ECOLOGICAL STUDIES OF THE CONNECTICUT RIVER VERNON, VERMONT REPORT 33

JANUARY – DECEMBER 2003

VERMONT YANKEE NUCLEAR POWER STATION BRATTLEBORO, VERMONT

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Table of Contents

List of Figures

Page

List of Tables

Page

1.0 INTRODUCTION

This report is submitted on behalf of the Entergy Nuclear Vermont Yankee, LLC and fulfills the requirements of the Final Discharge Permit #3-1199 Section IV (NPDES number VT0000264).

This is the third annual report submitted under the five-year discharge permit issued in August 2001 and the first presented under the final amended discharge permit issued June 2003 to Entergy Nuclear Vermont Yankee, LLC. Presented in this report are the results of the monthly thermal compliance monitoring (Section 2) and the methods and results of the environmental monitoring program, including water quality (Section 3), macroinvertebrates (Section 4), fish (Section 5), and zebra mussels (Section 6). The NPDES permit environmental sampling stations referred to in this report are presented in the sampling stations location map (Figure 1-1). An overview of the various permit-required sampling programs is presented in Table 1-1. The nature of each sampling program, including the specifics of the sampling locations and sampling schedule are discussed in the appropriate section for each program.

At the request of The Vermont Agency of Natural Resources, Department of Fish and Wildlife no adult American shad were processed during their spring 2003 upstream migration through the Vernon Dam fishway due to low passage numbers. Adult American shad will be processed during the 2004 migration season if numbers are sufficient.

Juvenile American shad studies were conducted during 2003; the final report outlining this study will be submitted under separate cover to the Environmental Advisory Committee in spring 2004 as Analytical Bulletin No. 81. The bulletin is titled "Abundance of juvenile American shad in the Vernon pool during 2003" Entergy Vermont Yankee/Connecticut River System Analytical Bulletin 81.

Annual Report 33 for 2003 was produced as a collaborative effort between Entergy Nuclear Vermont Yankee, LLC (Vermont Yankee) and Normandeau Associates, Inc.

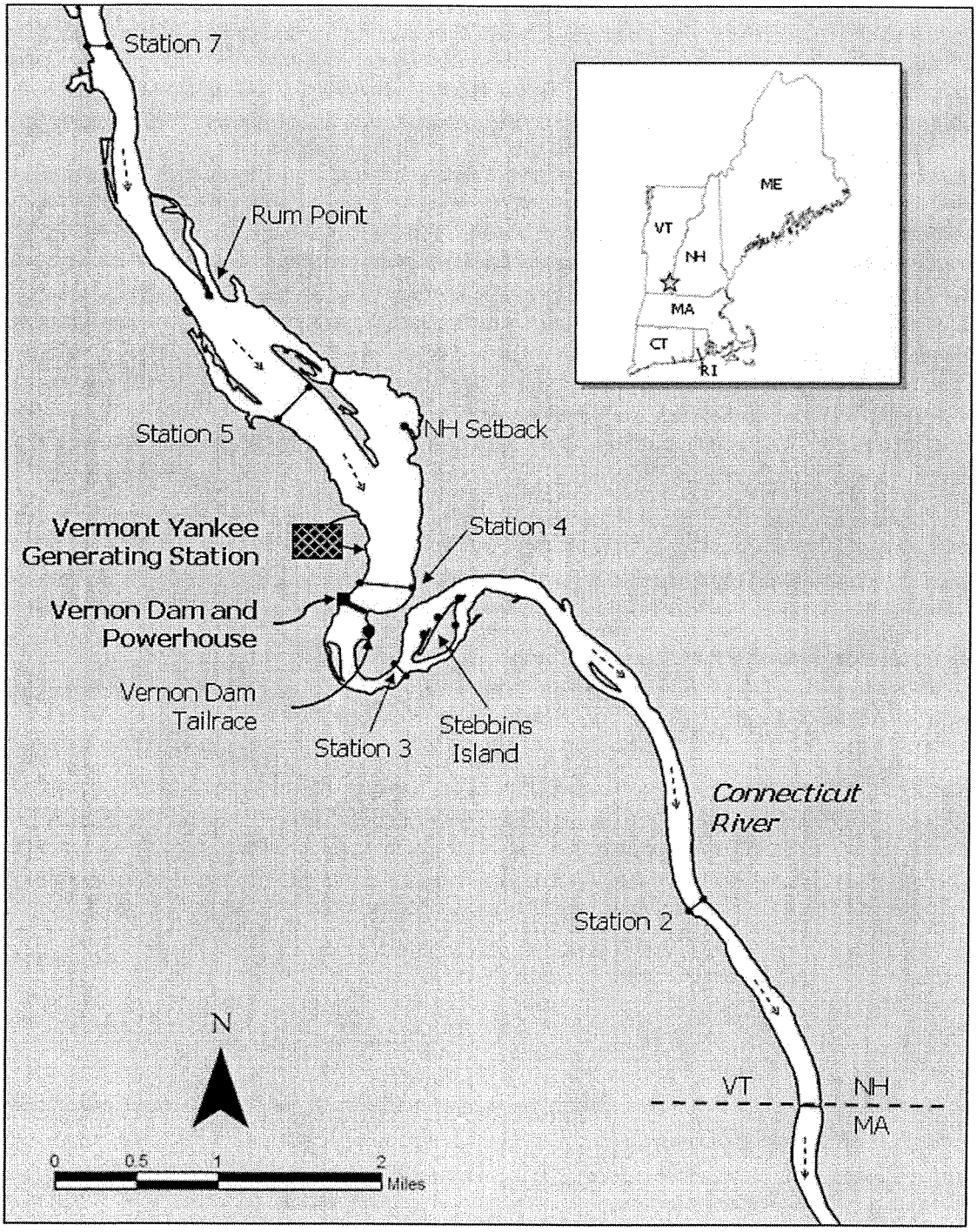

Figure 1-1. Connecticut River in the Vicinity of Vernon Pool.

Table 1-1. Sampling Station Numbers, Names, and Descriptions of Sampling Conducted for the Vermont Yankee NPDES Program in the Connecticut River in the Vicinity of Vernon, Vermont.

Station Number	Station Name	Sample Type(s)
Downstream Stations		
217	Station 2 NH South	General electrofishing
227	Station 2 VT South	Macroinvertebrates, anadromous electrofishing
031	Station 3 NH	Macroinvertebrates, anadromous electrofishing
032	Station 3 VT	Water quality, general electrofishing
624	Stebbins Island VT Lower	Anadromous electrofishing
614	Stebbins Island NH Lower	Anadromous electrofishing
613	Stebbins Island NH Mid	Anadromous electrofishing
615	Stebbins Island NH Upper	Anadromous electrofishing
724	0.1 Mi. Below Vernon VT (Lower)	General electrofishing
725	0.1 Mi. Below Vernon VT (Upper)	Anadromous electrofishing
020	Vernon Dam Fish Ladder	Water quality, adult shad
Upstream Stations		
051	Station 5 NH	Zebra mussel, corbicula, general electrofishing
053	Station 5 Mid-River	Zebra mussel, corbicula
052	Station 5 VT	Zebra mussel, corbicula, general electrofishing
072	Station 7 VT	Water quality
091	NH Setback	General electrofishing
102	Rum Point	General electrofishing
300	VY Discharge	Water quality
416	Station 4 NH North	Zebra mussel, corbicula, general electrofishing
436	Station 4 Mid-River North	Zebra mussel, corbicula
426	Station 4 VT North	Zebra mussel, corbicula, general electrofishing
417	Station 4 NH South	General electrofishing
427	Station 4 VT South	General electrofishing
800	VY Intakes	Larval fish, impingement

2.0 COMPLIANCE WITH THERMAL STANDARDS

2.1 THERMAL STANDARDS

The operational mode of Vermont Yankee's cooling water system is related to calendar dates and ambient Connecticut River water temperatures as specified in Vermont Yankee's discharge permit (Permit No. 3-1199, NPDES Number VT0000264) effective 29 August 2001. During the "summer" period of 16 May through 14 October period of each year, Vermont Yankee is permitted to discharge heat to the river within the following thermal standards (A.6.b of the NPDES permit):

Connecticut River Temperature at Station 7 (T7)	Calculated Increase in River Temperature above Ambient
T7>63°F	2°F
63°F⟨T7>59°F	3°F
59°F⟨T7>55°F	4°F
55°F⟨T7	5°F

During the "winter" period of 15 October through 15 May of each year, Vermont Yankee is permitted to discharge heat to the Connecticut River within the following thermal standards (Section A.6.a of the NPDES permit):

- The temperature at Monitor Station 3 during open cycle operation shall not exceed 65°F
- The rate of change of temperature at Monitor Station 3 shall not exceed 5°F per hour, and,
- The increase in temperature above ambient at Monitor Station 3 shall not exceed 13.4°F.

The river discharge near Vernon is regulated by Vernon Dam Hydroelectric Station to remain at or above 1250 cubic feet per second (cfs) or inflow if less than 1250 cfs. Since the theoretical maximum increase in temperature due to Vermont Yankee's thermal discharge at a river flow of 1250 cfs is 12.9°F, these standards, in effect, permit open cycle condenser cooling without cooling tower operation when ambient river temperatures are less than 52.1°F during 15 October through 15 May. If ambient river temperatures are equal to or greater than 52.1°F, the amount of heat discharged to the river can be reduced by using the cooling towers if the river flow is low.

2.2 METHODS OF DEMONSTRATING COMPLIANCE

Compliance with the criterion that limits open cycle operation to times when the downstream temperature is less than 65°F was demonstrated by examination of Connecticut River temperature and plant operating data. Rate of change of temperature is defined in the NPDES permit as the difference between consecutive hourly average temperatures. Measurements recorded in the Connecticut River below the Vernon Dam (Station 3) were used to calculate these differences.

Increase in temperature above ambient is defined in the NPDES permit as a plant-induced temperature increase as calculated by *equation 1-1 in the report 316 Demonstration* (Binkerd 1978, Downey and Binkerd 1990). This equation is based on the principle of conservation of energy, a principle which is integral to the computer simulation of the Vermont Yankee/Connecticut River system. Using measured upstream river temperature, plant operating data and core thermal power, the amount of heat discharged to the river was calculated. Then, using thermodynamic and hydrodynamic

principles and river discharge information, the mixed river temperature increase was calculated and compared with thermal standards.

Equation 1-1, rearranged for ease of computer computation using input from the plant environmental thermal sensor network, is as follows:

Equation 1a $H\_RECIRC_t = (TCI_{t-1} - TCI_t) * 472640.5 / 3600$

Equation 1b IF $(TCIT_{t-1} - TCIT_t) < |0.1|$ THEN $H\_RECIRC_t = 0$

Equations 1c IF $CWP_t = 1$ AND $CWBP_t = 0$ THEN $PUMP\_CAP_t = 267.38$

IF $CWP_t = 2$ AND $CWBP_t = 0$ THEN $PUMP\_CAP_t = 304.14$

IF $CWP_t = 2$ AND $CWBP_t > 0$ THEN $PUMP\_CAP_t = 267.38$

IF $CWP_t = 3$ AND $CWBP_t = 0$ THEN $PUMP\_CAP_t = 259.58$

IF $CWP_t = 3$ AND $CWBP_t > 0$ THEN $PUMP\_CAP_t = 254.01$

Equation 1b $H\_RIV_t = (PUMP\_CAP_t * CWP_t) * ((TCO_t - TCI_t) - (CWBP_t / CWP_t) * TCO_t - (TETO_t + TWTO_t) / 2)))$

Equation 1: $DELTA\_T_t = (H\_RIV_t + H\_RECIRC_t) / Q_t$

where,

H_RECIRC_t = heat content of the circulating water system and cooling towers in cfs °F at time interval t

TCI_{t-1} = condenser inlet temperature in °F at time interval t-1

TCI_t = condenser inlet temperature in °F at time interval t

CWP_t = number of circulating water intake pumps operating in time interval t

$CWBP_t$ = number of cooling tower booster pumps operating in time interval t

$PUMP\_CAP_t$ = pump capacity of the circulating water intake pumps in cfs

H_RIV_t = heat content of the cooling water discharge in cfs °F in time interval t

TCO_t = condenser outlet temperature in °F at time interval t

$TETO_t$ = east cooling tower outlet temperature in °F at time interval t

$TWTO_t$ = west cooling tower outlet temperature in °F at time interval t

$DELTA\_T_t$ = average simulated Connecticut River temperature increase at Station 3 in °F in time interval t

Q_t = average Connecticut River discharge observed at Vernon Dam in cfs in time interval t

Vermont Yankee's Azonix® thermistor temperature monitoring systems at Stations 3 and 7 are linked to the Station's process computer. This allows Vermont Yankee operators to utilize real time,

accurate temperature data for thermal compliance. It also allows Vermont Yankee's Environmental Group an opportunity to generate thermal compliance reporting. The WaDaR® units remain in the river at Stations 3 and 7 as the back-up temperature recorders to the Azonics®. Both the Azonix® thermistors and the WaDaR® temperature monitoring systems record ambient river water temperature to the nearest 0.1°F. The simulation is based on electronically acquired five-minute river discharge data from the Vernon Dam and Vermont Yankee's five minute observations of thermal temperatures at Stations 3 and 7 and thermal heat discharge to the river.

2.3 THERMAL IMPACT

Figures in this section illustrate the principle of conservation of energy as applied to the Vermont Yankee/Connecticut River system. Figure 2-1 depicts core thermal power produced and plant discharge flow by Vermont Yankee in 2003. This data was obtained from five minute records supplied by Vermont Yankee. The licensed maximum reactor core thermal power is limited to 1593 megawatts. About one-third of this power was converted to electrical power, while the remainder was transferred as heat to the atmosphere via the cooling towers, or discharged to the river (Figure 2-2). Vermont Yankee experienced a planned Station outage beginning on 27 September 2003 when the generator was taken off line. The generator was returned to service 4 October 2003. Otherwise the plant remained at full power throughout 2003, with occasional brief periods of power derating.

Figure 2-3 is a plot of hourly Connecticut River discharge for the Vernon Hydroelectric Station in Vernon, Vermont during 2003. The hourly average Connecticut River discharge was computed using five minute observations obtained by Vermont Yankee through their computer system from sensors installed at the Vernon Dam. When the flows were above 32,000 cfs electronic hourly river flow data was obtained from PG&E New England Generation.

Table 2-1 presents the average daily and monthly Connecticut River discharge computed from the hourly observations obtained for 2003 as described above. For discharge greater than 12,000 cfs, a rating curve was used by Vernon Dam to convert stage height to discharge. The rating curve was the same one used by the USGS prior to abandoning the Vernon gauging station (Aquatec 1995). This curve is believed to be sufficiently accurate because backwater from the Northfield Mountain Pump Storage Facility and the modification at Turners Falls Dam have had little impact on stage height near Vernon Dam during times of high discharge (Aquatec 1995). Below 12,000 cfs, discharge data were obtained from turbine rating curves at Vernon Station. The peak daily Connecticut River average flow for 2003 was 62,765 cfs, which occurred on 30 October 2003 compared to 59,113 cfs on 16 April 2002. The hourly average flows are represented in Figure 2-3. The peak hourly average Connecticut River flow of 66,018 cfs was observed on 29 October 2003 at 2200 DST. The lowest daily Connecticut River flow at Vernon Dam was 1606 cfs on 10 July 2003. The lowest hourly Connecticut River flow at Vernon Dam was 1276 cfs observed on 26 August 2003 at 0400 DST.

The simulated increases in Connecticut River temperature at Station 3 due to Vermont Yankee's operation are plotted for each hour of operation in Figure 2-4. Vermont Yankee's discharged heat remains dependant upon reactor power and plant operational mode. During normal full power operations these values range from 1035 to 1120 mwt. Connecticut River discharge (Figure 2-3), Vermont Yankee daily average discharge flow (Figure 2-2) and river temperature increase (Figure 2-4) illustrates that for a constant heat rejection rate to the river, the temperature increase is inversely proportional to the river discharge. Vermont Yankee's operation remained at or below the permit standards for all of 2003 except for one occasion on 19 September 2003 when the highest simulated

hourly average temperature increase for the month was 2.16°F when the Permit limit was 2.0°F. This occurred at an hourly average river flow of 2,625 cubic feet per second (cfs). On the morning of September 19, 2003, discussions with PG&E National Energy Group at the Wilder Hydroelectric Station, Vermont Yankee Operations personnel were informed that PG&E would be increasing Connecticut River flow out of the Wilder project, which would subsequently increase river flow at Bellows Falls and Vernon Dams. VY Operations set the Station operating parameters in anticipation of an increase in river discharge. However, PG&E did not increase river flow as much as planned and did not notify VY of their change in plans. When river flow did not increase as much as anticipated, VY Station Operators immediately readjusted the Station settings to correspond with the lower river flow. VY was above the 2.0°F permit limit for 11 minutes (0730-0741), resulting in the hourly average temperature increase of 2.16°F. This event was:

- 19 September 2003 0730-0741DST, +0.16°F (above permit limit), Permit Limit was + 2.0° F.

During the cold water period when the permit limit was 13.4° F, the maximum simulated river temperature increase observed was 13.16° F on 25 January 2003 when the river flow was 1,308 cfs.

Hourly average temperatures measured at Station 7 and Station 3 are plotted on Figure 2-5. Station 7 is well upstream of the plant, and water temperatures are unaffected by the plant's thermal discharge. Heat discharged from the plant was well mixed at Station 3, due to passage through the Vernon Dam. Temperatures measured at Station 3 reflected both the natural and plant-induced changes in temperature between the upstream and downstream locations, and never exceeded the 65°F limit during the period October 15 through May 15 (Figure 2-5). The rate of change of temperature at Station 3 did not exceed ±5°F permitted change per hour.

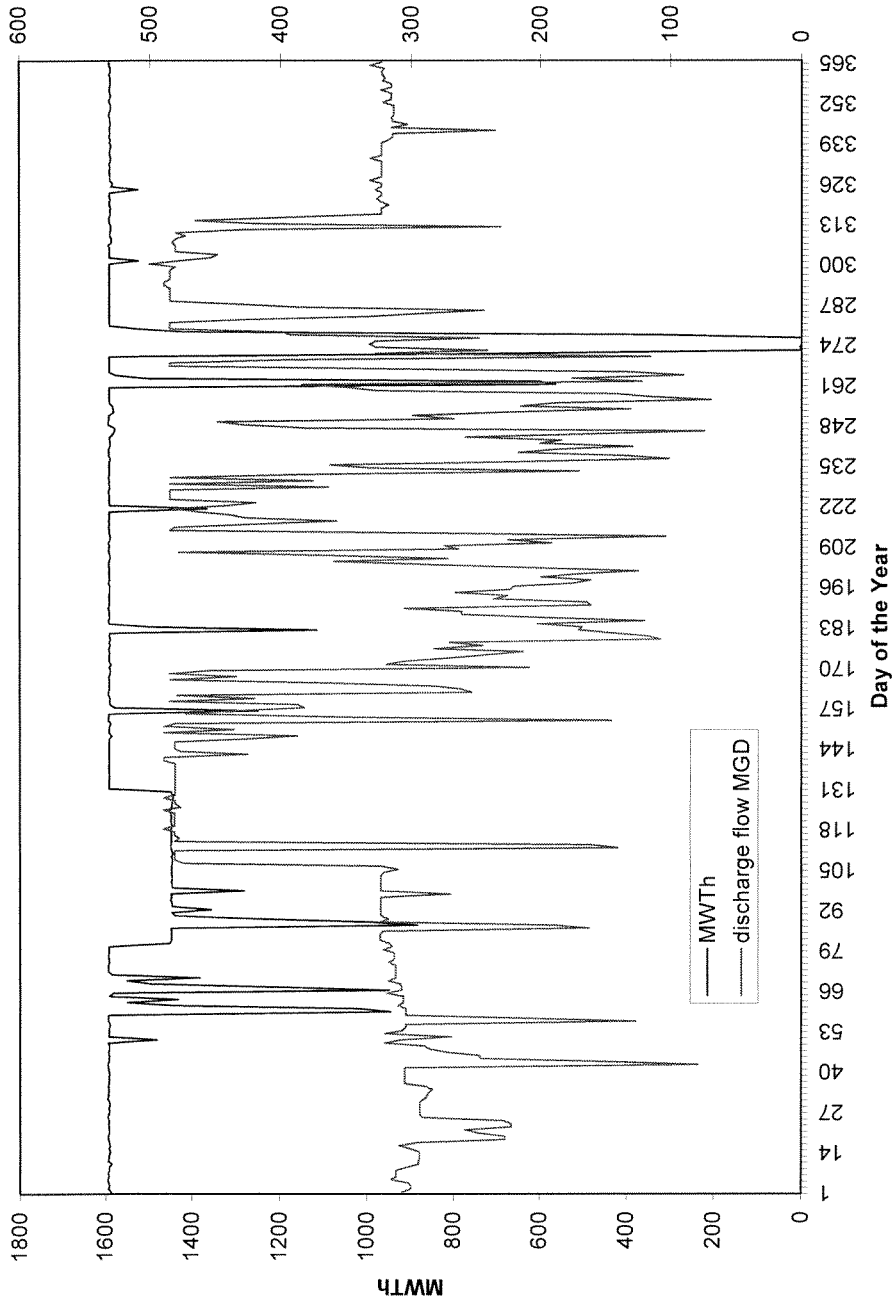

Figure 2-1. Vermont Yankee Core Thermal Power and Plant Discharge Flow 2003.

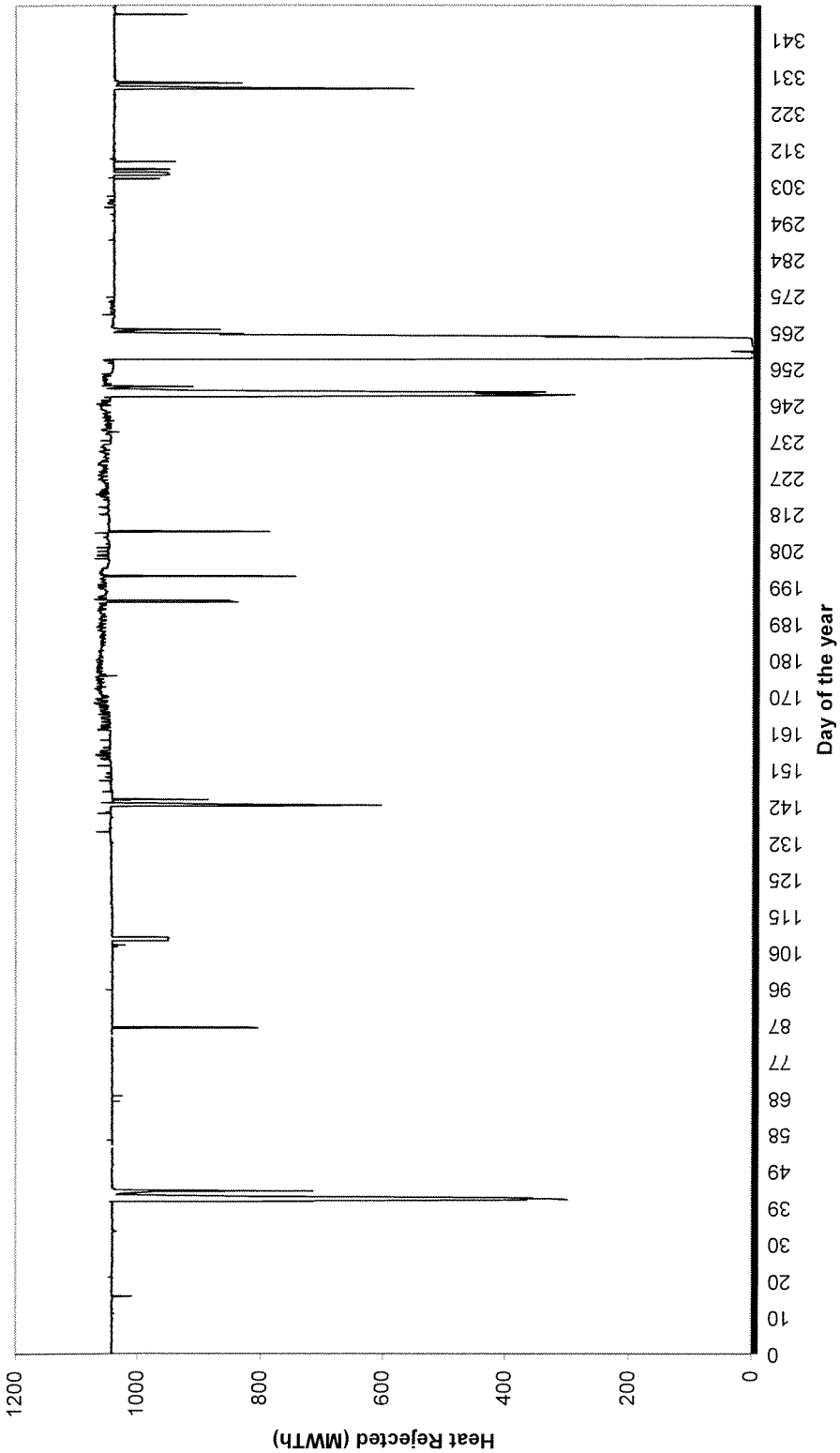

Figure 2-2. Hourly Average Heat Rejected by Vermont Yankee's Condenser during 2003.

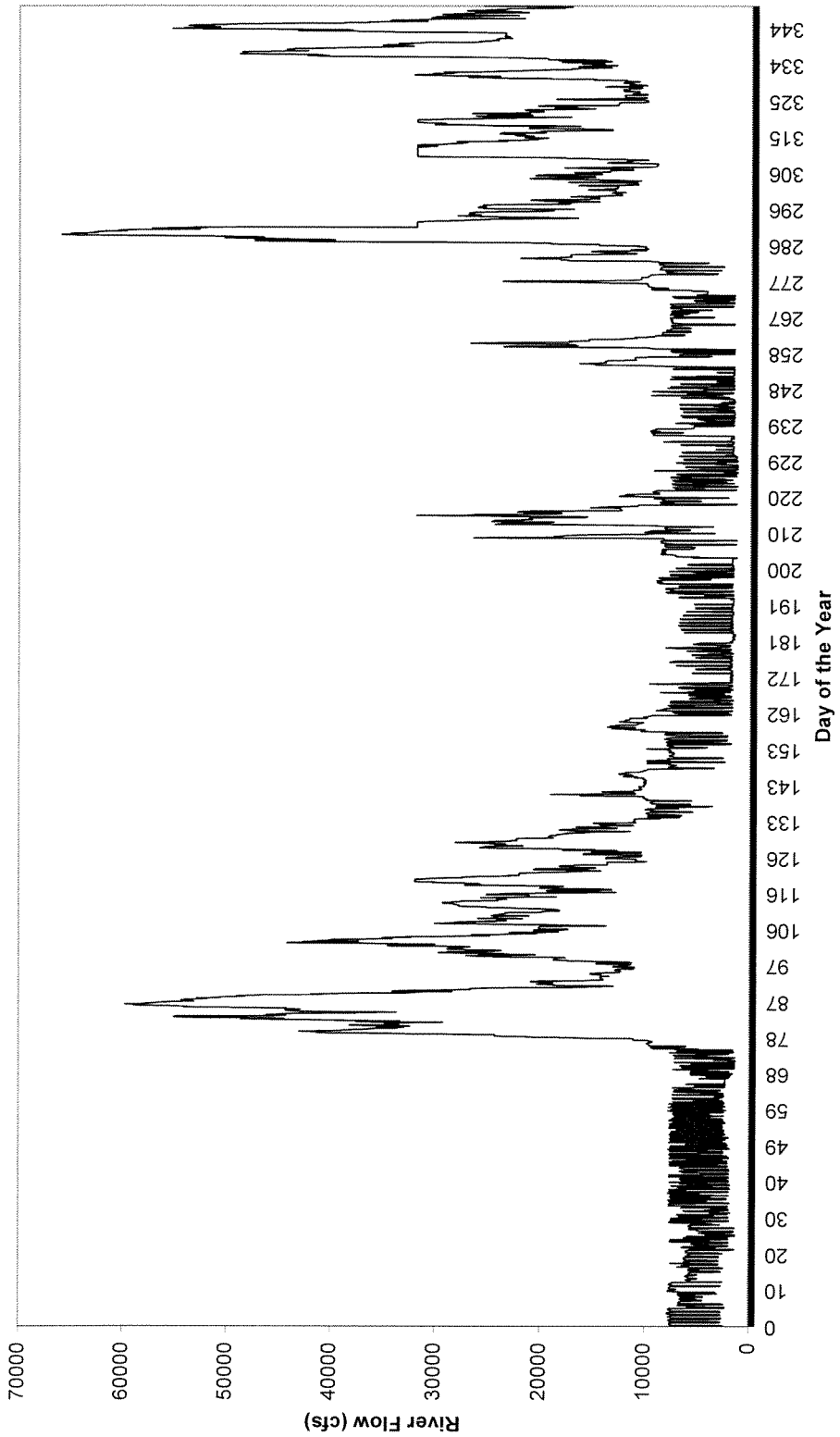

Figure 2-3. Hourly Average Connecticut River Flow During 2003.

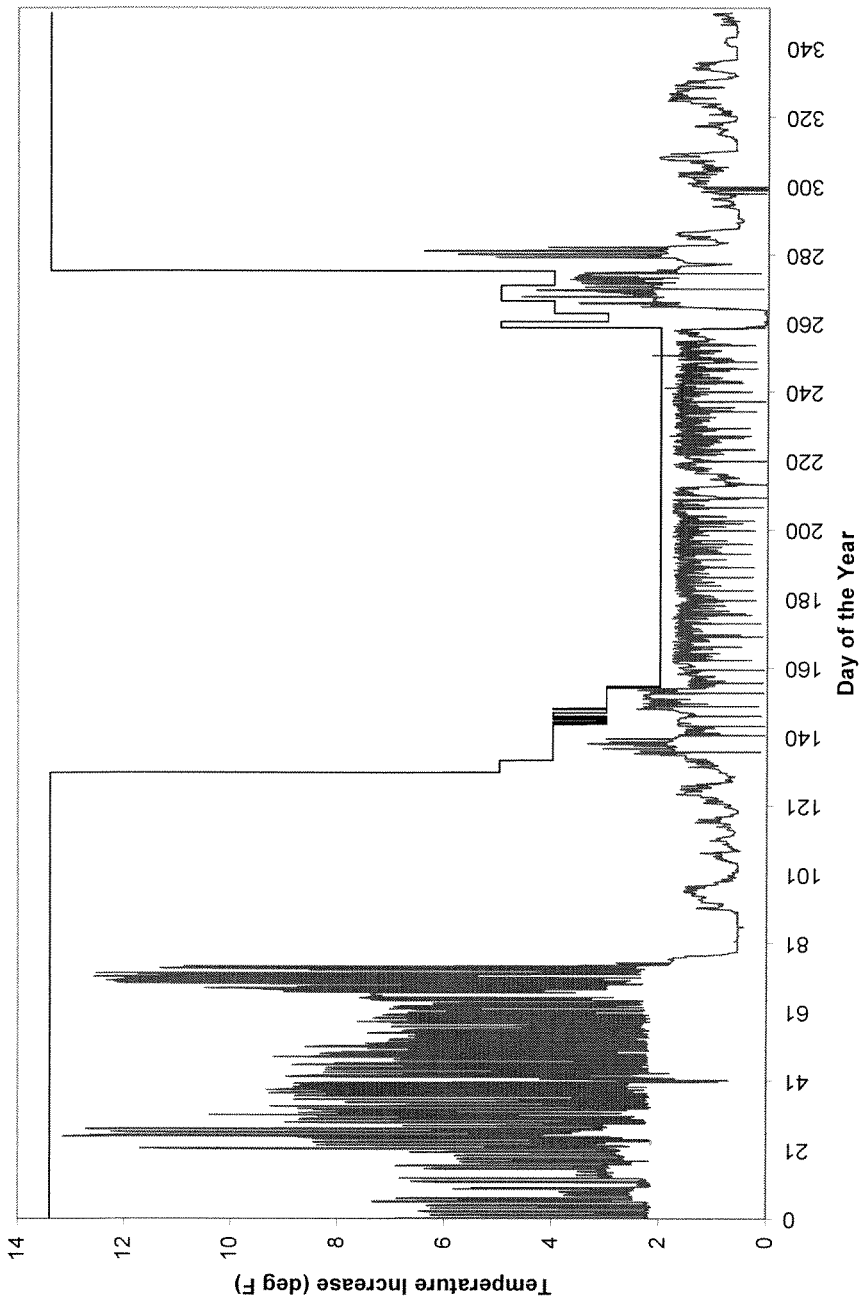

Figure 2-4. Simulated Hourly Connecticut River Temperature Increase at Downstream Monitor 3 During 2003.

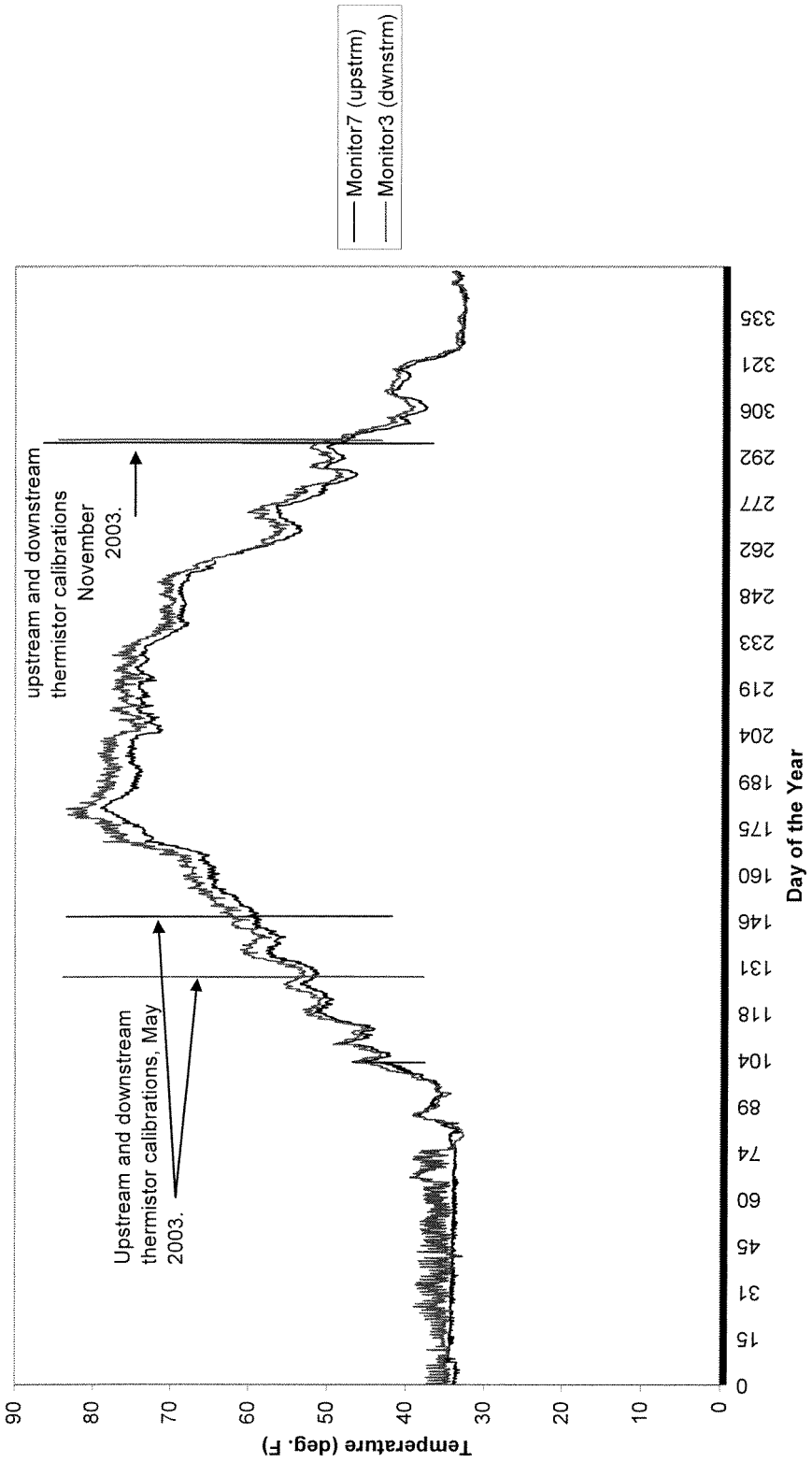

Figure 2-5. Measured Hourly Average Connecticut River Temperatures at Monitoring Stations 3 and 7 During 2003.

Table 2-1. Average Connecticut River Discharge (cfs) at Vernon Station for the Year 2003.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Day												
1	6055	3361	3711	51675	16707	10362	2670	3984	2999	10835	31970	23116
2	5762	3100	4125	43162	21049	11894	3130	8149	3095	7992	30764	22880
3	6058	5474	3313	31642	28742	10756	3807	8200	1783	7347	22697	18843
4	5817	5183	4590	20628	30619	7156	2235	6908	7230	7070	26710	16545
5	6341	4931	3470	19055	23425	8167	3067	6460	8956	5496	21851	11253
6	4827	5339	4679	16829	17990	6884	3116	9695	5888	7739	25210	13326
7	5456	4855	5099	14215	17751	6297	3982	17906	3884	6555	19841	11130
8	5720	3974	3070	13999	15364	7494	3734	8499	3139	6471	17664	11667
9	5560	3841	2313	12265	11136	8355	1707	7483	3442	6498	14345	11507
10	6806	4246	2371	11908	12253	6898	1606	13751	2532	5448	12938	11449
11	7328	4145	3025	13978	13227	5093	2586	22425	3903	3672	13791	13572
12	6092	4315	4068	18509	15571	5721	3193	19502	3732	3860	12751	25347
13	5635	4550	3778	24006	24436	5323	3431	22900	1762	3768	12329	29337
14	5570	4445	3038	26513	25058	7634	3036	16914	3083	6379	17563	19183
15	5429	3988	2308	28078	22117	11952	3047	12633	4285	9417	17444	14906
16	4403	3603	4612	34347	18897	11370	2817	6870	4800	13218	13428	15676
17	4996	4790	3529	40300	15655	11789	2614	7396	4119	13533	12065	20392
18	4870	4442	6231	31781	15751	10209	2752	9791	3054	10039	10535	42847
19	5190	3479	8681	23026	13767	4148	2451	9212	2802	6818	12485	46026
20	4958	3711	9756	19563	11123	6075	1622	6284	3945	7276	27318	38780
21	4999	4075	15948	18457	9045	5177	3557	4638	1984	7050	31971	33334
22	4207	3593	29932	27129	8767	4681	4793	5262	2881	10438	31971	25130
23	3647	3507	39514	24038	8806	3768	6058	5492	6992	18848	30975	23534
24	4913	4780	34705	23759	7456	3728	4255	2887	14544	14804	26674	25890
25	3547	4924	33612	20268	8550	4602	6672	2751	11658	12582	21132	44815
26	2956	4789	42410	22416	9162	4233	7015	2319	6216	10739	22750	51813
27	4061	4667	49798	28244	13335	4477	4424	3639	4026	20548	17790	38333
28	4464	4899	40781	26060	12272	1829	3711	2851	9581	43472	19392	30120
29	4917		44984	22427	10775	1807	2722	2260	19911	55928	28825	27367
30	4481		57152	20689	10314	2560	3031	3313	17760	62765	30903	24770
31	3831		55041		10100		1737	1912		55764		20758
Monthly Avg	*5126*	*4322*	*17085*	*24299*	*15459*	*6681*	*3373*	*8461*	*5799*	*14915*	*21203*	*24634*

3.0 WATER QUALITY

3.1 COPPER, IRON AND ZINC CONCENTRATIONS

Beginning in April 1996, and continuing through 2003, monthly grab samples of Connecticut River water from Stations 3, 7, and the plant discharge (Figure 3-1) were analyzed for total copper, iron, and zinc, as outlined in the NPDES permit #3-1199. Results of the analysis are presented in Table 3-1 and Figures 3-2, 3-3 and 3-4. Additionally, in 2003 additional samples were collected and analyzed for soluble copper, iron and zinc between January and May 2003. The soluble metal results for 2003 are included in Table 3-1 and Figures 3-2a, 3-3a, and 3-4a.

Total copper concentrations from the Connecticut River water upstream Station 7, Station discharge, and downstream Station 3 ranged from <0.002 to 0.01 mg/L, 0.0 to 0.099 mg/L, and from <0.002 to 0.065 mg/L, respectively, in 2003 (Table 3-1, Figure 3-2). The highest total concentration of copper observed at Station 7 was 0.01 mg/L on 15 July 2003. The highest total concentration of copper observed in the Vermont Yankee Station discharge was 0.099 mg/1 on 14 January 2003. The highest total copper concentration of 0.065 mg/L at Station 3 was observed on 16 December 2003 (Table 3-1, Figure 3-2). Soluble copper obtained from the first five monthly samples in 2003 ranged from <0.002 to 0.006 mg/L at upstream Station 7, <0.002 to 0.007 mg/L at the station discharge, and was between 0.003 and 0.005 mg/L at downstream Station 3 (Table 3-1, Figure 3-2a).

Except for five occassions, the total iron concentration in the Connecticut River water samples at all three monitoring locations was less than 0.5mg/L during 2003 (Table 3-1, Figure 3-3). The highest total iron concentration measured at the upstream Station 7 was 1.6mg/L on 16 December 2003. The highest total iron concentration measured in the Vermont Yankee Discharge water was 0.671 mg/L on 13 August 2003. The highest total iron concentration of 4.29 mg/L was observed at Station 3 on 16 December 2003 (Table 3-1, Figure 3-3). Soluble iron obtained from the first five monthly samples in 2003 ranged from 0.083 to 0.199 mg/L at upstream Station 7, 0.083 to 0.098 mg/L at the Vermont Yankee discharge, and was between 0.072 and 0.109 mg/L at downstream Station 3 (Table 3-1, Figure 3-3a).

Total zinc concentrations in Connecticut River water samples were generally less than 0.020 mg/L during 2003 (Table 3-1, Figure 3-4). The highest total zinc concentration at upstream Station 7 was 0.0.069 mg/L observed on 13 March 2003. The highest total zinc concentration in the Vermont Yankee discharge water was 0.046 mg/L on 13 March 2003 (Table 3-1, Figure 3-4). The highest total zinc concentration of 0.229 mg/L was observed at Station 3 on 14 January 2003. Soluble zinc obtained from the first five monthly samples in 2003 ranged from <0.005 to 0.069 mg/L at upstream Station 7, 0.007 to 0.037 mg/L at the Vermont Yankee discharge, and was between 0.014 and 0.071 mg/L at downstream Station 3 (Table 3-1, Figure 3-4a).

On most of the sampling dates and locations when both total and dissolved metal analysis were preformed and the highest concentrations were observed, the majority of the copper, iron and zinc was found in the particulate fraction. This observation was particularly common in the river water samples from downstream Station 3 and in the Vermont Yankee discharge flow, and probable reflects the resuspension of river sediments due to the turbulent nature of flow at these two locations.

3.2 WATER TEMPERATURE

Water temperature was measured continuously in the Connecticut River at Station 7 and Station 3 during 2003 and at the Vernon Dam fishway during operation. Daily and monthly average temperature data for Station 7 and Station 3 are summarized in Tables 3-2 and 3-3 and were discussed in Section 2.3; the hourly average temperature data for both stations are plotted on Figure 2-5. Hourly and daily average temperature data from the fishway are presented in Table 3-5 and Figure 3-5. The fishway operated daily from 22 May 2003 at 1030 to 30 June 2003 at 1900. During the 2003 period of fishway operation, the hourly water temperature ranged from a low of 56.9°F at 0500 on 26 May 2003 to a high of 81.2°F at 1141 on 26 June 2003.

Calibration of the primary upstream and downstream temperature probes linked to the Azonix® boxes occurred on May and again in November 2003; both calibrations are evident as spikes on Figure 2-5. The spikes occur when the probe has been removed from the river and placed into the calibration equipment.

On four occasions, the downstream Station 3 modem failed and the primary temperature data was not available from the Azonix® temperature probe system. For each of those occasions the backup temperature data from the WaDaR® data logger was utilized. The four time periods for which the backup data was utilized were 6-12 February 2003, 22-23 June 2003, 17-18 August 2003, and 21 August 2003.

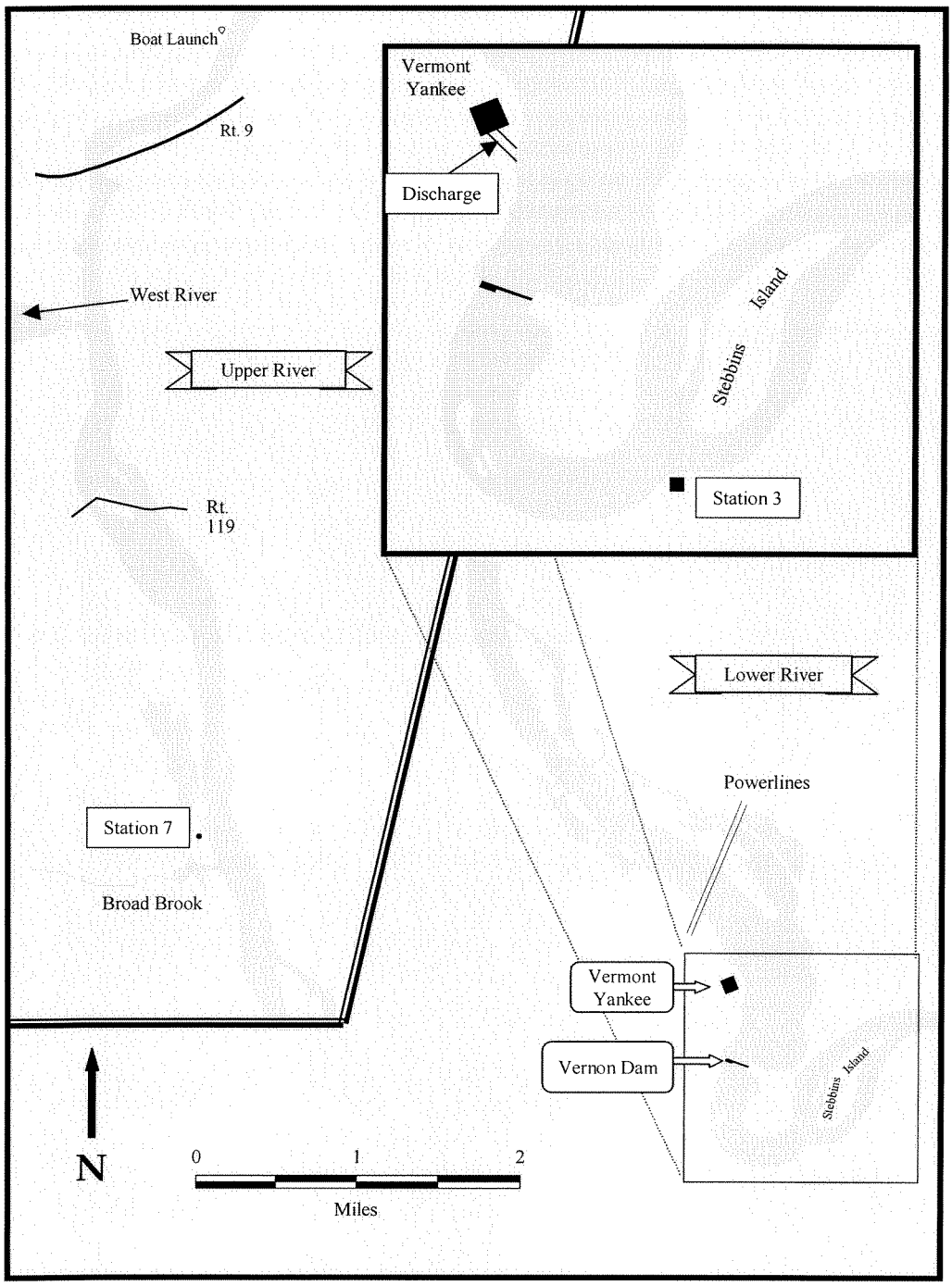

Figure 3-1. NPDES Sampling Stations.

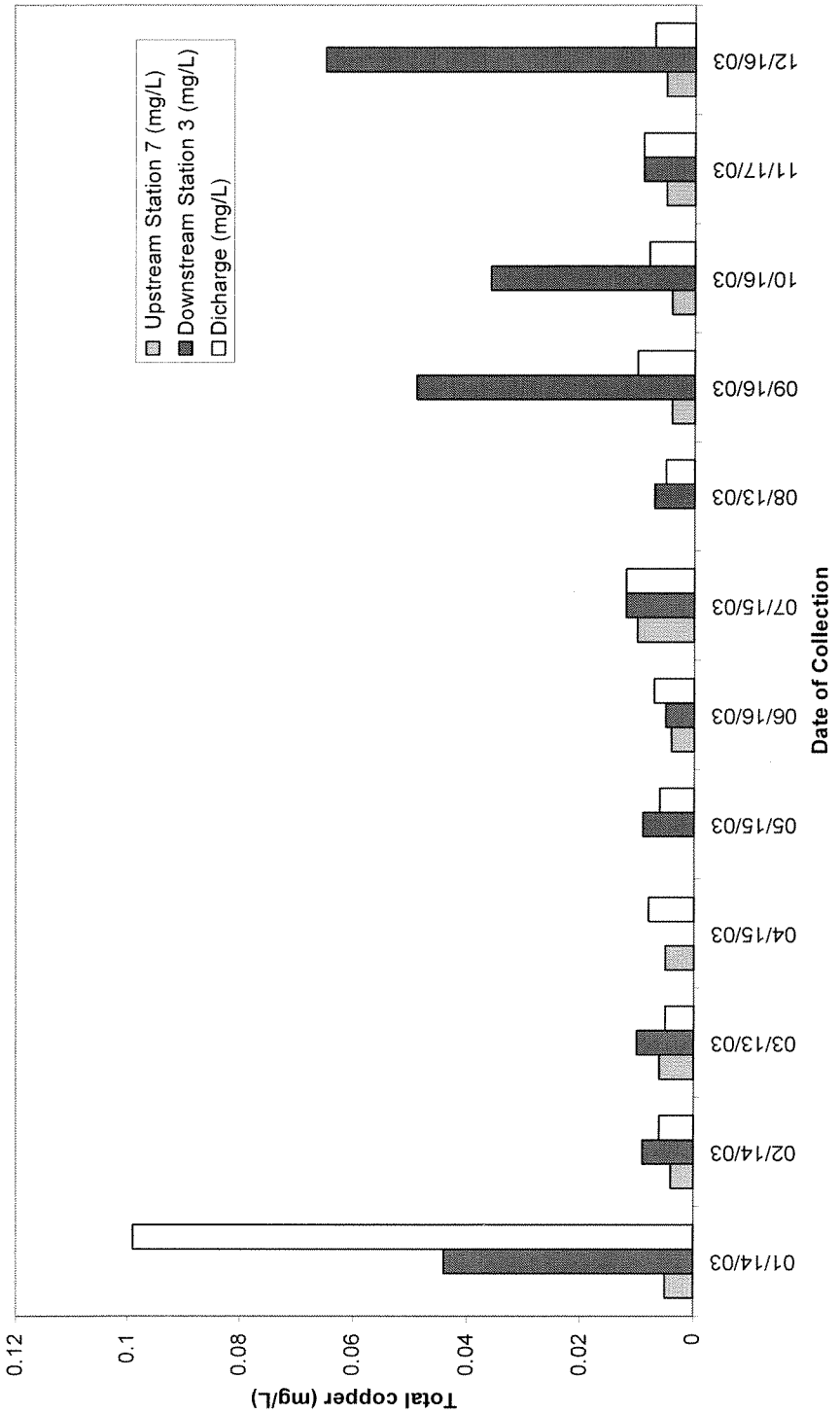

Figure 3-2. 2003 Monthly Total Copper Concentrations Observed from NPDES Permit Required Monitoring Stations

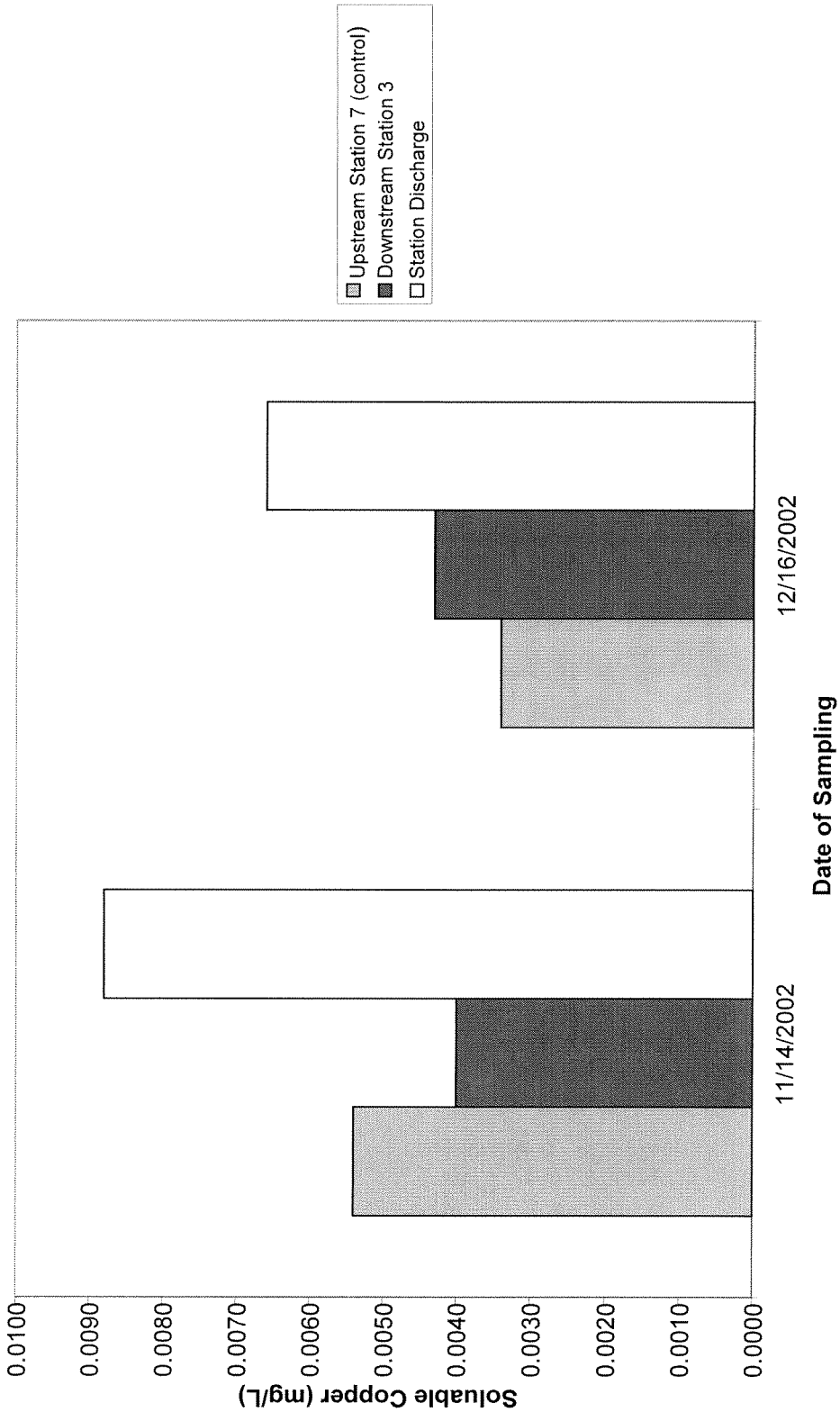

Figure 3-2a. 2003 Monthly Soluble Copper Concentrations Observed from the NPDES Permit Required Monitoring Stations.

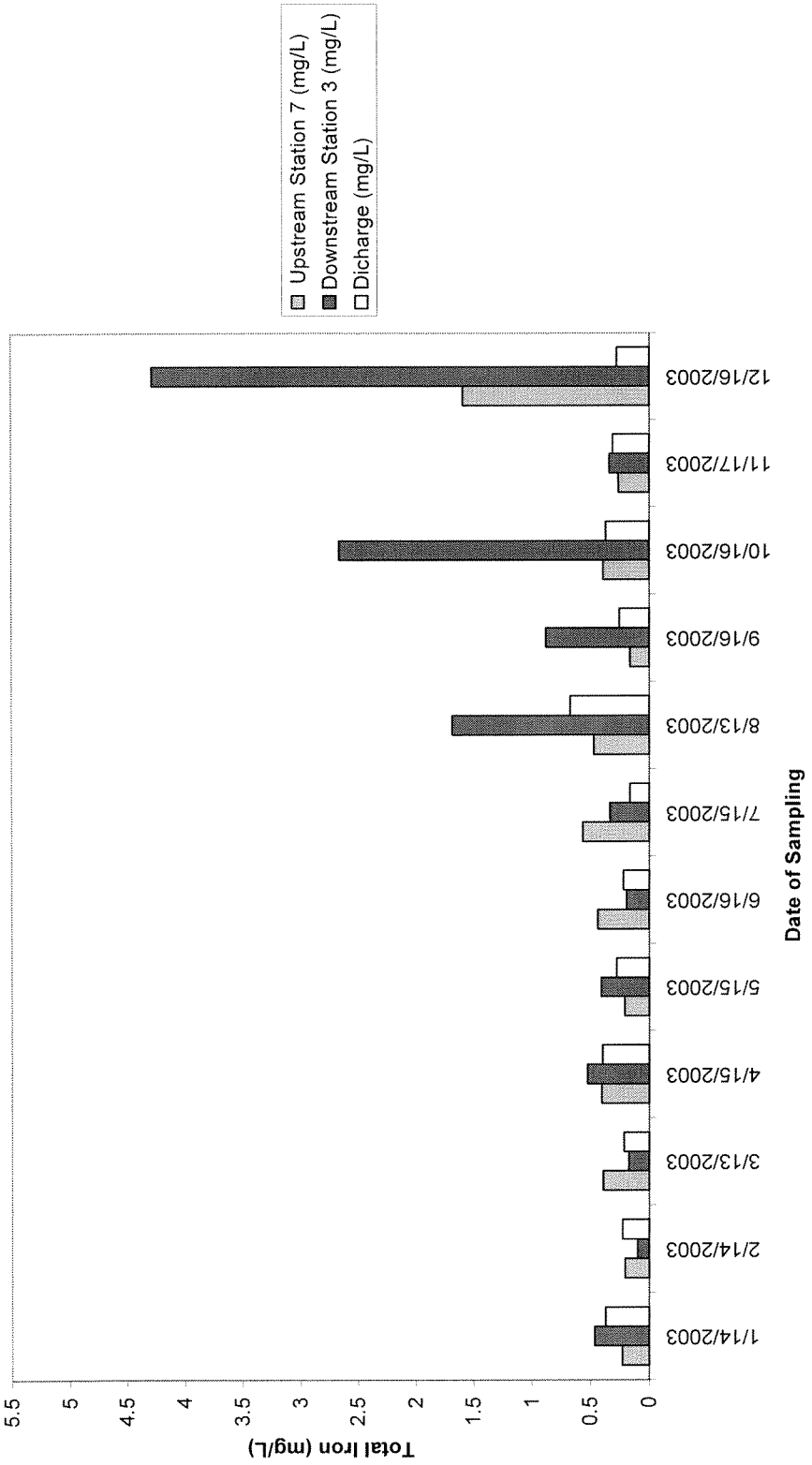

Figure 3-3. 2003 Monthly Total Iron Concentrations Observed from NPDES Permit Required Monitoring Stations.

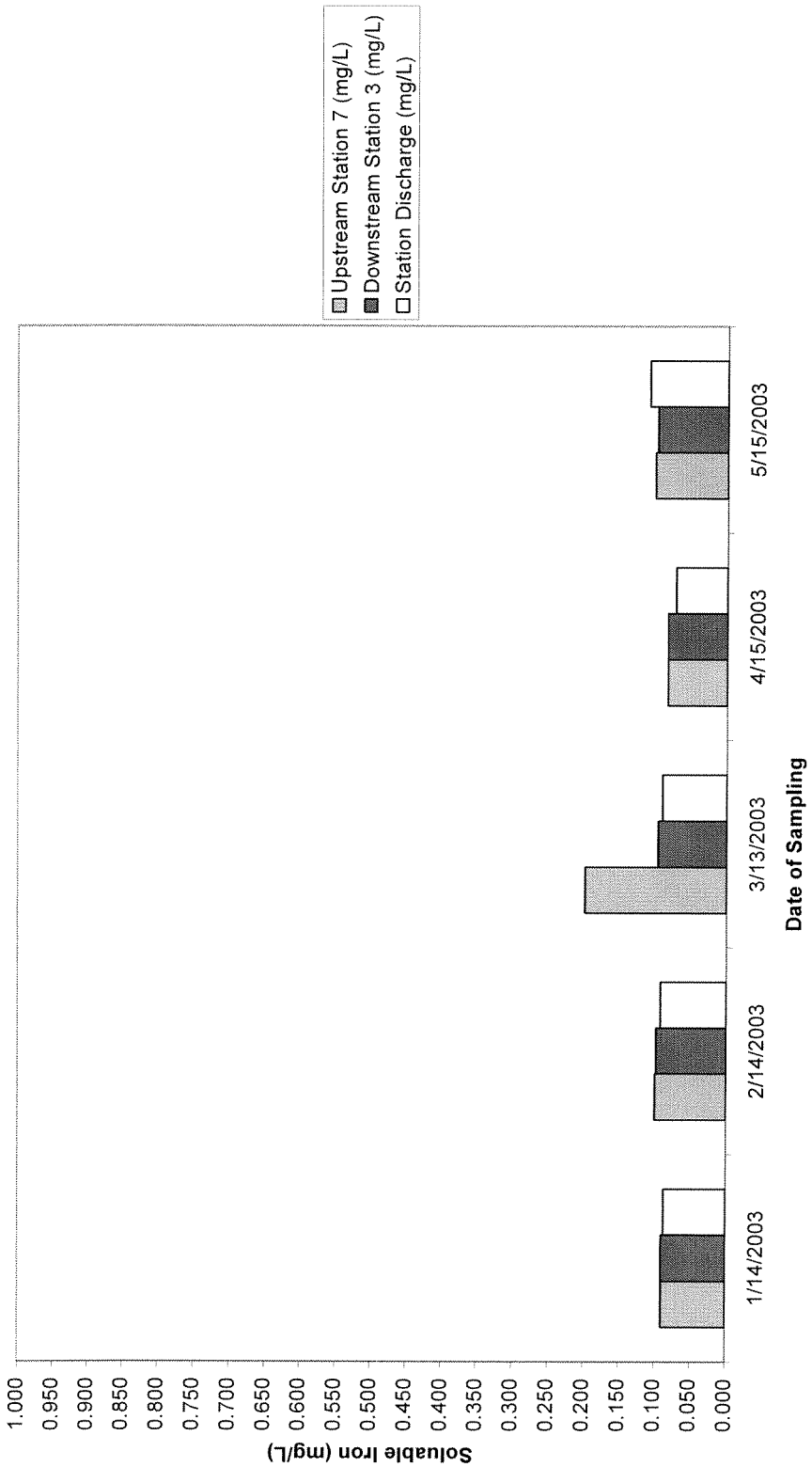

Figure 3-3a. 2003 Monthly Soluble Iron Concentrations Observed from NPDES Permit Required Monitoring Stations.

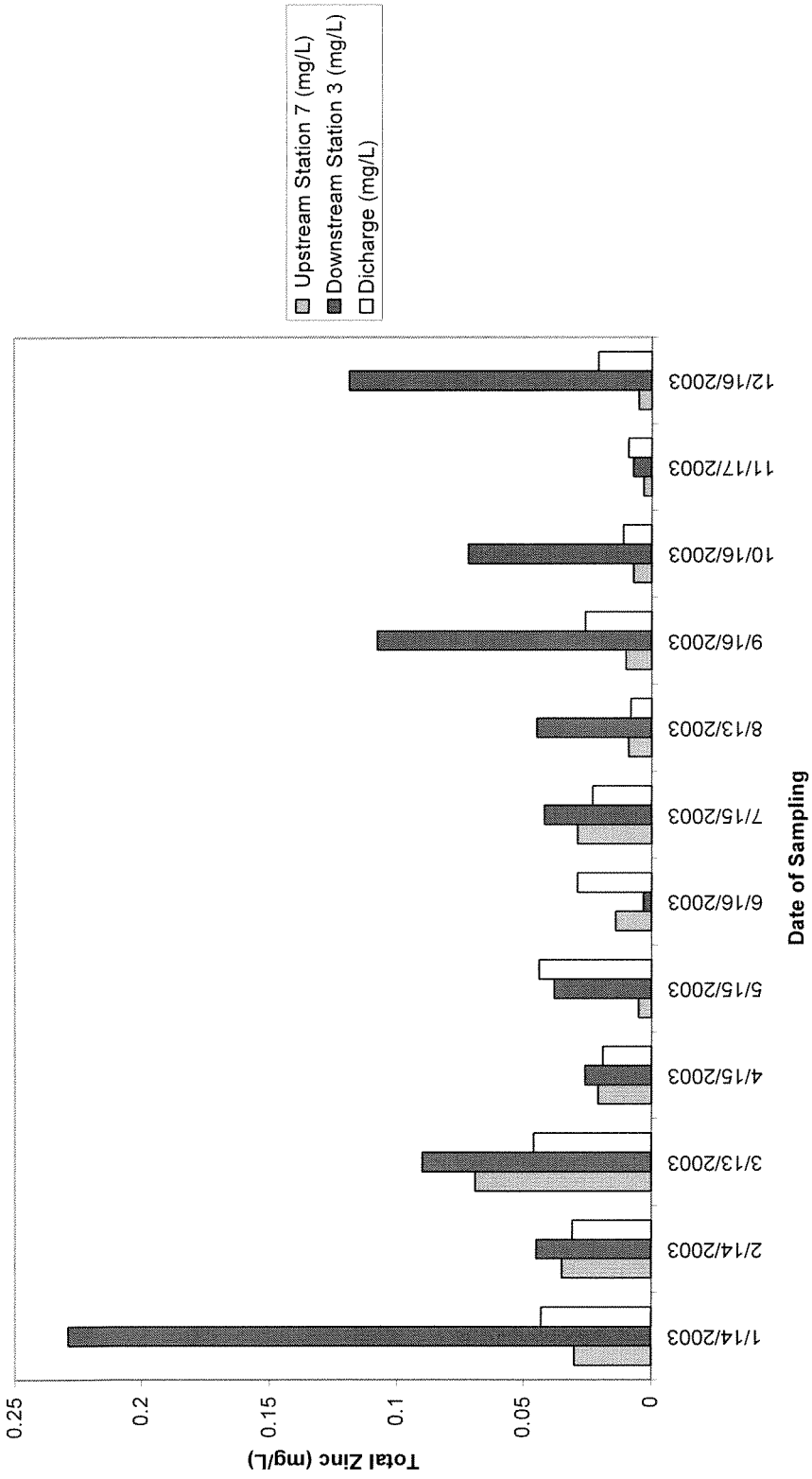

Figure 3-4. 2003 Monthly Total Zinc Concentrations Observed from the NPDES Permit Required Monitoring Stations.

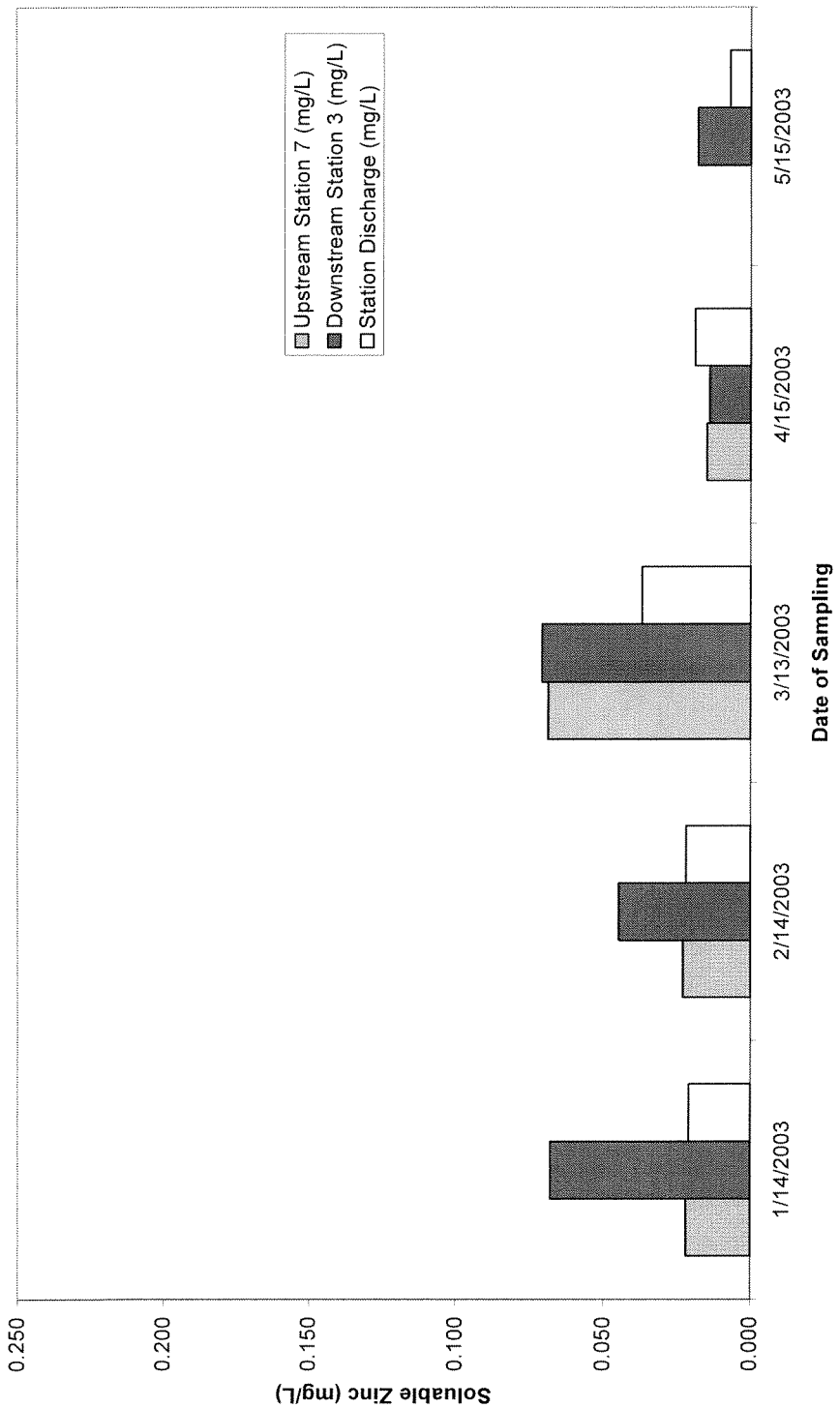

Figure 3-4a. 2003 Monthly Soluble Zinc Concentrations Observed from the NPDES Permit Required Monitoring Stations.

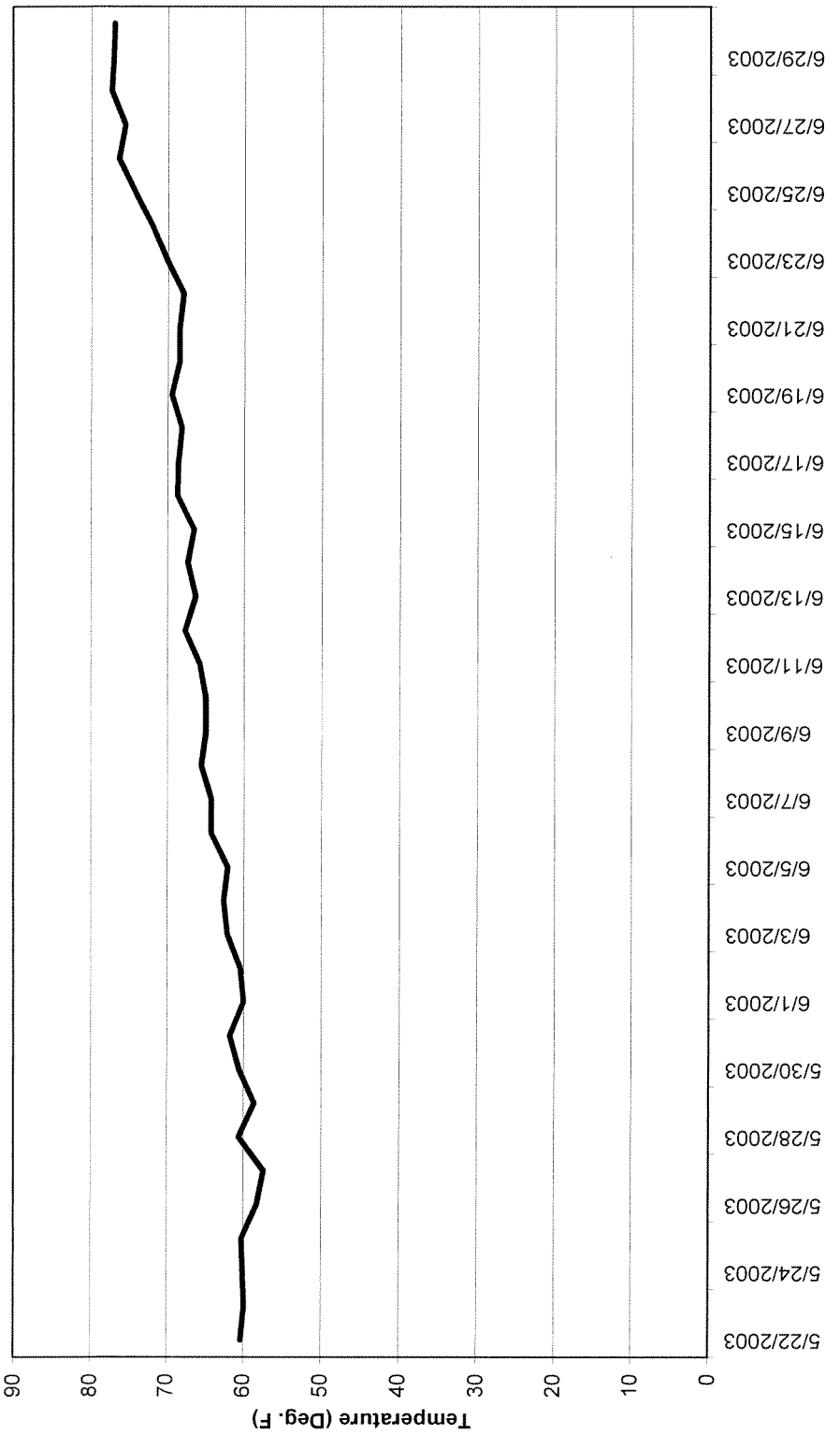

Figure 3-5. Hourly Vernon Dam Fishway Temperatures 22 May through 30 June 2003.

Table 3-1. 2003 NPDES River Water Metals (mg/L).

Total Metals	Upstream Station 7 (mg/L)			Downstream Station 3 (mg/L)			Discharge (mg/L)		
Date	Copper	Iron	Zinc	Copper	Iron	Zinc	Copper	Iron	Zinc
1/14/2003	0.005	0.23	0.03	0.044	0.463	0.229	0.099	0.37	0.043
2/14/2003	0.004	0.207	0.035	0.009	0.098	0.045	0.006	0.226	0.031
3/13/2003	0.006	0.392	0.069	0.010	0.174	0.09	0.0	0.216	0.046
4/15/2003	0.005	0.404	0.021	<0.002	0.526	0.026	0.008	0.398	0.019
5/15/2003	<0.005	0.208	0.005	0.009	0.408	0.038	0.006	0.276	0.044
6/16/2003	0.004	0.437	0.014	0.005	0.194	0.003	0.007	0.22	0.029
7/15/2003	0.01	0.564	0.029	0.012	0.335	0.042	0.012	0.162	0.023
8/13/2003	<0.002	0.471	0.009	0.007	1.69	0.045	0.005	0.671	0.008
9/16/2003	0.004	0.165	0.01	0.049	0.881	0.108	0.01	0.255	0.026
10/16/2003	0.004	0.394	0.007	0.036	2.67	0.072	0.008	0.37	0.011
11/17/2003	0.005	0.26	0.003	0.009	0.34	0.007	0.009	0.309	0.009
12/16/2003	0.005	1.6	0.005	0.065	4.29	0.119	0.007	0.278	0.021
Soluble Metals	***Upstream Station 7 (mg/L)***			***Downstream Station 3 (mg/L)***			***Station Discharge (mg/L)***		
Date	**Copper**	**Iron**	**Zinc**	**Copper**	**Iron**	**Zinc**	**Copper**	**Iron**	**Zinc**
1/14/2003	0.004	0.090	0.022	0.005	0.090	0.068	0.007	0.087	0.021
2/14/2003	<0.002	0.100	0.023	0.003	0.098	0.045	0.005	0.092	0.022
3/13/2003	0.006	0.199	0.069	0.005	0.096	0.071	<0.002	0.090	0.037
4/15/2003	0.003	0.083	0.015	0.003	0.083	0.014	0.007	0.072	0.019
5/15/2003	<0.005	0.101	<0.005	<0.005	0.098	0.018	0.005	0.109	0.007

Table 3-2. Average Connecticut River Temperature (degrees F) at Station 7 for the Year 2003.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Day												
1	33.82	34.21	33.92	37.19	50.02	59.13	73.57	74.48	72.08	57.44	49.72	36.30
2	33.75	34.08	33.89	36.62	50.98	59.01	74.06	72.41	71.17	56.40	49.98	35.25
3	33.64	34.12	33.86	36.61	51.09	59.88	75.04	71.62	70.45	55.27	51.85	34.51
4	33.57	34.02	33.85	36.32	50.48	59.30	75.85	71.77	69.85	54.44	47.63	33.62
5	33.48	34.01	33.96	35.74	49.98	59.79	76.37	72.71	69.11	53.68	47.12	33.29
6	33.64	34.07	33.79	35.73	49.88	60.43	77.14	72.68	68.42	53.95	46.24	33.06
7	33.58	34.08	33.81	36.08	50.05	61.17	77.85	72.52	68.39	54.21	44.40	33.12
8	34.19	34.07	33.77	36.10	50.35	61.56	78.54	73.13	68.94	54.92	42.22	33.07
9	34.60	34.05	33.85	36.37	50.94	61.76	78.66	74.19	68.91	55.68	40.72	33.06
10	34.53	34.06	33.94	36.89	52.05	62.56	78.04	74.27	68.85	56.27	40.05	33.10
11	34.44	34.08	33.91	38.06	52.75	63.56	77.43	73.31	68.73	56.34	40.67	33.16
12	34.44	34.06	33.81	38.61	53.01	63.89	76.42	73.81	68.61	56.46	40.12	33.16
13	34.39	33.97	33.73	39.83	52.21	64.60	75.81	74.18	68.38	56.54	38.76	32.97
14	34.24	34.02	33.74	40.96	51.73	64.52	75.37	73.45	68.50	54.97	37.81	32.88
15	34.35	34.01	33.79	41.62	51.53	64.65	74.78	73.56	68.70	53.49	37.75	32.90
16	34.37	34.04	33.74	44.41	51.75	64.95	74.88	73.97	68.91	52.45	38.28	32.87
17	34.39	33.95	33.73	43.86	52.26	64.61	74.77	74.30	69.00	51.28	38.79	32.87
18	34.28	33.93	33.72	42.33	53.27	64.92	74.62	74.15	68.91	50.82	40.69	32.85
19	34.25	33.97	33.87	42.73	54.46	64.74	74.40	73.27	68.84	50.65	41.69	32.71
20	34.20	34.03	34.21	43.95	56.13	65.41	74.25	72.80	68.66	50.56	41.94	32.79
21	34.18	33.91	34.33	44.79	57.17	65.77	74.25	73.44	68.10	49.03	41.24	32.77
22	34.21	33.88	34.47	47.62	57.43	65.99	74.52	74.05	68.01	47.81	40.96	32.70
23	34.22	33.99	34.36	46.52	57.22	65.70	75.22	74.57	67.88	46.84	40.70	32.75
24	34.20	33.90	33.70	45.18	56.86	66.69	75.18	74.11	66.24	46.73	40.08	32.75
25	34.23	33.85	33.71	45.01	56.31	68.28	75.25	73.50	65.31	47.95	39.82	33.26
26	34.25	33.83	34.97	45.22	56.55	70.05	75.34	73.16	64.90	50.33	39.95	33.31
27	34.17	33.84	35.11	44.44	55.99	71.96	75.38	73.73	64.54	50.01	40.97	33.71
28	34.12	33.87	36.77	45.64	56.94	72.76	75.05	73.74	62.39	49.04	40.09	33.80
29	34.20		38.08	47.52	57.18	72.68	75.12	73.38	61.32	48.30	39.26	33.36
30	34.17		38.25	49.06	58.22	73.54	75.14	73.50	60.18	48.55	38.20	33.43
31	34.21		37.50		59.12		74.90	72.70	58.41	49.23		33.63
Monthly Avg	34.14	34.00	34.46	41.37	53.67	64.79	75.59	73.43	67.44	52.25	41.92	33.32

Table 3-3. Average Connecticut River Temperature (deg F) at Station 3 for the Year 2003.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Day												
1	35.18	36.98	36.04	36.35	51.60	61.89	77.74	77.26	74.36	59.13	50.72	39.36
2	35.00	37.28	36.26	35.95	52.30	61.36	78.20	76.27	73.30	57.87	51.85	37.59
3	35.25	35.92	36.28	35.90	52.54	62.06	77.98	74.46	72.18	58.41	52.13	36.12
4	34.96	35.69	36.11	35.91	51.69	62.82	78.60	74.43	71.99	57.43	51.08	35.24
5	35.10	35.91	36.55	34.89	51.20	62.54	80.09	74.75	71.32	56.70	52.69	33.89
6	35.42	35.06	35.79	35.23	51.14	63.22	81.90	75.82	70.90	56.36	48.16	33.53
7	35.36	34.82	35.22	36.08	51.45	64.12	81.67	74.22	70.42	56.29	47.03	33.78
8	35.28	35.45	36.75	35.88	51.87	64.60	82.03	75.72	70.68	56.64	46.03	33.56
9	35.35	35.83	38.30	36.68	53.05	64.66	80.78	76.64	70.67	57.10	44.36	33.85
10	34.97	35.62	38.45	37.65	54.42	65.62	80.50	76.79	70.58	58.06	42.63	33.69
11	34.57	34.56	37.71	38.97	55.06	65.67	79.61	75.01	70.84	58.52	41.80	33.05
12	35.05	34.01	36.66	39.54	55.08	66.71	79.37	76.02	70.70	59.21	42.13	32.87
13	35.06	35.72	36.01	41.82	54.07	66.68	79.40	76.31	70.15	59.05	41.33	33.14
14	35.15	35.17	36.43	42.92	56.05	66.71	78.76	75.77	69.80	58.51	40.33	33.52
15	35.17	35.83	37.63	44.04	53.23	67.44	78.33	76.11	70.09	56.95	39.56	33.52
16	35.50	36.04	36.58	45.78	53.34	67.58	77.92	76.59	71.10	55.45	39.49	33.30
17	35.46	35.44	36.59	45.33	54.22	67.37	78.24	76.75	70.63	54.35	39.99	32.66
18	35.36	35.49	35.75	43.43	55.21	67.32	78.25	76.26	70.38	54.18	40.39	32.63
19	35.57	36.22	34.19	43.72	56.66	67.61	77.95	76.56	70.18	53.27	41.13	32.60
20	35.44	36.66	33.83	45.16	58.89	68.42	77.74	75.33	71.05	53.40	42.23	32.69
21	35.35	35.96	33.54	45.80	60.14	68.44	77.47	75.19	70.73	52.52	42.74	32.78
22	35.61	36.28	33.01	48.41	60.27	68.39	77.38	76.60	70.30	50.44	42.14	33.00
23	35.72	36.68	32.72	47.62	60.39	69.99	77.93	76.55	69.58	49.35	41.96	33.08
24	35.87	36.24	32.93	46.30	60.19	70.31	78.40	75.88	68.16	48.67	41.83	33.06
25	35.68	35.17	33.11	46.27	59.50	71.91	78.18	75.10	66.90	48.76	41.33	32.91
26	36.71	35.46	33.96	46.50	59.17	73.65	78.56	75.22	66.98	49.23	41.26	33.06
27	36.38	35.46	34.18	45.35	58.32	75.41	78.16	75.83	65.69	51.76	41.18	33.85
28	35.60	35.40	36.47	46.30	59.10	76.40	78.12	76.11	64.77	51.73	41.59	34.13
29	35.39		38.39	48.61	59.64	76.92	77.79	75.33	63.08	50.25	40.92	33.59
30	35.64		38.78	50.43	60.64	76.89	77.99	75.48	61.63	49.81	40.37	33.69
31	36.15		37.49		61.90		77.85	74.83	60.62	50.52		34.10
Monthly Avg	35.43	35.73	35.86	42.09	55.88	67.76	78.80	75.78	69.35	54.51	43.68	33.80

Table 3-4. Average Heat Rejected by the Condenser (MWt) for the Year 2003.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Day												
1	1042	1041	1042	1043	1043	1044	1063	1057	1055	4	1043	1044
2	1042	1041	1042	1043	1044	1045	1064	1052	1058	281	1043	1043
3	1042	1041	1042	1043	1044	1046	1063	1050	1059	948	1043	1043
4	1041	1041	1042	1043	1044	1046	1065	1053	1051	1009	1044	1043
5	1042	1041	1042	1043	1045	1047	1066	1056	1050	1046	1043	1044
6	1042	1042	1042	1043	1044	1047	1064	1054	1048	1045	1045	1043
7	1042	1042	1042	1043	1044	1047	1064	1052	1051	1044	1048	1044
8	1042	1042	1042	1043	1045	1045	1063	1051	1054	1045	1044	847
9	1042	1042	1042	1043	1045	1049	1064	1053	1053	1045	1043	1023
10	1041	1042	1042	1043	1045	1047	1062	1053	1053	1046	1044	1001
11	1042	528	1042	1043	1045	1055	1060	1015	1054	1046	1044	1043
12	1042	740	1043	1042	1045	1057	1060	1050	1055	1045	1044	1043
13	1042	971	1043	1043	1045	1055	1059	1051	1059	1044	1044	1043
14	1042	1014	1042	1043	1045	1051	1059	1050	1061	1043	1039	1043
15	1042	1042	1043	1043	1045	1048	1060	1051	1059	1043	969	1044
16	1038	1042	1043	1043	1045	1050	1063	1055	1053	1043	1031	1043
17	1042	1042	1043	1043	1045	1048	1062	1052	450	1044	1044	1044
18	1042	1042	1043	1043	1045	1049	1061	1054	549	1043	1033	1043
19	1042	1042	1043	1042	1046	1057	1060	1052	1010	1044	1044	1044
20	1042	1042	1043	1043	1047	1052	1061	1054	1052	1043	1044	1044
21	1042	1042	1043	1041	1047	1053	1061	1060	1057	1043	1044	1044
22	1042	1042	1043	1014	1049	1054	1059	1057	1057	1043	1044	1044
23	1042	1042	1043	985	1047	1056	947	1054	1052	1043	1044	1044
24	1042	1042	1043	1043	1047	1058	1061	1055	1045	1043	1044	1044
25	1041	1042	1043	1043	1046	1057	1057	1061	1044	1043	1044	1044
26	1041	1042	1043	1043	1045	884	1055	1062	1047	1043	1044	1044
27	1041	1043	1043	1043	1049	0	1060	1060	417	1044	1044	1044
28	1041	1042	1043	1043	1046	0	1060	1058	0	1044	1045	1034
29	1041		1043	1043	858	0	1060	1060	5	1044	1044	1043
30	1041		993	1043	1028	753	1012	1060	0	1043	1044	1043
31	1041		1043		1016		1062	1055	3	1043		1043
Monthly Avg	*1042*	*1009*	*1041*	*1040*	*1038*	*930*	*1056*	*1053*	*860*	*982*	*1041*	*1035*

4.0 MACROINVERTEBRATE COLLECTIONS IN ROCK BASKETS

4.1 METHODS OF COLLECTION AND PROCESSING

The current NPDES Permit requires the deployment of three rock baskets at downstream Station 2 and Station 3, with no required rock basket sampling at the upstream stations (Figure 4-1). Rock baskets used in 2003 were made of one-inch square, 14-gauge galvanized wire with a PVC coating. The cylindrical basket measured 6.5 inches in diameter and 11 inches in length. Each rock basket was filled with clean cobble sized rocks taken from the Connecticut River prior to sampling. Rock basket sampling was conducted during 2003 as stipulated in the current NPDES Permit.

On 2 June, 2 August and again on 6 October 2003, three replicate rock baskets were deployed each at Station 2 (Station No. 227) and at Station 3 (Station No. 031, Figure 5-1). The June, August and October rock baskets sampled for at least 30 days (Figure 5-1). On 25 June one of the three replicate rock baskets deployed at Station 2 was found missing. A replacement was deployed on 26 June and sampled for at least 30 days. The two remaining sampling periods were sampled simultaneously among all three replicate samplers from 2 August until 8 September, and again from 6 October until 11 November 2003. Station 2 near the Vermont shore is the most downstream rock basket sampling station. The sampling site is approximately 10-12 ft deep with a substrate of cobble, boulders, and mud. Station 3 is a swift-water riffle area approximately 4 to 5 feet in depth consisting of a sandy bottom, on the New Hampshire shore

Upon retrieval, each rock basket sampler was placed into an individual 5 gallon bucket. The rocks were washed onto a number 30 sieve (600μm) and examined for attached organisms in the field. The contents of each rock basket sample were preserved in 70% ethanol for later identification in the laboratory. A total of 18 rock basket samples, three samples from each of two stations for June, August, and October, were collected during 2003.

In the laboratory, the contents of each of the 18 macroinvertebrate rock basket samples were examined without subsampling under low magnification (2x) to separate (sort) the organisms from the sediment and detritus. Identification of organisms to the lowest possible taxonomic level, given their life stage and condition, was accomplished using dissecting (45x) and compound (1,000x) microscopes. Chironomids and oligochaetes were separated by subfamily, tribe, or recognizable type prior to identification to the genus/species level. All or representative subsamples from each grouping were prepared by clearing and mounting and then identified with a compound microscope. Where subsampled, the number of specimens identified to genus/species was used to proportion the remaining individuals from each group into specific taxa. In instances where chironomid or oligochaete specimens could be identified to genus or species without the aid of a compound microscope, no preparation was necessary. Taxonomic keys used to identify all specimens in addition to chironomids and oligochaetes, were: Burks (1953), Hitchcock (1974), Burch (1975), McCafferty (1975), Brown (1976), Simpson and Bode (1980), Wiederholm (1983), Klemm (1985), Roback (1985), Brinkhurst (1986), Peckarsky (1990), Jokinen (1992), Merritt and Cummins (1996), Wiggins (1996).

4.2 RESULTS

During June, August, and October 2003, a total of 18 rock basket samples were sampled and processed from Station 2 and Station 3 located in the Connecticut River downstream from Vernon

Dam. A total of 2171 macroinvertebrates were identified and enumerated from these two stations combined (Table 4-1). The combined macroinvertebrate community sampled by rock baskets at the two stations comprised 98 taxa, and was dominated by caddis flies (Trichoptera, n = 800 or 37%, comprising 18 taxa), true flies (Diptera, n = 612 or 28%, comprising 29 taxa), and mayflies (Ephemeroptera, n = 351 or 16% comprising 14 taxa) in 2003 (Table 4-1). More macroinvertebrates were collected at Station 2 (n = 1823 or 84%, represented by 83 taxa) than at Station 3 (n = 348 or 16 %, represented by 40 taxa) in 2003.

In June, August and October 2003 a total of 711, 290 and 822 macroinvertebrates, respectively, were collected at Station 2, which is located near the Vermont shore about 4.1 miles downstream from Vernon Dam (Table 4-2). Likewise, in June, August, and October a total of 158, 185 and 5 macroinvertebrates, respectively, were collected at Station 3, which is located near the New Hampshire shore about 0.5 miles downstream from Vernon Dam (Table 4-3).

4.2.1 June 2003 Rock Basket Collections – Stations 2 and 3

Benthic macroinvertebrates collected by rock basket during June 2003 were more abundant at Station 2 (n = 711; Table 4-2) than at Station 3 (n = 158; Table 4-3). Trichoptera (n = 403 or 57%), Mollusca (n = 122 or 17%), Diptera (n = 78 or 11%), and Ephemeroptera (n = 74 or 10%) comprised most of the Station 2 macroinvertebrate community during June 2003 (Table 4-2). The Station 3 benthic macroinvertebrate community sampled by rock baskets in June 2003 was dominated by Trichoptera (n = 62 or 39%) and Diptera (n = 57 or 36%; Table 4-3).

4.2.2 August 2003 Rock Basket Collections – Stations 2 and 3

A total of 290 and 185 macroinvertebrates were collected by rock baskets deployed at Station 2 and Station 3, respectively, in the August 2003 rock basket samples (Tables 4-2 and 4-3). Ephemeroptera, Trichoptera (n = 97 or 33%), Ephemeroptera (n = 66 or 23%) and Diptera (n = 39 or 13%) contributed most to the relative abundance at Station 2 in August 2003 (Table 4-2). Dipterans (n = 92 or 50%) and Ephemeropterans (n = 32 or 17%) were the most abundant insects in the macroinvertebrate community at Station 3 in August 2003, but Decapod Crustaceans (*Crangonyx* sp. And *Orconectes* sp.) were also common (n = 27 or 15%).

4.2.3 October 2003 Rock Basket Collections – Stations 2 and 3

During October 2003, a total of 822 and 5 macroinvertebrates were collected by rock baskets deployed at Station 2 and Station 3, respectively (Tables 4-2 and 4-3). Diptera (n = 423 or 51%), Ephemeroptera (n = 171 or 21%) and Trichoptera (n = 145 or 18%) were the most abundant members of the macroinvertebrate community at Station 2 in October 2003 (Table 4-2). One Oligochaete, one fingernail clam (*Pisidium* sp.), one mayfly (*Stenonema* sp.), one stonefly (*Isoperla* sp.), and one caddis fly (*Cheumatopsyche* sp.) comprised the entire catch macroinvertebrate community sampled by the rock basket samplers deployed at Station 3 in October 2003 (Table 4-3).

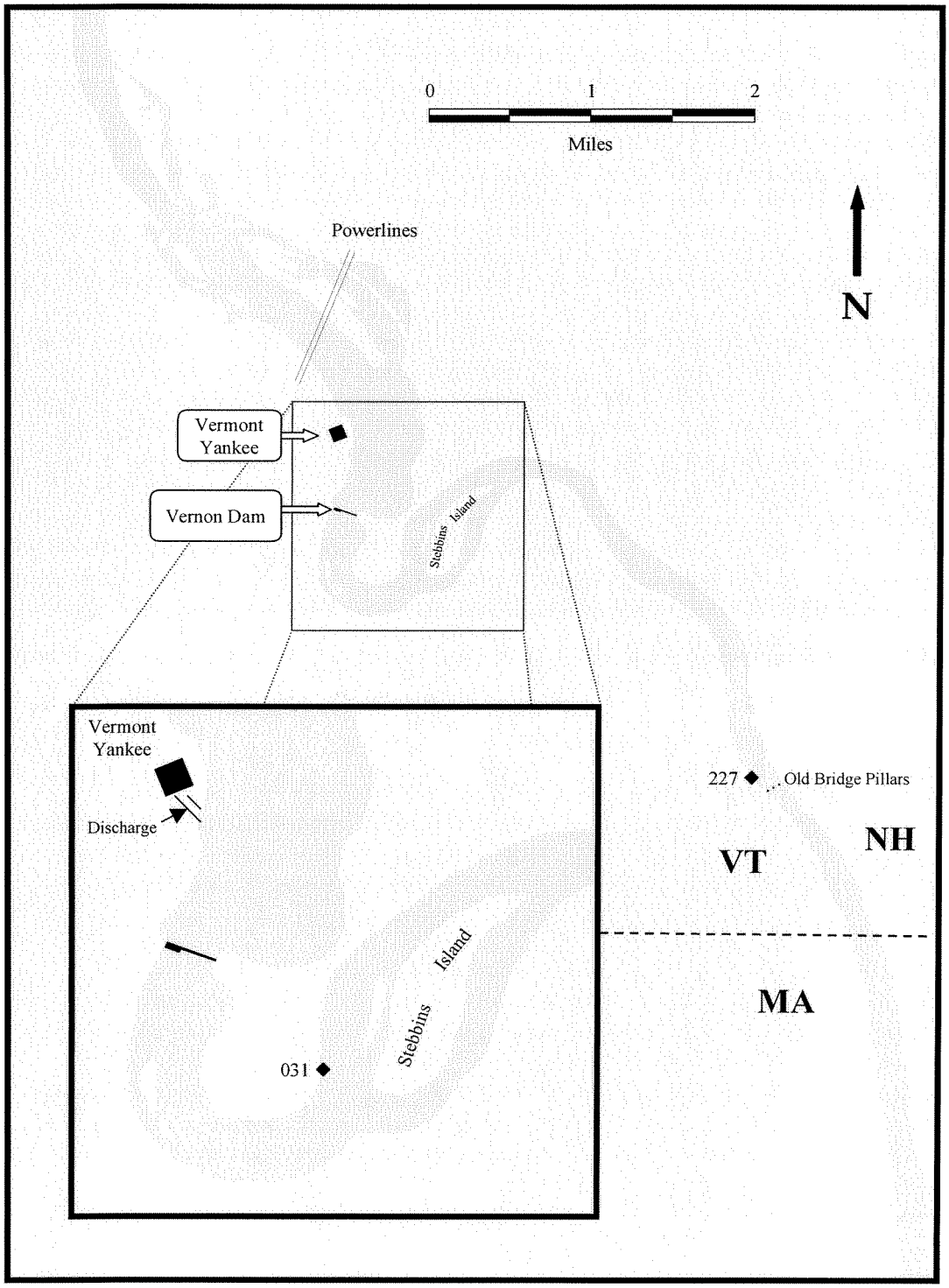

Figure 4-1. NPDES macroinvertebrate rock basket sampling at Stations 2 and 3.

Table 4-1. Total number, mean, and total percentage of macroinvertebrates collected at Stations 031 and 227 during June, August, and October 2003.

	Station 3 NH			Station 2 VT (South)		
Taxon	Count	Mean	% of Total	Count	Mean	% of Total
NEMATODA	0	0.0		1	0.1	100.0
Total	0	0.0		1	0.1	100.0
TURBELLARIA						
DUGESIA TIGRINA	4	0.4	100.0	5	0.6	100.0
Total	4	0.4	100.0	5	0.6	100.0
HOPLONEMERTEA						
PROSTOMA GRAESCENSE	1	0.1	100.0	0	0.0	
Total	1	0.1	100.0	0	0.0	
OLIGOCHAETA						
BOTHRIONEURUM VEJDOVSKYANUM	0	0.0	0.0	1	0.1	7.7
LIMNODRILUS SP.	1	0.1	12.5	7	0.8	53.8
LUMBRICIDAE	1	0.1	12.5	0	0.0	0.0
NAIDIDAE	0	0.0	0.0	1	0.1	7.7
OLIGOCHAETA	1	0.1	12.5	2	0.2	15.4
STYLODRILUS HERINGIANUS	5	0.6	62.5	1	0.1	7.7
TUBIFICIDAE	0	0.0	0.0	1	0.1	7.7
Total	8	0.9	100.0	13	1.4	100.0
MOLLUSCA						
AMNICOLA LIMOSA	0	0.0	0.0	38	4.2	22.0
FERRISSIA RIVULARIS	0	0.0	0.0	68	7.6	39.3
GASTROPODA	0	0.0	0.0	1	0.1	0.6
PHYSA SP.	2	0.2	100.0	66	7.3	38.2
Total	2	0.2	100.0	173	19.2	100.0
UNIONIDAE						
LAMPSILLIS RADIATA	2	0.2	100.0	0	0.0	
Total	2	0.2	100.0	0	0.0	
VENEROIDA						
PISIDIUM SP.	1	0.1	100.0	0	0.0	
Total	1	0.1	100.0	0	0.0	
HYDRACHNIDIA						
HYDRACHNIDA	0	0.0		1	0.1	100.0
Total	0	0.0		1	0.1	100.0
ISOPODA						
CAECIDOTEA SP.	28	3.1	100.0	0	0.0	
Total	28	3.1	100.0	0	0.0	
AMPHIPODA						
HYALELLA AZTECA	4	0.4	100.0	91	10.1	100.0
Total	4	0.4	100.0	91	10.1	100.0

(continued)

Table 4-1. (Continued)

Taxon	Station 3 NH Count	Mean	% of Total	Station 2 VT (South) Count	Mean	% of Total
DECAPODA						
CRANGONYX SP.	25	2.8	86.2	0	0.0	0.0
ORCONECTES SP.	4	0.4	13.8	1	0.1	50.0
ORCONECTES LIMOSUS	0	0.0	0.0	1	0.1	50.0
Total	29	3.2	100.0	2	0.7	100.0
EPHEMEROPTERA						
BAETIS SP.	0	0.0	0.0	2	0.2	0.6
CAENIDAE	0	0.0	0.0	1	0.1	0.3
CAENIS SP.	0	0.0	0.0	1	0.1	0.3
EPEORUS SP.	0	0.0	0.0	11	1.2	3.5
EURYLOPHELLA SP.	0	0.0	0.0	2	0.2	0.6
LEPTOPHLEBIA SP.	0	0.0	0.0	2	0.2	0.6
SERRATELLA SP.	0	0.0	0.0	1	0.1	0.3
STENACRON INTERPUNCTATUM	1	0.1	2.5	137	15.2	44.1
STENACRON SP.	0	0.0	0.0	46	5.1	14.8
STENONEMA FEMORATUM	3	0.3	7.5	0	0.0	0.0
STENONEMA MODESTUM	0	0.0	0.0	14	1.6	4.5
STENONEMA SP.	36	4.0	90.0	89	9.9	28.6
STENONEMA VICARIUM	0	0.0	0.0	1	0.1	0.3
TRICORYTHODES SP.	0	0.0	0.0	4	0.4	1.3
Total	40	4.4	100.0	311	34.6	100.0
ODONATA						
ARGIA SP.	0	0.0		13	1.4	52.0
BOYERIA SP.	0	0.0		1	0.1	4.0
BOYERIA VINOSA	0	0.0		2	0.2	8.0
EPITHECA SP.	0	0.0		7	0.8	28.0
MACROMIA SP.	0	0.0		1	0.1	4.0
NEUROCORDULIA SP	0	0.0		1	0.1	4.0
Total	0	0.0		25	2.8	100.0
PLECOPTERA						
ACRONEURIA SP.	0	0.0	0.0	2	0.2	14.3
ALLOCAPNIA SP.	0	0.0	0.0	3	0.3	21.4
ISOPERLA SP.	1	0.1	100.0	2	0.2	14.3
LEUCTRA SP.	0	0.0	0.0	3	0.3	21.4
STROPHOPTERYX SP.	0	0.0	0.0	1	0.1	7.1
TAENIOPTERYX SP.	0	0.0	0.0	3	0.3	21.4
Total	1	0.1	100.0	14	1.6	100.0
COLEOPTERA						
MACRONYCHUS GLABRATUS	0	0.0		1	0.1	100.0
Total	0	0.0		1	0.1	100.0
HYDROPHILOIDEA						
BEROSUS SP.	1	0.1	100.0	0	0.0	
Total	1	0.1	100.0	0	0.0	

(continued)

Table 4-1. (Continued)

Taxon	Station 3 NH Count	Mean	% of Total	Station 2 VT (South) Count	Mean	% of Total
NEUROPTERA						
SIALIS SP.	0	0.0		1	0.1	100.0
Total	0	0.0		1	0.1	100.0
TRICHOPTERA						
BRACHYCENTRUS SP.	0	0.0	0.0	1	0.1	0.2
CERACLEA SP.	0	0.0	0.0	1	0.1	0.2
CERATOPSYCHE MOROSA	0	0.0	0.0	1	0.1	0.2
CERATOPSYCHE SP.	1	0.1	0.6	0	0.0	0.0
CHEUMATOPSYCHE SP.	108	12.0	69.7	84	9.3	13.0
HYDATOPHYLAX SP.	0	0.0	0.0	5	0.6	0.8
HYDROPSYCHE PHALERATA	16	1.8	10.3	24	2.7	3.7
HYDROPSYCHE SP.	1	0.1	0.6	0	0.0	0.0
HYDROPSYCHIDAE	0	0.0	0.0	2	0.2	0.3
HYDROPTILA SP.	0	0.0	0.0	6	0.7	0.9
MACROSTEMUM CAROLINA	3	0.3	1.9	1	0.1	0.2
MACROSTEMUM SP.	14	1.6	9.0	1	0.1	0.2
NEURECLIPSIS SP.	0	0.0	0.0	406	45.1	62.9
OECETIS AVARA	0	0.0	0.0	5	0.6	0.8
OECETIS SP.	8	0.9	5.2	18	2.0	2.8
OXYETHIRA SP.	0	0.0	0.0	3	0.3	0.5
POLYCENTROPUS SP.	4	0.4	2.6	84	9.3	13.0
TRIAENODES SP.	0	0.0	0.0	3	0.3	0.5
Total	155	17.2	100.0	645	71.7	100.0
DIPTERA						
ABLABESMYIA SP.	0	0.0	0.0	15	1.7	2.8
CHIRONOMIDAE	0	0.0	0.0	6	0.7	1.1
CHIRONOMINI	0	0.0	0.0	7	0.8	1.3
CLADOTANYTARSUS SP.	0	0.0	0.0	2	0.2	0.4
DICROTENDIPES SP.	6	0.7	8.3	20	2.2	3.7
MALLACHOHELEA SP.	1	0.1	1.4	0	0.0	0.0
MICROTENDIPES PEDELLUS GP.	0	0.0	0.0	9	1.0	1.7
NANOCLADIUS SP.	0	0.0	0.0	1	0.1	0.2
NILOTHAUMA SP.	0	0.0	0.0	1	0.1	0.2
ORTHOCLADIINAE	0	0.0	0.0	17	1.9	3.1
ORTHOCLADIUS SP.	6	0.7	8.3	8	0.9	1.5
PALPOMYIA GR.	1	0.1	1.4	0	0.0	0.0
PARACLADOPELMA SP.	1	0.1	1.4	0	0.0	0.0
PARAMETRIOCNEMUS SP.	0	0.0	0.0	17	1.9	3.1
PARATANYTARSUS SP.	0	0.0	0.0	10	1.1	1.9
PHAENOPSECTRA JUCUNDUS	2	0.2	2.8	0	0.0	0.0
PHAENOPSECTRA OBEDIANS GR.	0	0.0	0.0	2	0.2	0.4
PHAENOPSECTRA SP.	0	0.0	0.0	2	0.2	0.4

(continued)

Table 4-1. (Continued)

	Station 3 NH			Station 2 VT (South)		
Taxon	**Count**	**Mean**	**% of Total**	**Count**	**Mean**	**% of Total**
POLYPEDILUM FLAVUM	11	1.2	15.3	1	0.1	0.2
POLYPEDILUM SP.	2	0.2	2.8	23	2.6	4.3
PROBEZZIA SP.	0	0.0	0.0	1	0.1	0.2
PSEUDOCHIRONOMUS SP.	0	0.0	0.0	2	0.2	0.4
RHEOTANYTARSUS SP.	22	2.4	30.6	346	38.4	64.1
SPHAEROMIAS SP.	1	0.1	1.4	1	0.1	0.2
STICTOCHIRONOMUS SP.	1	0.1	1.4	0	0.0	0.0
TANYPODINAE	0	0.0	0.0	3	0.3	0.6
TANYTARSUS SP.	13	1.4	18.1	30	3.3	5.6
THIENEMANNIMYIA GR.	5	0.6	6.9	13	1.4	2.4
TVETENIA SP.	0	0.0	0.0	3	0.3	0.6
Total	72	8.0	100.0	540	60.0	100.0
TOTAL	**348**	**38.7**	**100.0**	**1823**	**202.6**	**100.0**

Table 4-2. Macroinvertebrates collected at Downstream from Vernon Dam at Station 2 VT (Station No. 227) during June, August and October 2002.

	June			August			October		
Taxon	Count	Mean	% of Total	Count	Mean	% of Total	Count	Mean	% of Total
NEMATODA	1	0.3	100.0	0	0.0		0	0.0	
Total	1	0.3	100.0	0	0.0		0	0.0	
TURBELLARIA									
DUGESIA TIGRINA	2	0.7	100.0	3	1.0	100.0	0	0.0	
Total	2	0.7	100.0	3	1.0	100.0	0	0.0	
OLIGOCHAETA									
BOTHRIONEURUM VEJDOVSKYANUM	0	0.0	0.0	1	0.3	9.1	0	0.0	0.0
LIMNODRILUS SP.	0	0.0	0.0	7	2.3	63.6	0	0.0	0.0
NAIDIDAE	0	0.0	0.0	0	0.0	0.0	1	0.3	100.0
OLIGOCHAETA	0	0.0	0.0	2	0.7	18.2	0	0.0	0.0
STYLODRILUS HERINGIANUS	1	0.3	100.0	0	0.0	0.0	0	0.0	0.0
TUBIFICIDAE	0	0.0	0.0	1	0.3	9.1	0	0.0	0.0
Total	1	0.3	100.0	11	3.7	100.0	1	0.3	100.0
MOLLUSCA									
AMNICOLA LIMOSA	37	12.3	30.3	1	0.3	2.2	0	0.0	0.0
FERRISSIA RIVULARIS	34	11.3	27.9	32	10.7	71.1	2	0.7	33.3
GASTROPODA	0	0.0	0.0	1	0.3	2.2	0	0.0	0.0
PHYSA SP.	51	17.0	41.8	11	3.7	24.4	4	1.3	66.7
Total	122	40.7	100.0	45	15.0	100.0	6	2.0	100.0
HYDRACHNIDIA									
HYDRACHNIDA	0	0.0		1	0.3	100.0	0	0.0	
Total	0	0.0		1	0.3	100.0	0	0.0	
AMPHIPODA									
HYALELLA AZTECA	19	6.3	100.0	15	5.0	100.0	57	19.0	100.0
Total	19	6.3	100.0	15	5.0	100.0	57	19.0	100.0
DECAPODA									
ORCONECTES SP.	0	0.0		0	0.0		1	0.3	50.0
ORCONECTES LIMOSUS	0	0.0		0	0.0		1	0.3	50.0
Total	0	0.0		0	0.0		2	0.7	100.0
EPHEMEROPTERA									
BAETIS SP.	0	0.0	0.0	0	0.0	0.0	2	0.7	1.2
CAENIDAE	1	0.3	1.4	0	0.0	0.0	0	0.0	0.0
CAENIS SP.	0	0.0	0.0	0	0.0	0.0	1	0.3	0.6
EPEORUS SP.	0	0.0	0.0	0	0.0	0.0	11	3.7	6.4
EURYLOPHELLA SP.	0	0.0	0.0	0	0.0	0.0	2	0.7	1.2
LEPTOPHLEBIA SP.	0	0.0	0.0	0	0.0	0.0	2	0.7	1.2
SERRATELLA SP.	0	0.0	0.0	0	0.0	0.0	1	0.3	0.6
STENACRON INTERPUNCTATUM	59	19.7	79.7	13	4.3	19.7	65	21.7	38.0
STENACRON SP.	0	0.0	0.0	29	9.7	43.9	17	5.7	9.9
STENONEMA MODESTUM	0	0.0	0.0	0	0.0	0.0	14	4.7	8.2
STENONEMA SP.	13	4.3	17.6	21	7.0	31.8	55	18.3	32.2
STENONEMA VICARIUM	0	0.0	0.0	0	0.0	0.0	1	0.3	0.6
TRICORYTHODES SP.	1	0.3	1.4	3	1.0	4.5	0	0.0	0.0
Total	74	24.7	100.0	66	22.0	100.0	171	57.0	100.0

(continued)

Table 4-2 (Continued)

Taxon	June Count	June Mean	June % of Total	August Count	August Mean	August % of Total	October Count	October Mean	October % of Total
ODONATA									
ARGIA SP.	2	0.7	20.0	10	3.3	76.9	1	0.3	50.0
BOYERIA SP.	1	0.3	10.0	0	0.0	0.0	0	0.0	0.0
BOYERIA VINOSA	0	0.0	0.0	2	0.7	15.4	0	0.0	0.0
EPITHECA SP.	7	2.3	70.0	0	0.0	0.0	0	0.0	0.0
MACROMIA SP.	0	0.0	0.0	0	0.0	0.0	1	0.3	50.0
NEUROCORDULIA SP	0	0.0	0.0	1	0.3	7.7	0	0.0	0.0
Total	10	3.3	100.0	13	4.3	100.0	2	0.7	100.0
PLECOPTERA									
ACRONEURIA SP.	0	0.0		0	0.0		2	0.7	14.3
ALLOCAPNIA SP.	0	0.0		0	0.0		3	1.0	21.4
ISOPERLA SP.	0	0.0		0	0.0		2	0.7	14.3
LEUCTRA SP.	0	0.0		0	0.0		3	1.0	21.4
STROPHOPTERYX SP.	0	0.0		0	0.0		1	0.3	7.1
TAENIOPTERYX SP.	0	0.0		0	0.0		3	1.0	21.4
Total	0	0.0		0	0.0		14	4.7	100.0
COLEOPTERA									
MACRONYCHUS GLABRATUS	1	0.3	100.0	0	0.0		0	0.0	
Total	1	0.3	100.0	0	0.0		0	0.0	
NEUROPTERA									
SIALIS SP.	0	0.0		0	0.0		1	0.3	100.0
Total	0	0.0		0	0.0		1	0.3	100.0
TRICHOPTERA									
BRACHYCENTRUS SP.	0	0.0	0.0	0	0.0	0.0	1	0.3	0.7
CERACLEA SP.	0	0.0	0.0	0	0.0	0.0	1	0.3	0.7
CERATOPSYCHE MOROSA	0	0.0	0.0	0	0.0	0.0	1	0.3	0.7
CHEUMATOPSYCHE SP.	3	1.0	0.7	21	7.0	21.6	60	20.0	41.4
HYDATOPHYLAX SP.	4	1.3	1.0	1	0.3	1.0	0	0.0	0.0
HYDROPSYCHE PHALERATA	1	0.3	0.2	5	1.7	5.2	18	6.0	12.4
HYDROPSYCHIDAE	0	0.0	0.0	2	0.7	2.1	0	0.0	0.0
HYDROPTILA SP.	3	1.0	0.7	3	1.0	3.1	0	0.0	0.0
MACROSTEMUM CAROLINA	0	0.0	0.0	1	0.3	1.0	0	0.0	0.0
MACROSTEMUM SP.	0	0.0	0.0	0	0.0	0.0	1	0.3	0.7
NEURECLIPSIS SP.	333	111.0	82.6	33	11.0	34.0	40	13.3	27.6
OECETIS AVARA	5	1.7	1.2	0	0.0	0.0	0	0.0	0.0
OECETIS SP.	6	2.0	1.5	10	3.3	10.3	2	0.7	1.4
OXYETHIRA SP.	2	0.7	0.5	0	0.0	0.0	1	0.3	0.7
POLYCENTROPUS SP.	43	14.3	10.7	21	7.0	21.6	20	6.7	13.8
TRIAENODES SP.	3	1.0	0.7	0	0.0	0.0	0	0.0	0.0
Total	403	134.3	100.0	97	32.3	100.0	145	48.3	100.0

(continued)

Table 4-2 (Continued)

Taxon	June			August			October		
	Count	Mean	% of Total	Count	Mean	% of Total	Count	Mean	% of Total
DIPTERA									
ABLABESMYIA SP.	13	4.3	16.7	2	0.7	5.1	0	0.0	0.0
CHIRONOMIDAE	0	0.0	0.0	6	2.0	15.4	0	0.0	0.0
CHIRONOMINI	0	0.0	0.0	7	2.3	17.9	0	0.0	0.0
CLADOTANYTARSUS SP.	2	0.7	2.6	0	0.0	0.0	0	0.0	0.0
DICROTENDIPES SP.	17	5.7	21.8	1	0.3	2.6	2	0.7	0.5
MICROTENDIPES PEDELLUS GP.	5	1.7	6.4	4	1.3	10.3	0	0.0	0.0
NANOCLADIUS SP.	1	0.3	1.3	0	0.0	0.0	0	0.0	0.0
NILOTHAUMA SP.	1	0.3	1.3	0	0.0	0.0	0	0.0	0.0
ORTHOCLADIINAE	0	0.0	0.0	0	0.0	0.0	17	5.7	4.0
ORTHOCLADIUS SP.	3	1.0	3.8	5	1.7	12.8	0	0.0	0.0
PARAMETRIOCNEMUS SP.	0	0.0	0.0	0	0.0	0.0	17	5.7	4.0
PARATANYTARSUS SP.	3	1.0	3.8	0	0.0	0.0	7	2.3	1.7
PHAENOPSECTRA OBEDIANS GR.	2	0.7	2.6	0	0.0	0.0	0	0.0	0.0
PHAENOPSECTRA SP.	2	0.7	2.6	0	0.0	0.0	0	0.0	0.0
POLYPEDILUM FLAVUM	0	0.0	0.0	1	0.3	2.6	0	0.0	0.0
POLYPEDILUM SP.	4	1.3	5.1	12	4.0	30.8	7	2.3	1.7
PROBEZZIA SP.	0	0.0	0.0	0	0.0	0.0	1	0.3	0.2
PSEUDOCHIRONOMUS SP.	2	0.7	2.6	0	0.0	0.0	0	0.0	0.0
RHEOTANYTARSUS SP.	0	0.0	0.0	0	0.0	0.0	346	115.3	81.8
SPHAEROMIAS SP.	0	0.0	0.0	0	0.0	0.0	1	0.3	0.2
TANYPODINAE	0	0.0	0.0	0	0.0	0.0	3	1.0	0.7
TANYTARSUS SP.	23	7.7	29.5	0	0.0	0.0	7	2.3	1.7
THIENEMANNIMYIA GR.	0	0.0	0.0	1	0.3	2.6	12	4.0	2.8
TVETENIA SP.	0	0.0	0.0	0	0.0	0.0	3	1.0	0.7
Total	78	26.0	100.0	39	13.0	100.0	423	141.0	100.0
TOTAL	**711**	**237.0**	**100.0**	**290**	**96.7**	**100.0**	**822**	**274.0**	**100.0**

Table 4-3. Macroinvertebrates collected Downstream from Vernon Dam at Station 3 NH (Station No. 031) during June, August and October 2003.

	June			August			October		
Taxon	Count	Mean	% of Total	Count	Mean	% of Total	Count	Mean	% of Total
TURBELLARIA									
DUGESIA TIGRINA	4	1.3	100.0	0	0.0		0	0.0	
Total	4	1.3	100.0	0	0.0		0	0.0	
HOPLONEMERTEA									
PROSTOMA GRAESCENSE	1	0.3	100.0	0	0.0		0	0.0	
Total	1	0.3	100.0	0	0.0		0	0.0	
OLIGOCHAETA									
LIMNODRILUS SP.	1	0.3	14.3	0	0.0		0	0.0	0.0
LUMBRICIDAE	1	0.3	14.3	0	0.0		0	0.0	0.0
OLIGOCHAETA	0	0.0	0.0	0	0.0		1	0.3	100.0
STYLODRILUS HERINGIANUS	5	1.7	71.4	0	0.0		0	0.0	0.0
Total	7	2.3	100.0	0	0.0		1	0.3	100.0
MOLLUSCA									
PHYSA SP.	1	0.3	100.0	1	0.3	100.0	0	0.0	
Total	1	0.3	100.0	1	0.3	100.0	0	0.0	
UNIONIDAE									
LAMPSILLIS RADIATA	1	0.3	100.0	1	0.3	100.0	0	0.0	
Total	1	0.3	100.0	1	0.3	100.0	0	0.0	
VENEROIDA									
PISIDIUM SP.	0	0.0		0	0.0		1	0.3	100.0
Total	0	0.0		0	0.0		1	0.3	100.0
ISOPODA									
CAECIDOTEA SP.	12	4.0	100.0	16	5.3	100.0	0	0.0	
Total	12	4.0	100.0	16	5.3	100.0	0	0.0	
AMPHIPODA									
HYALELLA AZTECA	3	1.0	100.0	1	0.3	100.0	0	0.0	
Total	3	1.0	100.0	1	0.3	100.0	0	0.0	
DECAPODA									
CRANGONYX SP.	1	0.3	50.0	24	8.0	88.9	0	0.0	
ORCONECTES SP.	1	0.3	50.0	3	1.0	11.1	0	0.0	
Total	2	0.7	100.0	27	9.0	100.0	0	0.0	
EPHEMEROPTERA									
STENACRON INTERPUNCTATUM	1	0.3	14.3	0	0.0	0.0	0	0.0	0.0
STENONEMA FEMORATUM	0	0.0	0.0	3	1.0	9.4	0	0.0	0.0
STENONEMA SP.	6	2.0	85.7	29	9.7	90.6	1	0.3	100.0
Total	7	2.3	100.0	32	10.7	100.0	1	0.3	100.0
PLECOPTERA									
ISOPERLA SP.	0	0.0		0	0.0		1	0.3	100.0
Total	0	0.0		0	0.0		1	0.3	100.0
HYDROPHILOIDEA									
BEROSUS SP.	1	0.3	100.0	0	0.0		0	0.0	
Total	1	0.3	100.0	0	0.0		0	0.0	

(continued)

Table 4-3 (Continued)

	June			August			October		
Taxon	Count	Mean	% of Total	Count	Mean	% of Total	Count	Mean	% of Total
TRICHOPTERA									
CERATOPSYCHE SP.	1	0.3	1.6	0	0.0	0.0	0	0.0	0.0
CHEUMATOPSYCHE SP.	35	11.7	56.5	72	24.0	78.3	1	0.3	100.0
HYDROPSYCHE PHALERATA	0	0.0	0.0	16	5.3	17.4	0	0.0	0.0
HYDROPSYCHE SP.	0	0.0	0.0	1	0.3	1.1	0	0.0	0.0
MACROSTEMUM CAROLINA	0	0.0	0.0	3	1.0	3.3	0	0.0	0.0
MACROSTEMUM SP.	14	4.7	22.6	0	0.0	0.0	0	0.0	0.0
OECETIS SP.	8	2.7	12.9	0	0.0	0.0	0	0.0	0.0
POLYCENTROPUS SP.	4	1.3	6.5	0	0.0	0.0	0	0.0	0.0
Total	62	20.7	100.0	92	30.7	100.0	1	0.3	100.0
DIPTERA									
DICROTENDIPES SP.	6	2.0	10.5	0	0.0	0.0	0	0.0	
MALLACHOHELEA SP.	1	0.3	1.8	0	0.0	0.0	0	0.0	
ORTHOCLADIUS SP.	5	1.7	8.8	1	0.3	6.7	0	0.0	
PALPOMYIA GR.	1	0.3	1.8	0	0.0	0.0	0	0.0	
PARACLADOPELMA SP.	1	0.3	1.8	0	0.0	0.0	0	0.0	
PHAENOPSECTRA JUCUNDUS	1	0.3	1.8	1	0.3	6.7	0	0.0	
POLYPEDILUM FLAVUM	11	3.7	19.3	0	0.0	0.0	0	0.0	
POLYPEDILUM SP.	0	0.0	0.0	2	0.7	13.3	0	0.0	
RHEOTANYTARSUS SP.	17	5.7	29.8	5	1.7	33.3	0	0.0	
SPHAEROMIAS SP.	1	0.3	1.8	0	0.0	0.0	0	0.0	
STICTOCHIRONOMUS SP.	1	0.3	1.8	0	0.0	0.0	0	0.0	
TANYTARSUS SP.	8	2.7	14.0	5	1.7	33.3	0	0.0	
THIENEMANNIMYIA GR.	4	1.3	7.0	1	0.3	6.7	0	0.0	
Total	57	19.0	100.0	15	5.0	100.0	0	0.0	
TOTAL	**158**	**52.7**	**100.0**	**185**	**61.7**	**100.0**	**5**	**1.7**	**100.0**

5.0 FISH COLLECTIONS

The electrofishing samples were collected monthly in May, June, September and October 2003 at eight stations specified in the current NPDES permit (Figure 5-1). Larval fish were collected weekly from 7 May through 16 July 2003 in the vicinity of the Entergy Nuclear Vermont Yankee intakes. Fish impinged on the circulating water traveling screens were collected weekly beginning 31 March and continuing through 10 June, then resuming from 4 August through 28 October 2003. Electrofishing specifically for anadromous fish was conducted twice a month in July through October 2003, at the three stations specified in the NPDES permit.

5.1 METHODS OF COLLECTION AND PROCESSING

5.1.1 Electrofishing - General Sampling

General electrofishing was conducted with a boat-mounted Coffelt Electronics Model VVP-15 electroshocker. Monthly sampling was conducted during May, June, September, and October 2003 in the evening beginning approximately 0.5 h after sunset at the following eight stations (ten sites): Connecticut River at Rum Point, Station 5 (NH and VT), Station 4 (NH and VT), N.H. Setback, 0.1 mile south of the Vernon Dam, Station 3, Stebbin Island, and Station 2 (Figure 5-1). All fish collected in each sample were identified to species, weighed to the nearest gram (wet weight), and measured to the nearest millimeter (total length). NPDES permit conditions were met with respect to the general fisheries electrofishing program.

5.1.2 Electrofishing - Anadromous Fish

Juvenile American shad electrofishing, referred to as "anadromous fish electrofishing" was performed twice in each month during July through October 2003 at the following three stations (six sites): Connecticut River 0.1 mile south of Vernon Dam, Stebbins Island (4 sites), and Station 3 (Figure 5-1). This program was supplemental to the monthly sampling performed in the general electrofishing program described in Section 5.1.1 above, and was intended to sample juvenile American shad in the intervening periods. Anadromous fish electrofishing samples were successfully collected as specified in the current NPDES permit, however one sample period was forgone due to high flows due to an extraordinary rain event prohibiting electrofishing from 8 through 15 August 2003.

Non-target fish (non-clupeids) were not processed during the anadromous fish electrofishing runs. Only juvenile American shad were enumerated, weighed (to the nearest gram wet weight), and measured (mm total length).

5.1.3 Impingement

Weekly and 24 h spring and fall impingement samples were collected from the Vermont Yankee circulating water traveling screens located at the plant intake structure. Impingement samples were collected on Monday and Tuesday of each week during a spring period beginning 31 March through 10 June 2003, and again on the same days of each week during a fall period from 4 August through 28 October 2003. Per request of Vermont Yankee, one sample period was missed, 9 September 2003, due to an extraordinary event at the plant. Weekly samples (i.e., Monday collections) consisted of back-washing the traveling screens into the collection bin to obtain a sample of all fish and debris accumulated continuously for six days since the last (Tuesday) collection. Each weekly collection of fish and debris was then examined for anadromous fish only (Atlantic salmon in the spring, or American shad in the fall). The screens were again back-washed approximately 24 hours

later (i.e., Tuesday collections) and all fish were removed, identified to species, weighed (to the nearest gram wet weight), and measured (mm total length) from this 24 hour collection. The annual Atlantic salmon and American shad impingement limits of 364 Atlantic salmon and 1140 shad were not exceeded during 2003. Current NPDES permit compliance was met with respect to impingement sampling.

5.1.4 Larval Fish

Larval fish sampling is required annually per the NPDES Permit beginning during the first week in May and continuing weekly through mid-July of each year, when Entergy Nuclear Vermont Yankee is in an operational mode. During 2003, larval fish were collected weekly between 5 May and 17 July 2003 in the vicinity of the Entergy Nuclear Vermont Yankee intake structure (Fig. 1-1).

A 50-cm diameter, 363-μm nitex nylon plankton net was towed behind the boat, at surface (0.3 m deep), middle (1.8 m deep), and near bottom (3.7 m deep) locations. A flume-calibrated, General Oceanics Inc. Model 2030R mechanical flow meter was mounted in the net mouth and used to estimate the volume of each tow.

The contents of each retrieved plankton net sample were washed into a collection cup fastened to the distal end of the net. Larval fish samples were preserved in 5% formalin for laboratory sorting and identification. Ichthyoplankton was separated from debris using an 8x to 80x variable magnification dissecting microscope. Larval fish were identified to the lowest practical taxonomic level utilizing the following published larval keys: Fish (1930), Lippson and Moran (1974), Jones et al. (1978), and Auer (1982). All larval fish samples were collected in compliance with the current NPDES permit requirements.

5.2 RESULTS

Twenty-four taxa of fish were collected during 2003 (Table 5-1). The total number and species composition (Table 5-2) were similar to recent years (Aquatec 1993, 1995, and Normandeau Associates 1997- 2003). All fish species collected were typical of the Connecticut River drainage. No federally listed threatened or endangered species were collected.

5.2.1 Fish - NPDES General Electrofishing

During 2003, a total of 40 electrofishing collections representing 6.683 hours of sampling effort were completed among the eight general electrofishing Stations at ten sites (Fig. 5-1, Table 5-2). The total number of fish collected by electrofishing was 858 (Table 5-2). The overall catch per unit effort (CPUE) for the 40-electrofishing collections was 128.4 fish per hour (Table 5-3).

There were 636 fish weighing a total of 51,125 grams collected in the Connecticut River upstream from Vernon Dam and 222 fish weighing a total of 33,899 grams collected downstream from Vernon Dam during the 2003 general electrofishing survey (Table 5-2). Numerically, the most abundant fish species upstream from Vernon Dam were yellow perch (228 fish) and bluegill (202 fish, Table 5-2). Downstream from Vernon Dam, the numerically most abundant fish species were smallmouth bass (84 fish) and bluegill (42 fish, Table 5-2). Yellow perch (11,989 g), largemouth bass (10,695 g), and white sucker (10,300 g) accounted for the majority of the biomass of fishes collected by general electrofishing upstream from Vernon Dam (Table 5-2). Smallmouth bass (17,667 g), white sucker (5,968 g), and bluegill (3,409 g) accounted for the majority of the biomass of fishes collected by general electrofishing downstream from Vernon Dam (Table 5-2). No Atlantic salmon were collected

by general electrofishing either upstream or downstream from Vernon Dam during 2003 (Table 5-2). No American shad were collected upstream from Vernon Dam, and 15 American shad were caught downstream of Vernon Dam during the 2003 general electrofishing collections (Table 5-2).

Based on catch per unit of effort (catch per hour), which standardizes for differences in the number of general electrofishing samples and effort between upstream and downstream locations, yellow perch (56.8 fish/hour), bluegill (50.3 fish/hour), and pumpkinseed (18.7 fish/hour) were numerically the most abundant fishes upstream from Vernon Dam (Table 5-4). Based on grams of fish caught per hour, yellow perch (2,985 grams/hour), largemouth bass (2,663 grams/hour), and white sucker (2,564 grams/hour) accounted for the majority of the biomass of fishes collected by general electrofishing upstream from Vernon Dam (Table 5-4). Downstream from Vernon Dam, smallmouth bass (31.5 fish/hour), bluegill (15.8 fish/hour), and spottail shiner (11.6 fish/hour) were numerically the most abundant fishes caught by general electrofishing, while smallmouth bass (6,625 grams/hour), white sucker (2,238 g/hour), and bluegill (1,278 g/hour) accounted for the majority of the biomass of fishes (Table 5-4).

5.2.2 Fish - Impingement

Two Atlantic salmon and thirteen American shad were among the 1142 fish comprising 20 taxa collected off of the circulating water traveling screens (CWTS) at the Vermont Yankee intake structure (Table 5-2). Smallmouth bass (372 fish), tessellated darter (171 fish), bluegill (162 fish), yellow perch (126 fish), and pumpkinseed (108 fish) were numerically the most abundant species in the impingement samples during the six months of sampling (Table 5-2). Smallmouth bass (11,450 g), pumpkinseed (5,025 g), tessellated darter (3,837 g) and bluegill (2,044 g) exhibited the highest total biomass among the total fish impinged during 2003 (Table 5-2).

One of the Atlantic salmon was impinged during April, and one was impinged in August 2003 (Table 5-5). Nine American shad were impinged in August and 4 were impinged in October 2003. The American shad and Atlantic salmon impingement limits of 364 Atlantic salmon and 1140 American shad were not exceeded during 2003. The month of April 2003 exhibited the highest total number and biomass of fish impinged, representing 604 total fish or 53% of the total number fish collected and 11,230 g or 40% of the total biomass of fish impinged.

5.2.3 Anadromous Fish Electrofishing

In fulfillment of the NPDES permit requirements for anadromous fish sampling, electrofishing samples were collected twice a month during July through October 2003 at Station 3, Stebbin Island (Four sample sites) and 0.1 mile south of Vernon Dam (Figure 5-1). Results reported in this section include American shad collected and enumerated during the anadromous fish collections only and not those American shad reported above in the general electrofishing Section 5.2.1.

A total of 143 juvenile American shad was collected in the anadromous electrofishing program performed between July and October 2003 (Table 5-6). No American shad were caught in July 2003. August 2003 yielded the highest catch of American shad (81) compared to the other three months. American shad lengths recorded in August 2003 ranged from 70-99 mm total length and weight ranged from 3-8 g (Table 5-6). The CPUE in August was highest (46.5 fish/hour) at the Stebbins Island Station located 0.5 miles downstream from Vernon Dam. The bi-monthly collections during September and October resulted in the collection of 39 and 22 American shad, respectively. The American shad collected during September 2003 ranged in length from 85-108 mm. The CPUE in

September 2003 was highest (30.0 fish/hour) at Station 0.1 mile south of Vernon Dam (4.5), and was also relatively high (19.5 fish/hour) at the Stebbins Island Station (Table 5-6). October American shad collections produced a catch ranging in length from 94-111 mm. The CPUE in October was highest at Stebbins Island (13.2 fish/hour) and at the Station 0.1mile south of Vernon Dam (12.00 fish/hour; Table 5-6).

5.2.4 Ichthyoplankton

Thirty-three ichthyoplankton samples were collected in the Connecticut River near, but just outside, of the Entergy Nuclear Vermont Yankee intakes between 7 May and 16 July 2003 (Table 5-7). A total of 1,222 ichthyoplankters were identified and enumerated (Table 5-8). Spotttail shiner comprised 72% of the total ichthyoplankton collected. White perch, centrachids, yellow perch, common carp, white sucker, and walleye made up the remaining 18% of ichthyoplankton collected during 2003 (Table 5-9). Table 5-9 provides a breakdown of ichthyoplankton estimates presented as density (numbers per 100 cubic meters). Most fish were collected at the depths throughout the water column, although the most abundant taxon, spottail shiner, was found in highest abundance in the surface (0.3 m) samples (Table 5-9).

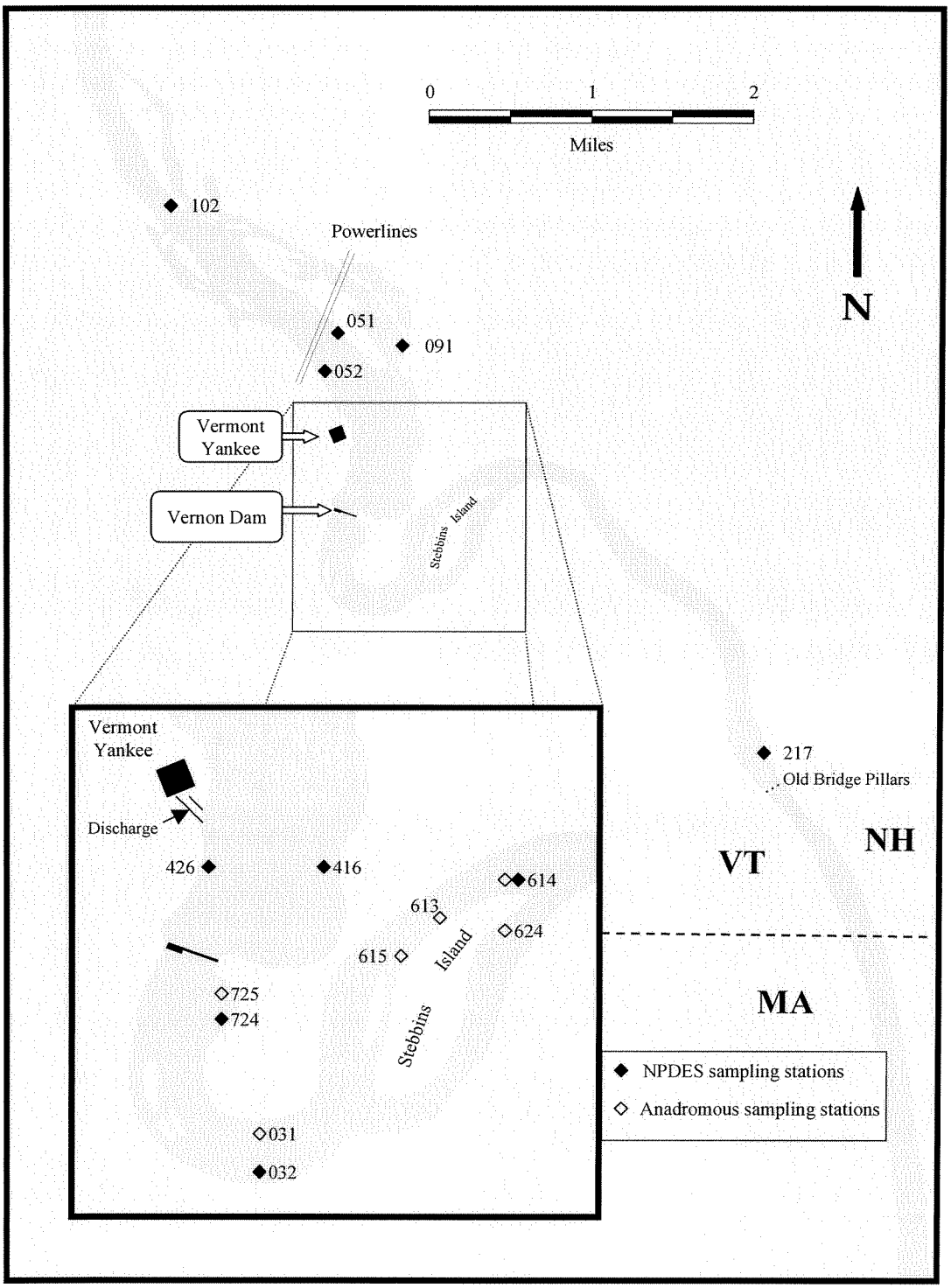

Figure 5-1. NPDES and anadromous fish electrofishing sampling stations.

Table 5-1. Checklist of Fishes (AFS 1991) Collected in the Connecticut River During 2003.

		Program				
		NPDES Ichthyoplankton Trawl	NPDES Impingement	Anadromous Electrofishing Only	NPDES Electrofishing Only	Anadromous & Electrofishing
CHORDATA						
AGNATHA						
PETROMYZONTIFORMES						
Petromyzontidae						
Petromyzon marinus	Sea lamprey		X		X	
OSTEICHTHYES						
CLUPEIFORMES						
Clupeidae						
Alosa sapidissima	American shad		X	X	X	X
CYPRINIFORMES						
Cyprinidae						
Cyprinus carpio	Common carp	X	X		X	
Luxilus cornutus	Common shiner				X	
Notemigonus crysoleucas	Golden shiner		X		X	
Notropis hudsonius	Spottail shiner	X	X		X	X
Semotilus corporalis	Fallfish				X	X
Catostomidae						
Catostomus commersoni	White sucker	X	X		X	X
SILURIFORMES						
Ictaluridae						
Ameiurus natalis	Yellow bullhead		X		X	
Ameiurus nebulosus	Brown bullhead				X	

(continued)

Table 5-1. (Continued)

		Program[a]				
		NPDES Ichthyoplankton Trawl	NPDES Impingement	Anadromous Electrofishing Only	NPDES Electrofishing Only	Anadromous & Electrofishing
SALMONIFORMES						
Salmonidae						
Salmo salar	Atlantic salmon		X			
Esocidae						
Esox lucius	Northern pike		X			
Esox niger	Chain pickerel		X		X	
PERCIFORMES						
Percichthyidae						
Morone americana	White perch	X	X		X	
Centrarchidae		X				
Ambloplites rupestris	Rock bass		X		X	X
Lepomis gibbosus	Pumpkinseed		X		X	
Lepomis macrochirus	Bluegill		X		X	X
Lepomis sp.					X	
Micropterus dolomieu	Smallmouth bass		X		X	X
Micropterus salmoides	Largemouth bass		X		X	
Pomoxis nigromaculatus	Black crappie		X		X	
Percidae						
Etheostoma olmstedi	Tessellated darter		X		X	
Perca flavescens	Yellow perch	X	X		X	X
Stizostedion vitreum	Walleye	X	X			X

[a] "Anadromous electrofishing Only" = 46 samples where only anadromous species were counted, "NPDES Electrofishing Only" = 38 samples applicable to only that program, and "Anadromous & Electrofishing" = 2 samples applicable to both programs.

Table 5-2. Numbers and Weights of Fishes Captured Upstream and Downstream of Vernon Dam in 2003 in General Electrofishing and Impingement.

	Electrofishing				Impingement		Summary			
	Upstream		Downstream		CWTS*					
	Number	Total Weight (g)	Number	Total Weight (g)	Number	Total Weight (g)	Total (#)	Relative Number (%)	Total (g)	Relative Weight (%)
Sea lamprey	4	16	1	10	2	4	7	0.4	30	0.0
American shad			15	117	13	75	28	1.4	192	0.2
Atlantic salmon					28	1093	28	1.4	1093	1.0
Northern pike					1	5	1	0.1	5	0.0
Chain pickerel	8	329	2	93	11	615	21	1.1	1037	0.9
Common carp			2		1	16	3	0.2	16	0.0
Common shiner	1	5	1	25			2	0.1	30	0.0
Golden shiner	19	718			7	257	26	1.3	975	0.9
Spottail shiner	18	80	31	66	9	32	58	2.9	178	0.2
Fallfish			6	2231			6	0.3	2231	2.0
White sucker	8	10300	7	5968	3	27	18	0.9	16295	14.4
Yellow bullhead	3	340			39	285	42	2.1	625	0.6
Brown bullhead	3	1070					3	0.2	1070	0.9
White perch	2	226	1	400	1	120	4	0.2	746	0.7
Rock bass	9	581	18	1097	108	5025	135	6.8	6703	5.9
Pumpkinseed	75	4483	5	127	162	2044	242	12.1	6654	5.9
Bluegill	202	8403	42	3409	372	11450	616	30.8	23262	20.5
Lepomis sp.	11	11					11	0.6	11	0.0
Smallmouth bass	5	443	84	17667	27	1070	116	5.8	19180	16.9
Largemouth bass	27	10695	2	1650	58	1228	87	4.4	13573	12.0
Black crappie	13	1436	1	120	126	873	140	7.0	2429	2.1
Tesselated darter			1	1	2	6	3	0.2	7	0.0
Yellow perch	228	11989	2	238	171	3837	401	20.1	16064	14.2
Walleye			1	680	1	140	2	0.1	820	0.7
Total	**636**	**51125**	**222**	**33899**	**1142**	**28202**	**2000**	**100.0**	**113226**	**100.0**

Table 5-3. Catch Per Unit of Effort (CPUE) Conducted for General Electrofishing Fish Collections in the Connecticut River in the Vicinity of Vernon Vermont during May, June, September and October 2003.

	General Electrofishing Stations	Number of Collections	Hours	Fish	CPUE (Fish/Hour)
Upstream	Rum Point (102)	4	0.683	76	111.2
	Station 5 - New Hampshire (051)	4	0.667	100	150.0
	Station 5 - Vermont (052)	4	0.667	102	153.0
	New Hampshire Setback (091)	4	0.667	189	283.5
	Station 4 - New Hampshire (416)	4	0.667	103	154.5
	Station 4 - Vermont (426)	4	0.667	66	99.0
	Upstream Subtotal	**24**	**4.017**	**636**	**158.3**
Downstream	0.1 Miles south of Vernon Dam (724)	4	0.667	39	58.5
	Station 3 - Vermont (032)	4	0.667	77	115.5
	Stebbin Island - New Hampshire Side (614)	4	0.667	57	85.5
	Station 2 - New Hampshire (217)	4	0.667	49	73.5
	Downstream Subtotal	**16**	**2.667**	**222**	**83.3**
TOTAL	**TOTAL**	**40**	**6.683**	**858**	**128.4**

Table 5-4. Catch Per Unit of Effort (CPUE, number and grams per hour) of Fishes Captured in the General Electrofishing Survey Conducted in the Connecticut River Upstream and Downstream from Vernon Dam in 2003.

	Electrofishing											
	Upstream				Downstream				TOTAL			
	By Number		By Weight		By Number		By Weight		By Number		By Weight	
Fish Taxa	CPUE	%	CPUE	%	CPUE	%	CPUE	%	CPUE	%	CPUE	%
Sea lamprey	1.0	0.6	4.0	0.0	0.4	0.5	3.8	0.0	0.7	0.6	3.9	0.0
American shad	0.0	0.0	0.0	0.0	5.6	6.8	43.9	0.3	2.2	1.7	17.5	0.1
Chain pickerel	2.0	1.3	81.9	0.6	0.8	0.9	34.9	0.3	1.5	1.2	63.1	0.5
Common carp	0.0	0.0	0.0	0.0	0.8	0.9	0.0	0.0	0.3	0.2	0.0	0.0
Common shiner	0.2	0.2	1.2	0.0	0.4	0.5	9.4	0.1	0.3	0.2	4.5	0.0
Golden shiner	4.7	3.0	178.8	1.4	0.0	0.0	0.0	0.0	2.8	2.2	107.4	0.8
Spottail shiner	4.5	2.8	19.9	0.2	11.6	14.0	24.8	0.2	7.3	5.7	21.8	0.2
Fallfish	0.0	0.0	0.0	0.0	2.3	2.7	836.6	6.6	0.9	0.7	333.8	2.6
White sucker	2.0	1.3	2564.3	20.1	2.6	3.2	2238.0	17.6	2.2	1.7	2434.1	19.1
Yellow bullhead	0.7	0.5	84.6	0.7	0.0	0.0	0.0	0.0	0.4	0.3	50.9	0.4
Brown bullhead	0.7	0.5	266.4	2.1	0.0	0.0	0.0	0.0	0.4	0.3	160.1	1.3
White perch	0.5	0.3	56.3	0.4	0.4	0.5	150.0	1.2	0.4	0.3	93.7	0.7
Rock bass	2.2	1.4	144.6	1.1	6.8	8.1	411.4	3.2	4.0	3.1	251.1	2.0
Pumpkinseed	18.7	11.8	1116.1	8.8	1.9	2.3	47.6	0.4	12.0	9.3	689.8	5.4
Bluegill	50.3	31.8	2092.0	16.4	15.8	18.9	1278.4	10.1	36.5	28.4	1767.4	13.9
Lepomis sp.	2.7	1.7	2.7	0.0	0.0	0.0	0.0	0.0	1.6	1.3	1.6	0.0
Smallmouth bass	1.2	0.8	110.3	0.9	31.5	37.8	6625.1	52.1	13.3	10.4	2709.7	21.3
Largemouth bass	6.7	4.2	2662.7	20.9	0.8	0.9	618.8	4.9	4.3	3.4	1847.1	14.5
Black crappie	3.2	2.0	357.5	2.8	0.4	0.5	45.0	0.4	2.1	1.6	232.8	1.8
Tessellated darter	0.0	0.0	0.0	0.0	0.4	0.5	0.4	0.0	0.1	0.1	0.1	0.0
Yellow perch	56.8	35.8	2984.8	23.5	0.8	0.9	89.3	0.7	34.4	26.8	1829.5	14.4
Walleye	0.0	0.0	0.0	0.0	0.4	0.5	255.0	2.0	0.1	0.1	101.7	0.8
Total	**158.3**	**100.0**	**12728.2**	**100.0**	**83.3**	**100.0**	**12712.1**	**100.0**	**128.4**	**100.0**	**12721.8**	**100.0**

Table 5-5. Monthly Impingement of Fish on Entergy Nuclear Vermont Yankee's Circulating Water Traveling Screens in 2003.

	April		May		June		August		September		October	
Fish Taxa	**#**	**Wt (g)**	**#**	**Wt (g)**	**#**	**Wt (g)**	**#**	**Wt (g)**	**#**	**Wt (g)**	**#**	**Wt (g)**
Sea lamprey	2	4										
Chain pickerel	1	24	3	98	24	971						
Golden shiner	8	365					1	250			2	
Spottail shiner	6	237					1	20				
White sucker	4	20	1	8	1	2	1	2			2	
Yellow bullhead	2	23	1	4								
Rock bass	4	168					32	115			3	2
Pumpkinseed	59	3726	13	244	11	792	5	133	4	116	16	14
Bluegill	141	1037	9	366	6	637	1	2			5	2
Smallmouth bass	173	1280	17	429	29	2959	35	2489	40	4235	78	58
Largemouth bass	10	558			4	455	9	35	3	22	1	
Black crappie	15	211			1	850	39	163			3	4
Yellow perch	42	441			3	9	29	173	1	185	51	65
Atlantic salmon	1	2					1	4				
Tessellated darter	136	3134	14	431	7	208	7	27	1	32	6	5
American shad							9	58			4	17
Northern pike							1	5				
Common carp							1	16				
White perch							1	120				
Walleye							1	140				
Total	**604**	**11230**	**58**	**1580**	**86**	**6883**	**174**	**3752**	**49**	**4590**	**171**	**167**

Table 5-6. Summary of American Shad Caught in the Anadromous Fish Electrofishing Survey Conducted at Stebbins Island, Station 3, and 0.1 Mile Below Vernon Dam in the Connecticut River during 2003.

Month and Station	No. of Fish	Hours	CPUE	Minimum Length (mm)	Maximum Length (mm)	Minimum Weight (g)	Maximum Weight (g)
July							
Station 3 (031)	0	0.33	0.00	-	-	-	-
Stebbin Island (613,614,615,624)	0	1.07	0.00	-	-	-	-
0.1 Miles south of Vernon Dam (725)	0	0.38	0.00	-	-	-	-
August							
Station 3 (031)	18	0.33	54.00	77	99	3	8
Stebbin Island (613,614,615,624)	62	1.33	46.50	70	94	3	7
0.1 Miles south of Vernon Dam (725)	2	0.33	6.00	80	93	4	7
September							
Station 3 (031)	3	0.33	9.00	87	92	5	7
Stebbin Island (613,614,615,624)	26	1.33	19.50	85	99	5	12
0.1 Miles south of Vernon Dam (725)	10	0.33	30.00	88	108	3	8
October							
Station 3 (031)	4	0.33	12.00	94	103	6	9
Stebbin Island (613,614,615,624)	17	1.28	13.20	94	111	6	11
0.1 Miles south of Vernon Dam (725)	1	0.27	3.80	97	97	7	7

Table 5-7. Ichthyoplankton Sampling Effort at Entergy Nuclear Vermont Yankee Intakes in 2003.

	Depth (m)							
	0.3		1.8		3.7		Mean	
	N	Volume	N	Volume	N	Volume	N	Volume
7-May-03	1	100.34	1	106.25	1	82.14	3	96.24
14-May-03	1	110.80	1	92.74	1	95.89	3	99.81
21-May-03	1	89.76	1	90.90	1	86.00	3	88.89
28-May-03	1	111.74	1	103.66	1	99.37	3	104.93
4-Jun-03	1	100.30	1	92.01	1	97.56	3	96.62
11-Jun-03	1	101.08	1	93.30	1	115.06	3	103.15
18-Jun-03	1	105.84	1	98.48	1	107.92	3	104.08
25-Jun-03	1	90.11	1	104.62	1	101.12	3	98.62
2-Jul-03	1	101.19	1	104.86	1	102.31	3	102.79
9-Jul-03	1	121.92	1	103.97	1	113.66	3	113.19
16-Jul-03	1	101.88	1	101.34	1	101.50	3	101.57
Total	**11**	**103.18**	**11**	**99.28**	**11**	**100.23**	**33**	**100.90**

* Mean volume at depth

Table 5-8. Earliest and Latest Collection Dates and Total Number of Ichthyoplankton Collected in the Connecticut River Near the Vermont Yankee Intake during 2003.

Species	Earliest Capture	Latest Capture	Volume Sampled* (cubic meters)	Number	Percent
Common carp	18-Jun-03	16-Jul-03	1560.72	27	2.2
Spottail shiner	18-Jun-03	16-Jul-03	1560.72	875	71.6
White sucker	28-May-03	4-Jun-03	604.65	2	0.2
White perch	14-May-03	2-Jul-03	2396.63	178	14.6
Centrarchidae	25-Jun-03	16-Jul-03	1248.49	100	8.2
Yellow perch	7-May-03	28-May-03	1169.59	39	3.2
Walleye	28-May-03	28-May-03	314.78	1	0.1
Total				**1222**	**100.0**

*Volume sampled is sum of volumes between earliest and latest capture date

Table 5-9. Weekly Density per 100 Cubic Meters for Ichthyoplankton Collected in Three Depth Strata of the Connecticut River Near the Vermont Yankee Intake during 2003.

		DEPTH (m)			
		0.3	1.8	3.7	Mean Density
7-May-03	Yellow perch	0.00	3.76	2.44	2.07
14-May-03	White perch	0.90	0.00	0.00	0.30
	Yellow perch	4.51	4.31	14.60	7.81
21-May-03	White perch	1.11	18.70	24.42	14.74
	Yellow perch	0.00	8.80	0.00	2.93
28-May-03	Walleye	0.00	0.96	0.00	0.32
	White perch	13.42	28.94	20.13	20.83
	White sucker	0.89	0.00	0.00	0.30
	Yellow perch	0.00	0.96	1.01	0.66
4-Jun-03	White perch	2.99	3.26	3.08	3.11
	White sucker	1.00	0.00	0.00	0.33
11-Jun-03	White perch	12.86	9.65	14.78	12.43
18-Jun-03	Common carp	0.00	1.02	0.93	0.65
	Spottail shiner	5.67	3.05	2.78	3.83
	White perch	3.78	8.12	9.27	7.06
25-Jun-03	Centrarchidae	3.33	2.87	0.00	2.07
	Common carp	3.33	5.74	4.94	4.67
	Spottail shiner	299.62	151.02	86.03	178.89
	White perch	0.00	1.91	0.00	0.64
2-Jul-03	Centrarchidae	56.33	13.35	15.64	28.44
	Common carp	3.95	2.86	2.93	3.25
	Spottail shiner	52.38	19.07	16.62	29.36
	White perch	0.00	0.00	0.98	0.33
9-Jul-03	Centrarchidae	0.82	3.85	0.00	1.56
	Spottail shiner	188.65	17.31	2.64	69.53
16-Jul-03	Centrarchidae	0.98	0.00	0.99	0.66
	Common carp	0.98	0.00	0.00	0.33
	Spottail shiner	5.89	0.99	0.00	2.29

6.0 2003 ZEBRA MUSSEL AND ASIATIC CLAM MONITORING

6.1 METHODS OF COLLECTION AND PROCESSING

Larval (veliger) sampling was conducted bi-weekly between 21 May and 22 October 2003. Collections were made at quarter point stations (NH and VT shores, and mid-river) at Entergy Nuclear Vermont Yankee Stations 4 and 5 (Fig 6-1). At each sample station, 1,000 liters of river water were pumped through a 64-micron plankton net at each quarter point for each collection. Six samples were collected during each bi-weekly sampling for a total of 60 pumped veliger samples in 2003. Samples were preserved in 70% ethanol for examination in the laboratory for the presence of the microscopic veligers.

Juvenile/adult (settling stage) zebra mussel sampling was conducted between 7 May and 22 October 2003 near the New Hampshire and Vermont shores at Vermont Yankee Stations 4 and 5 (Fig 6-1). One settlement plate sampler was deployed at each station for a total of four samplers. Settlement plates were made of six, six-inch by six-inch, plates of PVC thread laterally onto a single bolt with approximately 1.25 in between plates. The sampler was suspended in the water column at 2-3 m below the surface, depending on river depth at the sampling station. Approximately every two weeks, the plate sampler at each station was lifted out of the water and one PVC plate was randomly selected and cleaned into a number 64-micron sieve. The sample was then preserved in 70% ethanol for examination in the laboratory.

One plate sampler deployed at Station 5 on 16 July 2003, could not be located two weeks later when retrieval was attempted. A new plate sampler was deployed at that location on the day after the plate sampler was determined to be lost and was checked approximately two weeks later for settlement. Therefore, one zebra mussel settling plate sample was not collected between 16 July and 30 July 2003.

Asiatic clam (Corbicula) samples were collected with a 9-inch Ponar dredge in June, August, and October 2003 at the following stations: Station 4 (NH and VT shores, and mid river) and Station 5 (NH and VT shores, and mid river) (Figure 6-1). Dredge samples were collected at all six locations for a total of 18 dredges. All dredge samples were sieved through a standard USGS number 30-sieve in the field, prior to being preserved in 70% ethanol for laboratory examination.

6.1.1 Laboratory Identification Procedures

Each zebra mussel veliger sample was emptied into a Petri dish and examined in entirety with cross-polarized light on a dissecting microscope with 40x magnification. The use of cross polarized light allows zebra mussel veligers to be distinguished from other planktonic organisms that are also collected in the samples, as the larval shells stand out as bright spots against a dark background (Johnson 1996).

In the laboratory, the 18 Ponar dredge samples from each quarter point per location (NH, mid-stream, and VT), per station (Station 4 and 5) were examined in entirety under low magnification (2x).

6.2 SUMMARY

River water temperatures ranged from 11.3°C to 27.8°C, dissolved oxygen ranged from 5.8 to 11 mg/l, and pH ranged from 6.3 to 8.2 during veliger and settlement plate sampling in the vicinity of the Entergy Nuclear Vermont Yankee Plant (Stations 4 and 5).

There were no Asiatic clams or any life stages of zebra mussels found in any samples collected during the 2003 Vermont Yankee monitoring program.

In addition to the zebra mussel sample collections, zebra mussel information cards were distributed to local venders, such as sporting good stores, bait shops, and marinas, during 2003. An interactive website was also produced and incorporated onto the Entergy Vermont Yankee Chemistry intranet. The website contains information about the Zebra mussel monitoring program at Entergy, exotic species fact sheets, maps depicting local and national existing zebra mussel habitat and articles and publications on new technologies and experiments regarding the control and or extermination of zebra mussels.

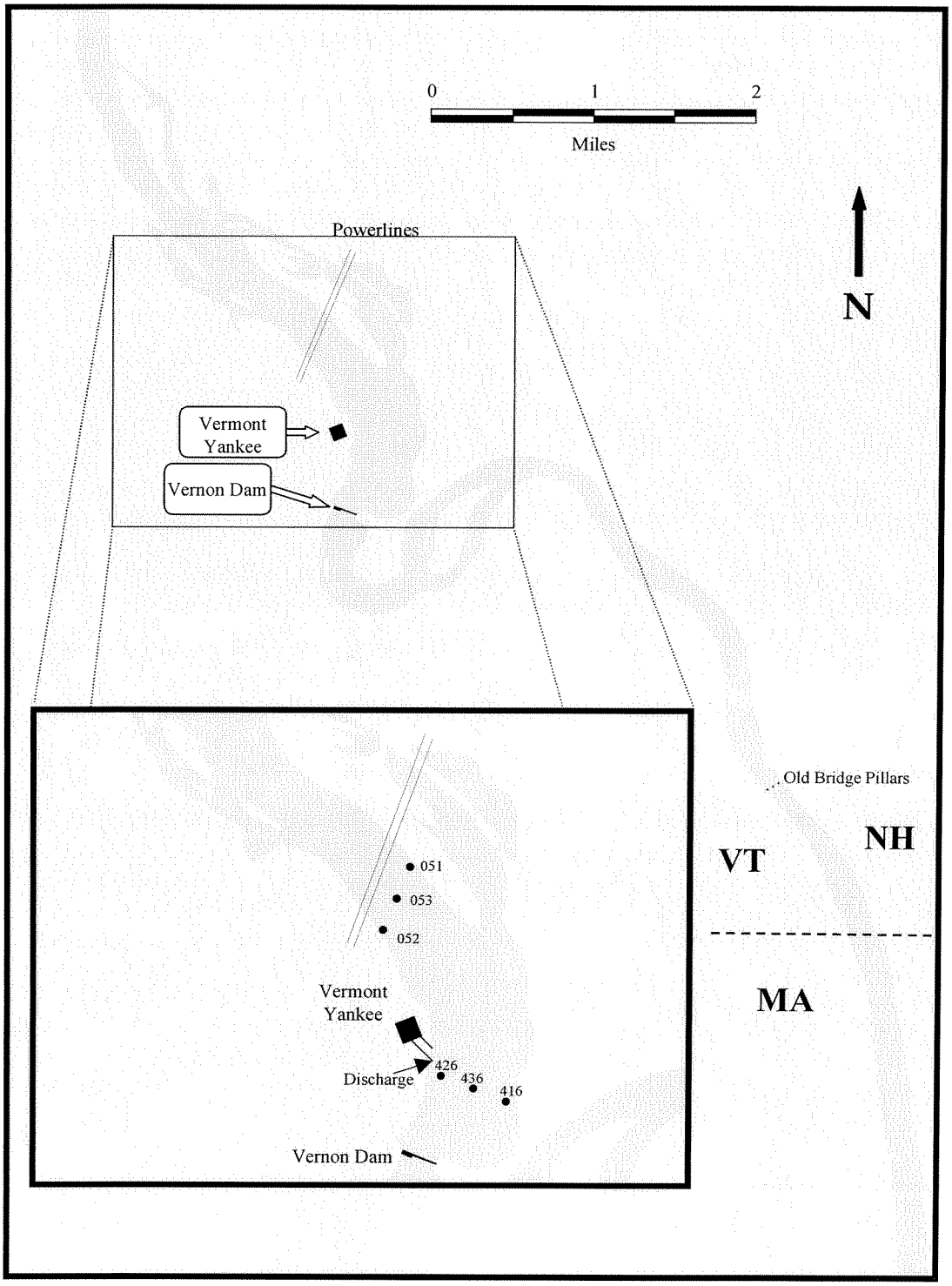

Figure 6-1. Zebra mussel and Asiatic clam monitoring stations. Zebra mussel veligers pump samples and Asiatic clam dredges at all stations. Zebra mussel plates at 051, 052, 426 and 416 only.

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