perch	Morone americana	60-79	28,224	864
033	Spot	Leiostomus xanthurus	80-99	21,456	1,008
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus	100-119	576	0
122	Mummichog	Fundulus heteroclitus	40-59	2,160	0
031	Striped bass	Morone saxatilis	100-119	1,008	0
213	Silver perch	Bairdiella chrysura	120-139	288	0
204	Crevalle jack	Caranx hippos	140-199	144	0
			TOTAL	194,256	11,664

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Ave. No. Circ. Pumps: 5
Temperature Min-Max: 7.8 10.3
Salinity Min-Max: 5.4 7.6
Survival Percentage: 95 %

Week Of Dec 10 Through Dec. 16, 1978

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus			
039	White catfish	Ictalurus catus	100-119	432	144
116	Brown bullhead	Ictalurus nebulosus	40-59	288	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata			
051	Gizzard shad	Dorosoma cepedianum	140-199	576	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	60-79-80-99	1,440	288
027	Blueback herring	Alosa aestivalis	40-59	122,256	4,896
037	Atlantic menhaden	Brevoortia tyrannus	80-99,120-139	432	0
103	Bay anchovy	Anchoa mitchilli	40-59	144	0
149	Tidewater silverside	Menidia beryllina	60-79	1,584	288
150	Atlantic silverside	Menidia menidia	80-99	3,888	288
135	Pumpkinseed	Lepomis gibbosus	40-59	576	0
032	White perch	Morone americana	60-79	9,216	1,152
033	Spot	Leiostomus xanthurus	80-99	3,024	0
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus	80-99	144	144
122	Mummichog	Fundulus heteroclitus	60-79	3,024	0
007	Weakfish	Cynoscion regalis	140-199	0	288
003	Summer flounder	Paralichthys dentatus	120-139	288	0
			TOTAL	147,312	7,488

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of Dec. 17 Through Dec. 23, 1978

Ave. No. Circ. Pumps: 5
Temperature Min-Max: 6.2 - 8.5
Salinity Min-Max: 3.9 - 7.3
Survival Percentage: 97 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus			
039	White catfish	Ictalurus catus	100-119	1,728	0
116	Brown bullhead	Ictalurus nebulosus	60-79, 200-299	432	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata			
051	Gizzard shad	Dorosoma cepedianum	140-199	864	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	60-79	5,328	720
027	Blueback herring	Alosa aestivalis	60-79	372,528	11,808
037	Atlantic menhaden	Brevoortia tyrannus	80-99	720	144
103	Bay anchovy	Anchoa mitchilli	60-79	864	0
149	Tidewater silverside	Menidia beryllina	60-79	864	0
150	Atlantic silverside	Menidia menidia	80-99	11,232	144
135	Pumpkinseed	Lepomis gibbosus	60-79	864	0
032	White perch	Morone americana	60-79	20,880	2,016
033	Spot	Leiostomus xanthurus	80-99	3,600	0
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus	80-99	3,024	0
030	American shad	Alosa sapidissima	140-199	144	0
122	Mummichog	Fundulus heteroclitus	60-79	2,880	0
007	Weakfish	Cynoscion regalis	100-119	288	0
372	Inshore sand lance	Ammodytes hexapetrus	140-199	288	0
			TOTAL	426,528	14,832

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SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of Dec. 24 Through Dec. 30, 1978

Ave. No. Circ. Pumps: 5
Temperature Min-Max: 4.4 - 7.0
Salinity Min-Max: 4.0 - 6.4
Survival Percentage: 95% %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	80-99	144	0
039	White catfish	Ictalurus catus	100-119	576	0
116	Brown bullhead	Ictalurus nebulosus	60-79, 140-199	432	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	140-199	576	0
051	Gizzard shad	Dorosoma cepedianum	140-199, 300-399	720	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	60-79, 80-99	864	144
027	Blueback herring	Alosa aestivalis	60-79	135,216	8,064
037	Atlantic menhaden	Brevoortia tyrannus	120-139	720	0
103	Bay anchovy	Anchoa mitchilli			
149	Tidewater silverside	Menidia beryllina	60-79	432	720
150	Atlantic silverside	Menidia menidia	80-99	9,792	0
135	Pumpkinseed	Lepomis gibbosus	60-79	288	0
032	White perch	Morone americana	60-79	79,056	3,024
033	Spot	Leiostomus xanthurus	80-99	1,440	288
005	Atlantic croaker	Micropogon undulatus	20-39, 40-59	864	144
151	Hogchoker	Trinectes maculatus	100-119	482	0
122	Mummichog	Fundulus heteroclitus	80-99	1,008	0
			TOTAL	232,560	12,384

Appendix 3.0

RIVER BIOTA STUDIES AT THE VEPCO SURRY NUCLEAR POWER STATION

Section I

RIVER BIOTA STUDIES AT THE VEPCO SURRY NUCLEAR POWER STATION

by

Robert A. Jordan

Patricia A. Goodwin

and

Charles E. Sutton

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Acknowledgements

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Introduction

The Surry Power Station, operated by the Virginia Electric and Power Company, is located on a peninsula that extends into the James River on its south shore. The tip of the peninsula is known as Hog Point, and it is approximately 30 miles (48 km) upstream from Chesapeake Bay and 50 miles (80 km) downstream from Richmond (Fig. 1). The section of the river bordering this peninsula is the transition zone between fresh water and saline water, where the salinities encountered are near the tolerance minima for most estuarine and marine species and near the tolerance maxima for freshwater species. Therefore, the biological community consists of a few resident species that can tolerate the entire range of conditions, and of visitors from upstream and downstream that can survive until their tolerance limits are exceeded. The region is biologically significant mainly as a nursery ground and migration corridor for fish species that are harvested elsewhere. The fish populations in the vicinity of the power station have been monitored by VEPCO personnel. VIMS was engaged by VEPCO to monitor the lower trophic levels, including the phytoplankton, zooplankton, benthic macroinvertebrates and fouling organisms. The monitoring study has been in progress since May, 1969, and intensified sampling programs for phytoplankton and zooplankton were conducted in the years 1975 through 1978. The present report covers the study period January through December 1978.

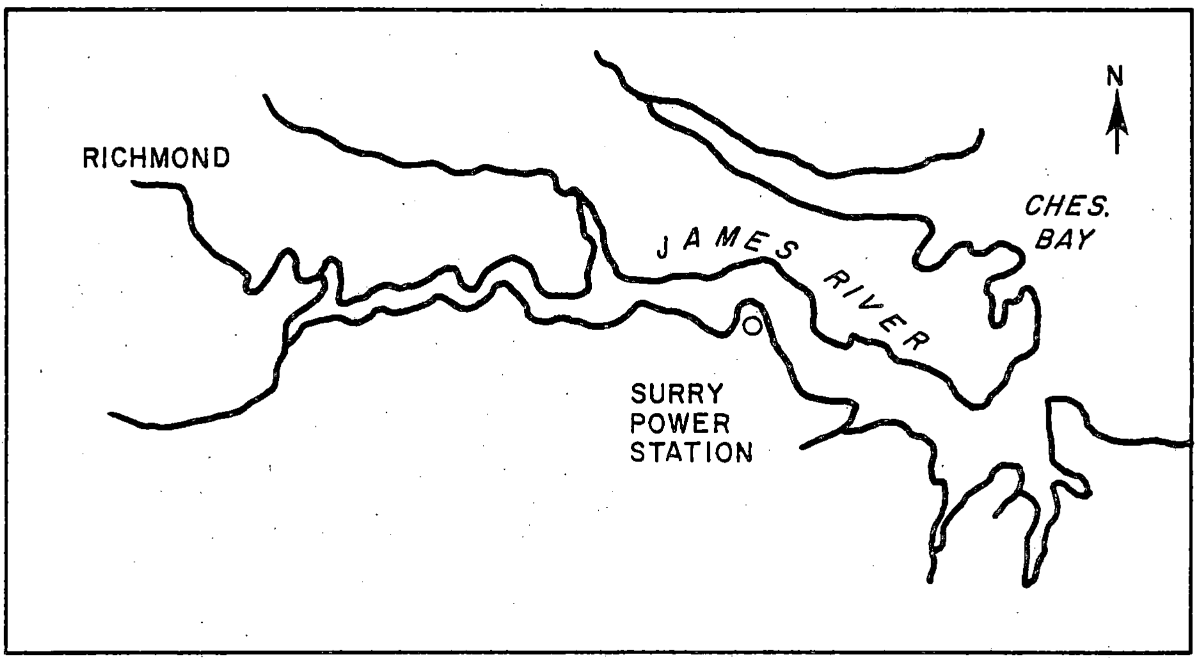

Figure 1. Location of the Surry Power Station.

The first of the two units of the power plant began commercial operation in December 1972, the second in May 1973. Together they require a cooling water flow of $106 m^3 sec^{-1}$, which is pumped from the river on the downstream side of the peninsula into a 2.74 km long elevated intake canal in which it flows by gravity for approximately 33 minutes to the power plant (Fig. 2). The water then flows by gravity through the condensers, where its temperature is raised a maximum of 8.3°C, into a 1 km long sea level discharge canal which has a time of passage of approximately 28 minutes. The cooling water encounters a constriction at the discharge canal mouth, which boosts its velocity to $1.8 m.sec^{-1}$, causing turbulent mixing of the cooling water with the river water. On ebbing tides the plume hugs the shore downstream from the discharge and elongates, while on flooding tides it is oriented upstream and remains more compact.

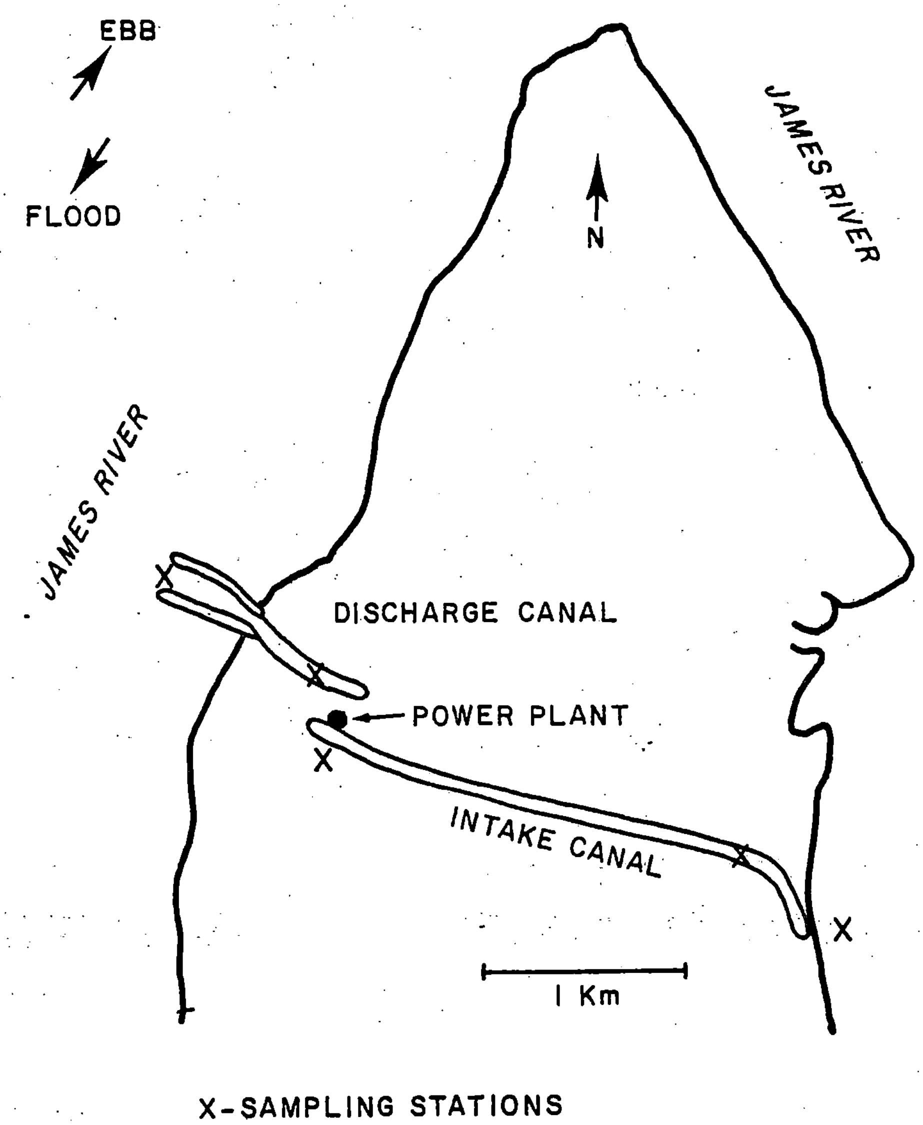

Figure 2. Surry Power Station cooling water canal system showing in-plant sampling stations.

Methods

Station Locations

Table 1 and Figure 3 show the locations of the phytoplankton and zooplankton sampling stations used in the river study. The intake canal was sampled at its upstream and downstream ends, while the discharge canal was sampled near the highway bridge about 0.8 km upstream from the canal mouth (Fig. 2). The benthos and fouling plate stations are shown in Table 2 and Figure 4.

Sampling and Sample Analysis Methods

Phytoplankton samples were accompanied by samples for determinations of chlorophyll *a* concentration, salinity, and dissolved oxygen concentration. Water temperature and Secchi Disk transparency were measured at each station. A non-metallic 2-liter Van Dorn bottle was used for sampling of phytoplankton and related parameters. Phytoplankton samples were preserved with Lugol's iodine solution, and cell counts and identifications were performed using the inverted microscope method. Chlorophyll *a* samples were preserved with mercuric chloride (40 mg/1), and stored in opaque bottles on ice until return to the laboratory. They were then filtered through glass fiber filters, which were subsequently ground in 90% acetone to extract the chlorophyll *a*. The chlorophyll concentration in the extract was determined using a Turner Fluorometer, model 111.

Table 1

Plankton Sampling Station Locations

Station	Depth (m)	Location
DWS	2	Adjacent to tower (QK Fl Lt "A")
Intake	1 8	Outside intake forebay - zooplankton sampling Inside intake forebay - phytoplankton sampling
HPS	5	Adjacent to tower (QK Fl Lt "C")
HPW3	2.5	Adjacent to tower (QK Fl Lt "D")
HPW2	3	Adjacent to tower (QK Fl Lt "E")
HPW1	1	Off west shore of Hog Point, midway between HPS and discharge
Discharge	2.5	Discharge canal mouth
CBE	1	Off west shore of Gravel Neck, south of discharge
CBC	3	Midway between discharge and range markers near Cobham Wharf
JI	8	Adjacent to tower (QK Fl Lt "G")
Intake Canal Uptake and Downstream		Within Surry power plant intake canal (sampled by VEPCO personnel)
Discharge Canal		Within Surry power plant discharge canal (sampled by VEPCO personnel)

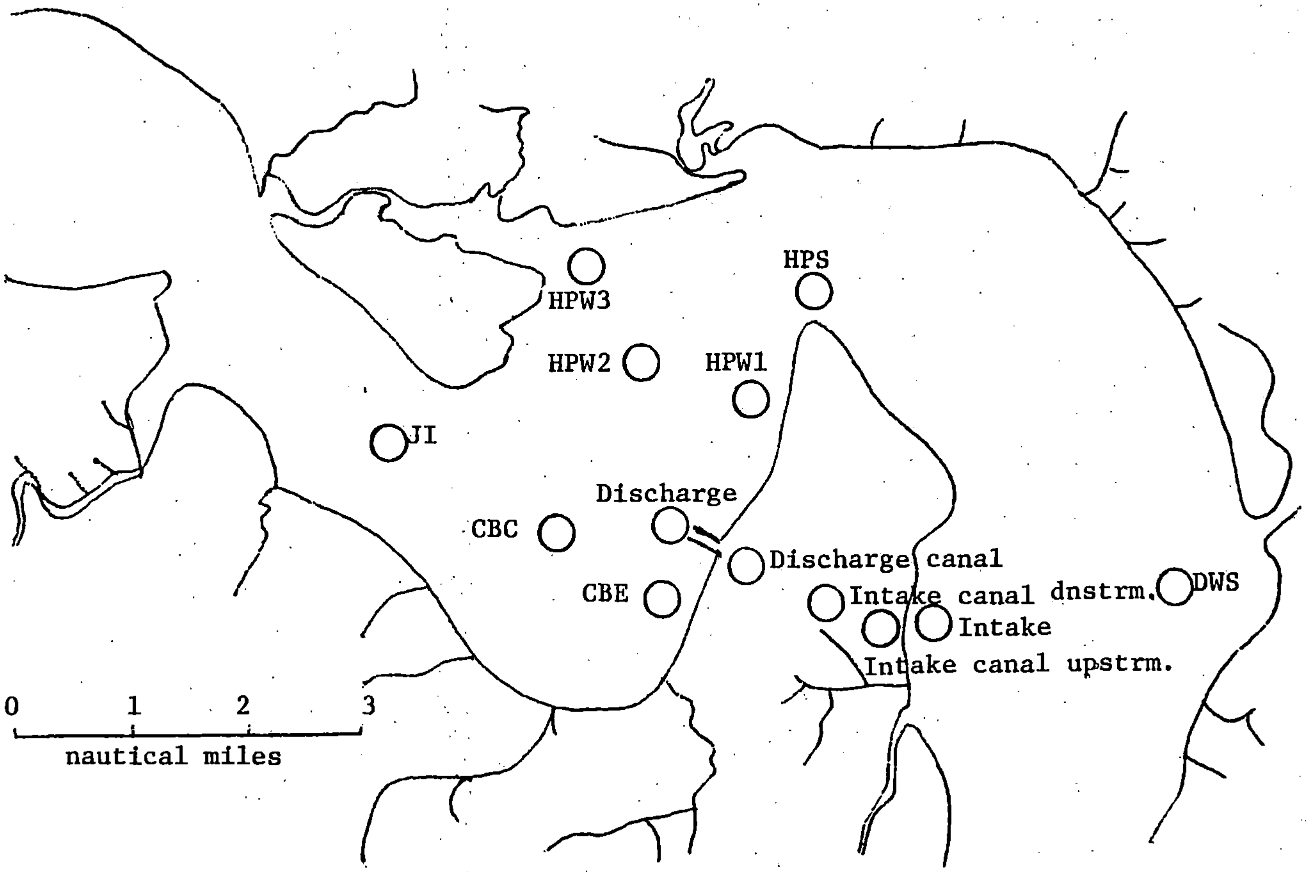

Figure 3. Plankton sampling stations

Table 2

Benthos and Fouling Plate Station Locations

Station	Depth (m)	Location
1	1.5	Off tower (QK Fl 38 ft.) near Cobham Wharf
2	2.5	Cobham Bay, off Chestnut Bluffs
3	1	Cobham Bay, between mouths of College Run and Lower Chippokes Creek
4	3	Center of Cobham Bay
5	3	Tower (QK Fl Lt "E")
6	1	In Thorofare off marker tower R "4"
7	1	Cobham Bay, off Gravel Neck
8	4	Tower (QK Fl Lt "F")
9	1	West of Hog Point
10	4	Between station 9 and black buoy "45"
11	5	Tower (QK Fl Lt "C")
12	.5	Off mouth of College Creek
13	1	East of Hog Point, on line with black and white buoy "J29"
14	6	Black and white buoy "J35"
15	1	Off power plant intake
16	2	Tower (QK Fl Lt "A")
DWS	2	Tower (QK Fl Lt "A")
CBN	2.5	Tower (QK Fl Lt "D")
CBS	3	Tower (QK Fl Lt "F")

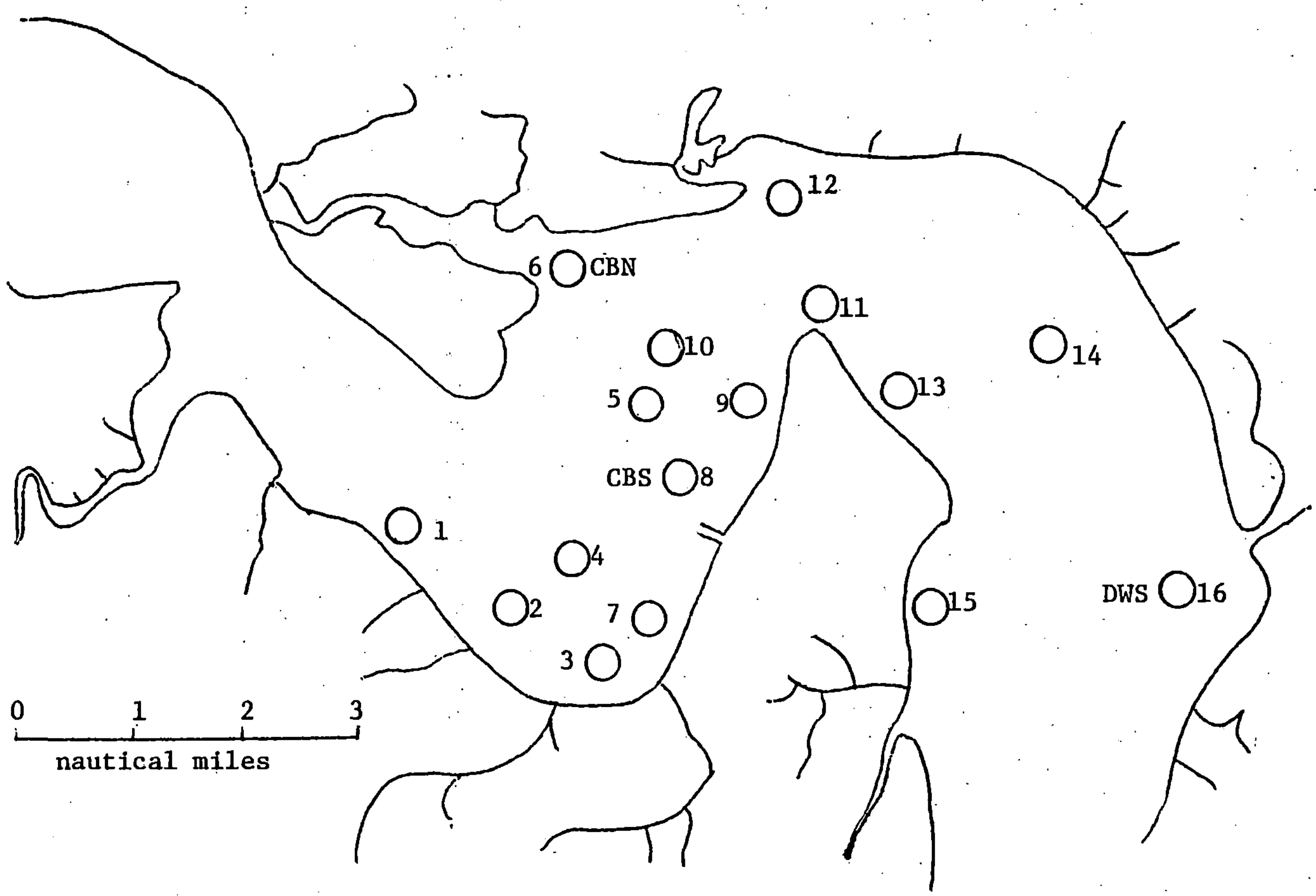

Figure 4. Benthos and fouling plate stations.

Zooplankton samples were taken with a 12.5 cm diameter Clarke-Bumpus quantitative sampler, equipped with a No. 20 (76µ pore size) net. Tow duration ranged from one minute to five minutes, depending on the turbidity conditions encountered. Samples were preserved with 5% buffered formalin, and counts and identifications were made using an Olympus dissecting microscope. Measurements of water temperature, salinity, dissolved oxygen, Secchi Disk transparency, and water depth accompanied each zooplankton tow.

Benthos was sampled with a .05 m^2 Ponar grab. The samples were sieved through 1.0 mm and 0.5 mm mesh screens, and the organisms were preserved in a formalin solution containing the stain Phloxine B. Counts and identifications were made under a dissecting microscope.

Fouling organisms were collected on 125 x 75 mm asbestos boards suspended in the river. Two pairs of horizontal and vertical fouling plates were suspended from a VEPCO instrument tower located at each station, one pair being replaced bi-monthly, the other pair yearly. The attached organisms were preserved by freezing, and were counted and identified under a dissecting microscope.

Temperature measurements were performed using a Hydrolab model RT-125 research thermometer equipped with a model L5 A50 thermistor probe. Salinity was measured on a Beckman model RS-7B salinometer. Dissolved oxygen concentrations were determined by the azide modification of the Winkler technique.

On June 29 a sediment sample was taken at each benthos sampling station for determination of particle size distribution and organic matter content. This was done in order to provide an updated basis for retaining or revising the station groupings employed in depicting the spatial distributions of the benthic organisms in relation to sediment type. The samples were taken with a K.B.® type heavy duty corer with a 20 inch (50.8 cm) long, 2 inch (5.08 cm) inside diameter core tube (Wildco Model 2400). The top 15 cm segment of each core was extruded in the field into a plastic bag and stored on ice. In the laboratory the contents of each bag were homogenized and approximately 10 g of the wet homogenate were weighed into a tared crucible for determination of organic content by loss on ignition. Ignition was performed for one hour at 500°C. A second aliquot of each wet homogenate was screened through a 63μ pore size sieve for separation into a sand fraction ($>63\mu$) and a silt-clay fraction ($<63\mu$). The relative oven dry weights (105°C) of these fractions were obtained. A third aliquot was wet sieved in the same manner. The sand fraction of this aliquot was dried (125°C) and its particle size distribution was obtained using the VIMS Rapid Sand Analyzer (Zeigler et al., 1960).

The particle size distribution of the fine particle fraction was obtained using a Coulter Counter model TA® (Coulter Electronics, Inc.). The fine and coarse size distributions were combined graphically, and from the graphs the sand, silt, and clay percentages for each benthos station were obtained.

Sampling Design

The sampling dates, stations, and biological parameters sampled are shown in Table 3. Phytoplankton and zooplankton samples for investigation of entrainment effects were taken in the intake and discharge canals by Surry Power Plant personnel. In all, eight complete plankton runs, including replicated sampling of surface phytoplankton, chlorophyll a, and zooplankton at ten river stations and of phytoplankton and zooplankton at three canal stations, were performed during the study year.

Benthos sampling was performed quarterly during the winter, spring, and fall, and monthly during the summer. Two samples were taken per station per sampling run.

All of the fouling plates were recovered on schedule in 1978. The annual plates were taken along with the bimonthly plates on June 29.

Data Presentation and Analysis

The raw data for each section of the study are presented in an appendix. Most of the plankton data have been subjected to an analysis of variance, followed by Student-Newman-Keuls' test (Steel and Torrie, 1960) to identify significant differences among sampling stations. Log or square root transformations were performed when necessary to normalize the data prior to analysis. Within the body of the report, data summaries are presented, which include parameter means and which depict differences that are significant at at least the .05 level.

Table 3

Summary of Biological Sampling Effort; sampling dates, stations sampled, and types of samples taken (Ph = phytoplankton, C = chlorophyll a, Z = zooplankton, B = benthos, F = fouling organisms)

Plankton Stations	Date (1978) 2 - 28	4 - 18	5 - 23	6 - 20	7 - 11	8 - 23	9 - 19	11 - 14
DWS	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z
Intake	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z
HPS	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z
HPW3	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z
HPW2	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z
HPW1	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z
Discharge	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z
CBE	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z
CBC	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z
JI	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z	Ph,C,Z
Intake Canal Upstrm.	Ph,Z	Ph,Z	Ph,Z	Ph,Z	Ph,Z	Ph,Z	Ph,Z	Ph,Z
Intake Canal Dnstrm.	Ph,Z	Ph,Z	Ph,Z	Ph,Z	Ph,Z	Ph,Z	Ph,Z	Ph,Z
Discharge canal	Ph,Z	Ph,Z	Ph,Z	Ph,Z	Ph,Z	Ph,Z	Ph,Z	Ph,Z

Table 3 (continued)

Benthos Stations	Date (1978) 1 - 18	4 - 10	6 - 13	7 - 12	8 - 7	10 - 18
1	B	B	B	B	B	B
2	B	B	B	B	B	B
3	B	B	B	B	B	B
4	B	B	B	B	B	B
5	B	B	B	B	B	B
6	B	B	B	B	B	B
7	B	B	B	B	B	B
8	B	B	B	B	B	B
9	B	B	B	B	B	B
10	B	B	B	B	B	B
11	B	B	B	B	B	B
12	B	B	B	B	B	B
13	B	B	B	B	B	B
14	B	B	B	B	B	B
15	B	B	B	B	B	B
16	B	B	B	B	B	B

Fouling Plate Stations	Date (1978) 2 - 28	5 - 3	6 - 29	8 - 23	10 - 18	12 - 29
DWS	F	F	F	F	F	F
CBN	F	F	F	F	F	F
CBS	F	F	F	F	F	F

The benthos data presented in this report include only the organisms recovered on the 1.0 mm mesh screen, which is the sieving device that was used in all preceding years of the study. The data for the 0.5 mm sieve organisms will be included in a subsequent compilation of the Surry study data.

Results - Plankton Studies

Data Presentation

The hydrographic data for the plankton sampling runs are presented in Appendix Table A1. The raw biological data are in appendix B, Table B1 (chlorophyll a) and Table B2 (total phytoplankton cell counts). The river tidal and water temperature conditions on the plankton sampling dates are summarized in Table 4, while the phytoplankton and zooplankton analysis of variance results are presented in Tables 5-20.

Phytoplankton Distribution Patterns

On the phytoplankton ANOVA summary tables (Tables 5-12) station means for chlorophyll a, total cell counts, and individual species cell counts are listed in ascending order. Means not sharing an underline are significantly different at the .05 level according to Student-Newman-Keuls' test.

Many of the significant differences detected by the variance analyses could be attributed to longitudinal gradients of phytoplankton abundance in the segment of the James River included in the study. Species that were most abundant toward the downstream limit of the study area included *Skeletonema costatum*, *Chaetoceros* sp., and *Asterionella japonica* in February; *Skeletonema costatum* and *Rhizosolenia minima* in June; *Cyclotella meneghiniana* in July; and *Skeletonema costatum* in August. The opposite longitudinal pattern was exhibited by *Melosira subsalsa* in May, *Melosira* sp. in July, and *Skeletonema costatum* in September.

Table 4

Environmental Conditions During Plankton Sampling Runs, 1978

Date	Tide	Surface Salinity Range (°/oo)	Discharge Temp. minus Intake Temp. (°C)	Discharge Surface Temp. (°C)	No. of Power Plant Units Operating	Stations Affected by Plume
Feb. 28	LWS-Flood	.37- 2.89	8.8	12.70	2	CBE,CBC,HPW1,HPS
Apr. 18	Ebb	.08- 2.64	7.0	21.20	2	HPW1,HPS, HPW2
May 23	Flood	.07- .34	6.4	28.10	1	CBE,CBC,HPW1
June 20	Flood	.73- 3.35	5.9	32.35	1	CBE,HPW1
July 11	Flood	1.24- 5.29	5.4	32.20	1	CBE,HPW1,HPS
Aug. 23	Flood	1.24- 6.21	9.0	37.50	2	CBE,CBC,HPW1,HPS
Sept. 19	Flood	3.95- 8.47	8.6	34.70	2	CBE,CBC,HPW1
Nov. 14	Flood	6.99-11.33	8.1	23.30	2	CBE,CBC,HPW1

In addition to longitudinal gradients, there were also distributions showing maximum abundance at one or two individual stations in the study area. For example, Katodinium rotundatum and the 16 µ Chroomonas sp. were most numerous at DWS in February, the Cyclotella meneghiniana population density was highest at DWS in June, and the 2 µ flagellate was most abundant at CBE in July.

In the cooler months of the year, the Surry Power Station affected the phytoplankton community in the vicinity of the discharge mainly by contributing organisms transported from the intake area. This pattern was apparent for Skeletonema costatum in February, Nitzschia vermicularis in April, and Amphiprora sp. in November. This type of transport also occurred in the summer, for Gyrosigma sp. in August and September. In these two months there were also species that declined in abundance or actually disappeared from the cooling water as it flowed from the intake to the discharge canal mouth. The two species of Chroomonas showed this pattern in both months; Katodinium rotundatum and the 3 µ flagellate showed losses in September. No similar declines were exhibited by these species in November.

One organism, that occurred in the study for the first time in the 1978 samples, appeared to originate in the embayment at the upper end of the intake canal. It was observed in the August and September canal samples, and is designated as a 2.5 µ flagellate in Tables 10 and 11. It was probably a zoospore or gamete released by algae attached to the intake canal walls.

Zooplankton Distribution Patterns

The zooplankton ANOVA results appear in Tables 13-20. As with the phytoplankton results, population density means are listed in ascending order, and means that are not significantly different (.05 level) are joined by underlines.

In most of the sampling months, but particularly in September and November, there were species that were distributed uniformly, according to the statistical test, throughout the study area. Most of the distributions that were not uniform involved longitudinal gradients of population densities within the study area. These included higher population densities toward the upstream limit of the study area: *Bosmina* sp. in February; *Eurytemora* sp., *Acartia* sp., cyclopoid copepods, and *Bosmina* sp. in April; copepod nauplii, rotifers, and *Bosmina* sp. in May; copepod nauplii, cyclopoid copepods, *Bosmina* sp., and other cladocerans in June; *Bosmina* sp. in July; and cyclopoid copepods, *Bosmina* sp., and other cladocerans in August. Distributions in which higher population densities appeared at the downstream-most stations were observed for copepod nauplii and barnacle nauplii in April, barnacle nauplii and polychaete larvae in May, and barnacle nauplii in August. In addition, two atypical longitudinal distributions appeared: rotifers in June were more abundant at the upstream-most and downstream-most stations than at intermediate stations, and copepod nauplii in February, and copepod nauplii and polychaete larvae in July were most abundant at intermediate stations.

The power plant influenced the composition of the zooplankton on the discharge side of Hog Point mainly by introducing water richer or poorer in a certain species than the receiving water. Organisms that were transported through the cooling water canal system from an area of high population density at the power plant intake into an area of lower population density near the discharge included barnacle nauplii in July and polychaete larvae in February, April, June, and August. There was an apparent production of barnacle nauplii in the canal system in May, June, and November. In two of the sampling months there was an apparent reduction in numbers of a particular species in the water passing through the canals: copepod nauplii in August and *Acartia* sp. in September. In areas of the river beyond the readily indentifiable cooling water plume, however, these power plant effects became rapidly obscured by the natural upstream-downstream variations in zooplankton population densities that are typical of the study area.

Table 5

James River Phytoplankton ANOVA Summary 2-28-78

Parameters	Stations and Means (Stations not sharing an underline are significantly different, $\alpha \leq .05$)												
Chl *a* ($\mu g \cdot l^{-1}$)	CBE	HPW1	CBC	JI	HPS	HPW3	HPW2	DWS	INT	Dis.			
	1.5	1.7	1.7	1.8	1.8	2.0	2.1	2.3	2.3	3.0			
Total cells ($cells \cdot ml^{-1}$)	HPW2	HPW3	JI	CBC	HPW1	CBE	HPS	DWS	INT	ICU	DC	ICD	Dis.
	127	157	192	235	352	356	397	474	721	871	1061	1166	1296
8 μ *Chroomonas* sp. ($cells \cdot ml^{-1}$)	Dis.	CBC	HPW2	HPS	DWS	HPW3	CBE	INT	JI	HPW1	DC	ICD	ICU
	7	9	10	11	12	15	15	16	18	22	23	24	24
16 μ *Chroomonas* sp. ($cells \cdot ml^{-1}$)	HPW2	JI	ICU	HPW3	ICD	DC	CBE	HPS	INT	Dis.	CBC	HPW1	DWS
	1	2	2	4	4	4	5	6	7	8	8	9	28
Katodinium rotundatum ($cells \cdot ml^{-1}$)	HPW3	HPW2	JI	HPS	DC	CBC	HPW1	Dis.	ICU	INT	CBE	ICD	DWS
	0	0	1	7	7	8	11	11	12	13	14	14	47
Cyclotella sp.[1] ($cells \cdot ml^{-1}$)	CBE	JI	ICD	CBC	HPW1	DWS	HPS	ICU	DC	INT	HPW3	HPW2	Dis.
	0	0	1	2	3	4	5	5	5	6	9	11	11
Cyclotella meneghiniana ($cells \cdot ml^{-1}$)	HPW2	HPW3	DWS	HPS	Dis.	INT	HPW1	CBE	CBC	DC	ICD	ICU	JI
	0	1	2	2	2	3	3	4	8	8	9	10	10
Cyclotella sp.[2] ($cells \cdot ml^{-1}$)	ICU	ICD	DWS	INT	DC	HPS	CBE	CBC	Dis.	HPW1	HPW3	JI	HPW2
	4	5	6	8	8	9	11	11	12	14	15	15	28
Skeletonema costatum ($cells \cdot ml^{-1}$)	HPW2	HPW3	JI	CBC	HPW1	CBE	HPS	INT	ICU	DWS	DC	ICD	Dis.
	44	80	86	121	192	225	296	507	610	703	791	954	1051
Chaetoceros sp. ($cells \cdot ml^{-1}$)	HPW2	HPW3	JI	HPS	CBC	CBE	HPW1	INT	Dis.	ICU	ICD	DC	DWS
	2	5	5	20	21	34	41	76	89	105	109	119	137

Table 5 (cont.)

James River Phytoplankton ANOVA Summary 2-28-78

Parameters	Stations and Means (Stations not sharing an underline are significantly different, $\alpha \leq .05$)												
Asterionella japonica (cells·ml^{-1})	HPW3	HPW2	JI	CBC	CBE	DWS	HPS	DC	HPW1	INT	ICD	ICU	Dis.
	0	0	0	3	4	6	6	7	8	14	19	25	36
Ankistrodesmus sp. (cells·ml^{-1})	HPW3	INT	HPW1	Dis.	DC	HPW2	ICU	HPS	CBC	CBE	JI	ICD	DWS
	0	1	1	1	1	3	4	5	5	6	6	6	8
Cryptomonas sp. (cells·ml^{-1})	DWS	CBE	HPW3	HPW1	HPS	INT	ICU	CBC	ICD	Dis.	DC	JI	HPW2
	0	0	1	1	2	2	2	3	3	3	5	6	11

Table 6

James River Phytoplankton ANOVA Summary 4-18-78

Stations and Means
(Stations not sharing an underline are significantly different, $\alpha \leq .05$)

Parameters													
Chl *a* ($\mu g \cdot l^{-1}$)	HPW1	DWS	CBE	HPW3	HPS	CBC	JI	HPW2	Dis.	INT			
	1.2	1.2	1.4	1.5	1.8	1.8	2.0	2.2	2.6	2.6			
Total Cells ($cells \cdot ml^{-1}$)	HPW2	HPW1	DC	ICD	CBE	DWS	ICU	CBC	JI	INT	HPS	HPW3	Dis.
	698	698	736	776	828	912	1189	1190	1280	1318	1383	1383	1576
8 μ *Chroomonas* sp. ($cells \cdot ml^{-1}$)	Dis.	CBC	JI	HPW1	CBE	HPS	HPW2	DWS	DC	ICD	IC U	HPW3	INT
	26	26	26	39	39	52	64	78	78	78	90	90	232
16 μ *Chroomonas* sp. ($cells \cdot ml^{-1}$)	HPW2	CBE	HPW3	HPW1	CBC	JI	Dis.	DWS	DC	HPS	ICD	ICU	INT
	0	0	13	13	13	13	26	32	52	90	90	104	129
5 μ Cryptophyte ($cells \cdot ml^{-1}$)	HPW1	DC	INT	HPW2	ICU	ICD	DWS	JI	Dis.	CBE	CBC	HPS	HPW3
	52	52	104	116	130	130	148	181	232	246	258	284	375
Melosira subsalsa ($cells \cdot ml^{-1}$)	JI	HPS	HPW2	HPW1	CBE	HPW3	DWS	ICU	CBC	INT	ICD	DC	Dis.
	26	52	64	64	64	90	116	116	130	155	168	207	232
Cyclotella meneghiniana ($cells \cdot ml^{-1}$)	INT	CBE	DWS	Dis.	HPS	DC	ICD	ICU	HPW2	HPW1	HPW3	CBC	JI
	0	0	26	52	64	78	90	103	129	129	142	206	284
Nitzschia kützingiana ($cells \cdot ml^{-1}$)	DWS	ICU	ICD	DC	CBE	INT	HPW1	HPW2	Dis.	HPW3	HPS	JI	CBC
	39	78	78	90	103	104	129	130	130	181	207	298	336
Nitzschia vermicularis ($cells \cdot ml^{-1}$)	HPW2	HPW3	CBE	CBC	JI	DWS	DC	HPW1	HPS	ICU	INT	ICD	Dis.
	0	0	0	0	0	.5	4	6	7	7	11	11	17
Ankistrodesmus sp. ($cells \cdot ml^{-1}$)	CBE	CBC	ICD	DC	HPW2	INT	JI	HPS	HPW3	DWS	ICU	HPW1	Dis.
	13	13	13	13	39	52	65	78	90	91	155	156	232
3 μ Flagellate ($cells \cdot ml^{-1}$)	DWS	ICD	DC	HPS	HPW1	HPW2	INT	ICU	HPW3	CBC	CBE	JI	Dis.
	13	13	26	39	39	52	78	78	90	90	104	129	207

Table 7

James River Phytoplankton ANOVA Summary 5-23-78

Parameters	Stations and Means (Stations not sharing an underline are significantly different, $\alpha \leq .05$)												
Chl *a* ($\mu g \cdot l^{-1}$)				CBE	HPW1	Dis.	INT	JI	CBC	DWS	HPS	HPW2	HPW3
				5.9	6.9	7.0	7.2	8.5	8.8	10.2	10.4	13.0	15.7
Total cells ($cells \cdot ml^{-1}$)	DC	Dis.	ICD	ICU	HPW1	HPS	INT	CBE	DWS	CBC	HPW2	JI	HPW3
	3671	3891	4292	4589	4602	4654	4977	5158	5868	6050	7962	8260	15,175
8μ *Chroomonas* sp. ($cells \cdot ml^{-1}$)	HPS	DC	CBC	ICU	DWS	ICD	HPW2	INT	Dis.	JI	HPW1	HPW3	CBE
	110	181	207	207	233	298	310	362	375	400	414	530	568
20μ Cryptomonas ($cells \cdot ml^{-1}$)	DC	HPW3	ICU	DWS	Dis.	HPW2	INT	ICD	HPS	CBE	JI	HPW1	CBC
	0	13	13	26	26	52	78	78	78	104	104	116	130
5μ Cryptophyte ($cells \cdot ml^{-1}$)	Dis.	DC	HPW3	ICU	CBE	JI	ICD	HPS	DWS	INT	HPW2	CBC	HPW1
	18	18	36	55	73	74	91	91	110	128	128	128	146
Melosira subsalsa ($cells \cdot ml^{-1}$)	Dis.	ICU	INT	DC	ICD	HPW1	HPS	CBE	DWS	CBC	HPW2	JI	HPW3
	1616	1628	1732	1771	2055	2172	2508	2702	3322	3916	5688	6024	12,604
Nitzschia kützingiana ($cells \cdot ml^{-1}$)	JI	Dis.	CBE	CBC	HPW3	DC	HPW1	DWS	HPS	HPW2	ICD	INT	ICU
	543	608	620	698	736	788	866	918	918	995	1124	1512	1797
Cyclotella meneghiniana ($cells \cdot ml^{-1}$)	ICU	ICD	HPS	DC	JI	INT	HPW2	Dis.	CBC	CBE	HPW3	HPW1	DWS
	272	362	388	400	517	543	633	686	698	711	724	736	853

Table 8

James River Phytoplankton ANOVA Summary 6-20-78

Parameters	Stations and Means (Stations not sharing an underline are significantly different, $\alpha \leq .05$)												
Chl *a* ($\mu g \cdot l^{-1}$)				HPW2	Dis.	CBE	HPW1	CBC	HPW3	DWS	JI	INT	HPS
				2.8	3.7	3.8	3.8	3.8	4.1	5.1	5.4	6.2	7.0
Total cells ($cells \cdot ml^{-1}$)	HPS	DC	ICD	Dis.	CBC	HPW3	HPW2	HPW1	DWS	CBE	ICU	INT	JI
	1332	1344	1460	1784	1848	1848	1862	2443	2921	3116	3180	3244	3374
8μ *Chroomonas* sp. ($cells \cdot ml^{-1}$)	DC	ICD	HPS	Dis.	INT	HPW2	ICU	HPW3	DWS	CBC	HPW1	CBE	JI
	181	194	246	259	375	466	478	492	517	672	802	1034	1318
Melosira subsalsa ($cells \cdot ml^{-1}$)	ICD	Dis.	HPS	CBC	INT	HPW1	HPW2	DWS	ICU	DC	HPW3	CBE	JI
	0	52	104	142	142	155	156	156	194	194	349	362	362
Skeletonema costatum ($cells \cdot ml^{-1}$)	HPW3	CBC	JI	CBE	DWS	DC	ICD	HPS	HPW1	Dis.	HPW2	INT	ICU
	0	0	0	13	52	65	90	104	130	246	246	426	568
Cyclotella meneghiniana ($cells \cdot ml^{-1}$)	HPS	CBC	Dis.	DC	ICD	HPW2	HPW3	HPW1	INT	CBE	ICU	JI	DWS
	194	323	388	426	517	543	582	595	698	840	892	995	1577
Nitzschia kützingiana ($cells \cdot ml^{-1}$)	DC	DWS	JI	HPW1	CBE	ICD	Dis.	CBC	HPW2	ICU	HPW3	HPS	INT
	64	129	142	155	168	194	220	232	246	258	272	298	414
Rhizosolenia minima ($cells \cdot ml^{-1}$)	JI	HPW3	CBC	HPW2	HPW1	DWS	DC	CBE	HPS	Dis.	ICD	ICU	INT
	0	13	13	90	194	130	155	181	181	388	414	478	556
3μ Flagellate ($cells \cdot ml^{-1}$)	DWS	HPS	HPW3	HPW2	Dis.	CBE	ICU	JI	ICD	CBC	DC	INT	HPW1
	0	13	13	13	26	26	26	39	39	52	52	78	90

Table 9

James River Phytoplankton ANOVA Summary 7-11-78

Parameters	Stations and Means (Stations not sharing an underline are significantly different, α ≤.05)												
Chl a ($\mu g \cdot l^{-1}$)	Dis.	JI	CBE	CBC	HPS	HPW1	HPW2	Int.	HPW3	DWS			
	5.6	6.3	6.8	7.6	7.8	8.0	8.6	9.0	11.0	11.3			
Total cells ($cells \cdot ml^{-1}$)	ICD	DC	Dis.	CBC	JI	CBE	ICU	HPW2	HPW1	HPS	Int.	HPW3	DWS
	4373	5512	5746	5980	6074	6463	6968	7522	7779	7909	8314	9311	10705
8 μ Chroomonas sp. ($cells \cdot ml^{-1}$)	Int.	DC	ICU	Dis.	HPW3	HPS	HPW2	ICD	HPW1	CBE	DWS	JI	CBC
	233	388	388	388	414	440	492	517	646	698	698	750	776
16 μ Chroomonas sp. ($cells \cdot ml^{-1}$)	JI	CBC	HPW3	Int.	HPS	Dis.	ICD	DC	ICU	HPW2	DWS	HPW1	CBE
	0	52	78	78	129	129	155	181	181	181	258	272	284
Pyramimonas sp. ($cells \cdot ml^{-1}$)	Dis.	ICD	DC	CBE	CBC	HPW3	Int.	JI	DWS	ICU	HPW2	HPW1	HPS
	0	0	0	26	103	129	155	181	207	207	232	284	388
Skeletonema costatum ($cells \cdot ml^{-1}$)	CBE	DC	JI	CBC	ICD	HPW1	Dis.	HPS	HPW2	ICU	Int.	DWS	HPW3
	268	600	634	857	926	1053	1170	1332	1602	1926	2808	2872	2958
Cyclotella meneghiniana ($cells \cdot ml^{-1}$)	HPW3	ICD	JI	Dis.	HPS	DC	CBC	HPW1	CBE	HPW2	ICU	DWS	Int.
	542	543	568	594	672	698	698	750	904	905	1215	1293	1422
Melosira subsalsa ($cells \cdot ml^{-1}$)	Int.	HPW2	Dis.	ICU	ICD	DC	CBC	DWS	HPS	CBE	HPW1	JI	HPW3
	0	0	0	0	0	0	1008	1086	1163	1525	1551	1732	2301
Melosira sp. ($cells \cdot ml^{-1}$)	DWS	Int.	HPW2	Dis.	ICU	ICD	DC	CBE	HPW1	HPS	CBC	JI	HPW3
	0	0	0	0	0	0	0	58	108	155	394	502	524

Table 9 (cont.)

James River Phytoplankton ANOVA Summary 7-11-78

Parameters	Stations and Means (Stations not sharing an underline are significantly different, α ≤.05)												
Rhizosolenia minima (cells·ml^{-1})	JI	CBC	HPW2	Dis.	HPW3	DC	ICD	Int.	ICU	CBE	DWS	HPS	HPW1
	129	284	310	465	465	646	647	698	724	1112	1215	1318	1576
Amphiprora sp. (cells·ml^{-1})	CBE	JI	DWS	HPW2	HPS	ICU	Dis.	CBC	DC	ICD	Int.	HPW1	HPW3
	0	0	2	4	4	5	5	6	7	8	10	12	13
3 μ Flagellate (cells·ml^{-1})	HPW1	CBE	CBC	HPW3	DWS	HPW2	ICD	JI	HPS	ICU	Int.	DC	Dis.
	0	0	0	26	52	52	78	130	155	1603	1784	2172	2172
2 μ Flagellate (cells·ml^{-1})	ICD	Int.	HPW1	ICU	DC	HPW3	DWS	Dis.	JI	CBC	HPW2	HPS	CBE
	130	155	194	258	259	310	336	362	388	543	543	543	956

Table 10

James River Phytoplankton ANOVA Summary 8-23-78

Parameters — Stations and Means
(Stations not sharing an underline are significantly different, $\alpha \leq .05$)

Parameters													
Chl *a* ($\mu g \cdot l^{-1}$)				Dis.	CBC	DWS	JI	HPW1	HPW3	INT	HPW2	CBE	HPS
				3.8	3.8	4.3	5.5	5.9	5.9	6.0	6.1	6.4	6.5
Total cells ($cells \cdot ml^{-1}$)	Dis.	DWS	DC	ICD	ICU	JI	INT	HPS	HPW3	HPW1	CBC	CBE	HPW2
	2212	2496	2516	2994	3064	4251	4436	4666	4674	5490	6070	6218	6702
8μ *Chroomonas* sp. ($cells \cdot ml^{-1}$)	Dis.	DC	ICU	DWS	HPS	HPW1	INT	ICD	JI	HPW2	CBE	HPW3	CBC
	0	13	65	116	116	155	168	194	220	258	272	298	646
16μ *Chroomonas* sp. ($cells \cdot ml^{-1}$)	Dis.	HPW3	HPW2	CBC	DC	JI	HPS	HPW1	CBE	ICD	DWS	ICU	INT
	13	26	26	26	39	52	64	65	78	90	129	168	246
Pyramimonus sp. ($cells \cdot ml^{-1}$)	JI	CBC	CBE	DC	HPW2	HPW1	Dis.	HPS	HPW3	DWS	ICD	ICU	INT
	0	39	64	90	103	103	116	142	168	181	194	582	594
Skeletonema costatum ($cells \cdot ml^{-1}$)	CBE	CBC	JI	DWS	HPW2	ICD	Dis.	DC	HPW1	HPW3	INT	HPS	ICU
	307	476	593	691	724	770	804	1016	1066	1158	1192	1292	1374
Gyrosigma sp. ($cells \cdot ml^{-1}$)	HPW2	CBE	JI	CBC	HPW1	HPS	HPW3	Dis.	DC	DWS	ICD	ICU	INT
	0	.50	.50	2	3	4	4	4	5	6	9	12	17
Cyclotella meneghiniana ($cells \cdot ml^{-1}$)	DC	HPW3	ICD	DWS	INT	HPW2	Dis.	ICU	HPS	JI	CBC	HPW1	CBE
	13	26	52	104	104	104	116	130	207	220	272	478	504
Nitzschia sp. ($cells \cdot ml^{-1}$)	DWS	JI	HPS	Dis.	ICU	DC	ICD	HPW2	HPW1	INT	CBC	HPW3	CBE
	26	26	39	78	78	78	78	103	116	142	142	156	168
2μ Flagellate ($cells \cdot ml^{-1}$)	HPW3	JI	DC	CBC	ICD	DWS	HPS	Dis.	HPW2	HPW1	INT	CBE	ICU
	0	0	52	64	116	116	155	155	181	272	284	349	828

Table 10 (continued)

James River Phytoplankton ANOVA Summary 8-23-78

Parameters	Stations and Means (Stations not sharing an underline are significantly different, α ≤.05)												
3µ Flagellate (cells·ml^{-1})	JI	DWS	CBE	CBC	HPW1	HPW2	HPS	HPW3	ICU	Dis.	INT	DC	ICD
	0	13	13	13	39	90	207	246	272	710	711	866	878
12µ Flagellate (cells·ml^{-1})	DC	DWS	Dis.	ICU	INT	ICD	JI	CBC	CBE	HPW1	HPW2	HPS	HPW3
	0	13	13	39	116	116	220	310	400	492	556	569	634
2.5µ Flagellate (cells·ml^{-1})	DWS	INT	HPS	HPW3	HPW2	HPW1	Dis.	CBE	CBC	JI	DC	ICD	ICU
	0	0	0	0	0	0	0	0	0	0	324	762	15,214

Table 11

James River Phytoplankton ANOVA Summary 9-19-78

Parameters	Stations and Means (Stations not sharing an underline are significantly different, $\alpha \leq .05$)												
Chl *a* ($\mu g \cdot l^{-1}$)	DWS	HPW2	HPW1	CBE	CBC	HPS	JI	Int.	Dis.	HPW3			
	1.7	1.8	2.0	2.5	2.6	2.6	2.8	3.2	3.3	3.7			
Total cells ($cells \cdot ml^{-1}$)	DC	HPS	HPW2	CBC	Dis.	ICD	DWS	CBE	HPW1	JI	HPW3	ICU	Int.
	880	1270	1286	1378	1524	1567	1774	1883	1894	2034	2143	2804	3643
8 μ *Chroomonas* sp. ($cells \cdot ml^{-1}$)	CBC	JI	DC	HPS	HPW3	HPW2	Dis.	ICD	HPW1	DWS	ICU	CBE	Int.
	103	142	155	155	155	181	232	258	336	356	388	414	853
16 μ *Chroomonas* sp. ($cells \cdot ml^{-1}$)	ICD	DC	Dis.	HPS	ICU	CBC	HPW3	HPW2	CBE	JI	HPW1	Int.	DWS
	0	0	0	13	26	39	65	78	90	104	129	181	181
5 μ Cryptophyte ($cells.ml^{-1}$)	JI	CBE	DC	HPS	HPW1	CBC	ICD	HPW3	HPW2	Dis.	ICU	DWS	Int.
	26	39	52	52	52	90	104	116	129	129	129	181	517
Pyramimonas sp. ($cells \cdot ml^{-1}$)	DC	HPS	CBC	ICD	Dis.	JI	HPW2	HPW1	HPW3	DWS	Int.	ICU	CBE
	0	26	26	78	78	90	116	130	130	136	155	284	336
Katodinium rotundatum ($cells \cdot ml^{-1}$)	ICU	DC	ICD	Dis.	HPS	CBC	HPW2	HPW1	DWS	CBE	JI	Int.	HPW3
	0	26	26	26	39	52	103	116	207	272	336	362	375
Skeletonema costatum ($cells \cdot ml^{-1}$)	DC	ICD	ICU	Dis.	Int.	DWS	HPW2	CBE	HPW1	HPS	CBC	HPW3	JI
	11	30	39	47	114	155	246	298	440	466	582	853	918
Nitzschun longissima ($cells \cdot ml^{-1}$)	HPW3	JI	HPW1	CBC	CBE	DWS	HPW2	HPS	Int.	DC	ICD	Dis.	ICU
	4	13	16	90	90	116	129	155	258	310	336	440	672
Gyrosigma sp. ($cells \cdot ml^{-1}$)	JI	HPW3	CBE	HPW1	CBC	HPW2	HPS	DC	ICD	ICU	Dis.	DWS	Int.
	1.5	10	12	14	18	24	41	61	63	76	78	84	232

Table 11 (cont.)

James River Phytoplankton ANOVA Summary 9-19-78

Parameters	Stations and Means (Stations not sharing an underline are significantly different, $\alpha \leq .05$)												
3 μ Flagellate (cells·ml^{-1})	Dis.	HPS	CBC	HPW2	DWS	DC	CBE	JI	HPW3	HPW1	ICD	ICU	Int.
	0	39	52	64	65	78	90	90	104	116	181	336	362
Gymnodinium sp. (cells·ml^{-1})	HPW3	CBC	JI	HPW1	HPW2	DC	CBE	ICD	HPS	Dis.	ICU	DWS	Int.
	.5	2	4	6	7	7	9	10	14	24	39	74	76
2.5 μ Flagellate (cells·ml^{-1})	DWS	Int.	HPS	HPW3	HPW2	HPW1	CBE	CBC	JI	DC	ICD	Dis.	ICU
	0	0	0	0	0	0	0	0	0	646	1137	1732	2792

Table 12

James River Phytoplankton ANOVA Summary 11-14-78

Stations and Means
(Stations not sharing an underline are significantly different, α ≤.05)

Parameters													
Chl a (μg·l^{-1})	DWS	HPW2	HPW1	CBE	CBC	HPS	JI	Int.	Dis.	HPW3			
	1.7	1.8	2.0	2.5	2.6	2.6	2.8	3.2	3.3	3.7			
Total Cells (cells.ml^{-1})	HPW3	HPW2	CBE	HPW1	ICD	DC	Dis.	HPS	JI	ICU	CBC	Int.	DWS
	569	814	846	853	853	853	904	924	938	950	996	1022	1164
8 μ Chroomonas sp. (cells·ml^{-1})	HPW1	HPW3	CBE	HPS	JI	DC	HPW2	Dis.	ICD	DWS	Int.	ICU	CBC
	84	90	97	103	110	110	116	129	129	155	168	181	207
16 μ Chroomonas sp. (cells·ml^{-1})	HPW1	HPW3	HPS	HPW2	CBC	CBE	DC	ICD	Int.	JI	Dis.	ICU	DWS
	58	97	110	122	142	148	148	174	194	206	213	226	349
5 μ Cryptophyte (cells·ml^{-1})	Int.	HPW3	ICD	CBE	ICU	DC	JI	Dis.	HPS	HPW2	DWS	HPW1	CBC
	20	58	65	71	71	71	78	104	110	129	142	174	188
Pyramimonas sp. (cells·ml^{-1})	HPW1	Dis.	HPW3	HPW2	ICD	HPS	DWS	CBC	Int.	JI	ICU	CBE	DC
	6	20	26	26	26	32	46	46	52	58	58	97	97
Katodinium rotundatum (cells·ml^{-1})	HPS	HPW3	HPW2	ICU	CBE	CBC	DWS	DC	ICD	Dis.	JI	Int.	HPW1
	0	0	13	13	20	20	26	32	46	52	71	78	116
Skeletonema costatum (cells·ml^{-1})	HPS	HPW2	HPW3	HPW1	CBC	CBE	JI	ICD	Int.	DWS	ICU	DC	Dis.
	6	6	26	26	26	48	52	58	58	71	71	90	155
Nitzschia longissima (cells·ml^{-1})	CBE	CBC	HPW1	DC	Dis.	DWS	HPW2	JI	ICU	ICD	HPW3	Int.	HPS
	20	20	26	39	46	52	78	84	84	84	129	148	168
Amphiprora sp. (cells.ml^{-1})	HPW1	CBE	HPW3	JI	CBC	HPW2	HPS	DWS	Dis.	DC	ICU	ICD	Int.
	0	0	1	1	2	2	2	3	4	4	5	5	6
3 μ Flagellate (cells·ml^{-1})	HPW3	ICD	Int.	ICU	Dis.	DC	HPS	DWS	HPW2	CBC	JI	HPW1	CBE
	20	32	39	52	58	84	116	129	181	181	200	238	272

Table 13

James River Zooplankton ANOVA Summary 2-28-78

Parameters	Stations and Means (Stations not sharing an underline are significantly different, α ≤.05)												
Copepod nauplii (No./100 l)	CBE	ICU	INT	JI	DC	DWS	HPW2	CBC	ICD	Dis.	HPW3	HPS	HPW1
	67	100	113	117	128	131	134	161	173	196	272	282	413
Barnacle nauplii (No./100 l)	CBE	DC	ICU	INT	HPW2	JI	HPW1	CBC	DWS	ICD	HPW3	Dis.	HPS
	5	5	9	9	9	10	11	12	13	16	17	18	20
Polychaete larvae (No./100 l)	JI	HPW2	CBE	CBC	HPW3	DWS	HPW1	ICU	DC	HPS	Dis.	INT	ICD
	3	5	19	22	23	24	50	60	62	62	69	72	88
Eurytemora sp. (No./100 l)	CBE	HPS	HPW2	JI	INT	HPW1	Dis.	CBC	DC	HPW3	ICU	DWS	ICD
	6	12	18	24	24	26	30	33	33	36	39	46	54
Acartia sp. (No./100 l)	HPS	INT	CBE	CBC	DWS	HPW2	JI	HPW1	HPW3	Dis.	ICU	DC	ICD
	0	.6	.7	.8	.8	2	2	3	4	6	7	9	28
Harpacticoid copepods (No./100 l)	CBE	DC	HPW2	JI	Dis.	INT	HPS	CBC	HPW1	DWS	HPW3	ICD	ICU
	0	0	.6	2	4	5	5	5	5	6	8	9	12
Cyclopoid copepods (No./100 l)	DC	HPS	CBE	HPW2	JI	Dis.	INT	CBC	ICU	HPW1	ICD	HPW3	DWS
	0	2	3	4	5	7	7	7	9	10	14	16	26
Rotifers (No./100 l)	DWS	CBE	INT	CBC	HPW2	HPS	JI	Dis.	ICD	HPW3	DC	ICU	HPW1
	0	6	9	10	16	16	24	30	39	39	40	46	48
Bosmina sp. (No./100 l)	DWS	INT	Dis.	ICD	CBE	HPW2	HPS	DC	CBC	HPW3	ICU	HPW1	JI
	0	0	0	0	.7	1	2	2	2	3	4	4	4

Table 14

James River Zooplankton ANOVA Summary 4-18-78

Parameters	Stations and Means (Stations not sharing an underline are significantly different, α ≤.05)												
Copepod nauplii (No./100 l)	JI	HPW3	HPW1	CBE	DC	CBC	HPW2	DWS	HPS	INT	Dis.	ICU	ICD
	472	523	699	808	1097	1484	1592	1620	1902	2051	2291	4454	4795
Barnacle nauplii (No./100 l)	JI	DC	CBE	CBC	HPW3	HPW1	ICD	Dis.	HPW2	ICU	DWS	HPS	INT
	5	12	34	57	73	74	114	122	172	174	210	288	360
Polychaete larvae (No./100 l)	DWS	DC	HPW2	JI	HPS	Dis.	CBE	HPW1	ICU	CBC	ICD	HPW3	INT
	.65	36	40	44	67	71	97	106	107	111	149	167	189
Eurytemora sp. (No./100 l)	CBE	DC	Dis.	DWS	HPW1	INT	HPS	HPW2	ICU	CBC	HPW3	ICD	JI
	74	130	153	175	225	234	315	377	406	465	469	522	632
Acartia sp. (No./100 l)	CBE	DC	Dis.	DWS	INT	ICD	HPW2	HPS	ICU	JI	HPW1	CBC	HPW3
	13	15	20	36	43	51	62	66	68	76	82	87	124
Harpacticoid copepods (No./100 l)	CBE	JI	CBC	HPW3	DWS	INT	ICU	Dis.	DC	HPW1	HPW2	HPS	ICD
	6	18	18	26	26	33	38	50	52	71	125	129	557
Cyclopoid copepods (No./100 l)	CBE	DC	HPS	INT	HPW3	ICD	DWS	ICU	Dis.	HPW1	HPW2	CBC	JI
	5	6	8	12	15	15	17	23	23	30	33	40	61
Rotifers (No./100 l)	INT	HPS	DC	HPW1	ICU	CBE	DWS	JI	HPW3	CBC	HPW2	ICD	Dis.
	1	2	3	4	6	6	7	7	8	9	10	11	22
Bosmina (No./100 l)	DWS	DC	ICU	Dis.	ICD	INT	HPW1	HPS	CBE	HPW2	CBC	HPW3	JI
	.6	.9	.9	1	2	4	5	6	8	18	19	24	42

Table 15

James River Zooplankton ANOVA Summary 5-23-78

Parameters	Stations and Means (Stations not sharing an underline are significantly different, α ≤.05)												
Copepod nauplii (No./100 1)	HPW2	DC	ICD	INT	ICU	HPW1	DWS	Dis.	HPS	CBE	CBC	HPW3	JI
	34	41	197	521	641	700	832	996	1242	1916	1950	1975	2454
Polychaete larvae (No./100 1)	HPW2	Dis.	CBE	CBC	JI	DC	ICD	HPW1	ICU	HPW3	HPS	INT	DWS
	0	0	0	0	0	0	2	6	8	22	40	127	1059
Eurytemora sp. (No./100 1)	ICD	HPW2	DC	DWS	INT	ICU	HPW1	Dis.	CBE	HPW3	CBC	HPS	JI
	10	13	20	41	44	63	67	76	96	109	152	201	280
Acartia sp. (No./100 1)	DC	ICD	HPW2	CBE	HPW3	DWS	JI	HPW1	INT	Dis.	HPS	CBC	ICU
	.85	2	4	6	7	11	12	15	19	20	22	22	24
Harpacticoid copepods (No./100 1)	CBE	JI	HPW2	HPW1	DC	ICU	Dis.	DWS	CBC	INT	HPW3	ICD	HPS
	4	6	8	10	14	17	20	24	27	31	31	32	131
Cyclopoid copepods (No./100 1)	HPW2	DWS	CBE	DC	ICD	HPW3	HPW1	JI	HPS	ICU	INT	CBC	Dis.
	7	24	36	41	50	105	124	162	169	195	237	279	1683
Rotifers (No./100 1)	DC	ICD	HPW2	ICU	Dis.	INT	CBE	HPS	HPW1	DWS	CBC	HPW3	JI
	4	6	14	15	99	112	153	173	181	354	432	1495	2159
Bosmina sp. (No./100 1)	HPW2	DC	DWS	ICD	CBE	HPW1	Dis.	HPS	INT	HPW3	ICU	CBC	JI
	11	23	49	73	100	182	195	225	238	243	254	264	291
Barnacle nauplii (No./100 1)	JI	CBC	CBE	Dis.	HPW1	HPW2	HPW3	HPS	Int.	ICD	DC	ICU	DWS
	0	0	0	0	0	0	0	0	0	0	.9	1.8	7.7

Table 16

James River Zooplankton ANOVA Summary 6-20-78

Parameters	Stations and Means (Stations not sharing an underline are significantly different, α ≤ .05)												
Copepod nauplii (No./100 l)	DC	ICD	HPW1	CBE	Dis.	ICU	CBC	HPS	DWS	HPW2	HPW3	INT	JI
	332	524	1973	2246	2689	2825	4352	6672	6839	7742	8557	8619	18531
Barnacle nauplii (No./100 l)	HPW3	HPW2	INT	JI	HPS	CBE	CBC	DWS	HPW1	ICD	DC	ICU	Dis.
	0	0	15	16	24	42	46	47	90	196	206	211	400
Polychaete larvae (No./100 l)	JI	HPW1	CBE	HPW2	CBC	HPW3	DC	DWS	ICD	Dis.	HPS	ICU	INT
	0	7	9	10	27	28	33	52	55	84	101	134	235
Pelecypod larvae (No./100 l)	ICD	CBE	ICU	DC	HPW3	HPW1	JI	CBC	Dis.	DWS	HPW2	HPS	INT
	53	143	157	207	468	541	731	887	1250	1282	3372	3614	3827
Eurytemora sp. (No./100 l)	ICD	CBE	DC	HPW1	ICU	Dis.	DWS	HPW3	JI	INT	HPS	CBC	HPW2
	25	40	63	79	100	126	251	251	316	631	794	1000	1259
Acartia sp. (No./100 l)	HPW3	CBE	HPW1	JI	ICD	DC	Dis.	DWS	ICU	CBC	HPW2	HPS	INT
	13	18	18	26	29	35	123	126	130	162	284	289	360
Harpacticoid copepods (No./100 l)	CBE	HPW1	ICD	ICU	DC	Dis.	HPW2	DWS	HPS	HPW3	CBC	INT	JI
	2	4	14	16	16	20	20	22	34	53	62	68	93
Cyclopoid copepods (No./100 l)	ICU	ICD	DWS	DC	Dis.	INT	CBC	HPW1	CBE	HPS	HPW2	JI	HPW3
	2	3	3	5	8	15	24	27	64	74	93	123	247
Rotifers (No./100 l)	DC	ICD	CBE	Dis.	HPW1	HPW2	ICU	CBC	HPS	HPW3	DWS	INT	JI
	12	16	44	61	63	70	78	80	212	539	595	875	2181
Bosmina sp. (No./100 l)	DWS	HPS	Dis.	DC	ICD	HPW1	ICU	INT	CBE	CBC	HPW2	JI	HPW3
	0	0	0	0	.9	6	7	15	20	42	53	84	244

Table 16 (continued)

James River Zooplankton ANOVA Summary 6-20-78

Parameters — Stations and Means
(Stations not sharing an underline are significantly different, α ≤.05)

Parameters													
Other Cladocerans (No./100 1)	ICD	DC	HPW1	ICU	DWS	Dis.	CBE	HPS	INT	HPW2	CBC	JI	HPW3
	4	11	21	25	29	30	33	84	243	514	529	923	1584
Gastropod larvae (No./100 1)	HPW3	DWS	HPW2	INT	HPW1	CBE	CBC	ICU	ICD	HPS	JI	DC	Dis.
	0	1	3	8	13	14	26	26	27	30	32	33	51

Table 17

James River Zooplankton ANOVA Summary 7-11-78

Parameters	Stations and Means (Stations not sharing an underline are significantly different, α ≤.05)												
Copepod nauplii (No./100 1)	ICU	DC	Dis.	ICD	JI	DWS	INT	HPW3	CBC	HPS	HPW1	CBE	HPW2
	21	690	745	1287	1480	1772	1839	2194	2768	3687	3692	3952	4105
Barnacle nauplii (No./100 1)	ICU	JI	ICD	DC	HPW3	HPW2	CBC	INT	CBE	Dis.	HPW1	DWS	HPS
	3	29	31	70	74	76	126	144	156	214	232	314	636
Polychaete larvae (No./100 1)	ICU	HPW3	DC	JI	ICD	CBE	INT	CBC	DWS	Dis.	HPW2	HPW1	HPS
	.9	6	14	24	26	39	41	49	66	67	79	122	199
Pelecypod larvae (No./100 1)	ICU	DC	ICD	Dis.	INT	JI	HPW2	CBC	CBE	HPW1	HPS	HPW3	DWS
	3	29	36	67	120	152	165	166	178	196	263	317	405
Eurytemora sp. (No./100 1)	ICU	ICD	DC	Dis.	HPW1	INT	DWS	HPS	HPW3	CBE	CBC	JI	HPW2
	3	3	4	73	111	150	197	261	259	327	690	736	1148
Acartia sp. (No./100 1)	ICU	ICD	DC	HPW1	HPS	Dis.	CBE	INT	HPW3	CBC	HPW2	JI	DWS
	18	54	107	244	391	441	441	504	544	605	834	874	918
Harpacticoid copepods (No./100 1)	INT	ICU	HPW3	DWS	HPS	DC	Dis.	ICD	CBE	HPW1	HPW2	CBC	JI
	0	.9	4	7	16	18	20	23	57	82	83	92	96
Cyclopoid copepods (No./100 1)	DWS	INT	HPW3	Dis.	DC	ICU	ICD	HPS	HPW1	CBE	CBC	HPW2	JI
	0	0	0	0	3	4	4	11	12	42	177	295	326
Rotifers (No./100 1)	ICU	DC	INT	HPS	JI	ICD	CBE	HPW1	Dis.	HPW3	HPW2	CBC	DWS
	2	25	31	33	35	37	39	53	54	116	120	162	171

Table 17 (continued)

James River Zooplankton ANOVA Summary 7-11-78

Parameters — Stations and Means
(Stations not sharing an underline are significantly different, α ≤.05)

Bosmina sp. (No./100 1)	DWS	INT	Dis.	ICU	ICD	DC	HPW1	CBE	HPW3	HPS	JI	HPW2	CBC
Means	0	0	0	0	0	0	4	18	20	21	97	149	229
Underline							____	____	____	____	____	____	____

Gastropod larvae (No./100 1)	HPW3	DWS	JI	HPW1	ICU	INT	DC	ICD	HPW2	CBC	Dis.	HPS	CBE
Means	0	21	21	28	35	52	58	61	70	99	100	100	166
Underline 1					____	____	____	____	____	____	____	____	____
Underline 2		____	____	____	____	____	____	____	____	____	____	____	

Table 18

James River Zooplankton ANOVA Summary 8-23-78

Parameters	Stations and Means (Stations not sharing an underline are significantly different, α ≤.05)												
Copepod nauplii (No./100 l)	DC	ICU	ICD	Dis.	DWS	HPS	INT	CBE	HPW1	CBC	HPW3	HPW2	JI
	156	458	459	648	759	1114	1444	1691	2409	2917	3376	3598	3676
Barnacle nauplii (No./100 l)	HPW2	CBC	HPW3	JI	CBE	ICD	DC	ICU	HPS	INT	Dis.	DWS	HPW1
	3	5	8	11	29	46	55	59	92	94	112	267	280
Polychaete larvae (No./100 l)	CBC	JI	CBE	HPW3	HPW2	HPS	DC	HPW1	ICD	ICU	INT	DWS	Dis.
	2	5	6	14	16	35	50	57	60	74	102	109	209
Pelecypod larvae (No./100 l)	DC	ICD	ICU	HPS	Dis.	INT	HPW2	JI	DWS	CBC	CBE	HPW1	HPW3
	24	36	48	190	259	329	330	352	429	456	587	1104	1647
Eurytemora sp. (No./100 l)	Dis.	DC	ICD	HPS	ICU	CBE	INT	HPW2	HPW1	CBC	DWS	HPW3	JI
	0	.9	2	6	7	8	23	28	31	41	60	100	120
Acartia sp. (No./100 l)	ICD	HPS	CBE	DC	HPW2	INT	HPW1	JI	Dis.	ICU	CBC	HPW3	DWS
	12	20	73	73	95	104	118	137	153	211	247	317	404
Harpacticoid copepods (No./100 l)	HPW2	HPS	INT	CBE	DWS	CBC	ICU	ICD	HPW3	DC	Dis.	HPW1	JI
	3	3	4	4	5	6	12	17	17	21	41	47	57
Cyclopoid copepods (No./100 l)	INT	Dis.	DWS	ICD	ICU	DC	HPS	CBE	HPW1	HPW2	HPW3	CBC	JI
	0	0	1	3	3.5	4	6	10	63	83	99	215	390
Rotifers (No./100 l)	DC	ICU	ICD	HPW2	DWS	Dis.	HPW3	INT	HPW1	JI	HPS	CBC	CBE
	10	22	26	97	116	150	204	205	212	335	340	352	414
Bosmina sp. (No./100 l)	DWS	INT	Dis.	ICU	DC	ICD	HPS	CBE	HPW1	HPW3	HPW2	CBC	JI
	0	0	0	.9	.9	2	5	20	54	65	118	255	995

Table 18 (continued)

James River Zooplankton ANOVA Summary 8-23-78

Parameters

Stations and Means
(Stations not sharing an underline are significantly different, α ≤.05)

Other Cladocerans (No./100 1)	INT	Dis.	ICU	DC	DWS	ICD	CBE	HPS	HPW1	HPW2	CBC	HPW3	JI
	0	0	0	0	3	6	12	20	31	37	108	116	192

Gastropod larvae (No./100 1)	HPW2	HPS	DC	ICU	ICD	INT	CBE	JI	HPW3	HPW1	CBC	DWS	Dis.
	6	9	14	15	18	19	25	29	30	31	41	44	48

Table 19

James River Zooplankton ANOVA Summary 9-19-78

Parameters — Stations and Means
(Stations not sharing an underline are significantly different, α ≤.05)

Parameters													
Copepod nauplii (No./100 l)	Dis.	ICU	DC	ICD	HPW1	DWS	HPW2	JI	CBC	CBE	INT	HPW3	HPS
	738	843	1096	1164	1211	1296	1446	1532	1775	2411	2994	3290	3861
Barnacle nauplii (No./100 l)	DWS	HPW2	ICU	JI	CBE	HPS	INT	CBC	ICD	HPW3	HPW1	Dis.	DC
	71	98	142	163	188	188	191	221	259	280	297	354	460
Polychaete larvae (No./100 l)	DWS	CBE	JI	HPW2	Dis.	CBC	HPS	HPW3	DC	HPW1	INT	ICU	ICD
	34	37	38	49	76	79	80	88	92	109	117	190	226
Pelecypod larvae (No./100 l)	ICU	DWS	DC	ICD	Dis.	INT	HPW1	HPS	HPW2	CBC	CBE	JI	HPW3
	67	142	158	173	269	340	470	882	1278	1595	2045	3742	4730
Eurytemora sp. (No./100 l)	INT	HPW3	ICD	HPW2	ICU	CBE	DWS	HPW1	HPS	DC	Dis.	CBC	JI
	0	0	4	6	7	8	10	12	13	16	23	44	44
Acartia sp. (No./100 l)	ICD	CBE	Dis.	ICU	DC	HPW1	HPW2	DWS	CBC	JI	HPW3	INT	HPS
	39	87	133	152	238	241	270	431	606	666	847	920	1323
Harpacticoid copepods (No./100 l)	INT	HPS	HPW2	ICU	DWS	JI	CBE	DC	ICD	HPW3	HPW1	CBC	HPS
	0	0	0	0	2	3	3	4	5	6	9	10	27
Cyclopoid copepods (No./100 l)	HPW2	Dis.	ICD	ICU	DC	HPW3	DWS	HPS	HPW1	CBE	JI	CBC	INT
	0	0	0	4	4	5	6	7	9	9	10	15	19
Rotifers (No./100 l)	CBC	Dis.	HPW3	HPW1	DC	DWS	JI	ICU	ICD	HPW2	HPS	CBE	INT
	66	66	88	120	120	124	139	141	164	264	339	442	762
Gastropod larvae (No./100 l)	DWS	CBC	CBE	INT	HPW2	DC	HPW1	ICD	ICU	JI	Dis.	HPW3	HPS
	11	13	14	19	22	23	29	30	35	54	68	85	97
Coelenterate medusae (No./100 l)	DWS	HPS	CBE	DC	HPW1	HPW3	ICU	CBC	HPW2	JI	Dis.	INT	ICD
	0	0	0	0	3	3	4	6	8	8	10	19	34

Table 20

James River Zooplankton ANOVA Summary 11-14-78

Parameters	Stations and Means (Stations not sharing an underline are significantly different, α ≤.05)												
Copepod nauplii (No./100 1)	DC	ICD	Dis.	HPW1	DWS	HPS	ICU	CBC	JI	INT	HPW2	CBE	HPW3
	102	181	183	201	308	399	406	517	578	592	629	714	1088
Barnacle nauplii (No./100 1)	JI	HPW2	HPW3	HPW1	CBC	CBE	DWS	HPS	ICU	INT	DC	ICD	Dis.
	2	6	10	14	14	14	17	23	33	39	84	106	128
Polychaete larvae (No./100 1)	DC	HPW1	ICD	ICU	Dis.	DWS	JI	CBC	CBE	INT	HPS	HPW3	HPW2
	35	73	82	87	164	176	281	285	309	336	394	1092	1111
Pelecypod larvae (No./100 1)	INT	DWS	DC	HPW1	Dis.	ICD	ICU	HPW2	HPS	JI	HPW3	CBE	CBC
	4	5	5	6	10	16	21	24	29	29	39	43	49
Eurytemora sp. (No./100 1)	INT	HPS	Dis.	DC	ICU	JI	ICD	CBC	HPW3	HPW1	DWS	CBE	HPW2
	0	0	0	0	.9	2	2	3	3	5	10	11	41
Acartia sp. (No./100 1)	DC	ICD	Dis.	CBE	DWS	ICU	CBC	HPW1	INT	JI	HPW3	HPS	HPW2
	9	9	42	70	78	106	135	136	142	194	289	325	465
Cyclopoid copepods (No./100 1)	HPS	HPW3	HPW1	CBE	JI	ICU	DWS	CBC	DC	ICD	HPW2	INT	Dis.
	0	0	0	0	0	0	.6	.8	.9	2	3	4	10
Rotifers (No./100 1)	DC	DWS	INT	ICD	ICU	HPW1	Dis.	HPS	CBC	JI	CBE	HPW3	HPW2
	4	5	8	8	8	15	16	19	33	106	115	284	291
Gastropod larvae (No./100 1)	DWS	INT	HPS	HPW3	HPW2	HPW1	Dis.	CBE	ICU	JI	CBC	DC	ICD
	0	0	0	0	0	0	0	.7	.9	1	3	4	5

Results - Benthos Studies

Data Presentation

The hydrographic data associated with the 1978 benthos sampling runs appear in Appendix Table A2. The benthos biological data are in Appendix C, Tables C1-C6 (species counts) and C7-C12 (diversity indices).

Benthos Distribution Patterns

The 1978 spatial distributions for the major benthic organisms of the study area are presented in Table 21. In this table the stations have been organized into three groups, based on the results of the sediment analyses performed in June (Table 22). Within the sediment groups control stations and stations at locations potentially under the influence of the power plant plume are indicated.

The 1978 spatial distributions of several of the benthic species were similar to distributions observed in previous study years (Jordan *et al*. 1977, 1978). Four of the six stations where *Congeria leucophaeta* was found (Table 21C) had a clayey-silt substrate, and three of the six stations were influenced by the plume. *Heteromastus filiformis* (Table 21I) was also found mainly at plume stations, particularly at station 11 where it had been most abundant in the 1977 study. *Leptocheirus plumulosus* (Table 21N), which had shown an apparent avoidance of the plume in three previous study years (Jordan *et al*. 1977, 1978), was collected least frequently at plume stations 8 and 11 in 1978.

Species that were collected more frequently at sandy stations were *Corbicula manilensis* (Table 21E) and *Lepidactylus dytiscus*

(Table 21M). Species that were more numerous in the finer sediment types included Rangia cuneata, Scolecolepides viridis, Gammarus sp., Leptocheirus plumulosus, and Cyathura polita (Tables 21 A, G, K, N, and O, respectively).

The overall abundance of Rangia cuneata in the 1978 benthos samples was lowest in April (Figure 5). The total number collected was 52, just one more than the total for April 1977 which was the lowest number of Rangia collected since the study began in 1969. The low point in 1977 followed an obvious winter kill, that was revealed by large numbers of decomposing individuals present in the March 1977 samples (Figure 5). Neither the January nor the April 1978 samples contained recently deceased Rangia. The only evidence that low winter temperatures in 1978 may have adversely affected the Rangia population in the study area is the observation that the total numbers of individuals collected during the study year at the control stations were generally lower than the total numbers collected at the plume stations, for the two fine sediment groups (Table 21A). Thus there is a suggestion of a positive effect of the power plant plume on Rangia survival in 1978.

Table 21

Seasonal and Spatial Distributions of Major Benthic Animals - 1978

A. <u>Rangia cuneata</u> (No. per 0.1 m^2)

Substrates and Station Numbers

	Sand					Sand-Silt-Clay						Clayey-Silt					
	Control				Plume	Control			Plume			Control			Plume		
Date	1	3	12	15	7	5	6	16	9	11	13	2	10	14	4	8	Total
Jan. 18	4	3	13		2	9	1	8	3	13	5	13			13	7	94
Apr. 10	3	1		1	1		2	6	1	3		4	1	1	19	9	52
June 13	4	4	1	2	7	2	28	6	4	3	15	4		4	13	6	103
July 12	3	1		13	6	1	22	5		5	6	9			3	9	83
Aug. 7	13	3	14	9	7	8	10	15	6	18	26	3	16		15	21	184
Oct. 18	4	8	3	5	3	13	7	6	4	36	6	10	4	2	10	17	138
Total	31	20	31	30	26	33	70	46	18	78	58	43	21	7	73	69	654

B. <u>Rangia cuneata</u> (g per 0.1 m^2)

Substrates and Station Numbers

	Sand					(Sand-Silt-Clay)						(Clayey-Silt)					
	Control				Plume	Control			Plume			Control			Plume		
Date	1	3	12	15	7	5	6	16	9	11	13	2	10	14	4	8	Total
Jan. 18	1.60	.62	8.64		1.68	1.72	1.15	2.52	.04	.99	1.70	5.67			4.04	1.82	32.19
Apr. 10	2.72	.76		.02	.73		1.40	1.74	.48	1.11		1.68	.14	.02	5.45	3.81	20.06
June 13	1.72	.04	.90	.05	1.92	.20	7.90	1.83	.63	1.27	.04	1.06		.72	3.89	.54	22.71
July 12	.03	.42		.74	1.96	.02	12.23	3.15		1.62	.64	5.16			.65	1.29	27.91
Aug. 7	6.66	.03	.03	.17	3.96	.22	3.73	3.30		7.16	3.41	1.47	.10		2.95	1.83	35.02
Oct. 18	3.86	1.06	.03	.03	1.25	.19	2.73	.65	.80	2.52	1.85	3.37	.03	.01	1.78	2.16	22.32
Total	16.59	2.93	9.60	1.01	11.50	2.35	29.14	13.19	1.95	14.67	7.64	18.41	.27	.75	18.76	11.45	160.21

Table 21 (continued)

Seasonal and Spatial Distributions of Major Benthic Animals - 1978

C. Congeria leucophaeta (No. per 0.1 m^2)

Substrates and Station Numbers

	Sand					Sand-Silt-Clay						Clayey-Silt					
	Control				Plume	Control			Plume			Control			Plume		
Date	1	3	12	15	7	5	6	16	9	11	13	2	10	14	4	8	Total
Jan. 18																	0
Apr. 10															1		1
June 13																	0
July 12																	0
Aug. 7														3		1	4
Oct. 18			3							1			1		1	7	13
Total	0	0	3	0	0	0	0	0	0	1	0	0	1	3	2	8	18

D. Macoma mitchelli (No. per 0.1 m^2)

Substrates and Station Numbers

	Sand					(Sand-Silt-Clay)						(Clayey-Silt)					
	Control				Plume	Control			Plume			Control			Plume		
Date	1	3	12	15	7	5	6	16	9	11	13	2	10	14	4	8	Total
Jan. 18	1		2		1	2		2		5	2	2	1		1		19
Apr. 10																	0
June 13																	0
July 12																	0
Aug. 7							1				1		2				4
Oct. 18				1				2		7			12				22
Total	1	0	2	1	1	2	1	4	0	12	3	2	15	0	1	0	45

Table 21 (continued)

Seasonal and Spatial Distributions of Major Benthic Animals - 1978

E. Corbicula manilensis (No. per 0.1 m^2)

Substrates and Station Numbers

	Sand					Sand-Silt-Clay						Clayey-Silt					
	Control				Plume	Control			Plume			Control			Plume		
Date	1	3	12	15	7	5	6	16	9	11	13	2	10	14	4	8	Total
Jan. 18										1							1
Apr. 10			1														1
June 13																	0
July 12			3														3
Aug. 7																1	1
Oct. 18			2														2
Total	0	0	6	0	0	0	0	0	0	1	0	0	0	0	0	1	8

F. Hydrobia sp. (No. per 0.1 m^2)

Substrates and Station Numbers

	Sand					(Sand-Silt-Clay)						(Clayey-Silt)					
	Control				Plume	Control			Plume			Control			Plume		
Date	1	3	12	15	7	5	6	16	9	11	13	2	10	14	4	8	Total
Jan. 18			2							5							7
Apr. 10	1			3		17		2		2					7		32
June 13		4			1												5
July 12																	0
Aug. 7					1		1							1			3
Oct. 18																	0
Total	1	4	2	3	2	17	1	2	0	7	0	0	0	1	7	0	47

Table 21 (continued)

Seasonal and Spatial Distributions of Major Benthic Animals - 1978

G. Scolecolepides viridis (No. per 0.1 m^2)

Substrates and Station Numbers

	Sand Control				Sand Plume	Sand-Silt-Clay Control			Sand-Silt-Clay Plume			Clayey-Silt Control			Clayey-Silt Plume		
Date	1	3	12	15	7	5	6	16	9	11	13	2	10	14	4	8	Total
Jan. 18			1					1		3	1						6
Apr. 10		1		1	1	2		1		2			1	1	2		12
June 13				3		13	7		3	25			4		5	3	63
July 12			1		1	2	30	4	1	25		2			9	6	81
Aug. 7						1	1	3		1	7				2		15
Oct. 18				1	2	4	3	5	1	1							17
Total	0	1	2	5	4	22	41	14	5	57	8	2	5	1	18	9	194

H. Nereis succinea (No. per 0.1 m^2)

Substrates and Station Numbers

	Sand Control				Sand Plume	(Sand-Silt-Clay) Control			(Sand-Silt-Clay) Plume			(Clayey-Silt) Control			(Clayey-Silt) Plume		
Date	1	3	12	15	7	5	6	16	9	11	13	2	10	14	4	8	Total
Jan. 18	2		17	1				3		4	1	1		2		6	37
Apr. 10	5	2	1	2				3		1	1					6	21
June 13							3	1			1						5
July 12								1			1						2
Aug. 7	2			1				1			2						6
Oct. 18	1	3	1		15				6	2	4		1	1		1	35
Total	10	5	19	4	15	0	3	9	6	7	10	1	1	3	0	13	106

Table 21 (continued)

Seasonal and Spatial Distributions of Major Benthic Animals - 1978

I. <u>Heteromastus filiformis</u> (No. per 0.1 m^2)

Substrates and Station Numbers

	Sand					Sand-Silt-Clay						Clayey-Silt					
	Control				Plume	Control			Plume			Control			Plume		
Date	1	3	12	15	7	5	6	16	9	11	13	2	10	14	4	8	Total
Jan. 18										3					1		4
Apr. 10						1				2					2		5
June 13				1						4							5
July 12										5	2						7
Aug. 7										4	2						6
Oct. 18										16							16
Total	0	0	0	1	0	1	0	0	0	34	4	0	0	0	3	0	43

J. Oligochaetes (No. per 0.1 m^2)

Substrates and Station Numbers

	Sand					(Sand-Silt-Clay)						(Clayey-Silt)					
	Control				Plume	Control			Plume			Control			Plume		
Date	1	3	12	15	7	5	6	16	9	11	13	2	10	14	4	8	Total
Jan. 18			1							1							2
Apr. 10													1				1
June 13							1										1
July 12	1						1										2
Aug. 7					1	4	3				1		2		5		16
Oct. 18					3					1							4
Total	1	0	1	0	4	4	5	0	0	2	1	0	3	0	5	0	26

Table 21 (continued)

Seasonal and Spatial Distributions of Major Benthic Animals - 1978

K. Gammarus sp. (No. per 0.1 m^2)

Substrates and Station Numbers

	Sand					Sand-Silt-Clay						Clayey-Silt					
	Control				Plume	Control			Plume			Control			Plume		
Date	1	3	12	15	7	5	6	16	9	11	13	2	10	14	4	8	Total
Jan. 18						1									1		2
Apr. 10	1														1		2
June 13														1	3		4
July 12							11			1							12
Aug. 7										1		1	1				3
Oct. 18																	0
Total	1	0	0	0	0	1	11	0	0	2	0	1	1	1	5	0	23

L. Corophium lacustre (No. per 0.1 m^2)

Substrates and Station Numbers

	Sand					(Sand-Silt-Clay)						(Clayey-Silt)					
	Control				Plume	Control			Plume			Control			Plume		
Date	1	3	12	15	7	5	6	16	9	11	13	2	10	14	4	8	Total
Jan. 18				1												1	2
Apr. 10								1									1
June 13									1							1	2
July 12			1		3		106									3	113
Aug. 7			1		3	1	1		9			1	1	5	1		23
Oct. 18			10											1			11
Total	0	0	12	1	6	1	107	1	10	0	0	1	1	6	1	5	152

Table 21 (continued)

Seasonal and Spatial Distributions of Major Benthic Animals - 1978

M. Lepidactylus dytiscus (No. per 0.1 m^2)

Substrates and Station Numbers

	Sand					Sand-Silt-Clay						Clayey-Silt					
	Control				Plume	Control			Plume			Control			Plume		
Date	1	3	12	15	7	5	6	16	9	11	13	2	10	14	4	8	Total
Jan. 18		2								1							3
Apr. 10		3	4		6	3			6							1	23
June 13		2	1						1					1			5
July 12		3	3						6								12
Aug. 7		3	9														12
Oct. 18				2					5								7
Total	0	13	17	2	6	3	0	0	18	1	0	0	0	1	0	1	62

N. Leptocheirus plumulosus (No. per 0.1 m^2)

Substrates and Station Numbers

	Sand					(Sand-Silt-Clay)						(Clayey-Silt)					
	Control				Plume	Control			Plume			Control			Plume		
Date	1	3	12	15	7	5	6	16	9	11	13	2	10	14	4	8	Total
Jan. 18			2				1	1						1			5
Apr. 10										1							1
June 13	1		2	25	4		25	3	5		8	10	1		8	1	93
July 12	4	5		1	6		12	29	1		8	25		20	13		124
Aug. 7	1	2	4	12	4	1	19	17	4		23	2	7	3	11	2	112
Oct. 18				7	1	5	8	13				7	1	10	10		62
Total	6	7	8	45	15	6	65	63	10	1	39	44	9	34	42	3	397

Table 21 (continued)

Seasonal and Spatial Distributions of Major Benthic Animals - 1978

O. *Cyathura polita* (No. per 0.1 m^2)

Substrates and Station Numbers

	Sand					Sand-Silt-Clay						Clayey-Silt					
	Control				Plume	Control			Plume			Control			Plume		
Date	1	3	12	15	7	5	6	16	9	11	13	2	10	14	4	8	Total
Jan. 18			2					1		3		3	1	2	1	1	14
Apr. 10				1								1	1		1		4
June 13										1						1	2
July 12				2			3					1				2	8
Aug. 7							3			2		1	1	3	3		13
Oct. 18			2					3			1	1		2			9
Total	0	0	4	3	0	0	6	4	0	6	1	7	3	7	5	4	50

P. Dipteran larvae (No. per 0.1 m^2)

Substrates and Station Numbers

	Sand					(Sand-Silt-Clay)						(Clayey-Silt)					
	Control				Plume	Control			Plume			Control			Plume		
Date	1	3	12	15	7	5	6	16	9	11	13	2	10	14	4	8	Total
Jan. 18			1									1					2
Apr. 10							1					1				1	3
June 13																	0
July 12							1								1		2
Aug. 7																	0
Oct. 18																	0
Total	0	0	1	0	0	0	2	0	0	0	0	2	0	0	1	1	7

Table 22

Benthos Station Sediment Characteristics June 29, 1978

Sediment type	Station No.	Loss on Ignition (%)	Sand (>63μ) (%)	Silt (4μ-63μ) (%)	Clay (<4μ) (%)
Sand	1	1.23	97.6	0.5	1.9
	3	0.35	98.8	0.4	0.8
	12	0.27	99.6	0.2	0.2
	15	2.34	91.3	6.0	2.7
	7	0.49	97.5	1.4	1.1
Sand-silt-clay	5	5.55	50.7	33.8	15.5
	6	6.52	36.7	37.3	26.0
	16	8.14	52.8	23.0	24.2
	9	3.31	33.5	37.0	29.5
	11	2.21	77.2	12.0	10.8
	13	1.86	68.9	17.3	13.8
Clayey silt	2	8.74	25.4	40.8	33.8
	10	8.56	13.6	43.9	42.5
	14	9.32	5.8	47.2	47.0
	4	9.67	12.0	56.4	31.6
	8	9.17	7.0	49.0	44.0

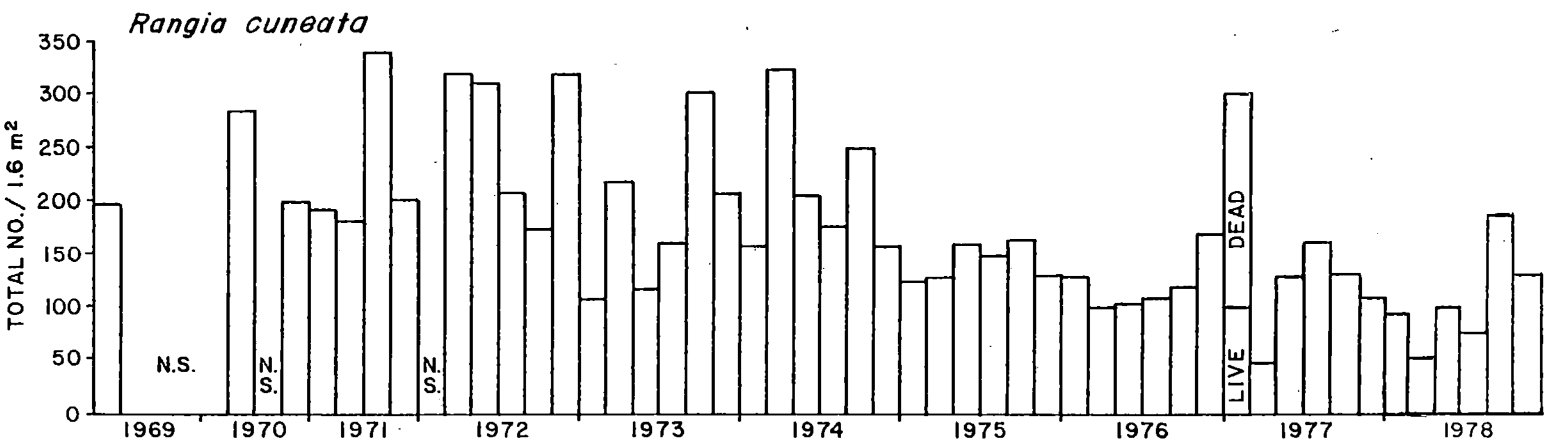

Figure 5. Temporal distribution of Rangia cuneata in the study area, May 1969 - Oct. 1978.

N.S. = Not sampied

Results - Fouling Organisms Study

The 1978 fouling organism data appear in Tables 23-25. Very few organisms were found on the plates exposed during the January-February and March-April periods. The May-June plates at station DWS were densely colonized by barnacles, while only a few appeared on the CBS plates and none were present on the CBN plates exposed during this period. Colonization by *Corophium lacustre* was distinctly more dense on the annual than on the May-June bimonthly plates recovered at stations CBS and CBN.

During the second half of the year colonization by barnacles and *Corophium lacustre* was the most dense in the July-August period at station CBN, in the September-October period at station CBS, and was similarly dense in these two periods at station DWS.

Congeria leucophaeta occurred in small numbers on the July-August and September-October plates from station DWS. This species exhibited higher population densities at the other two stations, and was especially abundant on the horizontal plate recovered from station CBN in August. The November-December plates from all stations yielded a few barnacles, but the most numerous species on most of the plates was *Corophium lacustre*. Ectoprocts were present on plates recovered from all three stations in the second half of the year, but occurred most consistently and achieved the densest coverage at station DWS.

The differences observed among the fouling plate stations appear to relate to the locations of the stations relative to the longitudinal salinity gradient of the James River. Seasonally, colonization by barnacles commenced first at the downstream-most (highest salinity) station, DWS. Coincidentally this was the only river station at which barnacle nauplii were found in the zooplankton samples taken in May (Table 15). The presence of barnacle nauplii in the intake and discharge canal samples suggests that the barnacles attached to the May-June plates at CBS could have originated from larvae pumped through from the power plant intake or produced by adults residing in the cooling water canals. Ectoproct coverage was also greatest at Station DWS. Congeria leucophaeta, an oligohaline pelecypod (Wass et al. 1972), was least abundant at station DWS. The temporal patterns of fouling organism colonization at the two upstream stations, CBN, remote from the power plant, and CBS, near the discharge canal mouth, were similar. The major quantitative differences between these two stations appeared on the September-October plates, which supported higher barnacle and Corophium populations at CBS. This is the major possible power plant effect apparent in the 1978 fouling plate data, and could relate to the attachment of barnacle larvae released from the power plant cooling canal system. The resulting establishment of a large surface area, on and among the barnacle shells, would be favorable for subsequent Corophium colonization.

Table 23

Fouling Organisms
1978
Station DWS

		No. Organisms/dm^2			
Horizontal Plate		Jan-Feb	Mar-Apr	May-Jun	Annual*
Barnacles	Balanus sp.			113	89
Bivalves	Brachidontes recurvus				
	Congeria leucophaeta				
Amphipods	Corophium lacustre			523	841
	Leptocheirus plumulosus				
	Gammarus sp.			8	1
Polychaetes	Nereis succinea				
	Scolecolepides viridis				
Decapods	Rhithropanopeus harrisii				
Ectoprocts	Bowerbankia sp.				
	Membranipora tenuis				
Hydroids		X		X	X
Dipteran Larvae				1	
Total No. of Genera (not including Hydroids and Dipteran Larvae)		0	0	3	3
Total No. of Organisms (not including Ectoprocts and Hydroids)		0	0	645	931
Vertical Plate					
Barnacles	Balanus sp.			318	531
Bivalves	Brachidontes recurvus				
	Congeria leucophaeta				
Amphipods	Corophium lacustre		1	712	579
	Leptocheirus plumulosus				
	Gammarus sp.			40	7
Polychaetes	Nereis succinea				
	Scolecolepides viridis				
Decapods	Rhithropanopeus harrisii				
Ectoprocts	Bowerbankia sp.				
	Membranipora tenuis				
Hydroids				X	X
Dipteran Larvae			2	4	5
Total No. of Genera (not including Hydroids and Dipteran Larvae)		0	1	3	3
Total No. of Organisms (not including Ectoprocts and Hydroids)		0	3	1074	1122

Table 23 (Cont.)

Fouling Organisms
1978
Station DWS

		No. Organisms/dm^2		
Horizontal Plate		July-Aug	Sep-Oct	Nov-Dec
Barnacles	Balanus sp.	79	59	10
Bivalves	Brachidontes recurvus			
	Congeria leucophaeta	16	5	
Amphipods	Corophium lacustre	759	280	21
	Leptocheirus plumulosus			
	Gammarus sp.			2
Polychaetes	Nereis succinea		29	
	Scolecolepides viridis			
Decapods	Rhithropanopeus harrisii		3	
Ectoprocts	Bowerbankia sp.			
	Membranipora tenuis	X	X	X
Hydroids		X	X	X
Dipteran Larvae				
Total No. of Genera (not including Hydroids and Dipteran Larvae)		4	6	4
Total No. of Organisms (not including Ectoprocts and Hydroids)		854	376	33
Vertical Plate				
Barnacles	Balanus sp.	29	201	14
Bivalves	Brachidontes recurvus			
	Congeria leucophaeta	2	4	1
Amphipods	Corophium lacustre	233	297	108
	Leptocheirus plumulosus			
	Gammarus sp.		1	2
Polychaetes	Nereis succinea	2	23	
	Scolecolepides viridis			
Decapods	Rhithropanopeus harrisii			
Ectoprocts	Bowerbankia sp.			
	Membranipora tenuis	X	X	X
Hydroids		X	X	X
Dipteran Larvae				
Total No. of Genera (not including Hydroids and Dipteran Larvae)		5	6	5
Total No. of Organisms (not including Ectoprocts and Hydroids)		266	526	125

Table 24

Fouling Organisms
1978
Station CBN

Horizontal Plate		No. Organisms/dm^2 Jan-Feb	Mar-Apr	May-Jun	Annual
Barnacles	Balanus sp.				
Bivalves	Brachidontes recurvus				
	Congeria leucophaeta				
Amphipods	Corophium lacustre	1	2	156	476
	Leptocheirus plumulosus		3		
	Gammarus sp.		1	70	56
Polychaetes	Nereis succinea				
	Scolecolepides viridis				
Decapods	Rhithropanopeus harrisii				
Ectoprocts	Bowerbankia sp.				
	Membranipora tenuis	X			
Hydroids		X		X	X
Dipteran Larvae			11	24	8
Total No. of Genera (not including Hydroids and Dipteran Larvae)		2	3	2	2
Total No. of Organisms (not including Ectoprocts and Hydroids)		1	17	250	540

Vertical Plate		Jan-Feb	Mar-Apr	May-Jun	Annual
Barnacles	Balanus sp.				18
Bivalves	Brachidontes recurvus				
	Congeria leucophaeta				
Amphipods	Corophium lacustre	1		150	408
	Leptocheirus plumulosus		1	2	
	Gammarus sp.		4	24	135
Polychaetes	Nereis succinea				
	Scolecolepides viridis				
Decapods	Rhithropanopeus harrisii				
Ectoprocts	Bowerbankia sp.				
	Membranipora tenuis				
Hydroids		X	X	X	X
Dipteran Larvae			3	22	24
Total No. of Genera (not including Hydroids and Dipteran Larvae)		1	2	3	3
Total No. of Organisms (not including Ectoprocts and Hydroids)		1	8	198	585

Table 24 (Cont.)

Fouling Organisms
1978
Station CBN

Horizontal Plate		No. Organisms/dm^2 July-Aug	Sep-Oct	Nov-Dec
Barnacles	Balanus sp.	125	107	14
Bivalves	Brachidontes recurvus			
	Congeria leucophaeta	295	83	5
Amphipods	Corophium lacustre	501	101	117
	Leptocheirus plumulosus	1		
	Gammarus sp.	34	3	59
Polychaetes	Nereis succinea		3	
	Scolecolepides viridis			
Decapods	Rhithropanopeus harrisii		10	
Ectoprocts	Bowerbankia sp.			
	Membranipora tenuis	X	X	X
Hydroids		X	X	X
Dipteran Larvae		1		
Total No. of Genera (not including Hydroids and Dipteran Larvae)		6	7	5
Total No. of Organisms (not including Ectoprocts and Hydroids)		957	307	195
Vertical Plate				
Barnacles	Balanus sp.	305	255	21
Bivalves	Brachidontes recurvus			
	Congeria leucophaeta	101	23	
Amphipods	Corophium lacustre	774	111	2
	Leptocheirus plumulosus			
	Gammarus sp.	22	1	2
Polychaetes	Nereis succinea			
	Scolecolepides viridis			
Decapods	Rhithropanopeus harrisii	2	9	
Ectoprocts	Bowerbankia sp.			
	Membranipora tenuis			X
Hydroids		X	X	X
Dipteran Larvae		2		
Total No. of Genera (not including Hydroids and Dipteran Larvae)		5	5	4
Total No. of Organisms (not including Ectoprocts and Hydroids)		1206	399	25

Table 25

Fouling Organisms
1978
Station CBS

Horizontal Plate		No. Organisms/dm^2 Jan-Feb	Mar-Apr	May-Jun	Annual
Barnacles	*Balanus* sp.			11	1
Bivalves	*Brachidontes recurvus*				
	Congeria leucophaeta				
Amphipods	*Corophium lacustre*			33	62
	Leptocheirus plumulosus				
	Gammarus sp.			3	65
Polychaetes	*Nereis succinea*				
	Scolecolepides viridis				
Decapods	*Rhithropanopeus harrisii*				
Ectoprocts	*Bowerbankia* sp.				
	Membranipora tenuis				
Hydroids				X	X
Dipteran Larvae			2	4	27
Total No. of Genera (not including Hydroids and Dipteran Larvae)		0	0	3	3
Total No. of Organisms (not including Ectoprocts and Hydroids)		0	2	51	155
Vertical Plate					
Barnacles	*Balanus* sp.	1		3	1
Bivalves	*Brachidontes recurvus*				
	Congeria leucophaeta				
Amphipods	*Corophium lacustre*			12	28
	Leptocheirus plumulosus		5		1
	Gammarus sp.			2	3
Polychaetes	*Nereis succinea*				
	Scolecolepides viridis				
Decapods	*Rhithropanopeus harrisii*				
Ectoprocts	*Bowerbankia* sp.				
	Membranipora tenuis	X		X	
Hydroids		X			X
Dipteran Larvae			1	3	11
Total No. of Genera (not including Hydroids and Dipteran Larvae)		2	1	4	4
Total No. of Organisms (not including Ectoprocts and Hydroids)		1	6	20	44

Table 25 (Cont.)

Fouling Organisms
1978
Station CBS

Horizontal Plate		No. Organisms/dm^2 July-Aug	Sep-Oct	Nov-Dec
Barnacles	Balanus sp.	256	212	8
Bivalves	Brachidontes recurvus			
	Congeria leucophaeta	119	139	1
Amphipods	Corophium lacustre	606	1439	56
	Leptocheirus plumulosus		2	
	Gammarus sp.	3		6
Polychaetes	Nereis succinea		8	
	Scolecolepides viridis			
Decapods	Rhithropanopeus harrisii	1	4	
Ectoprocts	Bowerbankia sp.			
	Membranipora tenuis		X	X
Hydroids		X	X	X
Dipteran Larvae				
Total No. of Genera (not including Hydroids and Dipteran Larvae)		5	7	5
Total No. of Organisms (not including Ectoprocts and Hydroids)		985	1804	71
Vertical Plate				
Barnacles	Balanus sp.	148	427	11
Bivalves	Brachidontes recurvus			
	Congeria leucophaeta	62	30	
Amphipods	Corophium lacustre	387	733	19
	Leptocheirus plumulosus			
	Gammarus sp.	6		3
Polychaetes	Nereis succinea		12	
	Scolecolepides viridis			
Decapods	Rhithropanopeus harrisii		8	
Ectoprocts	Bowerbankia sp.			
	Membranipora tenuis		X	X
Hydroids		X	X	X
Dipteran Larvae				
Total No. of Genera (not including Hydroids and Dipteran Larvae)		4	6	4
Total No. of Organisms (not including Ectoprocts and Hydroids)		603	1210	33

Conclusions

The major findings of previous study years (Jordan et al. 1976, 1977, 1978), regarding the effects of the Surry Power Station cooling water discharge on the James River plankton and benthos populations, were again confirmed by the 1978 study. Negative entrainment effects were observed for both phytoplankton and zooplankton species in August and September, but reduced population densities of these species were not observed at river stations beyond the immediate discharge canal mouth. As in previous years barnacle nauplii were contributed to the river by the cooling water canals, and in this study year in particular there was a high population density of barnacles attached to the autumn fouling plates at the station closest to the discharge, that may have reflected this contribution. In the summer 1978 phytoplankton data there was an indication that the canals may also have been a source for the motile reproductive stages of an attached alga.

In the benthos, an amphipod that had appeared to avoid the discharge plume in previous years exhibited this pattern again in 1978. The Rangia distribution suggested that the plume may have favored the survival of this species through the winter of 1977-78.

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Appendix A

Hydrographic Data Tables

Table A1

James River Hydrographic Data 1978

Plankton Sampling Runs

Date	Parameter	Station: DWS	INTAKE	HPS	HPW3	HPW2	HPW1	DISCHARGE	CBE	CBC	JI
2-28	Time (EST)	1013	1040	1109	1132	1152	1214	1235	1702	1638	1610
	Secchi Depth (cm)	17	23	21	17	18	22	21	21	19	17
	Sample Depth (m)	0	0	0	0	0	0	0	0	0	0
	Temp. (^oC)	3.45	3.95	7.35	4.20	3.55	6.65	12.70	8.10	5.50	3.60
	Sal. ($^o/oo$)	2.62	2.28	1.42	.64	.37	1.48	2.89	1.31	1.06	.43
	D.O. (mg/l)	11.74	11.64	10.92	12.07	12.01	11.62	11.37	11.68	11.45	12.05
	Sample Depth (m)	1	3.75	2	1	1.5	1	1	1	1.75	4
	Temp. (^oC)	3.40	3.85	7.60	4.20	3.50	6.55	12.60	7.40	5.65	3.90
	Sal. ($^o/oo$)	2.63	2.29	1.61	.63	.38	1.45	2.89	1.43	1.17	.53
	D.O. (mg/l)	11.80	11.23	11.84	12.03	12.03	11.43	11.60	11.56	11.66	11.80
	Sample Depth (m)	2	7.5	4	2	3		2		3.5	8
	Temp. (^oC)	3.40	3.85	7.65	4.15	3.45		12.70		5.60	4.00
	Sal. ($^o/oo$)	3.07	2.29	1.68	.65	.39		2.86		1.21	.64
	D.O. (mg/l)	11.97	11.43	11.39	12.05	12.38		11.47		11.82	11.74
4-18	Time (EST)	1002	1032	1106	1137	1206	1233	1303	1329	1355	1426
	Secchi Depth (cm)	61	30	36	40	29	35	35	54	36	32
	Sample Depth (m)	0	0	0	0	0	0	0	0	0	0
	Temp. (^oC)	14.20	14.15	15.90	14.90	15.90	16.10	21.20	15.00	15.40	15.20
	Sal. ($^o/oo$)	2.37	2.64	1.22	.42	.75	1.05	2.58	.44	.34	.08
	D.O. (mg/l)	8.94	8.56	8.64	8.94	8.64	8.48	8.54	8.62	8.46	8.50
	Sample Depth (m)	1	3.5	2	1	1.5	1	1		1.5	3.5
	Temp. (^oC)	14.20	14.15	15.80	14.90	15.80	16.80	21.20		15.40	15.05
	Sal. ($^o/oo$)	2.59	2.63	1.22	.81	.75	1.09	2.60		.33	.08
	D.O. (mg/l)	8.50	8.76	8.16	9.12	8.62	8.58	8.72		8.70	8.76
	Sample Depth (m)	2	7	4	2	3		2		3	7
	Temp. (^oC)	14.20	14.25	15.80	14.90	15.80		21.05		15.40	15.05
	Sal. ($^o/oo$)	4.51	2.80	1.26	.26	.76		2.57		.34	.09
	D.O. (mg/l)	8.44	9.06	9.42	8.24	8.36		8.96		8.58	8.50

Table A1 (cont.)

James River Hydrographic Data 1978

Plankton Sampling Runs

Date	Parameter	Station: DWS	INTAKE	HPS	HPW3	HPW2	HPW1	DISCHARGE	CBE	CBC	JI
5-23	Time (EDT)	0956	1028	1101	1128	1149	1215	1242	1304	1351	1415
	Secchi Depth (cm)	27	31	21	31	23	30	25	44	43	34
	Sample Depth (m)	0	0	0	0	0	0	0	0	0	0
	Temp. (°C)	21.80	21.55	21.85	21.40	21.80	23.55	28.10	23.10	22.00	21.80
	Sal. (°/oo)	.26	.30	.12	.07	.10	.16	.34	.11	.11	.09
	D.O. (mg/l)	7.38	7.64	7.24	7.82	7.58	7.86	7.10	8.02	7.32	8.16
	Sample Depth (m)	1	3.75	2.25	1.5	1.75	1	1	1	1.75	3.75
	Temp. (°C)	21.60	21.50	21.85	21.60	21.85	23.50	27.90	22.60	22.05	21.60
	Sal. (°/oo)	.26	.37	.11	.08	.09	.17	.33	.12	.10	.10
	D.O. (mg/l)	7.56	7.18	7.38	8.08	7.72	7.76	7.78	7.58	7.66	8.06
	Sample Depth (m)	2	7.5	4.5	3	3.5		2		3.5	7.5
	Temp. (°C)	21.60	21.50	22.00	21.70	22.00		27.90		22.10	21.50
	Sal. (°/oo)	.26	.40	.11	.08	.10		.32		.10	.27
	D.O. (mg/l)	7.10	7.04	7.30	7.92	7.70		7.50		7.78	7.96
6-20	Time (EDT)	1013	1039	1106	1127	1144	1204	1223	1245	1300	1320
	Secchi Depth (cm)	46	37	20	31	37	47	36	39	35	35
	Sample Depth (m)	0	0	0	0	0	0	0	0	0	0
	Temp. (°C)	25.80	26.40	26.40	26.20	26.70	28.80	32.35	30.00	27.20	27.40
	Sal. (°/oo)	3.06	2.97	2.28	.74	1.96	1.97	3.35	1.68	1.18	.73
	D.O. (mg/l)	7.55	7.36	6.73	7.49	7.22	7.49	6.96	7.49	7.43	7.87
	Sample Depth (m)	1	3.75	2	1.25	1.75	1	1	.75	1.75	3.5
	Temp. (°C)	25.60	26.20	26.50	25.85	26.10	28.75	32.30	29.80	26.40	26.10
	Sal. (°/oo)	3.13	2.84	2.26	.73	1.90	1.98	3.37	1.98	1.31	.68
	D.O. (mg/l)	7.91	7.36	7.17	7.60	7.41	7.55	7.15	7.51	6.98	7.53
	Sample Depth (m)	2	7.5	4	2.5	3.5		2		3.5	7
	Temp. (°C)	25.50	26.20	26.60	26.00	26.10		32.35		26.40	26.40
	Sal. (°/oo)	3.29	2.88	2.27	.78	1.83		3.36		1.36	1.23
	D.O. (mg/l)	8.01	7.28	7.05	7.42	7.04		7.07		7.20	7.30

Table A1
(cont.)
James River Hydrographic Data 1978
Plankton Sampling Runs

		Station									
Date	Parameter	DWS	INTAKE	HPS	HPW3	HPW2	HPW1	DISCHARGE	CBE	CBC	JI
7-11	Time (EDT)	1050	1132	1210	1236	1257	1315	1336	1440	1503	1530
	Secchi Depth (cm)	47	32	47	36	40	61	39	38	37	36
	Sample Depth (m)	0	0	0	0	0	0	0	0	0	0
	Temp. (°C)	27.10	26.80	28.90	27.10	27.10	28.30	32.20	27.60	27.30	26.90
	Sal. (°/oo)	5.29	4.40	3.13	2.00	1.34	3.04	4.78	2.65	1.78	1.24
	D.O. (mg/l)	6.83	6.53	6.81	6.91	6.65	6.97	6.11	6.45	7.16	6.61
	Sample Depth (m)	1	2.75	1.25	1.25	1.75	1	1	1	1.5	2.5
	Temp. (°C)	26.90	26.30	28.80	27.00	26.90	28.10	31.90	28.50	27.30	26.80
	Sal. (°/oo)	5.34	4.50	3.14	2.01	1.34	3.02	4.80	2.90	1.80	1.35
	D.O. (mg/l)	6.63	6.65	6.53	7.44	6.61	6.73	6.13	6.41	6.69	6.75
	Sample Depth (m)	2	5.5	2.5	2.5	3.5		2		3	5
	Temp (°C)	26.90	26.20	28.70	26.90	26.90		31.90		27.30	26.70
	Sal. (°/oo)	5.26	4.71	3.16	2.09	1.37		4.77		1.83	1.23
	D.O. (mg/l)	6.53	6.61	6.81	6.83	6.93		5.97		6.57	6.93
8-23	Time (EDT)	1000	1045	1120	1200	1220	1243	1334	1420	1445	1510
	Secchi Depth (cm)	52	52	61	45	53	52	35	52	52	45
	Sample Depth (m)	0	0	0	0	0	0	0	0	0	0
	Temp. (°C)	28.20	28.75	30.80	29.20	29.25	31.50	37.50	29.90	30.40	29.30
	Sal. (°/oo)	6.21	5.28	3.25	1.70	1.35	3.28	5.82	1.49	1.35	1.24
	D.O. (mg/l)	6.12	6.14	6.42	6.44	6.26	6.72	6.54	7.40	6.88	6.38
	Sample Depth (m)	1	2	2	1.25	1.75	1	1	1	1.75	3.5
	Temp. (°C)	27.90	28.40	30.30	28.80	28.80	31.70	37.40	30.10	30.20	29.00
	Sal. (°/oo)	6.25	5.41	3.76	1.72	1.38	3.45	5.82	1.57	2.63	1.30
	D.O. (mg/l)	5.76	6.28	6.06	6.48	6.12	6.30	6.26	7.54	6.00	6.14
	Sample Depth (m)	2	4	4	2.5	3.5		2		3.5	7
	Temp. (°C)	27.80	28.10	30.10	28.85	29.00		37.40		30.80	29.10
	Sal. (°/oo)	6.25	5.55	3.79	1.75	1.39		5.74		2.92	1.77
	D.O. (mg/l)	5.98	5.86	5.84	6.16	6.14		6.38		6.08	5.86

Table A1
(cont.)
James River Hydrographic Data 1978
Plankton Sampling Runs

Date	Parameter	DWS	INTAKE	HPS	HPW3	HPW2	HPW1	DISCHARGE	CBE	CBC	JI
		Station									
9-19	Time (EDT)	1012	1047	1125	1147	1210	1230	1300	1345	1402	1425
	Secchi Depth (cm)	76	44	32	65	51	79	47	57	58	52
	Sample Depth (m)	0	0	0	0	0	0	0	0	0	0
	Temp. (°C)	26.10	26.05	26.90	26.70	26.90	28.40	34.70	29.50	27.50	26.50
	Sal. (°/oo)	6.90	8.40	6.55	4.59	5.69	5.69	8.47	5.67	5.57	3.95
	D.O. (mg/l)	6.37	6.15	6.23	6.27	6.27	6.49	5.55	6.37	6.11	6.21
	Sample Depth (m)	1	4	2.25	1.25	1.75	1	1	1	1.5	4
	Temp. (°C)	26.10	26.00	26.90	26.60	26.90	28.60	34.60	29.80	27.50	26.70
	Sal. (°/oo)	6.95	8.56	6.52	4.64	5.70	5.72	8.47	5.72	5.56	4.59
	D.O. (mg/l)	6.23	6.05	6.19	6.19	6.11	4.62	5.57	6.35	5.97	6.09
	Sample Depth (m)	2	8	4.5	2.5	3.5		2		3.25	8
	Temp. (°C)	26.10	26.05	26.90	26.60	27.00		34.60		27.50	26.80
	Sal. (°/oo)	7.17	8.60	6.55	4.73	5.62		8.43		5.56	5.38
	D.O. (mg/l)	6.01	5.99	6.11	6.17	6.25		5.55		6.07	6.63
11-14	Time (EDT)	0845	0917	0947	1010	1036	1105	1137	1234	1258	1328
	Secchi Depth (cm)	110	63	52	40	73	104	50	86	82	66
	Sample Depth (m)	0	0	0	0	0	0	0	0	0	0
	Temp. (°C)	15.20	15.20	15.90	15.90	16.25	18.40	23.30	16.90	17.60	16.50
	Sal. (°/oo)	9.93	11.02	10.01	8.06	9.20	8.71	11.33	6.99	8.69	7.21
	D.O. (mg/l)	7.72	7.76	7.68	7.96	7.82	7.86	7.60	8.08	7.78	--
	Sample Depth (m)	1.25	4	2.5	1.5	2	1	1	1	2	4.5
	Temp. (°C)	15.10	15.20	16.00	15.90	16.20	17.90	23.25	17.20	17.40	16.10
	Sal. (°/oo)	10.89	11.06	9.99	8.06	9.20	9.00	11.31	7.41	8.95	8.17
	D.O. (mg/l)	7.68	7.86	7.76	7.86	7.70	7.90	7.51	8.46	7.78	7.60
	Sample Depth (m)	2.5	8	5	3	4	2	2		4	9
	Temp. (°C)	15.10	15.20	16.00	15.90	16.25	17.90	23.20		17.30	16.10
	Sal. (°/oo)	11.09	10.98	9.94	8.10	9.17	9.00	11.24		9.19	8.46
	D.O. (mg/l)	7.78	7.68	7.82	7.68	7.74	7.70	7.27		7.80	6.99

Table A2

James River Hydrographic Data 1978

Benthos Sampling Runs

Date	Station	6	12	14	16	15	13	11	10
Jan. 18	Time (EST)	1005	1025	1036	1051	1115	1127	1135	1149
	Secchi Depth (cm)	18	22	16	22	15	21	24	17
	Sample Depth (m)	0	0	0	0	0	0	0	0
	Temp. (^oC)	2.80	2.60	2.30	2.60	4.90	6.80	6.80	4.70
	Sal. ($^o/oo$)	.14	.17	.09	.10	.32	.18	.18	.14
	D.O. (mg/l)	12.07	12.21	11.70	12.07	12.01	11.70	12.75	11.40
	Sample Depth (m)	1.5	1	8	2			4	4
	Temp. (^oC)	2.75	2.70	2.30	2.65			6.80	4.70
	Sal. ($^o/oo$)	.33	.16	.10	.10			.17	.14
	D.O. (mg/l)	13.17	12.27	11.88	11.97			11.68	11.48

Date	Station	5	9	8	4	7	3	2	1
	Time (EST)	1200	1215	1225	1236	1246	1256	1305	1317
	Secchi Depth (cm)	18	18	17	13	33	23	17	21
	Sample Depth (m)	0	0	0	0	0	0	0	0
	Temp.(^oC)	5.00	9.20	4.40	3.50	3.80	3.60	2.80	3.40
	Sal. ($^o/oo$)	.38	.20	.11	.09	.10	.10	.08	.10
	D.O. (mg/l)	11.56	10.54	11.36	11.16	11.88	11.62	11.99	11.94
	Sample Depth (m)	3		4	3			1.5	5
	Temp.(^oC)	5.00		4.80	3.70			2.80	3.40
	Sal. ($^o/oo$)	.15		.11	.09			.08	.10
	D.O. (mg/l)	11.42		11.50	11.60			11.34	11.82

Table A2
(cont.)

James River Hydrographic Data 1978

Benthos Sampling Runs

Date	Station	6	12	14	16	15	13	11	10
April 10	Time (EST)	1003	1016	1034	1050	1103	1116	1125	1134
	Secchi Depth (cm)	26	29	31	28	19	22	23	30
	Sample Depth (m)	0	0	0	0	0	0	0	0
	Temp. (^oC)	14.55	15.4	15.20	15.05	14.80	15.35	16.35	16.00
	Sal. (^{o}/oo)	.10	.10	-	.14	.18	.14	.10	.10
	D.O. (mg/l)	8.45	8.46	8.98	8.69	9.00	9.04	8.45	8.77
	Sample Depth (m)	1.5		7	2			4.5	4
	Temp. (^oC)	14.55		15.05	15.00			16.00	16.00
	Sal. (^{o}/oo)	.58		3.66	.16			-	.10
	D.O. (mg/l)	8.42		8.54	8.87			9.10	8.86

Date	Station	5	9	8	4	7	3	2	1
	Time (EST)	1142	1150	1220	1230	1240	1247	1256	1305
	Secchi Depth (cm)	26	25	25	24	28	32	26	43
	Sample Depth (m)	0	0	0	0	0	0	0	0
	Temp. (^oC)	16.35	17.40	16.35	15.85	18.20	16.10	15.20	15.60
	Sal. (^{o}/oo)	.10	.11	.10	.10	.12	.09	-	-
	D.O. (mg/l)	8.96	8.69	8.71	8.82	8.94	9.16	9.06	8.86
	Sample Depth (m)	3		4	4			2	
	Temp. (^oC)	16.35		16.35	15.60			15.20	
	Sal. (^{o}/oo)	.13		.10	-			.09	
	D.O. (mg/l)	8.54		8.63	8.69			9.08	

Table A2
(cont.)

James River Hydrographic Data 1978

Date	Station	Benthos Sampling Runs							
	Station	6	12	14	16	15	13	11	10
June 13	Time (EDT)	0710	0723	0738	0750	0805	0815	0823	0840
	Secchi Depth (cm)	26	23	40	42	31	30	34	33
	Sample Depth (m)	0	0	0	0	0	0	0	0
	Temp. (°C)	25.0	24.3	24.9	23.9	23.8	23.8	25.4	24.8
	Sal. (°/oo)	.20	.23	.58	1.89	1.75	1.29	.70	.53
	D.O. (mg/l)	7.39	6.80	6.64	7.43	6.94	6.88	6.84	6.98
	Sample Depth (m)	1.5		7	2			4.5	4
	Temp. (°C)	24.7		24.5	23.8			25.4	24.8
	Sal. (°/oo)	.30		.76	1.86			.72	.54
	D.O. (mg/l)	4.65		7.23	8.02			6.88	6.80
	Station	5	9	8	4	7	3	2	1
	Time (EDT)	0849	0859	0931	0940	0948	0958	1035	1045
	Secchi Depth (cm)	29	29	47	36	22	26	39	40
	Sample Depth (m)	0	0	0	0	0	0	0	0
	Temp. (°C)	25.3	25.2	24.9	24.5	23.2	24.4	24.6	24.2
	Sal. (°/oo)	.67	.58	.33	.21	.18	.18	.16	.14
	D.O. (mg/l)	6.88	6.68	6.82	6.74	7.59	7.39	7.04	7.11
	Sample Depth (m)	3		4	3			2	
	Temp. (°C)	25.1		24.6	24.5			24.4	
	Sal. (°/oo)	.65		.30	.22			.16	
	D.O. (mg/l)	6.86		6.72	6.80			6.80	

Table A2
(cont.)

James River Hydrographic Data 1978

Benthos Sampling Runs

Date	Station	6	12	14	16	15	13	11	10
July 12	Time (EDT)	0656	0709	0722	0736	0750	0806	0816	0828
	Secchi Depth (cm)	35	36	63	39	27	33	34	47
	Sample Depth (m)	0	0	0	0	0	0	0	0
	Temp. (°C)	25.6	25.0	25.7	25.6	24.2	25.0	26.3	25.8
	Sal. (°/oo)	2.15	2.49	6.18	5.65	5.01	4.05	3.69	3.81
	D.O. (mg/l)	7.01	6.03	6.93	7.36	5.99	6.71	7.04	6.79
	Sample Depth (m)	1		7	2			4.5	4
	Temp. (°C)	25.3		26.4	25.3			26.1	25.8
	Sal. (°/oo)	2.74		7.55	6.01			3.70	3.78
	D.O. (mg/l)	6.45		5.73	6.41			6.73	6.71
	Station	5	9	8	4	7	3	2	1
	Time (EDT)	0837	0845	0855	0906	0916	0925	0940	0950
	Secchi Depth (cm)	34	37	50	40	36	26	39	44
	Sample Depth (m)	0	0	0	0	0	0	0	0
	Temp. (°C)	25.9	26.0	26.8	25.9	27.0	24.5	25.0	24.0
	Sal. (°/oo)	3.20	2.83	3.21	2.06	3.14	2.00	1.71	1.23
	D.O. (mg/l)	7.14	6.93	6.71	6.71	6.73	7.20	6.95	7.64
	Sample Depth (m)	3		4	3			2	
	Temp (°C)	25.7		26.3	26.1			25.0	
	Sal. (°/oo)	3.34		3.29	2.68			1.72	
	D.O. (mg/l)	6.43		7.01	6.57			6.91	

Table A2
(cont.)

James River Hydrographic Data 1978

Date	Station	6	12	14	16	15	13	11	10
Aug. 7	Time (EDT)	0742	0756	0814	0835	0853	0858	0910	0922
	Secchi Depth (cm)	33	37	48	26	25	28	31	28
	Sample Depth (m)	0	0	0	0	0	0	0	0
	Temp. (^oC)	27.5	27.2	28.5	28.0	27.0	29.8	32.5	28.2
	Sal. ($^o/oo$)	1.26	1.45	2.30	3.40	4.15	2.98	3.46	1.22
	D.O. (mg/l)	5.44	5.89	6.15	5.99	4.65	6.21	5.85	5.85
	Sample Depth (m)	1		6	1.5			4	3.5
	Temp. (^oC)	27.5		28.5	28.0			32.5	28.0
	Sal. ($^o/oo$)	1.38		2.52	3.42			3.42	1.26
	D.O. (mg/l)	6.01		6.11	5.97			5.80	6.03

Station	5	9	8	4	7	3	2	1
Time (EDT)	0925	0933	0943	0955	1003	1015	1025	1033
Secchi Depth (cm)	35	41	31	27	26	27	32	42
Sample Depth (m)	0	0	0	0	0	0	0	0
Temp. (^oC)	28.0	31.8	28.2	28.0	27.5	28.0	28.2	28.0
Sal. ($^o/oo$)	1.03	3.42	1.34	.86	1.55	1.52	1.02	1.35
D.O. (mg/l)	5.87	6.27	5.72	5.86	6.48	6.09	5.74	6.88
Sample Depth (m)	2.5		3	2.5			1.75	
Temp. (^oC)	28.0		27.8	27.8			28.0	
Sal. ($^o/oo$)	1.04		1.30	.89			1.04	
D.O. (mg/l)	5.12		5.66	5.83			5.76	

Table A2
(cont.)

James River Hydrographic Data 1978

Benthos Sampling Runs

Date	Station	6	12	14	16	15	13	11	10
Oct. 18	Time (EDT)	0940	1005	1020	1045	1140	1155	1206	1222
	Secchi Depth (cm)	80	66	79	106	51	60	34	71
	Sample Depth (m)	0	0	0	0	0	0	0	0
	Temp. (^{o}C)	15.4	16.1	17.5	17.3	17.0	16.8	18.4	18.1
	Sal. (^{o}/oo)	5.08	6.83	7.28	9.30	9.84	9.02	8.46	7.04
	D.O. (mg/l)	7.78	7.52	7.90	7.94	7.86	8.02	7.94	8.24
	Sample Depth (m)	1.5		7	2.5		1	5	4.5
	Temp. (^{o}C)	16.5		17.0	16.7		16.8	18.3	17.4
	Sal. (^{o}/oo)	6.09		8.85	10.66		9.04	8.46	7.95
	D.O. (mg/l)	8.04		7.74	7.84		7.84	7.92	7.98

Date	Station	5	9	8	4	7	3	2	1
	Time (EDT)	1230	1240	1300	1310	1347	1357	1408	1417
	Secchi Depth (cm)	34	76	67	46	56	90	79	106
	Sample Depth (m)	0	0	0	0	0	0	0	0
	Temp. (^{o}C)	17.6	19.8	19.0	17.8	20.9	17.6	17.4	17.1
	Sal. (^{o}/oo)	7.38	7.68	7.43	6.40	7.04	5.57	5.91	5.28
	D.O. (mg/l)	8.06	7.92	7.78	8.12	7.98	8.40	8.26	8.90
	Sample Depth (m)	3.5	1	4.5	3.5	1	1	2.5	1
	Temp. (^{o}C)	17.6	19.6	18.5	18.0	20.8	17.5	16.7	17.0
	Sal. (^{o}/oo)	7.48	7.66	7.50	6.56	7.00	6.04	5.65	5.28
	D.O. (mg/l)	8.04	7.96	7.84	8.10	8.14	8.58	8.34	8.72

Appendix B

Biological Data Tables for the Plankton Studies

Table B1

James River Chlorophyll Concentrations 1978
(μg Chl a per liter, surface samples, two samples per station)

Station	Feb. 28	Apr. 18	May 23	June 20	July 11	Aug. 23	Sept. 19	Nov. 14
DWS	2.2	1.3	8.9	5.2	11.7	3.9	4.9	1.7
	2.4	1.2	11.5	4.9	10.9	4.7	5.2	1.8
Intake	2.3	2.6	7.2	5.5	9.4	5.8	7.6	3.5
	2.4	2.7	7.2	6.9	8.6	6.2	7.6	3.0
HPS	1.5	1.8	11.5	7.4	7.9	7.1	3.0	3.5
	2.2	1.8	9.2	6.6	7.8	5.8	3.2	1.8
HPW3	1.9	1.4	15.8	4.5	10.8	5.6	3.0	3.7
	2.0	1.8	15.7	3.8	11.2	6.2	3.0	3.7
HPW2	1.8	2.4	15.5	3.1	8.9	6.3	3.5	1.8
	2.3	2.1	10.6	2.6	8.3	6.0	3.2	1.9
HPW1	1.7	1.2	6.9	4.2	8.2	5.8	2.9	1.8
	1.7	1.3	6.8	3.5	7.8	6.0	3.2	2.1
Discharge	3.0	2.7	7.3	3.9	5.5	3.8	3.0	4.0
	2.9	2.5	6.6	3.5	5.7	3.7	2.5	2.7
CBE	1.6	1.6	5.4	3.9	5.4	6.7	4.9	2.0
	1.4	1.3	6.5	3.7	8.1	6.0	4.6	3.1
CBC	1.8	1.8	8.6	4.1	7.5	3.6	2.6	2.7
	1.7	1.8	8.9	3.6	7.8	4.0	1.8	2.5
JI	1.7	1.9	8.3	6.5	6.2	5.7	2.8	2.8
	2.0	2.1	8.7	4.4	6.4	5.4	2.9	2.8

Table B2

James River Phytoplankton Cell Counts, 1978
(Total cells per ml, surface samples, two samples per station)

Station	Feb. 28	Apr. 18	May 23	June 20	July 11	Aug. 23	Sept. 19	Nov. 14
DWS	1050	900	6600	2900	9850	2450	1750	1300
	950	900	5100	2950	11550	2550	1800	1000
Intake	700	1350	4800	3850	8000	4600	3850	950
	750	1300	5150	2650	8650	4300	3450	1100
HPS	450	1500	4900	1250	7900	4850	1100	900
	350	1250	4400	1400	7900	4500	1400	950
HPW3	150	1300	16400	1950	9550	4600	2050	550
	150	1450	13950	1750	9100	4750	2250	550
HPW2	150	700	7400	1950	7250	6800	1250	750
	100	700	8550	1800	7800	6600	1300	900
HPW1	350	700	5100	2150	7650	5500	1900	900
	350	700	4100	2750	7900	5500	1900	850
Intake Canal	750	1000	4600	3500	7350	3550	3400	900
(Upstream)	1000	1350	4600	2850	6550	2600	2200	1000
Intake Canal	1200	800	4650	1600	4150	2700	1400	900
(Downstream)	1100	750	3950	1300	4600	3250	1750	800
Discharge Canal	1100	650	3750	1250	5450	2150	900	900
	1050	800	3600	1450	5600	2900	850	850
CBE	400	900	4350	3200	4350	6600	1850	850
	300	800	5950	3050	8600	5850	1950	850
CBC	250	1100	6250	2050	6450	5550	1050	1050
	250	1250	5850	1650	5500	6600	1700	950
JI	200	1450	9000	3900	6350	4900	1850	950
	200	1100	7500	2850	5800	3600	2250	950
Discharge	1400	1650	4400	1800	5700	2150	1400	950
	1200	1500	3350	1800	5800	2300	1650	850

Appendix C

Biological Data Tables for the Benthos Study

Table C1

James River Benthos; January 18, 1978

Species, Number of Individuals and Total Wet Weight (Without Clam Shell) in Grams per 0.1 m^2 at Each Station

Species	Station 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mollusks																
Rangia cuneata	4	13	3	13	9	1	2	7	3		13	13	5			8
Congeria leucophaeta																
Macoma mitchelli	1	2		1	2		1			1	5	2	2			2
Macoma balthica																
Corbicula manilensis											1					
Hydrobia sp.											5	2				
Mya arenaria																
Modiolus demissus								5							2	2
Unknown gastropod		1												1		1
Annelids																
Polychaetes																
Scolecolepides viridis											3	1	1			1
Nereis succinea	2	1						6			4	17	1	2	1	3
Lysipiddes grayi																
Polydora ligni																
Laeonereis culveri	1															
Heteromastus filiformis				1							3					
Oligochaetes											1	1				
Amphipods																
Gammarus sp.				1	1											
Corophium lacustre								1							1	
Lepidactylus dytiscus			2								1					
Leptocheirus plumulosus						1						2		1		1
Monoculodes edwardsi																
Caprella sp.										1						

Table C1 (cont'd)

Species	Station 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Decapods																
Callinectes sapidus																1
Isopods																
Cyathura polita		3		1				1		1	3	2		2		1
Edotea triloba																
Chiridotea almyra									1							
Diperan larvae		1										1				
Nemerteans					1			1								
Hydroids				X	X		X	X		X	X					X
Balanus sp.								13			2				32	16
Nematodes						1										
Ectoprocts				X		X		X			X	X		X	X	
Biomass (grams)	1.62	5.70	.63	4.05	1.74	1.16	1.70	1.84	.04	.01	1.10	8.70	1.74	.02	.02	2.55

Table C2

James River Benthos; April 10, 1978

Species, Number of Individuals and Total Wet Weight
(Without Clam Shell) in Grams per 0.1 m^2 at Each Station

Species	Station 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mollusks																
Rangia cuneata	3	4	1	19		2	1	9	1	1	3			1	1	6
Congeria leucophaeta				1												
Macoma mitchelli																
Macoma balthica							1	2								
Corbicula manilensis												1				
Hydrobia sp.	1			7	17						2				3	2
Mya arenaria																
Modiolus demissus								4								1
Unknown gastropod										1						
Annelids																
Polychaetes																
Scolecolepides viridis			1	2	2		1			1	2			1	1	1
Nereis succinea	5		2					6			1	1	1		2	3
Lysipiddes grayi																
Polydora ligni																
Laeonereis culveri																
Heteromastus filiformis				2	1						2					
Oligochaetes										1						
Nemertean				1												
Oyster spat																3

Table C2 (cont'd)

Species	Station 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Amphipods																
Gammarus sp.	1			1												
Corophium lacustre																1
Lepidactylus dytiscus			3		3		6	1	6			4				
Leptocheirus plumulosus											1					
Monoculodes edwardsi																
Caprella sp.																
Isopods																
Cyathura polita		1		1						1					1	
Edotea triloba															1	
Chiridotea almyra												2				
Dipteran larvae		1				1		1								
Nemerteans																
Hydroids		X		X		X		X		X	X	X		X	X	X
Balanus sp.								13								2
Nematodes																
Ectoproct								X			X	X			X	X
Biomass (Grams)	2.74	1.70	.78	5.47	.04	1.43	.74	3.84	.49	.15	1.13	.02	.01	.02	.04	1.76

Table C3

James River Benthos; June 13, 1978
Species, Number of Individuals and Total Wet Weight
(Without Clam Shell) in Grams per 0.1 m^2 at Each Station

Species	Station 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mollusks																
Rangia cuneata	4	4	4	13	2	28	7	6	4		3	1	15	4	2	6
Congeria leucophaeta																
Macoma mitchelli																
Macoma balthica																
Corbicula manilensis																
Hydrobia sp.			4				1									
Mya arenaria																
Modiolus demissus																
Shelless Opisthobranch															1	
Annelids																
Polychaetes																
Scolecolepides viridis				5	13	7		3	3	4	25				3	
Nereis succinea						3							1			1
Lysipiddes grayi																
Polydora ligni																
Laeonereis culveri																
Heteromastus filiformis											4				1	
Oligochaetes						1										
Amphipods																
Gammarus sp.				3										1		
Corophium lacustre								1	1							
Lepidactylus dytiscus			2						1			1		1		
Leptocheirus plumulosus	1	10		8		25	4	1	5	1		2	8		25	3
Monoculodes edwardsi																
Caprella sp.																

Table C3 (cont'd.)

Species	Station 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
<u>Isopods</u>																
<u>Cyathura</u> <u>polita</u>								1			1					
<u>Edotea</u> <u>triloba</u>																
<u>Chiridotea</u> <u>almyra</u>					2						7					
<u>Decapods</u>																
<u>Rhithropanopeus</u> <u>harrisii</u>										1						
<u>Dipteran Larvae</u>																
<u>Nemerteans</u>					1				1							
<u>Hydroids</u>				X		X		X	X	X	X	X	X		X	
<u>Balanus</u> sp.	2							1						1		
<u>Nematodes</u>																
<u>Ectoprocts</u>								X	X		X		X	X		
Biomass (grams)	1.75	1.10	.06	4.00	.25	8.10	2.05	.60	.65	1.05	1.30	.90	.05	.72	.10	1.90

Table C4

James River Benthos; July 12, 1978
Species, Number of Individuals and Total Wet Weight
(Without Clam Shell) in Grams per 0.1 m^2 at Each Station

Species	Station 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mollusks																
Rangia cuneata	3	9	1	3	1	22	6	9			5		6		13	5
Congeria leucophaeta																
Macoma mitchelli																
Macoma balthica																
Corbicula manilensis												3				
Hydrobia sp.																
Mya arenaria																
Modiolus demissus																
Annelids																
Polychaetes																
Scolecolepides viridis		2		9	2	30	1	6	1		25	1				4
Nereis succinea													1			1
Lysipiddes grayi						4										
Polydora ligni																
Laeonereis culveri																
Heteromastus filiformis											5		2			
Oligochaetes	1					1										
Amphipods																
Gammarus sp.						11					1					
Corophium lacustre						106	3	3				1				
Lepidactylus dytiscus			3						6			3				
Leptocheirus plumulosus	4	25	5	13		12	6		1				8	20	1	29

Table C4 (cont'd.)

Species	Station 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Monoculodes edwardsi																
Caprella sp.																
Isopods																
Cyathura polita		1				3		2							2	
Edotea triloba																
Chiridotea almyra					1						1					
Dipteran Larvae				1		1										
Nemerteans																
Hydroids	X	X		X	X	X					X			X		
Balanus sp.																
Nematodes																
Biomass (grams)	.05	5.25	.44	.67	.02	12.30	2.00	1.35	.02		1.64	.02	.65	.02	.80	3.20

Table C5

James River Benthos; August 7, 1978

Species, Number of Individuals and Total Wet Weight (Without Clam Shell) in Grams per 0.1 m^2 at Each Station

Species	Station 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mollusks																
Rangia cuneata	13	3	3	15	8	10	7	21	6	16	18	14	26		9	15
Congeria leucophaeta								1						3		
Macoma mitchelli						1				2			1			
Macoma balthica																
Corbicula manilensis								1								
Hydrobia sp.						1	1							1		
Mya arenaria																
Modiolus demissus														1		
Annelids																
Polychaetes																
Scolecolepides viridis				2	1	1					1		7			3
Nereis succinea	2												2		1	1
Lysipiddes grayi																
Polydora ligni														2		
Laeonereis culveri																
Heteromastus filiformis											4		2			
Oligochaetes				5	4	3	1			2			1			
Amphipods																
Gammarus sp.		1								1	1					
Corophium lacustre		1		1	1	1	3		9	1		1		5		
Lepidactylus dytiscus			3									9				
Leptocheirus plumulosus	1	2	2	11	1	19	4	2	4	7		4	23	3	12	17

Table C5 (cont'd.)

Species	Station 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Monoculodes edwardsi																
Caprella sp.																
Isopods																
Cyathura polita		1		3		3				1	2			3		
Edotea triloba																
Chiridotea almyra					7						9					
Dipteran Larvae																
Nemerteans													1			
Hydroids			X					X			X					
Balanus sp.								1								1
Nematodes		1														
Ectoprocts								X								
Biomass (grams)	7.70	1.50	.05	3.00	.25	3.75	4.00	2.85	.05	.12	7.20	.05	3.35	.02	.20	3.35

Table C6

James River Benthos; October 18, 1978

Species, Number of Individuals and Total Wet Weight (Without Clam Shell) in Grams per 0.1 m^2 at Each Station

Species	Station 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mollusks																
Rangia cuneata	4	10	8	10	13	7	3	17	4	4	36	3	6	2	5	6
Congeria leucophaeta								7		1	1	3				
Macoma mitchelli										12	7				1	2
Macoma balthica												3				
Corbicula manilensis												2				
Hydrobia sp.																
Mya arenaria																
Modiolus demissus																
Annelids																
Polychaetes																
Scolecolepides viridis					4	3	2		1		1				1	5
Nereis succinea	1		3				15	1	6	1	2	1	4	1		
Lysipiddes grayi																
Polydora ligni																
Laeonereis culveri																
Heteromastus filiformis											16					
Oligochaetes							3				1					
Amphipods																
Gammarus sp.																
Corophium lacustre												10		1		
Lepidactylus dytiscus									5						2	
Leptocheirus plumulosus		7		10	5	8	1			1				10	7	13

Table C6 (cont'd.)

Species	Station 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Monoculodes edwardsi					1											
Caprella sp.																
Isopods																
Cyathura polita		1										2	1	2		3
Edotea triloba																
Chiridotea almyra					1							1				
Decapods																
Rhithropanopeus harrisii								2								
Dipteran Larvae																
Nemerteans					1					1	3					
Hydroids		X			X						X					
Balanus sp.					1			5							6	
Nematodes																
Biomass (grams)	4.00	3.40	1.15	1.80	.25	2.75	1.30	2.25	.82	.05	3.02	.08	1.90	.02	.04	.70

Table C7

Diversity and Related Parameters for Benthic Samples

January 18, 1978

Station Number	Number of Individuals	Number of SPECIES	SHANNON Formula H-PRIME	RICHNESS S-1/LN N
1	8	4	1.7500	1.4427
2	21	6	1.7799	1.6423
3	5	2	0.9710	0.6213
4	17	5	1.2577	1.4118
5	13	4	1.3520	1.1696
6	3	3	1.5850	1.8205
7	3	2	0.9183	0.9102
8	34	7	2.2970	1.7015
9	4	2	0.8113	0.7213
10	3	3	1.5850	1.8205
11	41	11	3.0261	2.6928
12	41	9	2.2943	2.1543
13	9	4	1.6577	1.3654
14	6	4	1.9183	1.6743
15	36	4	0.6699	0.8372
16	36	10	2.4823	2.5115
All Stations Combined	280	23	3.0497	3.9043

Table C8

Diversity and Related Parameters for Benthic Samples

April 10, 1978

Station Number	Number of Individuals	Number of SPECIES	SHANNON Formula H-PRIME	RICHNESS S-1/LN N
1	10	4	1.6855	1.3029
2	6	3	1.2516	1.1162
3	7	4	1.8424	1.5417
4	34	8	2.0180	1.9850
5	23	4	1.2087	0.9568
6	3	2	0.9183	0.9102
7	9	4	1.4466	1.3654
8	36	7	2.3326	1.6743
9	7	2	0.5917	0.5139
10	5	5	2.3219	2.4853
11	11	6	2.4817	2.0852
12	8	4	1.7500	1.4427
13	1	1	0.0000	
14	2	2	1.0000	1.4427
15	9	6	2.4194	2.2756
16	19	8	2.7206	2.3774
All Stations Combined	190	22	3.3393	4.0020

Table C9

Diversity and Related Parameters for Benthic Samples

June 13, 1978

Station Number	Number of Individuals	Number of SPECIES	SHANNON Formula H-PRIME	RICHNESS S-1/LN N
1	7	3	1.3788	1.0278
2	14	2	0.8631	0.3789
3	10	3	1.5219	0.8686
4	29	4	1.8073	0.8909
5	18	4	1.2752	1.0379
6	64	5	1.7014	0.9618
7	12	3	1.2807	0.8048
8	13	6	2.1416	1.9494
9	15	6	2.2826	1.8463
10	6	3	1.2516	1.1162
11	40	5	1.6094	1.0843
12	4	3	1.5000	1.4427
13	24	3	1.1432	0.6293
14	7	4	1.6645	1.5417
15	32	5	1.1609	1.1542
16	10	3	1.2955	0.8686
All Stations Combined	305	16	2.5297	2.6075

Table C10

Diversity and Related Parameters for Benthic Samples

July 12, 1978

Station Number	Number of Individuals	Number of SPECIES	SHANNON Formula H-PRIME	RICHNESS S-1/LN N
1	8	3	1.4056	0.9618
2	37	4	1.2466	0.8308
3	9	3	1.3516	0.9102
4	26	4	1.5700	0.9208
5	4	3	1.5000	1.4427
6	190	9	2.0314	1.5247
7	16	4	1.7641	1.0820
8	20	4	1.7822	1.0014
9	8	3	1.0613	0.9618
10	0	0	0.0000	0.0000
11	37	5	1.4442	1.1078
12	8	4	1.8113	1.4427
13	17	4	1.6457	1.0589
14	20	1	0.0000	0.0000
15	16	3	0.8684	0.7213
16	39	4	1.1702	0.8189
All Stations Combined	455	14	2.6185	2.1241

Table C11

Diversity and Related Parameters for Benthic Samples

August 7, 1978

Station Number	Number of Individuals	Number of SPECIES	SHANNON Formula H-PRIME	RICHNESS S-1/LN N
1	16	3	0.8684	0.7213
2	9	6	2.4194	2.2756
3	8	3	1.5613	0.9618
4	37	6	2.1008	1.3847
5	22	6	2.1116	1.6176
6	39	8	2.1203	1.9107
7	16	5	1.9746	1.4427
8	26	5	1.0759	1.2277
9	19	3	1.5090	0.6792
10	30	7	1.9852	1.7641
11	35	6	1.8839	1.4063
12	28	4	1.5990	0.9003
13	63	8	2.0105	1.6895
14	18	7	2.6214	2.0758
15	22	3	1.2072	0.6470
16	37	5	1.6190	1.1078
All Stations Combined	425	21	2.6470	3.3046

Table C12

Diversity and Related Parameters for Benthic Samples

October 18, 1978

Station Number	Number of Individuals	Number of SPECIES	SHANNON Formula H-PRIME	RICHNESS S-1/LN N
1	5	2	0.7219	0.6213
2	18	3	1.2327	0.6920
3	11	2	0.8454	0.4170
4	21	3	1.2286	0.6569
5	26	7	2.0960	1.8416
6	18	3	1.4807	0.6920
7	24	5	1.6636	1.2586
8	32	5	1.7891	1.1542
9	16	4	1.8050	1.0820
10	20	6	1.7710	1.6690
11	67	8	1.9389	1.6648
12	25	8	2.5845	2.1747
13	11	3	1.3222	0.8341
14	16	5	1.6738	1.4427
15	22	6	2.2426	1.6176
16	29	5	2.0311	1.1879
All Stations Combined	361	18	3.0416	2.8868