Admin # 201

MERRIMACK STATION (BOW)

FISHERIES STUDY

Prepared for

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
Manchester, New Hampshire

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1.0 INTRODUCTION

Merrimack Station, located in Bow, New Hampshire, draws substantial volumes of once-through cooling water from the Hooksett Pool section of the Merrimack River. This electric generating facility has been in operation in its present capacity since 1968. From 1967 through 1978, numerous thermal and biological studies of the river were conducted assessing potential impacts from operation of Merrimack Station by Normandeau Associates (NAI) for Public Service of New Hampshire (PSNH).

During NPDES permitting proceedings, review agencies raised a number of concerns relative to Merrimack Station's potential impacts to the river, given the current state of water quality and fishery recovery/re-introductions. In response, PSNH revisited the historical data and successfully satisfied some of the agencies' concerns. However, data were not sufficient to address all issues and it was concluded that three additional studies would be required to complete the evaluation of potential impact from Merrimack Station's thermal plume:

1. An assessment of the effects of thermal inputs from Merrimack Station on the potential duration of the anadromous fish migration season.

2. An assessment of the potential for entrainment of yellow perch larvae in the thermal plume at Merrimack Station.

3. An assessment of the abundance of yellow perch in Hooksett Pool relative to their historical abundance and collection of additional information on the spatial distribution of target fish populations in Hooksett Pool in relation to the portions of those populations in the present discharge canal.

Studies were conducted during the period October 1994 to September 1995 by Normandeau Associates to address the agency concerns.

2.0 METHODS

2.1 ICHTHYOPLANKTON

Ichthyoplankton samples were collected weekly for eight weeks during May and June 1995 using a 50-cm diameter 505-μm mesh plankton net with a width-to-length ratio of 4:1. A propeller type flow meter (General Oceanics model 2030R) was placed slightly off-center in the mouth of the net to allow calculation of the volume of water filtered.

Three areas in Hooksett Pool were sampled: the ambient zone upstream from the station, the mixing zone in the immediate area of the thermal plume, and the thermally affected zone downstream from the station (Figure 2-1, Table 2-1). In each of the three sampling areas, samples were collected in three locations: midstream and approximately 10-12 meters from each bank. At each location samples were collected at two depths, near surface (approximately 0.2 m below the surface) and near bottom (approximately 1.5-2.0 m depth). A total of 144 samples were collected (8 dates x 3 areas x 3 locations x 2 depths).

Ichthyoplankton tows were taken during the day. The tow duration at each location was seven minutes, to assure a minimum filtered volume of 50 m^3. Water temperature and dissolved oxygen concentration were measured at each sampling depth at each location. Samples were preserved in 5-10% buffered formalin.

In the laboratory, samples were drained and rinsed in a sieve and then sorted under magnification to remove the ichthyoplankton from the detritus. Following initial sorting, three randomly selected samples from each weekly sampling were re-sorted. If additional organisms from the re-sorted samples amounted to 15% (average of three percentages) of the total from the original and re-sorted samples, or if any one re-sorted sample contained more than 25% of the total for that sample, all samples for that week were re-sorted. Fish larvae were identified to species. No fish eggs were collected. A collection of reference specimens was prepared to allow independent verification.

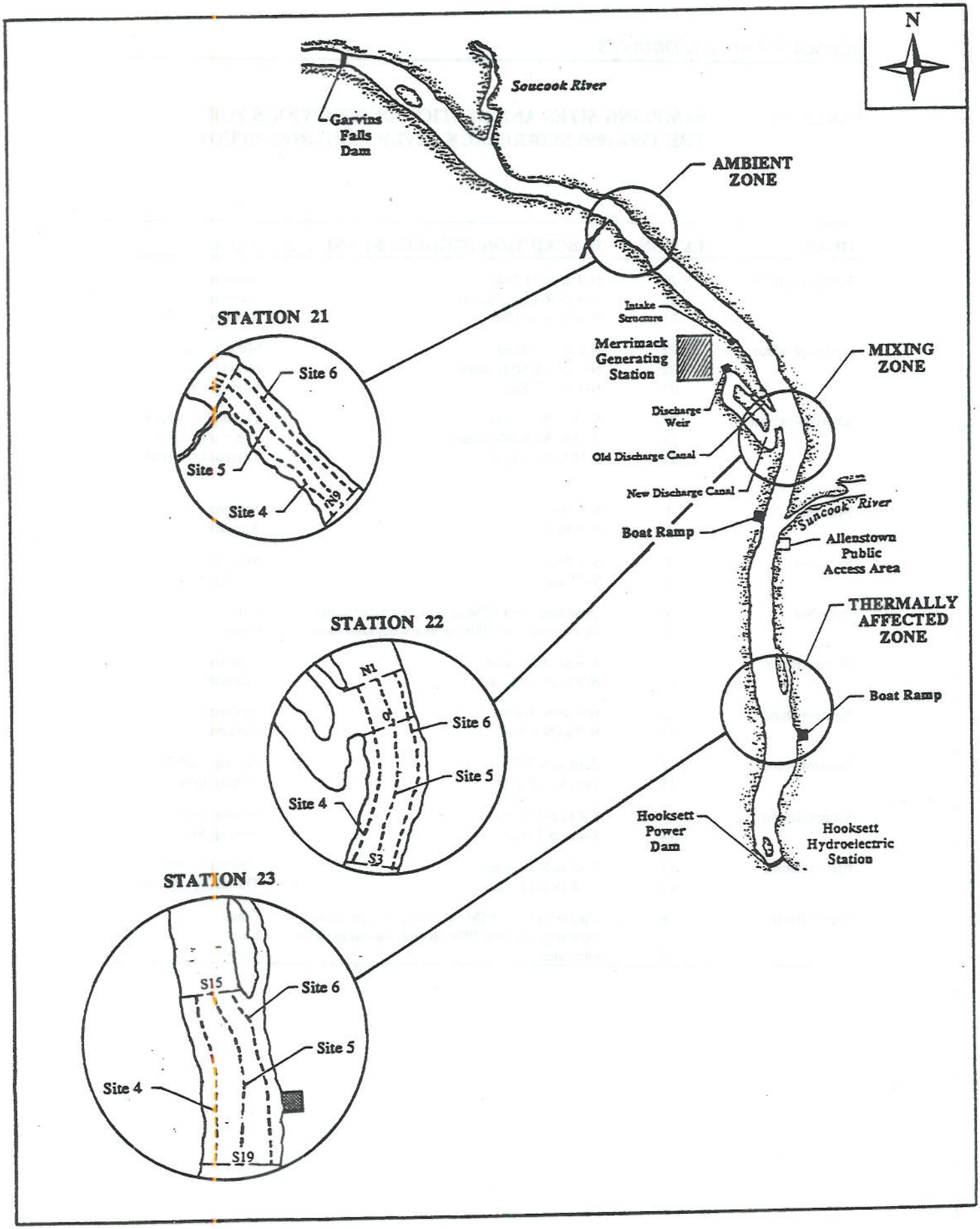

Figure 2-1. Ichthyoplankton stations, Merrimack River Monitoring Program, Hooksett Pool, New Hampshire 1994-1995.

TABLE 2-1. SAMPLING SITES AND STATION DESCRIPTIONS FOR THE 1994-1995 MERRIMACK RIVER FISHERIES STUDY.

GEAR	STATION	DESCRIPTION (FIGURES 2-1 AND 2-2)	AREA
Ichthyoplankton	21	N-9 to N-11 West	Ambient
	21	N-9 to N-11 Midstream	Ambient
	21	N-9 to N-11 East	Ambient
Ichthyoplankton	22	N-1 to S-3 West	Mixing zone
	22	N-1 to S-3 Midstream	Mixing zone
	22	N-1 to S-3 East	Mixing zone
Ichthyoplankton	23	S-15 to S-19 West	Thermally affected
	23	S-15 to S-19 Midstream	Thermally affected
	23	S-15 to S-19 East	Thermally affected
Fyke Net	1	N-9 West	Ambient
	1	N-9 East	Ambient
Fyke Net	2	S-2 West	Mixing zone
	3	S-4 East	Mixing zone
Fyke Net	4	Upstream from PSM in new discharge canal	Canal
	5	Downstream for PSM in new discharge canal	Canal
Electrofishing	11	N-9 to N-10 West	Ambient
	11	N-9 to N-10 East	Ambient
Electrofishing	12	N-8 to N-9 West	Ambient
	12	N-8 to N-9 East	Ambient
Electrofishing	13	Zero to S-2 West	Mixing zone
	13	Zero to S-2 East	Mixing zone
Electrofishing	14	S-4 to S-5 West	Mixing zone
	14	S-4 to S-5 East	Mixing zone
Electrofishing	15	S-13 to S-15 West	Thermally affected
	15	S-13 to S-15 East	Thermally affected
Electrofishing	16	Upstream from PSM in new discharge canal	Canal
	17	Downstream from PSM in new discharge canal	Canal
	18	Old canal	Canal

Estimated densities of larvae by species were calculated for each sample based on the volume of water filtered.

2.2 ELECTROFISHING

All shocking was done during the day, between one-half hour after sunrise and one-half hour before sunset. Samples were collected once per month during October and December 1994, and March, May, June, July, August, and September 1995. The shocking equipment was operated at 10 amps of pulsed DC (120 pps) current. Shocking runs typically followed the shoreline from downstream to upstream and centered on available cover (vegetation, rock piles, etc.). Shocking runs were restricted to depths less than 6-8 feet since capture efficiency at greater depths is substantially reduced. The sampling effort was 300 m (1000 ft) of shoreline fished, which was usually accomplished in 15-20 minutes of shocking power on. Data were recorded separately for each of two 150-m segments within the 300-m transect (downstream and upstream).

Electrofishing was conducted by fishing 300-m sections (Figure 2-2; Table 2-1) along both east and west banks at five locations in the river. In addition, three 150-m electrofishing transects were sampled: one in the old canal and one each above and below the Pressure Spray Modules (PSM) in the existing (new) discharge canal.

Electrofishing began by moving the boat into the area to be sampled. Sampling boat speed was consistent among all sampling zones. As the boat was moved, the two netters captured all stunned fish and retained them in a live well for processing. The fish from the downstream 150-m portion of each 300-m transect were held separately from the upstream 150-m portion so that the two subsamples could be analyzed separately. At the end of the shocking run all fish were processed (identified, counted, measured for length and weight, and any anomalies noted) and sampling activities documented (sampling time, date, location, physical-chemical data, investigators, etc.). The shock unit model number and type, current type, voltage, amps, and pulse rate used to collect each sample were recorded.

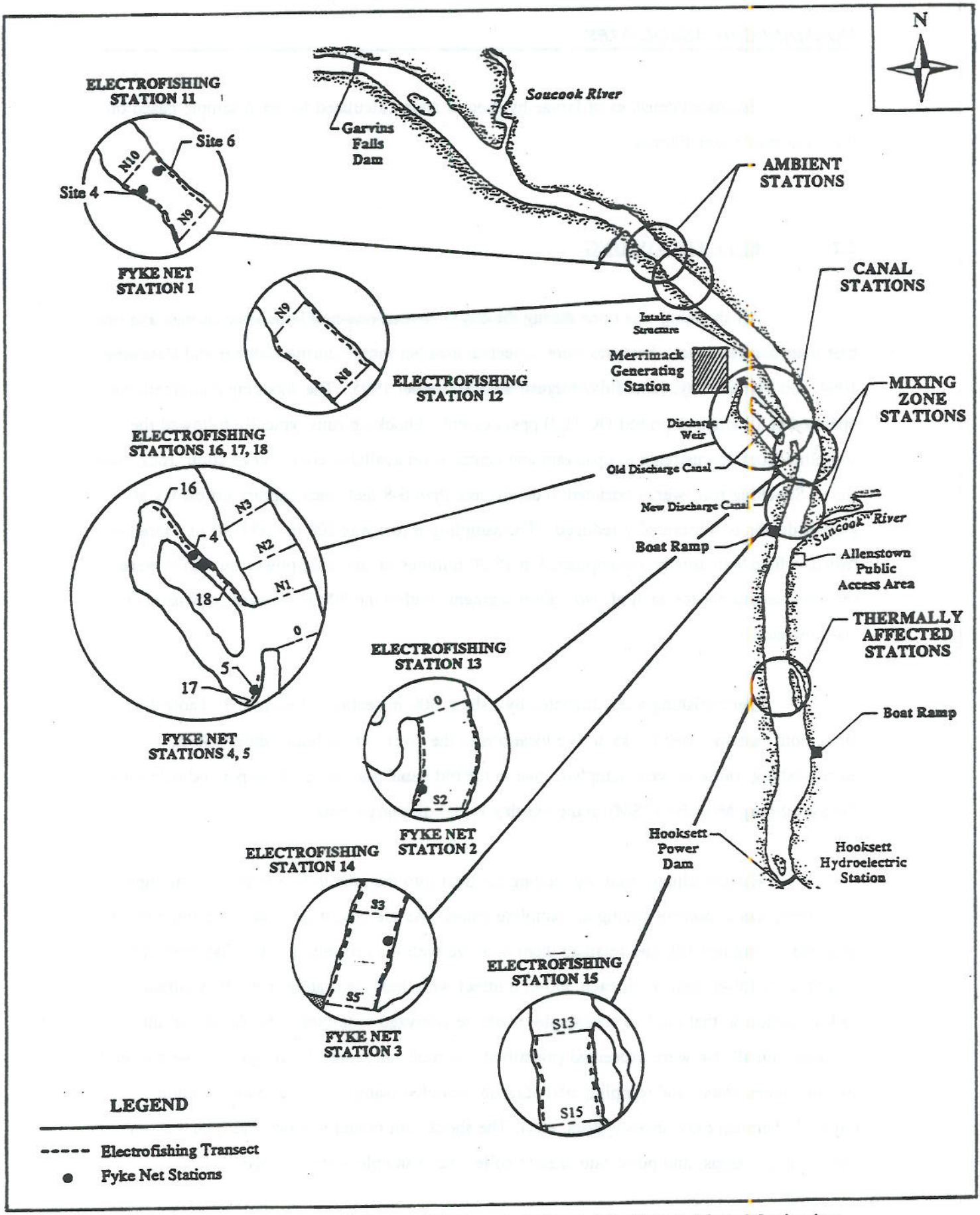

Figure 2-2. Electrofishing and Fyke net stations, Merrimack River Monitoring Program, Hooksett Pool, New Hampshire 1994-1995.

2.3 FYKE NETS

Fyke nets were made from 2-inch multi-filament stretch netting and 3-foot hoops. The leaders were 100 ft in length, and the wings were 20-25 feet in length. Samples were collected once per month during October and December 1994, and April through September 1995. Sampling duration, or soak time, was approximately 48 hours. Two consecutive 48-hour sets constituted one sampling effort. Leaders were staked to shore with a 3-foot length of 3/8-inch rebar. Wings were also staked in place (4-foot to 6-foot rebar). The wing angle was generally 45-50 degrees off the lead. The pot end was anchored with a float for easy retrieval.

The specific sampling locations had an even slope with no sudden drop-offs or debris such as stumps. The sampling locations were out of the current and sheltered from wind as much as possible. Nets were set perpendicular to shore unless special need dictated other orientations.

Fyke netting was conducted at four locations in the river (N-10 east, N-10 west, S-2 west and S-4 east, Figure 2-2; Table 2-1) and at two locations in the new discharge canal (upstream and downstream from the PSM).

The wings, lead and trap of each net were inspected for damage prior to sampling and repaired or replaced as needed. The lead was secured to shore, then fully extended perpendicular to shore. The gear deployment, set time, date, and location were documented on the field data sheet.

After approximately 48 hours the trap was retrieved and any captured fish transferred to a wash tub or live well. The net was reset and retrieved again after the second 48 hour set. Fish were processed (identified, counted, measured for length and weight), and any anomalies noted.

2.4 WATER QUALITY

Air temperature, water temperature, and dissolved oxygen (DO) were measured at each sampling location each time a sample was collected, at the time each sample was removed from the sampling gear for processing (immediately before or after each ichthyoplankton tow, just prior to the pull time for hoop nets, and at the end of each electrofishing transect). Depths for water temperature and DO were 30 cm below the surface and 10 cm above the river bottom. Temperature and dissolved oxygen (nearest 0.1 mg/l) were measured with a YSI model 57 dissolved oxygen meter. Air temperature (nearest 1.0°C) was measured with a mercury thermometer.

A table of saturation concentrations of DO in water at various water temperatures was used to check readings from the DO meter. If a reading exceeded saturation, the meter connections were checked, the membrane was checked for contamination and bubbles, and the reading was retaken. Meters were recalibrated at the end of the sampling day to determine if calibration drifted during the course of the day.

3.0 RESULTS

3.1 ICHTHYOPLANKTON

Larvae of 13 fish species were present in the May-June ichthyoplankton sampling season (Table 3-1). No fish eggs were present in the samples. The most abundant species over all dates and sampling zones were bluegill, spottail shiner, rainbow smelt, and common shiner (scientific names are listed in Appendix Table 1). The most abundant species, bluegill, was abundant both in the mixing zone and in the thermally affected zone, but was absent from the ambient zone. Spottail shiner and common shiner were both more abundant in the ambient zone than in either the mixing zone or the thermally affected zone, whereas rainbow smelt was most abundant in the downstream section of the study area (the thermally affected zone). Among the three sampling areas, the mixing zone and the thermally affected zone were most similar, being strongly dominated by bluegill, in contrast to the ambient zone, which was dominated primarily by spottail shiner and common shiner.

Yellow perch larvae were present in only the first two of the eight sampling dates, accounting for approximately 4% of the ichthyoplankton over the eight-week sampling season (Table 3-1). Densities of yellow perch larvae were higher on the first sampling date (0.6 per 50 m^3) than on the second sampling date (0.2 per 50 m^3), suggesting that additional yellow perch larvae could have been present before the sampling season started (Table 3-2).

Yellow perch were present in all three sampling areas (ambient zone, mixing zone, and thermally affected zone), in all three locations within each area (west, midstream, and east), and at both surface and bottom depths in each area (Table 3-2). Distribution of yellow perch larvae was fairly even among sampling areas, with densities (number per 50 m^3) of 0.3 in the ambient zone, and 0.4 both in the mixing zone and in the thermally affected zone downstream of Merrimack Station. Spatial distribution of densities was also fairly uniform among sampling locations (0.4 along the west shore, 0.3 in midstream, and 0.4 along the east shore) and between the two depths (0.3 near the surface and 0.4 near the bottom). These slight differences in densities among zones, locations, and depths were not statistically significant (analysis of variance at $\alpha=0.05$).

TABLE 3-1. MEAN DENSITIES OF LARVAL FISH (NUMBER PER 50 CUBIC METERS) BY SAMPLING AREA AND DATE, AND OVERALL PERCENT COMPOSITION FOR THE YEAR, FOR ICHTHYOPLANKTON TOWS IN THE HOOKSETT POOL OF THE MERRIMACK RIVER IN 1995.

SAMPLING AREA	SPECIES	10MAY	16MAY	23MAY	30MAY	06JUN	13JUN	20JUN	27JUN	OVERALL PERCENT COMP.
AMBIENT ZONE	Common shiner	0.0	0.0	0.0	0.0	1.0	0.8	1.5	0.0	26
	Fallfish	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1	3
	Golden shiner	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	1
	Pumpkinseed	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	2
	Rainbow smelt	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	3
	Spottail shiner	0.0	0.0	0.0	2.4	2.7	1.6	0.0	0.0	53
	Tessellated darter	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	3
	White sucker	0.0	0.0	0.2	0.0	0.3	0.0	0.1	0.0	5
	Yellow perch	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	4
	All species	0.4	0.2	0.4	2.8	4.3	2.4	1.7	0.2	100
MIXING ZONE	Bluegill	0.9	0.0	1.3	0.4	0.1	2.1	6.9	0.3	64
	Common shiner	0.0	0.0	0.0	0.0	0.0	0.6	0.1	0.0	4
	Fallfish	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	1
	Pumpkinseed	0.0	0.0	0.3	0.0	0.0	0.2	0.0	0.0	3
	Rainbow smelt	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	1
	Redbreast sunfish	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	3
	Spottail shiner	0.0	0.0	0.0	1.4	1.2	0.7	0.0	0.0	18
	White sucker	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.0	2
	Yellow perch	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	4
	All species	1.7	0.3	1.7	2.0	1.6	3.7	7.7	0.3	100
THERMALLY AFFECTED ZONE	Bluegill	7.2	0.0	2.8	3.0	0.3	3.0	0.2	0.1	64
	Common shiner	0.0	0.0	0.0	0.0	0.0	0.2	0.6	0.0	3
	Pumpkinseed	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	1
	Rainbow smelt	0.0	0.0	0.0	5.3	0.0	0.0	0.0	0.0	20
	Rock bass	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	1
	Spottail shiner	0.0	0.0	0.0	1.2	0.5	0.0	0.1	0.0	7
	White perch	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	<1
	White sucker	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	1
	Yellow perch	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	3
	All species	7.8	0.3	3.0	9.4	1.0	3.6	0.9	0.2	100

TABLE 3-2. SPATIAL DISTRIBUTION OF YELLOW PERCH LARVAE (NUMBER PER 50 CUBIC METERS) COLLECTED ON TWO DATES IN THE HOOKSETT POOL OF THE MERRIMACK RIVER IN 1995.

			LOCATION		
DATE	SAMPLING AREA	DEPTH	WEST	MIDSTREAM	EAST
10MAY	AMBIENT ZONE	SURFACE	0.0	0.6	0.0
		BOTTOM	0.0	0.8	0.7
	MIXING ZONE	SURFACE	1.6	0.0	0.8
		BOTTOM	0.7	0.7	0.6
	THERMALLY AFFECTED ZONE	SURFACE	0.0	0.7	0.6
		BOTTOM	1.5	0.0	0.7
16MAY	AMBIENT ZONE	SURFACE	0.5	0.0	0.0
		BOTTOM	0.0	0.5	0.0
	MIXING ZONE	SURFACE	0.0	0.0	0.0
		BOTTOM	0.0	0.0	0.5
	THERMALLY AFFECTED ZONE	SURFACE	0.0	0.0	0.0
		BOTTOM	0.5	0.0	0.7

10 may 11/18 contained larvae

16 may 5/18 contained larvae.

There was no evidence that temperature influenced the distribution of yellow perch larvae. Temperatures on the two dates when yellow perch larvae were present were all within the range 12.9-14.7°C except for a single observation at 17.1°C (near the surface on the west side of the mixing zone on 16 May). Samples containing yellow perch larvae occurred throughout the observed temperature range. There were no yellow perch larvae in the sample from the 17.1°C water, but there were also samples without yellow perch larvae throughout the entire range of temperatures. There was no discernable difference in the abundance of yellow perch larvae between higher temperatures and lower temperatures, and a linear regression analysis of these data was not significant ($F=0.44$; $p>0.05$).

3.2 ADULT FISH

3.2.1 Yellow Perch Population

Both total catch and standardized CPUE of yellow perch in the 1994-1995 fyke net sampling were the lowest observed in 11 years of sampling (Table 3-3). The reduced total catch in 1994-1995 was probably influenced by low catches during the winter. However, CPUE of yellow perch in 1994-1995 was also the lowest observed when data are standardized for the June through September period common to most previous years.

Standardized CPUE of yellow perch in fyke nets decreased significantly during the 12-year period between 1967 and 1978 (Stetson-Harza 1992). The low 1994-1995 standardized CPUE data were consistent with a continuing decreasing trend in CPUE. However, with a 17-year gap between 1978 and 1995, it is not possible to determine if the low CPUE in June through September of 1995 is a continuation of the previous consistent decreasing trend, or if there had been significant variation in yellow perch CPUE during the period when no sampling was conducted.

TABLE 3-3. ABUNDANCE OF TARGET SPECIES IN FYKE NET CATCHES IN HOOKSETT POOL[a].

TOTAL CATCH (NUMBER) AND CATCH PER UNIT EFFORT (CPUE) FOR FYKE NET SAMPLING

			SMALLMOUTH BASS		LARGEMOUTH BASS		PUMPKINSEED		YELLOW PERCH	
YEAR[a]	EFFORT	MONTHS SAMPLED	NUMBER	CPUE[b]	NUMBER	CPUE[b]	NUMBER	CPUE[b]	NUMBER	CPUE[b]
1967	354	Jun-Sep	376	1.06	0	0.00	5243	14.81	3478	9.82
1968	425	Jun-Sep	172	0.40	2	0.00	2418	5.69	2245	5.28
1969	168	Jun-Sep	140	0.83	10	0.06	621	3.70	662	3.94
1972	48	Aug-Oct	150	3.13	4	0.08	279	5.81	302	6.29
1973	80	Jun-Oct	201	2.51	1	0.01	406	5.08	302	3.78
1974	96	May-Oct	119	1.24	3	0.03	563	5.86	271	2.82
1975	96	May-Oct	128	1.33	16	0.17	569	5.93	282	2.94
1976	96	May-Oct	83	0.86	2	0.02	274	2.85	213	2.22
1977	80	May-Sep	71	0.89	3	0.04	142	1.78	90	1.13
1978	96	May-Oct	146	1.52	0	0.00	369	3.84	158	1.65
1994-1995	210	Oct 94-Sep 95	47	0.22	10	0.05	312	1.49	22	0.10

[a]Catch data does not include any samples from the canal.

(continued)

TABLE 3-3. (Continued)

TOTAL CATCH (NUMBER) AND CATCH PER UNIT EFFORT (CPUE) FOR FYKE NET SAMPLING

			SMALLMOUTH BASS		LARGEMOUTH BASS		PUMPKINSEED		YELLOW PERCH	
YEAR[b]	EFFORT	MONTHS SAMPLED	NUMBER	CPUE[c]	NUMBER	CPUE[c]	NUMBER	CPUE[c]	NUMBER	CPUE[c]
1967	354	Jun-Sep	376	1.06	0	0.00	5243	14.81	3478	9.82
1968	425	Jun-Sep	172	0.40	2	0.00	2418	5.69	2245	5.28
1969	168	Jun-Sep	140	0.83	10	0.06	621	3.70	662	3.94
1972	32	Aug-Sep	insufficient data							
1973	64	Jun-Sep	173	2.70	0	0.00	301	4.70	253	3.95
1974	64	Jun-Sep	110	1.72	3	0.05	429	6.70	151	2.36
1975	64	Jun-Sep	109	1.70	15	0.23	404	6.31	178	2.78
1976	64	Jun-Sep	77	1.20	2	0.03	251	3.92	73	1.14
1977	64	Jun-Sep	57	0.89	3	0.05	111	1.73	56	0.88
1978	64	Jun-Sep	112	1.75	0	0.00	226	3.53	158	2.47
1995	96	Jun-Sep	38	0.40	8	0.08	13	0.13	6	0.06

[b]1967-1978 from Stetson-Harza (1992).
[c]CPUE = catch per 48-hour sample.

3.2.2 Discharge Canal Populations of Target Species

Largemouth bass, smallmouth bass and pumpkinseed were found in fyke net samples in the canal, while yellow perch were not found in the canal at any time (Table 3-4). Largemouth bass were present in the canal during October, May, June and September. Smallmouth bass and pumpkinseed were present more often and were found in October, December, and April through September. Bluegills were found in the canal in October, December, April, May, June, August and September.

The canal population of smallmouth bass, pumpkinseed, and bluegill sampled by fyke netting represented a significant portion of the overall Hooksett Pool population of these species on an annual basis (Table 3-4). An index of the relative standing crop found in each segment of Hooksett Pool (ambient, canal, thermally affected) was calculated following the method of Stetson-Harza (1992). The mean CPUE of target species in each segment of Hooksett Pool was weighted by the centerline length of the segment to develop an index of the standing crop in each segment (Table 3-4). If a species had an even distribution over all segments, then the index of standing crop would be similar to the length of the segment. For example, the canal represents 11% (1.2 km/10.8 km) of the total length of Hooksett Pool. If a significant portion of the Hooksett Pool population was found in the canal, then the weighted mean index of standing crop would be greater than 11%.

The weighted index of standing crop in the canal exceeded 11% for all target species except yellow perch and largemouth bass. No yellow perch were found in fyke net samples in the canal area. Although catches were relatively light, the index for yellow perch was greater in the ambient (56.24%) than in the thermally affected segment (43.75%) . The index of standing crop for largemouth bass was close to 11%, indicating no special preference for the canal segment. The index was highest in the thermally affected segment (88.79%), indicating that a significant portion of the Hooksett Pool largemouth bass population was found downstream of the discharge. However, the total 1994-1995 catch of largemouth bass was relatively low (17 fish) and the index could be significantly affected by the capture of a few fish.

The indices for smallmouth bass (47.09%), pumpkinseed (73.84%), and bluegill (48.00%) in the canal exceeded 11%, indicating a significant portion of the population of each of these species was found in this segment. Catches of all three species in the canal were highest in September.

TABLE 3-4. CATCH PER UNIT EFFORT (NUMBER PER 24-HOUR SET) AND WEIGHTED INDEX OF STANDING CROP FOR TARGET SPECIES CAPTURED IN FYKE NET SAMPLES IN HOOKSETT POOL, 1994-1995.

MONTH	LARGEMOUTH BASS			SMALLMOUTH BASS			PUMPKINSEED			YELLOW PERCH			BLUEGILL		
	AMBIENT	CANAL	THERMALLY AFFECTED	AMBIENT	CANAL	THERMALLY AFFECTED	AMBIENT	CANAL	THERMALLY AFFECTED	AMBIENT	CANAL	THERMALLY AFFECTED	AMBIENT	CANAL	THERMALLY AFFECTED
Oct	0.0	0.2	0.2	0.0	1.3	0.3	0.5	5.4	1.0	0.5	0.0	0.3	0.5	0.6	0.6
Nov[a]															
Dec	0.0	0.0	0.0	0.2	1.0	0.0	0.2	0.7	0.0	0.0	0.0	0.0	0.3	2.0	0.0
Jan[a]															
Feb[a]															
Mar[a]															
Apr	0.0	0.0	0.0	0.0	0.3	0.0	0.0	1.0	0.0	0.1	0.0	0.3	0.0	0.5	0.0
May	0.0	0.1	0.0	0.3	1.0	0.5	0.0	0.8	0.4	0.4	0.0	0.5	0.0	0.6	0.1
Jun	0.0	0.1	0.0	0.6	0.4	1.0	0.0	1.5	0.3	0.0	0.0	0.3	0.0	0.5	0.3
Jul	0.0	0.0	0.0	0.1	1.4	0.8	0.0	1.4	0.4	0.1	0.0	0.0	0.2	0.0	0.1
Aug	0.0	0.0	0.4	0.6	0.4	0.7	0.0	0.4	0.4	0.1	0.0	0.1	0.1	0.1	0.2
Sep	0.0	0.1	0.6	0.0	14.0	0.9	0.1	26.9	0.5	0.1	0.0	0.0	0.1	5.9	0.4
CPUE[b]	0.00	0.06	0.15	0.23	2.48	0.53	0.10	4.76	0.38	0.16	0.00	0.19	0.15	1.28	0.21
Weighing Factor (%)[c]	5.8 (53.7)	1.2 (11.11)	3.8 (35.19)	5.8 (53.7)	1.2 (11.11)	3.8 (35.19)	5.8 (53.7)	1.2 (11.11)	3.8 (35.19)	5.8 (53.7)	1.2 (11.11)	3.8 (35.19)	5.8 (53.7)	1.2 (11.11)	3.8 (35.19)
Weighted Index of Standing Crop (%)[d]	0.00	11.12	88.79	21.03	47.09	31.87	7.50	73.84	18.67	56.24	0.00	43.75	27.15	48.00	24.94

[a]No samples were scheduled to be collected in November and January through March.

[b]CPUE=catch per 24-hour soak.

[c]Weighting factor (WF)=Segment length in km.

[d]Weighted index of standing crop = $CPUE_i \times \frac{WF_i}{\sum_{i=1}^{3} (CPUE_i \times WF_i)} \times 100$, where i = segment.

The canal population of largemouth bass, smallmouth bass, pumpkinseed, yellow perch, and bluegill sampled by electrofishing represented a significant portion of the overall Hooksett Pool population of these species on an annual basis (Table 3-5). The weighted index of standing crop for bluegill (15.87%) was slightly larger than the percentage length of the canal (11.11%), indicating that this fish showed a weak preference for the canal.

Catches of largemouth bass were highest in the canal in June, while smallmouth bass catches were highest in May. Pumpkinseed were found in the canal in the greatest numbers in October and yellow perch catches were highest in March.

Centrarchids, primarily bluegill, largemouth bass, and redbreast sunfish, were observed on spawning nests in the canal in May at water temperatures between 19.4 and 23.2°C. These fishes generally begin spawning around 20°C (Smith 1985), but this temperatures is typically reached later in the year. Water temperature in the ambient segment during May ranged from 12.6-13.1°C., and did not reach 20°C until June or July.

3.2.3 Relationship Between Water Temperature and Relative Abundance

Regression techniques were used to investigate the relationship between water temperature and fish relative abundance. Mean monthly bottom water temperatures during fish sampling ranged from 0.9°C in the thermally affected section in December to 40.8°C in the canal segment in July (Table 3-6). Catch per unit effort of target species in the fyke net and electrofish samples (dependent variable) was regressed on water temperature (independent variable) for each segment of Hooksett Pool and for all segments combined.

3.2.3.1 Fyke Net Sampling

There was no significant relationship between water temperature and CPUE for any of the target species captured in fyke net samples in the ambient or canal segments. In these segments catches of target species were generally lowest at the coldest water temperatures and appeared to vary randomly as temperatures increased. In the thermally affected segment, CPUE

TABLE 3-5. CATCH PER UNIT EFFORT (NUMBER PER 1000-FT TRANSECT) AND WEIGHTED INDEX OF STANDING CROP FOR TARGET SPECIES CAPTURED IN ELECTROFISHING SAMPLES IN HOOKSETT POOL, 1994-1995.

MONTH	LARGEMOUTH BASS				SMALLMOUTH BASS				PUMPKINSEED				YELLOW PERCH				BLUEGILL			
	AMBI-ENT	CANAL	MIXING ZONE	THERMALLY AFFECTED	AMBI-ENT	CANAL	MIXING ZONE	THERMALLY AFFECTED	AMBIENT	CANAL	MIXING ZONE	THERMALLY AFFECTED	AMBI-ENT	CANAL	MIXING ZONE	THERMAL Y AFFECTED	AMBIENT	CANAL	MIXING ZONE	THERMALLY AFFECTED
Oct	2.00	31.48	2.25	2.00	0.50	1.50	3.00	0.00	0.00	62 .97	0.75	0.00	0.25	0.00	0.00	0.00	0.50	64.47	3.75	0.00
Nov[a]																	0.00	28.49	0.25	0.00
Dec	0.25	52.47	3.25	0.00	0.00	6.00	0.50	0.00	0.00	17.99	0.00	0.00	0.00	1.50	0.25	0.00				
Jan[a]																				
Feb[a]																				
Mar	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	16.49	0.25	0.00	0.00	65.97	0.25	0.00	0.00	3.00	0.00	0.00
Apr																				
May	0.00	1.50	0.00	0.00	0.25	16.49	1.00	1.00	0.00	17.99	2.00	0.50	0.00	1.50	0.00	0.00	0.00	4.50	0.00	0.00
Jun	0.00	85.46	1.25	0.00	0.75	4.50	2.25	0.50	0.25	4.50	1.25	1.50	0.00	0.00	0.25	0.00	0.25	4.50	0.25	1.00
Jul	0.75	0.00	5.75	1.00	0.00	0.00	2.25	12.50	0.00	3.00	1.25	2.00	0.00	0.00	0.00	0.00	0.50	3.00	71.25	49.00
Aug	4.50	10.49	8.25	5.50	0.25	0.00	2.00	2.50	0.00	0.00	1.25	0.00	0.25	0.00	0.00	0.50	15.50	6.00	94.50	89.50
Sep	1.75	7.50	5.75	14.50	1.25	0.00	2.25	0.00	0.00	1.50	2.50	2.00	0.25	0.00	0.00	0.50	16.75	74.96	35.50	141.50
AVE. CPUE	1.16	23.61	3.31	2.88	0.38	3.56	1.78	2.06	0.03	15.56	1.16	0.75	0.09	8.62	0.09	0.13	4.19	23.61	25.69	35.13
Weighting Factor (%)[b]	5.8 (53.70)	1.2 (11.11)	0.8 (7.41)	3.0 (27.78)	5.8 (53.70)	1.2 (11.11)	0.8 (7.41)	3.0 (27.78)	5.8 (53.70)	1.2 (11.11)	0.8 (7.41)	3.0 (27.78)	5.8 (53.70)	1.2 (11.11)	0.8 (7.41)	3.0 (27.78)	5.8 (53.70)	1.2 (11.11)	0.8 (7.41)	3.0 (27.78)
Weighted Index of Standing Crop (%)[c]	14.48	61.23	5.72	18.62	15.58	30.61	10.21	44.32	0.82	84.76	4.21	10.22	4.80	91.24	0.66	3.21	13.60	15.87	59.02	11.51

[a]No samples were scheduled to be collected in November, January, February and April.
[b]Weighting Factor (WF)=Segment length in km

[c]Weighted index of standing crop = $CPUE_i \times \frac{WF_i}{\sum_{i=1}^{4} (CPUE_i \times WF_i)}$ x 100, where i = segment.

TABLE 3-6. MEAN MONTHLY BOTTOM WATER TEMPERATURES (°C) AND RANGES COLLECTED DURING FYKE NET AND ELECTROFISH SAMPLING FOR EACH RIVER SEGMENT IN HOOKSETT POOL DURING 1994-1995.

	SEGMENT							
	AMBIENT		CANAL		MIXING ZONE		THERMALLY AFFECTED	
MONTH	MEAN	RANGE	MEAN	RANGE	MEAN	RANGE	MEAN	RANGE
October	12.2	11.2-12.6	16.8	12.9-18.4	13.3	12.2-14.2	13.4	12.2-16.0
December	1.5	1.0-2.4	14.2	7.3-16.5	3.6	1.5-5.8	3.2	0.9-7.3
March	5.5	5.3-5.7	15.9	12.8-17.8	7.1	5.4-9.2	5.8	4.8-6.8
April	3.5	2.7-4.4	16.2	15.0-17.2	–	–	5.7	2.7-8.6
May	13.1	12.6-13.5	21.2	15.2-25.4	13.2	12.8-13.6	13.3	12.2-14.4
June	19.5	18.0-20.7	30.3	26.6-33.4	23.8	21.5-27.5	20.2	18.2-23.1
July	23.9	23.0-24.6	36.1	31.9-40.8	28.6	27.8-29.1	26.8	25.6-29.4
August	24.8	24.1-25.9	35.3	32.4-39.9	30.1	29.4-31.3	26.1	24.9-27.7
September	18.2	17.5-18.8	30.6	27.9-34.6	25.1	24.5-25.8	21.2	19.9-23.9

was also lowest at the coldest water temperatures for all target species. There was no significant relationships between temperature and CPUE for any of the target species in the thermally affected segment, with the exception of smallmouth bass where CPUE increased significantly with temperature (Table 3-7). The highest CPUE of 2.7 fish per 24-hour set occurred at the highest water temperature in this segment of 29.4 °C. There was no evidence of decreasing CPUE of smallmouth bass at higher water temperatures.

Data from all segments were combined to investigate the relationship between water temperature and CPUE in Hooksett Pool. With the increased sample size and water temperature ranges, regressions were significant for bluegill, pumpkinseed, and smallmouth bass (Table 3-7). The highest CPUE for bluegill occurred at water temperatures between 28.9°C and 34.9°C in the canal segment. No bluegills were captured in the five samples with water temperatures above 35.0°C, possibly indicating a decreased CPUE at the highest water temperatures. The highest CPUE for pumpkinseed and smallmouth bass occurred between 28.9°C and 34.6°C in the canal. No pumpkinseed or smallmouth bass were captured in the three samples with water temperature above 37.0°C.

If CPUE decreased with increasing temperature, the relationship between CPUE and temperature might be better described by a parabola (second order equation) than a straight line. To investigate this possibility, a parabola was fitted to the CPUE and temperature data for each of the target species in each segment, and for all segments combined. The second order equation was significant only for pumpkinseed and smallmouth bass in all segments combined. Even though the parabolic model was significant, the overall fit of the model was reduced compared to the straight line model.

3.2.3.2 Electrofish Sampling

The relationship between electrofish CPUE (catch per 1000 ft transect) data and water temperature was also investigated using regression techniques (Table 3-8). There were no significant relationships between CPUE of the selected species and water temperatures in the ambient segment at water temperatures between 1.2°C and 24.8°C. In the canal, CPUE of pumpkinseed decreased significantly with increasing water temperatures between 7.3°C and

TABLE 3-7. REGRESSION RELATIONSHIP BETWEEN WATER TEMPERATURE (°C) AND FYKE NET CATCH PER UNIT EFFORT (CATCH PER 24-HOUR SET) IN HOOKSETT POOL, 1994-1995.

SPECIES	SEGMENT	Pr>F	RELATIONSHIP	TEMPERATURE RANGE OF SAMPLING (°C)
Smallmouth bass	Thermally affected	0.0062	Positive	1.1-29.4
Bluegill	All combined	0.0451	Positive	1.0-40.8
Pumpkinseed	All combined	0.0082	Positive	1.0-40.8
Smallmouth bass	All combined	0.0062	Positive	1.0-40.8

TABLE 3-8. REGRESSION RELATIONSHIP BETWEEN WATER TEMPERATURE (°C) AND ELECTROFISH CATCH PER UNIT EFFORT (CATCH PER 1000 FT SEGMENT) IN HOOKSETT POOL, 1994-1995.

SPECIES	SEGMENT	Pr>F	RELATIONSHIP	TEMPERATURE RANGE OF SAMPLING (°C)
Pumpkinseed	Canal	0.0407	Negative	7.3-38.0
Bluegill	Mixing zone	0.0001	Positive	1.5-31.3
Largemouth bass	Mixing zone	0.0016	Positive	1.5-31.3
Bluegill	Thermally affected	0.0223	Positive	0.9-27.7
Smallmouth bass	Thermally affected	0.0477	Positive	0.9-27.7
Bluegill	All combined	0.0107	Positive	0.9-38.0

38.0°C. The significant negative regression was heavily influenced by one very high catch of 61 pumpkinseed at 12.9°C. No pumpkinseed were captured above 33.1°C.

In the mixing zone there was a significant positive relationship for both bluegill and largemouth bass. Bluegill were captured between 5.8°C and the maximum water temperature in the canal of 31.3°C. Largemouth bass were captured between 1.5°C and the maximum water temperature of 31.3°C. In the thermally affected segment bluegill and smallmouth bass had significant positive relationships between water temperature and CPUE. Both these fishes were captured at the highest water temperatures of 27.7°C in the segment.

When data from all segments were combined there was a significant positive relationship between water temperature and CPUE only for bluegill. The highest CPUE occurred at a water temperature of 21.1°C in the thermally affected segment. No bluegill were captured at above 33.1°C.

A parabola was fitted to the water temperature and CPUE data to determine if CPUE decreased at high water temperatures. The parabola was only significant for bluegill in all segments combined, and the fit of the model was reduced compared to the straight line model.

4.0 DISCUSSION

4.1 ICHTHYOPLANKTON

Based on the results of the 1995 ichthyoplankton sampling program, yellow perch larvae do become entrained in the thermal plume of Merrimack Station. The proportion of the Hooksett Pool population of yellow perch larvae subjected to the plume appears to be approximately the same as the proportion of Hookset Pool water that is contained by the plume. This is because the densities of yellow perch larvae in the plume area are similar to those elsewhere in Hookset Pool. There was no indication that the larvae were especially vulnerable to plume entrainment by being concentrated in near-surface water (although only a very substantial depth preference could have been detected with the small numbers of larvae that were collected in this study).

Although yellow perch larvae do occur in the Merrimack Station thermal plume, this does not occur at times when temperatures are potentially lethal. Wismer and Christie (1987) reported thermal tolerances of yellow perch larvae as high as 33.7°C and preferred temperatures of 12-25°C. Temperatures at the time of year when yellow perch larvae were present in 1995 were well within these limits. It is unlikely that substantially higher temperatures than those observed in 1995 would occur when larval yellow perch are present in other years, because the high rate of flow typical for the Merrimack River in May greatly dilutes the warm water discharge from Merrimack Station.

4.2 ADULT FISH

CPUE of yellow perch in fyke nets decreased significantly between 1967 and 1978 (Table 5-2 in Stetson-Harza 1992) and catches of yellow perch decreased in electrofish samples between 1972 and 1976 (Table 6-1 in Stetson-Harza 1992). The decrease in abundance of yellow perch in both fyke nets and electrofish samples appeared to occur in both the upstream ambient, and the downstream thermally affected sections of Hooksett Pool, and presently is at its lowest level (Table 4-1). However, with a 17-year gap in fyke net data, and a 19-year gap in electrofish data, it is not possible to determine if yellow perch abundance has been consistently

TABLE 4-1. HISTORICAL SUMMER CATCH PER UNIT EFFORT OF YELLOW PERCH IN FYKE NETS (NUMBER PER 24-HOUR SET) AND ELECTROFISH (NUMBER PER 1000 FOOT TRANSECT) IN HOOKSETT POOL.

		CPUE		
YEAR	GEAR	NORTH	SOUTH	MIXING
1973	Fyke net	1.40	1.84	–
1974	Fyke Net	0.40	1.50	–
1975	Fyke net	1.78	0.45	–
1976	Fyke net	0.19	0.73	–
1977	Fyke net	0.16	0.54	–
1978	Fyke net	0.53	0.61	–
1995	Fyke net	0.04	0.04	–
1972	Electrofish	12.33	6.50	2.83
1973	Electrofish	8.58	6.00	4.00
1974	Electrofish	3.25	2.92	3.83
1975	Electrofish	5.25	5.00	1.67
1976	Electrofish	2.50	1.50	0.00
1995	Electrofish	0.75	1.00	0.75

decreasing since the 1970s, or if there is a natural periodicity in yellow perch abundance. The decrease in yellow perch abundance is probably not due to the thermal discharge from Merrimack Station because it also occurred in the ambient segment that is beyond the thermal influence of the station.

The second major change in the adult fish community of Hooksett Pool since the 1970s has been the increase in abundance of bluegill. Bluegill have become a major portion of the Hooksett Pool fish community at some point between the 1978 and 1994-1995 sampling. Prior to 1978 bluegill were only reported occasionally in both fyke net and electrofish samples.

The decrease in yellow perch abundance and increase in the abundance of bluegill may be related, although the fisheries literature does not document direct competition between these two species. Competition between yellow perch and bluegill may be possible because competition has been documented between yellow perch and other fishes. White perch and yellow perch were demonstrated to have a high potential for competition for food items, and the invasion of Lake Erie by white perch adversely affected yellow perch (Parrish and Margraf 1990). Both bluegill and yellow perch feed on benthic and pelagic organisms. Mittelbach (1984) found small bluegills fed on vegetation dwelling prey, and large bluegills foraged primarily on open water zooplankton such as *Daphnia*. Small bluegill in a thermally stressed reservoir fed on planktonic prey, but depended more on benthic prey (Taylor et al. 1991). Yellow perch also fed on benthos in Lake Erie, especially in the spring and fall (Parrish and Margraf 1990). Due to the common preference for benthic food items, during at least part of the year, there is a potential for food competition between bluegill and yellow perch. If food items are limiting, competition for benthic food resources may partially explain the reduction in yellow perch abundance.

The risk to target species of exposure to high water temperatures in the canal can be assessed by determining if a significant portion of the Hooksett Pool population is found in the canal, and through analysis of CPUE and temperature data for the segments of the river. The canal population of smallmouth bass, pumpkinseed, and bluegill sampled by fyke nets and largemouth bass, smallmouth bass, pumpkinseed, yellow perch and possibly bluegill sampled by electrofishing represented a significant portion of the overall Hooksett Pool population of these species. A pattern of decreasing CPUE of these species in the canal during periods of highest

water temperature (July and August), and increasing CPUE in the other segments during the same period, may indicate that these fishes are leaving the canal and seeking refuge in the cooler waters of Hooksett Pool.

A significant portion of the Hooksett Pool population of largemouth bass were found in the canal by electrofishing gear. Largemouth bass were most numerous in electrofish sampling in June. Largemouth bass were captured at temperatures as high as 33.4°C, although only a few were captured at temperatures above 31.0°C. The preferred water temperature range for largemouth bass is 25°C to 32°C (Stetson-Harza 1992), and the upper median tolerance limit was 36.4°C for fish acclimated to 30°C. It is possible that at temperatures above 31.0°C largemouth bass move out of the canal and seek cooler water in the main stem of the river. The electrofish data may indicate a decrease in CPUE in the canal during July and August when water temperatures were above 30°C, and an increase in CPUE in the other segments (Table 3-5). A behavioral response to high temperatures, where largemouth bass avoid extremely high temperatures and seek deeper, cooler waters, has been documented by Block (1984).

The canal population of smallmouth bass was a significant portion of the overall Hooksett Pool population as sampled by both fyke nets and electrofishing. Smallmouth bass were most common in fyke net samples during September and were common in electrofish samples in May. Few smallmouth bass were captured in the canal at temperatures above 34.6°C. The upper preferred temperature range for smallmouth bass is approximately 34°C (NAI 1979), and water temperatures were greater than 34°C in the canal during July and August. Electrofish data indicate a decrease in CPUE in the canal during July and August and an increase in the other segments, although this pattern is not apparent in fyke net data. Smallmouth bass may have moved out of the canal during periods of warm water temperatures and sought cooler temperatures in other segments of Hooksett Pool.

A significant portion of the pumpkinseed population of Hooksett Pool was found in the canal, particularly in September and October. Pumpkinseed were captured at temperatures as high as 37.0°C (fyke net, July), but were not common above 30.0°C. The upper limit of the preferred temperature range for pumpkinseed is approximately 31.5°C for juveniles and 32.2°C for adults (NAI 1990). Temperatures above the preferred range were commonly reached in July and August. Both fyke net and electrofish data indicate a drop in CPUE during July and August,

but CPUE did not greatly increase in the other segments. Pumpkinseed may have moved out of the canal in July and August, but mortality is not suspected because the highest CPUE in the canal for both gears occurred in the following months of September and October. Pumpkinseed may have re-entered the canal in September and October when water temperature declined.

A significant portion of the total bluegill population as sampled by fyke nets occurred in the canal, and the highest CPUE occurred in September. Bluegill were captured at temperatures as high as 34.9°C (September), but were uncommon above 32°C. Bluegill have a final temperature preferendum (FTP) of about 31°C (Wismer and Christie 1987). The FTP is the temperature around which fish will ultimately congregate in an infinite temperature gradient (Giattinna and Garton 1982). Bluegill CPUE was lowest in the canal in July and August when temperatures were highest. There was no apparent significant increase in CPUE in other segments of Hooksett Pool during these months, but mortality is not suspected because the highest CPUE observed occurred in September as temperatures generally dropped below 30°C.

The canal population of yellow perch comprised a significant portion of the total Hooksett Pool population as sampled by electrofishing, primarily due to a single high catch in March. Yellow perch were captured at temperatures as high as 27°C, but catches were low above 20.1°C. The FTP for yellow perch is variable, but appears to range between 14 and 24°C. Other than the single high catch in March, yellow perch were not abundant in any segment of Hooksett Pool at any time of the year, and no yellow perch were found in the canal during the warmest water temperatures in July and August.

The target fishes were exposed to higher water temperatures than occurred in the rest of Hooksett Pool, but they appeared to be at little risk of exposure to lethal temperatures. Fishes appeared to avoid high temperatures in the canal by seeking thermal refuge in the main body of Hooksett Pool. This was evidenced either by (1) opposite trends in CPUE between the canal and other segments during July and August; or (2) increasing CPUE in the canal during September and October as fish returned to the relatively warm waters of the canal as water temperatures decrease in the main body of Hooksett Pool.

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APPENDIX

APPENDIX TABLE 1. SCIENTIFIC AND COMMON NAMES OF FISH SPECIES COLLECTED IN THE 1994-1995 MERRIMACK STATION FISHERY STUDY.

SCIENTIFIC NAME	COMMON NAME	ICHTHYO-PLANKTON	ELECTRO-FISHING	FYKE NETS
Anguillidae	freshwater eels			
Anguilla rostrata	American eel		X	X
Cyprinidae	carps and minnows			
Luxilus cornutus	common shiner	X	X	
Notemigonus crysoleucas	golden shiner	X	X	X
Notropis atherinoides	emerald shiner		X	
Notropis hudsonius	spottail shiner	X	X	X
Semotilus atromaculatus	creek chub		X	
Semotilus corporalis	fallfish	X	X	X
Catostomidae	suckers			
Catostomus commersoni	white sucker	X	X	X
Ictaluridae	bullhead catfishes			
Ameiurus natalis	yellow bullhead		X	X
Ameiurus nebulosus	brown bullhead		X	X
Noturus insignis	margined madtom		X	
Esocidae	pikes			
Esox niger	chain pickerel		X	X
Osmeridae	smelts			
Osmerus mordax	rainbow smelt	X		
Salmonidae	trouts			
Oncorhynchus mykiss	rainbow trout			X
Percichthyidae	temperate basses			
Morone americana	white perch	X	X	X
Centrarchidae	sunfishes			
Ambloplites rupestris	rock bass	X	X	X
Lepomis auritus	redbreast sunfish	X	X	X
Lepomis gibbosus	pumpkinseed	X	X	X
Lepomis macrochirus	bluegill	X	X	X
Micropterus dolomieu	smallmouth bass		X	X
Micropterus salmoides	largemouth bass		X	X
Percidae	perches			
Etheostoma olmstedi	tessellated darter	X	X	
Perca flavescens	yellow perch	X	X	X
Stizostedion vitreum	walleye			X

APPENDIX TABLE 2. FYKE NET CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

19-23 OCTOBER 1994

STATION	Pumpkinseed	Rock bass	Bluegill	Smallmouth bass	White sucker	Yellow perch	Largemouth bass	Chain pickerel	Redbreast sunfish	Fallfish	TOTAL
N-9 West					1	3		1			5
N-9 East	3	2	3								8
S-2 West	4			1			2				7
S-2 East	4	5	5	1	5	2		2	1	2	25
Upstream from PSM in new discharge canal	2	4	1	1							8
Downstream from PSM in new discharge canal	42	6	4	9	1		2		2		66
TOTAL	55	15	13	12	7	5	4	3	3	2	119

APPENDIX TABLE 2. FYKE NET CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

3-7 DECEMBER 1994

STATION	Pumpkinseed	Rock bass	Bluegill	Smallmouth bass	White sucker	Yellow perch	Chain pickerel	Redbreast sunfish	Fallfish	Spottail shiner	White perch	TOTAL
N-9 West									1			1
N-9 East	1	1	2	1	1					2		8
S-2 West					1	1						2
S-4 East												
Upstream from PSM in new discharge canal		1	1				2	1				5
Downstream from PSM in new discharge canal	6	13	15	8	4		4	3			1	54
TOTAL	7	15	18	9	6	1	6	4	1	2	1	70

APPENDIX TABLE 2. FYKE NET CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

3-6 APRIL 1995

STATION	Pumpkinseed	Rock bass	Bluegill	Smallmouth bass	White sucker	Yellow perch	Chain pickerel	Fallfish	Rainbow trout	Walleye	TOTAL
N-9 West		1			2			2			5
N-9 East					2	1		7			10
S-2 West		11				2			1		14
S-4 East						1					1
Upstream from PSM in new discharge canal	2		2		1		2				7
Downstream from PSM in new discharge canal	8	3	3	2						1	17
TOTAL	10	15	5	2	5	4	2	9	1	1	54

APPENDIX TABLE 2. FYKE NET CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

15-17 MAY 1995

STATION	Pumpkinseed	Rock bass	Bluegill	Smallmouth bass	White sucker	Yellow perch	Largemouth bass	Chain pickerel	Redbreast sunfish	Fallfish	White perch	Brown bullhead	TOTAL
N-9 West				1	1								2
N-9 East		3		1		3							7
S-2 West	3	4	1	2	1	2							13
S-4 East		2		2	1	2		1		1			9
Upstream from PSM in new discharge canal			1		7						1	2	11
Downstream from PSM in new discharge canal	6	13	4	8	11		1	1	2			4	50
TOTAL	9	22	6	14	21	7	1	2	2	1	1	6	92

APPENDIX TABLE 2. FYKE NET CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

12-14 JUNE 1995

STATION	Pumpkinseed	Rock bass	Bluegill	Smallmouth bass	White sucker	Yellow perch	Largemouth bass	Redbreast sunfish	TOTAL
N-9 West		5		5	7			2	19
N-9 East									
S-2 West	1		1	3		2			7
S-4 East	1	14	1	5	4			8	33
Upstream from PSM in new discharge canal	10	1	4	3			1	2	21
Downstream from PSM in new discharge canal	2				5				7
TOTAL	14	22	6	16	16	2	1	12	89

APPENDIX TABLE 2. FYKE NET CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

12-14 JULY 1995

STATION	Pumpkinseed	Rock bass	Bluegill	Smallmouth bass	White sucker	Yellow perch	Redbreast sunfish	Fallfish	Brown bullhead	Yellow bullhead	TOTAL
N-9 West					5			1			6
N-9 East		22	2	1		1					26
S-2 West				1							1
S-4 East	3	2	1	5			7			1	19
Upstream from PSM in new discharge canal											
Downstream from PSM in new discharge canal	11			10			5		1		27
TOTAL	14	24	3	17	5	1	12	1	1	1	79

APPENDIX TABLE 2. FYKE NET CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

16-18 AUGUST 1995

STATION	Pumpkinseed	Rock bass	Bluegill	Smallmouth bass	White sucker	Yellow perch	Largemouth bass	Chain pickerel	Redbreast sunfish	American eel	TOTAL
N-9 West		5	1	5	12	1		1			25
N-9 East	1					1	3			1	1
S-2 West	2	9	2	4					5		5
S-4 East											24
Upstream from PSM in new discharge canal											55
Downstream from PSM in new discharge canal	3		1	3							7
TOTAL	6	14	4	14	12	2	3	1	5	1	62

APPENDIX TABLE 2. FYKE NET CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

13-15 SEPTEMBER 1995

STATION	Pumpkinseed	Rock bass	Bluegill	Smallmouth bass	White sucker	Yellow perch	Largemouth bass	Chain pickerel	Redbreast sunfish	Brown bullhead	Golden shiner	TOTAL
N-9 West					6	1						7
N-9 East	1	2	1		8				5	1		18
S-2 West	3		1	6			3					13
S-4 East	1	13	2	1	3		2	3	2			27
Upstream from PSM in new discharge canal	146	13	36	49					15		2	261
Downstream from PSM in new discharge canal	69	21	11	63			3		7	6		180
TOTAL	220	49	51	119	17	1	8	3	29	7	2	506

APPENDIX TABLE 2. FYKE NET CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

. DATES COMBINED

TATION	Pumpkinseed	Rock bass	Bluegill	Smallmouth bass	White sucker	Yellow perch	Largemouth bass	Chain pickerel	Redbreast sunfish	Fallfish	Spottail shiner	White perch	Rainbow trout
I-9 West		11	1	11	34	5		2	2	4			
I-9 East	5	30	8	3	11	5			5	7	2		1
S-2 West	[illegible]	[illegible]	3	13	2	8	8						
S-4 East	11	45	11	[illegible]	[illegible]	5	2	6	23	3			
Upstream from PSM in new discharge canal	160	19	45	53	8		1	4	18			1	
Downstream from PSM in new discharge canal	147	56	38	103	21		6	5	19			1	
TOTAL	335	176	106	203	89	23	17	17	67	14	2	2	1

ALL DATES COMBINED

STATION	Walleye	Brown bullhead	Yellow bullhead	American eel	Golden shiner	TOTAL
N-9 West						70
N-9 East			1			78
S-2 West				1		62
S-4 East						140
Upstream from PSM in new discharge canal						
Downstream from PSM in new discharge canal			2		2	313
TOTAL	1	1	11 14	1	1	2	408 1071

APPENDIX TABLE 3. ELECTROFISHING CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

21-22 OCTOBER 1994

STATION	Bluegill	Pumpkinseed	Largemouth bass	Smallmouth bass	Redbreast sunfish	Fallfish	American eel	Spottail shiner	Tessellated darter	Rock bass	White sucker	Chain pickerel	Yellow perch
N-9 to N-10 West			1			2		2	2			1	1
N-9 to N-10 East	1		2	2		1		1					
N-8 to N-9 West	1		5										
N-8 to N-9 East													
Zero to S-2 West	9	3	2	6							1		
Zero to S-2 East	1		1										
S-4 to S-5 West	2		1	1	1	1							
S-4 to S-5 East	3		5	5	5				1		1		
S-13 to S-15 West			2										
S-13 to S-15 East			2										
Upstream from PSM in new discharge canal			4	1									
Downstream from PSM in new discharge canal		1	1										
Old canal	43	41	16				3			2			
TOTAL	60	45	42	15	6	4	3	3	3	2	2	1	1

21-22 OCTOBER 1994

STATION	TOTAL
N-9 to N-10 West	9
N-9 to N-10 East	7
N-8 to N-9 West	6
N-8 to N-9 East	
Zero to S-2 West	20
Zero to S-2 East	3
S-4 to S-5 West	6
S-4 to S-5 East	18
S-13 to S-15 West	4
S-13 to S-15 East	2
Upstream from PSM in new discharge canal	5
Downstream from PSM in new discharge canal	2
Old canal	105
TOTAL	187

APPENDIX TABLE 3. ELECTROFISHING CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

1 DECEMBER 1994

STATION	Bluegill	Pumpkinseed	Largemouth bass	Smallmouth bass	Redbreast sunfish	Fallfish	Spottail shiner	Rock bass	White sucker	Yellow perch	White perch	Golden shiner	TOTAL
N-9 to N-10 West									1				1
N-9 to N-10 East			1				2					1	4
N-8 to N-9 West							1						1
N-8 to N-9 East													
Zero to S-2 West	1		11	2	2		2			1			19
Zero to S-2 East			2				1						3
S-4 to S-5 West						2							2
S-4 to S-5 East							14						14
S-13 to S-15 West													
S-13 to S-15 East													
Upstream from PSM in new discharge canal	1	5	3	2	1			2					14
Downstream from PSM in new discharge canal	2	5	12	2			1				4		26
Old canal	16	2	20				2			1			41
TOTAL	20	12	49	6	3	2	23	2	1	2	4	1	125

APPENDIX TABLE 3. ELECTROFISHING CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

28 MARCH 1995

STATION	Bluegill	Pumpkinseed	Smallmouth bass	Fallfish	Spottail shiner	Tessellated darter	Rock bass	White sucker	Yellow perch	Golden shiner	Brown bullhead	Creek chub	Emerald shiner
N-9 to N-10 West				1	1								
N-9 to N-10 East													1
N-8 to N-9 West					1								
N-8 to N-9 East													
Zero to S-2 West			3		103								
Zero to S-2 East			1		6						1		
S-4 to S-5 West					5	8			1	1		1	
S-4 to S-5 East		1		1	5					1			
S-13 to S-15 West					2								
S-13 to S-15 East													
Upstream from PSM in new discharge canal	2	7					1						
Downstream from PSM in new discharge canal		1											
Old canal		3						1	44				
TOTAL	2	12	4	2	123	8	1	1	45	2	1	1	1

28 MARCH 1995

STATION	TOTAL
N-9 to N-10 West	2
N-9 to N-10 East	1
N-8 to N-9 West	1
N-8 to N-9 East	
Zero to S-2 West	106
Zero to S-2 East	8
S-4 to S-5 West	16
S-4 to S-5 East	8
S-13 to S-15 West	2
S-13 to S-15 East	
Upstream from PSM in new discharge canal	10
Downstream from PSM in new discharge canal	1
Old canal	48
TOTAL	203

APPENDIX TABLE 3. ELECTROFISHING CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

9 MAY 1995

STATION	Bluegill	Pumpkinseed	Largemouth bass	Smallmouth bass	Redbreast sunfish	Fallfish	American eel	Spottail shiner	Tessellated darter	Rock bass	Chain pickerel	Yellow perch	Margined madtom
N-9 to N-10 West							1	3	9				
N-9 to N-10 East									1		1		
N-8 to N-9 West								2	10				
N-8 to N-9 East				1					10				
Zero to S-2 West		4		1			4	1		3			1
Zero to S-2 East							2		3				
S-4 to S-5 West							1	16	2				
S-4 to S-5 East		4		3		1		8	4				1
S-13 to S-15 West		1		2			1		2				
S-13 to S-15 East									2				
Upstream from PSM in new discharge canal	1	2		11									
Downstream from PSM in new discharge canal		2	1		1		1						
Old canal	2	8					3			11		1	
TOTAL	3	21	1	18	1	1	13	30	43	14	1	1	2

9 MAY 1995

STATION	Sunfish family	TOTAL
N-9 to N-10 West	1	14
N-9 to N-10 East		2
N-8 to N-9 West		12
N-8 to N-9 East		11
Zero to S-2 West		14
Zero to S-2 East		5
S-4 to S-5 West		19
S-4 to S-5 East		21
S-13 to S-15 West		6
S-13 to S-15 East		2
Upstream from PSM in new discharge canal		14
Downstream from PSM in new discharge canal		5
Old canal		25
TOTAL	1	150

APPENDIX TABLE 3. ELECTROFISHING CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

8 JUNE 1995

STATION	Bluegill	Pumpkinseed	Largemouth bass	Smallmouth bass	Redbreast sunfish	Fallfish	Spottail shiner	Tessellated darter	Rock bass	White sucker	Yellow perch	Golden shiner	Brown bullhead
N-9 to N-10 West	1			1									
N-9 to N-10 East				1	2	2	16		2	1			
N-8 to N-9 West				1		5	77	2		1			
N-8 to N-9 East		1			2				1				
Zero to S-2 West	1	1	5	3	6				1				
Zero to S-2 East		1											
S-4 to S-5 West				4									
S-4 to S-5 East		3		2	8	2					1		
S-13 to S-15 West				1									
S-13 to S-15 East	2	3											1
Upstream from PSM in new discharge canal			1	1	1								
Downstream from PSM in new discharge canal	1	2	10	1									
Old canal	2	1	46	1								1	
TOTAL	7	12	62	16	19	9	93	2	4	2	1	1	1

8 JUNE 1995

STATION	Margined madtom	Common shiner	TOTAL
N-9 to N-10 West			2
N-9 to N-10 East		9	33
N-8 to N-9 West		59	145
N-8 to N-9 East			4
Zero to S-2 West	1		18
Zero to S-2 East			1
S-4 to S-5 West			4
S-4 to S-5 East			16
S-13 to S-15 West			1
S-13 to S-15 East			6
Upstream from PSM in new discharge canal			3
Downstream from PSM in new discharge canal			15
Old canal			51
TOTAL	1	68	299

APPENDIX TABLE 3. ELECTROFISHING CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

18 JULY 1995

STATION	Bluegill	Pumpkinseed	Largemouth bass	Smallmouth bass	Redbreast sunfish	Fallfish	Spottail shiner	Tessellated darter	Rock bass	White sucker	Chain pickerel	Golden shiner	Common shiner
N-9 to N-10 West	2		1		2	17	327		1	12	1		29
N-9 to N-10 East					3				3				
N-8 to N-9 West			1			3	58	2					131
N-8 to N-9 East			1		2								
Zero to S-2 West	58		8	3	1				2				
Zero to S-2 East	63	2	6	2	18				1				
S-4 to S-5 West	106	3	4	1	3							1	
S-4 to S-5 East	58		5	3	19				3				
S-13 to S-15 West	18		1	9	6								
S-13 to S-15 East	80	4	1	16	23		4						
Upstream from PSM in new discharge canal													
Downstream from PSM in new discharge canal													
Old canal	2	2											
TOTAL	387	11	28	34	77	20	389	2	10	12	1	1	160

18 JULY 1995

STATION	Yellow bullhead	TOTAL
N-9 to N-10 West		392
N-9 to N-10 East		6
N-8 to N-9 West		195
N-8 to N-9 East		3
Zero to S-2 West		72
Zero to S-2 East	2	94
S-4 to S-5 West		118
S-4 to S-5 East		88
S-13 to S-15 West		34
S-13 to S-15 East		128
Upstream from PSM in new discharge canal		
Downstream from PSM in new discharge canal		
Old canal		4
TOTAL	2	1134

APPENDIX TABLE 3. ELECTROFISHING CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

22 AUGUST 1995

STATION	Bluegill	Pumpkinseed	Largemouth bass	Smallmouth bass	Redbreast sunfish	Fallfish	Spottail shiner	Tessellated darter	Rock bass	White sucker	Chain pickerel	Yellow perch	Golden shiner
N-9 to N-10 West	59		11		3	5	1131	1	1	1			
N-9 to N-10 East					1								
N-8 to N-9 West	3		6			4	17			1		1	
N-8 to N-9 East			1	1	1								
Zero to S-2 West	65	3	11	2	3								
Zero to S-2 East	135	1	9	3	11								
S-4 to S-5 West	124	1	3	1	3								
S-4 to S-5 East	54		10	2	21								
S-13 to S-15 West	121		5	2	10							1	
S-13 to S-15 East	58		6	3	12						1		4
Upstream from PSM in new discharge canal													
Downstream from PSM in new discharge canal			5										
Old canal	4		2		1								
TOTAL	623	5	69	14	66	9	1148	1	1	2	1	2	4

22 AUGUST 1995

STATION	Common shiner	TOTAL
N-9 to N-10 West	66	1278
N-9 to N-10 East		1
N-8 to N-9 West		32
N-8 to N-9 East	2	5
Zero to S-2 West		84
Zero to S-2 East		159
S-4 to S-5 West		132
S-4 to S-5 East	1	88
S-13 to S-15 West		139
S-13 to S-15 East		84
Upstream from PSM in new discharge canal		
Downstream from PSM in new discharge canal		5
Old canal		7
TOTAL	69	2014

APPENDIX TABLE 3. ELECTROFISHING CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

19 SEPTEMBER 1995

STATION	Bluegill	Pumpkinseed	Largemouth bass	Smallmouth bass	Redbreast sunfish	Spottail shiner	Tessellated darter	Rock bass	White sucker	Chain pickerel	Yellow perch	Common shiner	TOTAL
N-9 to N-10 West	64		2			1						1	68
N-9 to N-10 East			1	3	2	12		1					19
N-8 to N-9 West	2		4						2		1		9
N-8 to N-9 East	1			2									3
Zero to S-2 West	67	6	10		3			5					91
Zero to S-2 East	23	1	3		4								31
S-4 to S-5 West	17	3	6	1	1								28
S-4 to S-5 East	35		4	8	32			3					82
S-13 to S-15 West	147	2	18										167
S-13 to S-15 East	136	2	11		11		1			1	1		163
Upstream from PSM in new discharge canal					1								1
Downstream from PSM in new discharge canal			3										3
Old canal	50	1	2										53
TOTAL	542	15	64	14	54	13	1	9	2	1	2	1	718

APPENDIX TABLE 3. ELECTROFISHING CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

ALL DATES COMBINED

STATION	Bluegill	Pumpkinseed	Largemouth bass	Smallmouth bass	Redbreast sunfish	Fallfish	American eel	Spottail shiner	Tessellated darter	Rock bass	White sucker	Chain pickerel	Yellow perch
N-9 to N-10 West	126		15	1	5	25	1	1465	12	2	14	2	1
N-9 to N-10 East	1		4	6	8	3		31	1	6	1	1	
N-8 to N-9 West	6		16	1		12		156	14		4		2
N-8 to N-9 East	1	1	2	4	5				10	1			
Zero to S-2 West	201	17	47	20	15		4	106		11			1
Zero to S-2 East	222	5	21	6	33		2	7	3	1	1		
S-4 to S-5 West	249	7	14	8	8	1	1	21	10				1
S-4 to S-5 East	150	8	24	23	85	6		13	4	6			1
S-13 to S-15 West	286	3	26	14	16		1	16	3		1		1
S-13 to S-15 East	276	9	20	19	46			4	3			2	1
Upstream from PSM in new discharge canal	4	14	8	15	3					3			
Downstream from PSM in new discharge canal	3	11	32	3	1		1	1					
Old canal	119	58	86	1	1		6	2		13	1		4
TOTAL	1644	133	315	121	226	47	16	1822	60	43	22	5	5

ALL DATES COMBINED

STATION	White perch	Golden shiner	Brown bullhead	Creek chub	Emerald shiner	Margined madtom	Sunfish family	Common shiner	Yellow bullhead	TOTAL
N-9 to N-10 West							1	96		1766
N-9 to N-10 East		1			1			9		73
N-8 to N-9 West								190		401
N-8 to N-9 East								2		26
Zero to S-2 West						2				424
Zero to S-2 East			1						2	304
S-4 to S-5 West		2		1						323
S-4 to S-5 East		1				1		1		323
S-13 to S-15 West										347
S-13 to S-15 East		4	1							385
Upstream from PSM in new discharge canal										47
Downstream from PSM in new discharge canal	4		1							57
Old canal		1								334
TOTAL	4	9	3	1	1	3	1	298	2	4830

APPENDIX TABLE 4. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ICHTHYOPLANKTON SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

10 MAY 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-11 West	13.8	13.8	13.8	9.2	9.1	9.2
N-9 to N-11 Mid	14.7	13.7	14.2	8.8	9.1	9.0
N-9 to N-11 East	14.0	14.0	14.0	8.8	8.7	8.8
N-1 to S-3 West	13.8	13.8	13.8	8.7	8.8	8.8
N-1 to S-3 Mid	14.1	13.4	13.8	8.4	8.4	8.4
N-1 to S-3 East	13.9	13.8	13.9	8.6	8.7	8.7
S-15 to S-19 West	13.7	13.7	13.7	9.2	9.2	9.2
S-15 to S-19 Mid	13.5	13.2	13.4	8.9	8.9	8.9
S-15 to S-19 East	13.8	13.6	13.7	8.6	8.6	8.6

APPENDIX TABLE 4. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ICHTHYOPLANKTON SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

16 MAY 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-11 West	13.5	13.4	13.5	8.8	8.8	8.8
N-9 to N-11 Mid	17.1	13.3	15.2	8.0	8.7	8.4
N-9 to N-11 East	13.4	13.4	13.4	8.6	8.5	8.6
N-1 to S-3 West	13.4	13.3	13.4	8.7	8.8	8.8
N-1 to S-3 Mid	13.2	13.1	13.2	8.8	8.0	8.4
N-1 to S-3 East	13.1	13.1	13.1	8.2	8.3	8.3
S-15 to S-19 West	13.4	13.4	13.4	8.9	8.8	8.9
S-15 to S-19 Mid	13.0	12.9	13.0	8.9	8.9	8.9
S-15 to S-19 East	13.3	13.0	13.2	8.4	8.5	8.5

APPENDIX TABLE 4. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ICHTHYOPLANKTON SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

23 MAY 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-11 West	16.3	16.2	16.3	9.6	9.6	9.6
N-9 to N-11 Mid	16.6	16.6	16.6	9.2	9.5	9.4
N-9 to N-11 East	16.2	16.1	16.2	9.4	9.4	9.4
N-1 to S-3 West	16.3	16.2	16.3	9.6	9.6	9.6
N-1 to S-3 Mid	16.2	16.2	16.2	9.6	9.6	9.6
N-1 to S-3 East	16.1	16.0	16.1	9.4	9.4	9.4
S-15 to S-19 West	16.3	16.2	16.3	9.6	9.7	9.7
S-15 to S-19 Mid	17.4	15.9	16.7	9.3	9.5	9.4
S-15 to S-19 East	16.1	15.9	16.0	9.5	9.4	9.5

APPENDIX TABLE 4. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ICHTHYOPLANKTON SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

30 MAY 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-11 West	17.7	17.6	17.7	8.6	8.6	8.6
N-9 to N-11 Mid	19.1	17.6	18.4	8.0	8.3	8.2
N-9 to N-11 East	18.0	17.9	18.0	8.2	8.1	8.2
N-1 to S-3 West	17.7	17.6	17.7	8.6	8.6	8.6
N-1 to S-3 Mid	17.4	17.3	17.4	8.4	8.4	8.4
N-1 to S-3 East	18.0	17.9	18.0	8.1	8.2	8.2
S-15 to S-19 West	17.6	17.5	17.6	8.8	8.7	8.8
S-15 to S-19 Mid	17.4	17.2	17.3	8.6	8.4	8.5
S-15 to S-19 East	17.8	17.8	17.8	8.3	8.1	8.2

APPENDIX TABLE 4. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ICHTHYOPLANKTON SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

06 JUNE 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-11 West	21.6	21.5	21.6	8.7	8.7	8.7
N-9 to N-11 Mid	22.3	21.3	21.8	8.8	8.4	8.6
N-9 to N-11 East	22.6	21.5	22.1	7.7	7.8	7.8
N-1 to S-3 West	21.6	21.4	21.5	8.7	8.7	8.7
N-1 to S-3 Mid	24.9	21.0	23.0	7.9	8.4	8.2
N-1 to S-3 East	22.2	21.7	22.0	7.7	7.6	7.7
S-15 to S-19 West	21.5	21.3	21.4	8.6	8.6	8.6
S-15 to S-19 Mid	27.3	20.9	24.1	7.5	8.3	7.9
S-15 to S-19 East	21.6	21.1	21.4	7.6	7.4	7.5

APPENDIX TABLE 4. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ICHTHYOPLANKTON SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

13 JUNE 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-11 West	19.4	19.3	19.4	8.3	8.3	8.3
N-9 to N-11 Mid	22.4	19.2	20.8	7.9	8.1	8.0
N-9 to N-11 East	21.2	20.6	20.9	8.0	7.9	8.0
N-1 to S-3 West	19.4	19.2	19.3	8.4	8.3	8.4
N-1 to S-3 Mid	24.0	19.3	21.7	7.6	8.0	7.8
N-1 to S-3 East	21.0	20.0	20.5	8.0	7.6	7.8
S-15 to S-19 West	19.3	19.2	19.3	8.5	8.4	8.5
S-15 to S-19 Mid	26.2	19.1	22.7	7.4	8.0	7.7
S-15 to S-19 East	20.4	19.8	20.1	8.0	7.6	7.8

APPENDIX TABLE 4. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ICHTHYOPLANKTON SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

20 JUNE 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-11 West	24.6	24.5	24.6	8.9	8.8	8.9
N-9 to N-11 Mid	30.5	24.5	27.5	7.2	8.2	7.7
N-9 to N-11 East	27.9	25.3	26.6	7.8	8.0	7.9
N-1 to S-3 West	24.4	24.3	24.4	8.9	8.7	8.8
N-1 to S-3 Mid	31.2	24.3	27.8	7.2	8.2	7.7
N-1 to S-3 East	27.1	24.4	25.8	7.6	7.7	7.7
S-15 to S-19 West	24.3	24.1	24.2	8.6	8.6	8.6
S-15 to S-19 Mid	30.6	24.2	27.4	6.8	8.1	7.5
S-15 to S-19 East	26.2	23.9	25.1	8.1	7.9	8.0

APPENDIX TABLE 4. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ICHTHYOPLANKTON SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

27 JUNE 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-11 West	24.4	24.3	24.4	8.2	8.2	8.2
N-9 to N-11 Mid	29.6	24.6	27.1	6.9	7.3	7.1
N-9 to N-11 East	27.4	25.3	26.4	7.2	7.4	7.3
N-1 to S-3 West	24.4	24.4	24.4	8.0	8.0	8.0
N-1 to S-3 Mid	30.5	24.3	27.4	6.8	7.1	7.0
N-1 to S-3 East	27.1	25.3	26.2	7.1	6.9	7.0
S-15 to S-19 West	24.4	24.4	24.4	8.1	8.0	8.1
S-15 to S-19 Mid	31.1	24.2	27.7	6.7	7.0	6.9
S-15 to S-19 East	26.9	24.9	25.9	6.8	6.3	6.6

APPENDIX TABLE 4. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ICHTHYOPLANKTON SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

ALL DATES COMBINED

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-11 West	18.9	18.8	18.9	8.8	8.8	8.8
N-9 to N-11 Mid	21.8	18.9	20.3	8.1	8.5	8.3
N-9 to N-11 East	20.1	19.3	19.7	8.2	8.2	8.2
N-1 to S-3 West	18.9	18.8	18.8	8.7	8.7	8.7
N-1 to S-3 Mid	21.4	18.6	20.0	8.1	8.3	8.2
N-1 to S-3 East	19.8	19.0	19.4	8.1	8.1	8.1
S-15 to S-19 West	18.8	18.7	18.8	8.8	8.8	8.8
S-15 to S-19 Mid	22.1	18.5	20.3	8.0	8.4	8.2
S-15 to S-19 East	19.5	18.8	19.1	8.2	8.0	8.1

APPENDIX TABLE 5. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH FYKE NET SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

19-23 OCTOBER 1994

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 West	12.1	11.8	11.9	10.2	10.2	10.2
N-9 East	12.2	11.9	12.0	10.1	10.2	10.1
S-2 West	14.5	14.3	14.4	9.6	9.8	9.7
S-4 East	14.1	13.4	13.7	9.5	9.9	9.7
Upstream from PSM in new discharge canal	17.9	17.6	17.7	8.9	9.0	8.9
Downstream from PSM in new discharge canal	17.2	17.0	17.1	8.9	8.9	8.9

APPENDIX TABLE 5. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH FYKE NET SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

3-7 DECEMBER 1994

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 West	1.9	1.9	1.9	13.7	13.6	13.6
N-9 East	1.9	1.8	1.8	13.8	13.7	13.7
S-2 West	7.5	7.5	7.5	12.7	12.6	12.6
S-4 East	2.0	1.9	1.9	13.6	13.6	13.6
Upstream from PSM in new discharge canal	15.9	16.0	15.9	11.7	11.6	11.6
Downstream from PSM in new discharge canal	15.5	15.5	15.5	11.6	11.6	11.6

APPENDIX TABLE 5. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH FYKE NET SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

3-6 APRIL 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 West	3.5	3.6	3.5	12.8	12.8	12.8
N-9 East	3.4	3.5	3.5	12.6	12.9	12.7
S-2 West	7.7	7.8	7.7	12.1	12.0	12.1
S-4 East	3.7	3.6	3.6	12.7	12.7	12.7
Upstream from PSM in new discharge canal	16.5	16.5	16.5	10.8	10.9	10.9
Downstream from PSM in new discharge canal	15.9	15.9	15.9	10.9	11.0	10.9

APPENDIX TABLE 5. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH FYKE NET SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

15-17 MAY 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 West	12.9	12.9	12.9	8.8	8.7	8.7
N-9 East	12.8	12.9	12.8	8.8	8.8	8.8
S-2 West	14.5	14.3	14.4	8.5	8.5	8.5
S-4 East	13.1	13.1	13.1	9.1	9.0	9.0
Upstream from PSM in new discharge canal	23.8	23.2	23.5	7.0	6.9	7.0
Downstream from PSM in new discharge canal	22.0	17.3	19.7	7.1	7.8	7.4

APPENDIX TABLE 5. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH FYKE NET SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

12-14 JUNE 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 West	18.4	18.4	18.4	8.5	8.5	8.5
N-9 East	18.5	18.5	18.5	8.4	8.2	8.3
S-2 West	18.8	18.7	18.7	8.4	8.5	8.4
S-4 East	19.6	19.1	19.3	8.3	8.3	8.3
Upstream from PSM in new discharge canal	32.0	31.7	31.8	7.3	7.4	7.3
Downstream from PSM in new discharge canal	27.9	27.6	27.7	7.4	7.5	7.4

APPENDIX TABLE 5. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH FYKE NET SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

18 JULY 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 West	23.9	23.8	23.9	6.8	6.8	6.8
N-9 East	23.8	23.8	23.8	6.6	6.5	6.5
S-2 West	29.9	27.1	28.5	6.4	7.1	6.7
S-4 East	30.5	27.5	29.0	6.4	6.3	6.3
Upstream from PSM in new discharge canal	39.4	39.2	39.3	6.0	6.1	6.0
Downstream from PSM in new discharge canal	34.6	34.5	34.5	6.4	6.4	6.4

APPENDIX TABLE 5. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH FYKE NET SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

19 SEPTEMBER 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 West	18.7	18.6	18.6	8.0	8.2	8.1
N-9 East	18.6	18.5	18.5	7.7	7.6	7.6
S-2 West	24.4	22.7	23.5	7.1	7.1	7.1
S-4 East	24.4	20.4	22.4	7.5	8.2	7.8
Upstream from PSM in new discharge canal	33.5	33.2	33.3	6.0	6.0	6.0
Downstream from PSM in new discharge canal	30.5	30.3	30.4	6.0	5.9	5.9

APPENDIX TABLE 5. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH FYKE NET SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

ALL DATES COMBINED

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 West	14.6	14.5	14.5	9.4	9.5	9.5
N-9 East	14.5	14.5	14.5	9.3	9.3	9.3
S-2 West	18.4	17.2	17.8	8.9	9.0	8.9
S-4 East	17.1	15.5	16.3	9.2	9.3	9.2
Upstream from PSM in new discharge canal	27.2	26.9	27.0	7.9	7.9	7.9
Downstream from PSM in new discharge canal	24.7	24.0	24.4	8.1	8.2	8.2

APPENDIX TABLE 6. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ELECTROFISH SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

21-22 OCTOBER 1994

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-10 West	12.3	12.3	12.3	9.4	9.5	9.5
N-9 to N-10 East	12.4	12.4	12.4	9.8	9.8	9.8
N-8 to N-9 West	12.4	12.4	12.4	9.7	9.7	9.7
N-8 to N-9 East	12.4	12.3	12.4	9.9	9.6	9.8
Zero to S-2 West	13.0	12.8	12.9	10.0	9.9	10.0
Zero to S-2 East	15.2	14.2	14.7	8.9	9.4	9.2
S-4 to S-5 West	12.6	12.2	12.4	9.6	9.9	9.8
S-4 to S-5 East	14.2	13.9	14.1	9.7	9.7	9.7
S-13 to S-15 West	12.8	12.8	12.8	9.4	9.5	9.5
S-13 to S-15 East	12.3	12.2	12.3	9.4	9.6	9.5
Upstream from PSM in new discharge canal	18.6	18.4	18.5	8.6	8.6	8.6
Downstream from PSM in new discharge canal	17.7	17.6	17.7	8.7	8.6	8.7
Old canal	15.2	12.9	14.1	8.7	9.3	9.0

APPENDIX TABLE 6. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ELECTROFISH SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

1 DECEMBER 1994

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-10 West	1.2	1.2	1.2	13.2	13.2	13.2
N-9 to N-10 East	1.8	1.8	1.8	13.9	13.8	13.9
N-8 to N-9 West	1.3	1.3	1.3	13.4	13.4	13.4
N-8 to N-9 East	1.7	1.7	1.7	14.0	14.0	14.0
Zero to S-2 West	7.3	5.8	6.6	12.2	12.6	12.4
Zero to S-2 East	1.7	1.5	1.6	13.4	13.5	13.5
S-4 to S-5 West	5.5	5.6	5.6	12.6	12.6	12.6
S-4 to S-5 East	1.6	1.6	1.6	13.4	13.4	13.4
S-13 to S-15 West	4.1	4.1	4.1	12.2	12.2	12.2
S-13 to S-15 East	1.0	0.9	1.0	13.2	13.2	13.2
Upstream from PSM in new discharge canal	14.1	13.8	14.0	11.7	11.8	11.8
Downstream from PSM in new discharge canal	15.1	15.1	15.1	11.4	11.4	11.4
Old canal	7.3	7.3	7.3	12.3	12.3	12.3

APPENDIX TABLE 6. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ELECTROFISH SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

28 MARCH 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-10 West	5.7	5.4	5.6	13.1	13.0	13.1
N-9 to N-10 East	5.7	5.7	5.7	13.0	12.9	13.0
N-8 to N-9 West	5.3	5.3	5.3	13.0	13.0	13.0
N-8 to N-9 East	5.6	5.6	5.6	13.0	12.9	13.0
Zero to S-2 West	9.4	9.2	9.3	12.4	12.3	12.4
Zero to S-2 East	5.9	5.7	5.8	13.1	13.1	13.1
S-4 to S-5 West	8.0	7.9	8.0	12.3	12.2	12.3
S-4 to S-5 East	5.6	5.4	5.5	13.0	13.0	13.0
S-13 to S-15 West	6.9	6.8	6.9	12.2	12.2	12.2
S-13 to S-15 East	4.8	4.8	4.8	12.2	12.2	12.2
Upstream from PSM in new discharge canal	17.8	17.8	17.8	11.2	11.3	11.3
Downstream from PSM in new discharge canal	17.1	17.1	17.1	11.0	10.9	11.0
Old canal	15.7	12.8	14.3	11.2	11.1	11.2

APPENDIX TABLE 6. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ELECTROFISH SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

9 MAY 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-10 West	13.2	13.1	13.2	10.3	10.1	10.2
N-9 to N-10 East	13.5	13.5	13.5	10.6	10.5	10.6
N-8 to N-9 West	12.9	12.9	12.9	10.3	10.2	10.3
N-8 to N-9 East	13.6	13.5	13.6	10.6	10.4	10.5
Zero to S-2 West	13.7	13.6	13.7	9.9	9.8	9.9
Zero to S-2 East	13.1	13.2	13.2	10.0	10.0	10.0
S-4 to S-5 West	13.1	12.8	13.0	10.0	9.9	10.0
S-4 to S-5 East	13.0	13.0	13.0	10.0	10.0	10.0
S-13 to S-15 West	13.0	12.9	13.0	9.8	9.8	9.8
S-13 to S-15 East	12.2	12.2	12.2	10.1	9.8	10.0
Upstream from PSM in new discharge canal	25.5	25.4	25.5	8.0	7.9	8.0
Downstream from PSM in new discharge canal	24.1	24.0	24.1	7.8	7.9	7.9
Old canal	19.5	17.9	18.7	9.1	9.6	9.4

APPENDIX TABLE 6. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ELECTROFISH SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

8 JUNE 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-10 West		20.7	20.7		7.9	7.9
N-9 to N-10 East		20.5	20.5		7.7	7.7
N-8 to N-9 West		20.7	20.7		8.0	8.0
N-8 to N-9 East		20.5	20.5		7.6	7.6
Zero to S-2 West		21.5	21.5		8.2	8.2
Zero to S-2 East		27.5	27.5		7.3	7.3
S-4 to S-5 West		22.6	22.6		7.7	7.7
S-4 to S-5 East	23.8	23.6	23.7	7.6	7.6	7.6
S-13 to S-15 West		23.1	23.1		7.1	7.1
S-13 to S-15 East		22.5	22.5		7.3	7.3
Upstream from PSM in new discharge canal		33.4	33.4		6.9	6.9
Downstream from PSM in new discharge canal		31.0	31.0		6.8	6.8
Old canal		29.0	29.0		6.9	6.9

APPENDIX TABLE 6. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ELECTROFISH SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

12-14 JULY 1995

STATION	TEMP		D_O	
	BOTTOM	DEPTHS COMBINED	BOTTOM	DEPTHS COMBINED
N-9 to N-10 West	23.8	23.8	8.0	8.0
N-9 to N-10 East	24.0	24.0	8.4	8.4
N-8 to N-9 West	23.9	23.9	7.9	7.9
N-8 to N-9 East	24.0	24.0	8.3	8.3
Zero to S-2 West	28.9	28.9	7.2	7.2
Zero to S-2 East	29.1	29.1	7.1	7.1
S-4 to S-5 West	28.4	28.4	7.1	7.1
S-4 to S-5 East	27.8	27.8	7.0	7.0
S-13 to S-15 West	26.2	26.2	6.5	6.5
S-13 to S-15 East	25.7	25.7	6.8	6.8
Upstream from PSM in new discharge canal	38.0	38.0	7.0	7.0
Downstream from PSM in new discharge canal	34.4	34.4	6.8	6.8
Old canal	32.8	32.8	7.0	7.0

APPENDIX TABLE 6. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ELECTROFISH SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

16-18 AUGUST 1995

STATION	TEMP		D_O	
	BOTTOM	DEPTHS COMBINED	BOTTOM	DEPTHS COMBINED
N-9 to N-10 West	24.1	24.1	8.4	8.4
N-9 to N-10 East	24.8	24.8	8.6	8.6
N-8 to N-9 West	24.2	24.2	8.6	8.6
N-8 to N-9 East	24.6	24.6	8.8	8.8
Zero to S-2 West	29.4	29.4	7.5	7.5
Zero to S-2 East	31.3	31.3	6.9	6.9
S-4 to S-5 West	29.9	29.9	6.9	6.9
S-4 to S-5 East	29.7	29.7	6.7	6.7
S-13 to S-15 West	27.7	27.7	6.8	6.8
S-13 to S-15 East	26.5	26.5	6.7	6.7
Upstream from PSM in new discharge canal	37.8	37.8	7.3	7.3
Downstream from PSM in new discharge canal	33.1	33.1	6.7	6.7
Old canal	32.4	32.4	6.3	6.3

APPENDIX TABLE 6. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ELECTROFISH SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

13-15 SEPTEMBER 1995

STATION	TEMP		D_O	
	BOTTOM	DEPTHS COMBINED	BOTTOM	DEPTHS COMBINED
N-9 to N-10 West	17.8	17.8	8.5	8.5
N-9 to N-10 East	18.3	18.3	8.6	8.6
N-8 to N-9 West	17.5	17.5	8.5	8.5
N-8 to N-9 East	18.1	18.1	8.6	8.6
Zero to S-2 West	25.2	25.2	7.4	7.4
Zero to S-2 East	25.8	25.8	7.7	7.7
S-4 to S-5 West	24.8	24.8	7.8	7.8
S-4 to S-5 East	24.5	24.5	7.7	7.7
S-13 to S-15 West	21.1	21.1	7.9	7.9
S-13 to S-15 East	20.1	20.1	7.8	7.8
Upstream from PSM in new discharge canal	31.5	31.5	7.3	7.3
Downstream from PSM in new discharge canal	28.1	28.1	6.9	6.9
Old canal	27.9	27.9	7.4	7.4

APPENDIX TABLE 6. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ELECTROFISH SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

ALL DATES COMBINED

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-10 West	8.1	14.8	12.6	11.5	9.8	10.4
N-9 to N-10 East	8.4	15.1	12.9	11.8	10.0	10.6
N-8 to N-9 West	8.0	14.8	12.5	11.6	9.9	10.5
N-8 to N-9 East	8.3	15.0	12.8	11.9	10.0	10.6
Zero to S-2 West	10.9	18.3	15.8	11.1	9.4	10.0
Zero to S-2 East	9.0	18.5	15.4	11.4	9.4	10.0
S-4 to S-5 West	9.8	18.0	15.3	11.1	9.3	9.9
S-4 to S-5 East	11.6	17.4	15.2	10.7	9.4	9.9
S-13 to S-15 West	9.2	16.8	14.3	10.9	9.0	9.6
S-13 to S-15 East	7.6	15.6	12.9	11.2	9.2	9.9
Upstream from PSM in new discharge canal	19.0	27.0	24.3	9.9	8.5	9.0
Downstream from PSM in new discharge canal	18.5	25.1	22.9	9.7	8.3	8.7
Old canal	14.4	21.6	19.2	10.3	8.7	9.3

Admin # 201

MERRIMACK STATION (BOW)

FISHERIES STUDY

Prepared for

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
Manchester, New Hampshire

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1.0 INTRODUCTION

Merrimack Station, located in Bow, New Hampshire, draws substantial volumes of once-through cooling water from the Hooksett Pool section of the Merrimack River. This electric generating facility has been in operation in its present capacity since 1968. From 1967 through 1978, numerous thermal and biological studies of the river were conducted assessing potential impacts from operation of Merrimack Station by Normandeau Associates (NAI) for Public Service of New Hampshire (PSNH).

During NPDES permitting proceedings, review agencies raised a number of concerns relative to Merrimack Station's potential impacts to the river, given the current state of water quality and fishery recovery/re-introductions. In response, PSNH revisited the historical data and successfully satisfied some of the agencies' concerns. However, data were not sufficient to address all issues and it was concluded that three additional studies would be required to complete the evaluation of potential impact from Merrimack Station's thermal plume:

1. An assessment of the effects of thermal inputs from Merrimack Station on the potential duration of the anadromous fish migration season.

2. An assessment of the potential for entrainment of yellow perch larvae in the thermal plume at Merrimack Station.

3. An assessment of the abundance of yellow perch in Hooksett Pool relative to their historical abundance and collection of additional information on the spatial distribution of target fish populations in Hooksett Pool in relation to the portions of those populations in the present discharge canal.

Studies were conducted during the period October 1994 to September 1995 by Normandeau Associates to address the agency concerns.

2.0 METHODS

2.1 ICHTHYOPLANKTON

Ichthyoplankton samples were collected weekly for eight weeks during May and June 1995 using a 50-cm diameter 505-μm mesh plankton net with a width-to-length ratio of 4:1. A propeller type flow meter (General Oceanics model 2030R) was placed slightly off-center in the mouth of the net to allow calculation of the volume of water filtered.

Three areas in Hooksett Pool were sampled: the ambient zone upstream from the station, the mixing zone in the immediate area of the thermal plume, and the thermally affected zone downstream from the station (Figure 2-1, Table 2-1). In each of the three sampling areas, samples were collected in three locations: midstream and approximately 10-12 meters from each bank. At each location samples were collected at two depths, near surface (approximately 0.2 m below the surface) and near bottom (approximately 1.5-2.0 m depth). A total of 144 samples were collected (8 dates x 3 areas x 3 locations x 2 depths).

Most larvae are caught @ night

Ichthyoplankton tows were taken during the day. The tow duration at each location was seven minutes, to assure a minimum filtered volume of 50 m^3. Water temperature and dissolved oxygen concentration were measured at each sampling depth at each location. Samples were preserved in 5-10% buffered formalin.

In the laboratory, samples were drained and rinsed in a sieve and then sorted under magnification to remove the ichthyoplankton from the detritus. Following initial sorting, three randomly selected samples from each weekly sampling were re-sorted. If additional organisms from the re-sorted samples amounted to 15% (average of three percentages) of the total from the original and re-sorted samples, or if any one re-sorted sample contained more than 25% of the total for that sample, all samples for that week were re-sorted. Fish larvae were identified to species. No fish eggs were collected. A collection of reference specimens was prepared to allow independent verification.

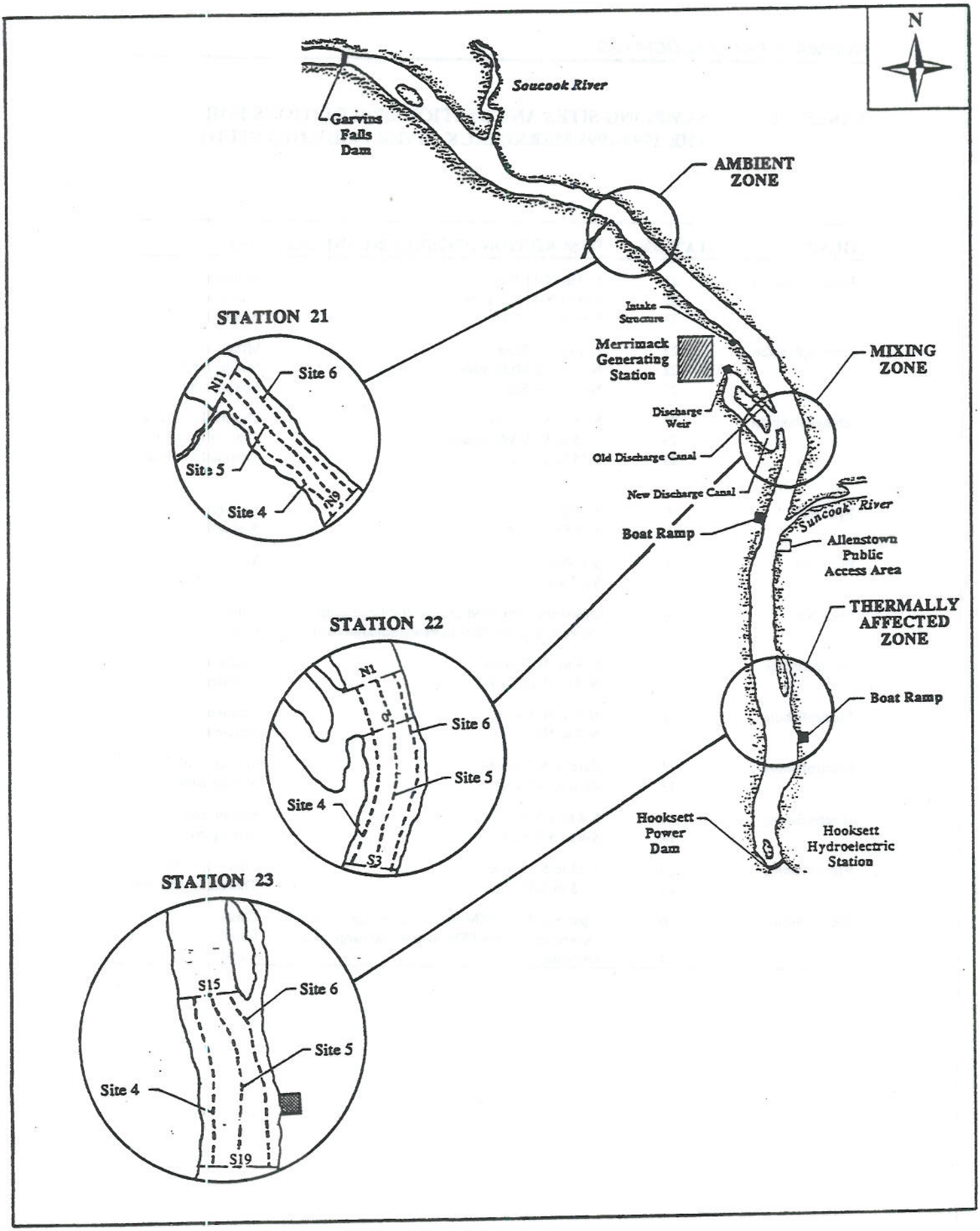

Figure 2-1. Ichthyoplankton stations, Merrimack River Monitoring Program, Hooksett Pool, New Hampshire 1994-1995.

TABLE 2-1. SAMPLING SITES AND STATION DESCRIPTIONS FOR THE 1994-1995 MERRIMACK RIVER FISHERIES STUDY.

GEAR	STATION	DESCRIPTION (FIGURES 2-1 AND 2-2)	AREA
Ichthyoplankton	21	N-9 to N-11 West	Ambient
	21	N-9 to N-11 Midstream	Ambient
	21	N-9 to N-11 East	Ambient
Ichthyoplankton	22	N-1 to S-3 West	Mixing zone
	22	N-1 to S-3 Midstream	Mixing zone
	22	N-1 to S-3 East	Mixing zone
Ichthyoplankton	23	S-15 to S-19 West	Thermally affected
	23	S-15 to S-19 Midstream	Thermally affected
	23	S-15 to S-19 East	Thermally affected
Fyke Net	1	N-9 West	Ambient
	1	N-9 East	Ambient
Fyke Net	2	S-2 West	Mixing zone
	3	S-4 East	Mixing zone
Fyke Net	4	Upstream from PSM in new discharge canal	Canal
	5	Downstream for PSM in new discharge canal	Canal
Electrofishing	11	N-9 to N-10 West	Ambient
	11	N-9 to N-10 East	Ambient
Electrofishing	12	N-8 to N-9 West	Ambient
	12	N-8 to N-9 East	Ambient
Electrofishing	13	Zero to S-2 West	Mixing zone
	13	Zero to S-2 East	Mixing zone
Electrofishing	14	S-4 to S-5 West	Mixing zone
	14	S-4 to S-5 East	Mixing zone
Electrofishing	15	S-13 to S-15 West	Thermally affected
	15	S-13 to S-15 East	Thermally affected
Electrofishing	16	Upstream from PSM in new discharge canal	Canal
	17	Downstream from PSM in new discharge canal	Canal
	18	Old canal	Canal

Estimated densities of larvae by species were calculated for each sample based on the volume of water filtered.

2.2 ELECTROFISHING

All shocking was done during the day, between one-half hour after sunrise and one-half hour before sunset. Samples were collected once per month during October and December 1994, and March, May, June, July, August, and September 1995. The shocking equipment was operated at 10 amps of pulsed DC (120 pps) current. Shocking runs typically followed the shoreline from downstream to upstream and centered on available cover (vegetation, rock piles, etc.). Shocking runs were restricted to depths less than 6-8 feet since capture efficiency at greater depths is substantially reduced. The sampling effort was 300 m (1000 ft) of shoreline fished, which was usually accomplished in 15-20 minutes of shocking power on. Data were recorded separately for each of two 150-m segments within the 300-m transect (downstream and upstream).

Electrofishing was conducted by fishing 300-m sections (Figure 2-2; Table 2-1) along both east and west banks at five locations in the river. In addition, three 150-m electrofishing transects were sampled: one in the old canal and one each above and below the Pressure Spray Modules (PSM) in the existing (new) discharge canal.

Electrofishing began by moving the boat into the area to be sampled. Sampling boat speed was consistent among all sampling zones. As the boat was moved, the two netters captured all stunned fish and retained them in a live well for processing. The fish from the downstream 150-m portion of each 300-m transect were held separately from the upstream 150-m portion so that the two subsamples could be analyzed separately. At the end of the shocking run all fish were processed (identified, counted, measured for length and weight, and any anomalies noted) and sampling activities documented (sampling time, date, location, physical-chemical data, investigators, etc.). The shock unit model number and type, current type, voltage, amps, and pulse rate used to collect each sample were recorded.

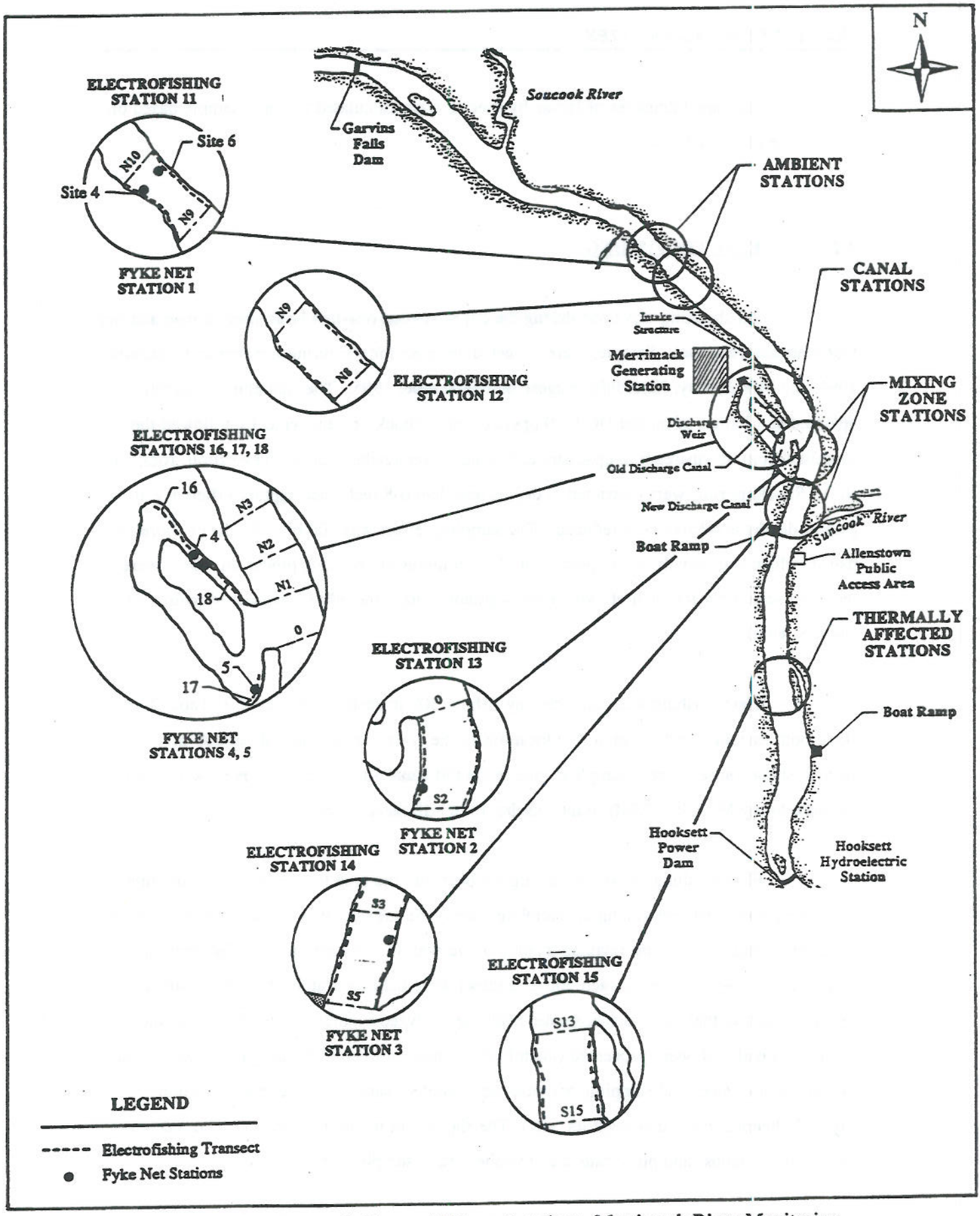

Figure 2-2. Electrofishing and Fyke net stations, Merrimack River Monitoring Program, Hooksett Pool, New Hampshire 1994-1995.

2.3 FYKE NETS

Fyke nets were made from 2-inch multi-filament stretch netting and 3-foot hoops. The leaders were 100 ft in length, and the wings were 20-25 feet in length. Samples were collected once per month during October and December 1994, and April through September 1995. Sampling duration, or soak time, was approximately 48 hours. Two consecutive 48-hour sets constituted one sampling effort. Leaders were staked to shore with a 3-foot length of 3/8-inch rebar. Wings were also staked in place (4-foot to 6-foot rebar). The wing angle was generally 45-50 degrees off the lead. The pot end was anchored with a float for easy retrieval.

The specific sampling locations had an even slope with no sudden drop-offs or debris such as stumps. The sampling locations were out of the current and sheltered from wind as much as possible. Nets were set perpendicular to shore unless special need dictated other orientations.

Fyke netting was conducted at four locations in the river (N-10 east, N-10 west, S-2 west and S-4 east, Figure 2-2; Table 2-1) and at two locations in the new discharge canal (upstream and downstream from the PSM).

The wings, lead and trap of each net were inspected for damage prior to sampling and repaired or replaced as needed. The lead was secured to shore, then fully extended perpendicular to shore. The gear deployment, set time, date, and location were documented on the field data sheet.

After approximately 48 hours the trap was retrieved and any captured fish transferred to a wash tub or live well. The net was reset and retrieved again after the second 48 hour set. Fish were processed (identified, counted, measured for length and weight), and any anomalies noted.

2.4 WATER QUALITY

Air temperature, water temperature, and dissolved oxygen (DO) were measured at each sampling location each time a sample was collected, at the time each sample was removed from the sampling gear for processing (immediately before or after each ichthyoplankton tow, just prior to the pull time for hoop nets, and at the end of each electrofishing transect). Depths for water temperature and DO were 30 cm below the surface and 10 cm above the river bottom. Temperature and dissolved oxygen (nearest 0.1 mg/l) were measured with a YSI model 57 dissolved oxygen meter. Air temperature (nearest 1.0°C) was measured with a mercury thermometer.

A table of saturation concentrations of DO in water at various water temperatures was used to check readings from the DO meter. If a reading exceeded saturation, the meter connections were checked, the membrane was checked for contamination and bubbles, and the reading was retaken. Meters were recalibrated at the end of the sampling day to determine if calibration drifted during the course of the day.

3.0 RESULTS

3.1 ICHTHYOPLANKTON

Larvae of 13 fish species were present in the May-June ichthyoplankton sampling season (Table 3-1). No fish eggs were present in the samples. The most abundant species over all dates and sampling zones were bluegill, spottail shiner, rainbow smelt, and common shiner (scientific names are listed in Appendix Table 1). The most abundant species, bluegill, was abundant both in the mixing zone and in the thermally affected zone, but was absent from the ambient zone. Spottail shiner and common shiner were both more abundant in the ambient zone than in either the mixing zone or the thermally affected zone, whereas rainbow smelt was most abundant in the downstream section of the study area (the thermally affected zone). Among the three sampling areas, the mixing zone and the thermally affected zone were most similar, being strongly dominated by bluegill, in contrast to the ambient zone, which was dominated primarily by spottail shiner and common shiner.

Yellow perch larvae were present in only the first two of the eight sampling dates, accounting for approximately 4% of the ichthyoplankton over the eight-week sampling season (Table 3-1). Densities of yellow perch larvae were higher on the first sampling date (0.6 per 50 m^3) than on the second sampling date (0.2 per 50 m^3), suggesting that additional yellow perch larvae could have been present before the sampling season started (Table 3-2).

Yellow perch were present in all three sampling areas (ambient zone, mixing zone, and thermally affected zone), in all three locations within each area (west, midstream, and east), and at both surface and bottom depths in each area (Table 3-2). Distribution of yellow perch larvae was fairly even among sampling areas, with densities (number per 50 m^3) of 0.3 in the ambient zone, and 0.4 both in the mixing zone and in the thermally affected zone downstream of Merrimack Station. Spatial distribution of densities was also fairly uniform among sampling locations (0.4 along the west shore, 0.3 in midstream, and 0.4 along the east shore) and between the two depths (0.3 near the surface and 0.4 near the bottom). These slight differences in densities among zones, locations, and depths were not statistically significant (analysis of variance at $\alpha=0.05$).

TABLE 3-1. MEAN DENSITIES OF LARVAL FISH (NUMBER PER 50 CUBIC METERS) BY SAMPLING AREA AND DATE, AND OVERALL PERCENT COMPOSITION FOR THE YEAR, FOR ICHTHYOPLANKTON TOWS IN THE HOOKSETT POOL OF THE MERRIMACK RIVER IN 1995.

SAMPLING AREA	SPECIES	10MAY	16MAY	23MAY	30MAY	06JUN	13JUN	20JUN	27JUN	OVERALL PERCENT COMP.
AMBIENT ZONE	Common shiner	0.0	0.0	0.0	0.0	1.0	0.8	1.5	0.0	26
	Fallfish	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1	3
	Golden shiner	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	1
	Pumpkinseed	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	2
	Rainbow smelt	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	3
	Spottail shiner	0.0	0.0	0.0	2.4	2.7	1.6	0.0	0.0	53
	Tessellated darter	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	3
	White sucker	0.0	0.0	0.2	0.0	0.3	0.0	0.1	0.0	5
	Yellow perch	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	4
	All species	0.4	0.2	0.4	2.8	4.3	2.4	1.7	0.2	100
MIXING ZONE	Bluegill	0.9	0.0	1.3	0.4	0.1	2.1	6.9	0.3	64
	Common shiner	0.0	0.0	0.0	0.0	0.0	0.6	0.1	0.0	4
	Fallfish	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	1
	Pumpkinseed	0.0	0.0	0.3	0.0	0.0	0.2	0.0	0.0	3
	Rainbow smelt	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	1
	Redbreast sunfish	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	3
	Spottail shiner	0.0	0.0	0.0	1.4	1.2	0.7	0.0	0.0	18
	White sucker	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.0	2
	Yellow perch	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	4
	All species	1.7	0.3	1.7	2.0	1.6	3.7	7.7	0.3	100
THERMALLY AFFECTED ZONE	Bluegill	7.2	0.0	2.8	3.0	0.3	3.0	0.2	0.1	64
	Common shiner	0.0	0.0	0.0	0.0	0.0	0.2	0.6	0.0	3
	Pumpkinseed	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	1
	Rainbow smelt	0.0	0.0	0.0	5.3	0.0	0.0	0.0	0.0	20
	Rock bass	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	1
	Spottail shiner	0.0	0.0	0.0	1.2	0.5	0.0	0.1	0.0	7
	White perch	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	<1
	White sucker	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	1
	Yellow perch	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	3
	All species	7.8	0.3	3.0	9.4	1.0	3.6	0.9	0.2	100

TABLE 3-2. SPATIAL DISTRIBUTION OF YELLOW PERCH LARVAE (NUMBER PER 50 CUBIC METERS) COLLECTED ON TWO DATES IN THE HOOKSETT POOL OF THE MERRIMACK RIVER IN 1995.

DATE	SAMPLING AREA	DEPTH	LOCATION		
			WEST	MIDSTREAM	EAST
10MAY	AMBIENT ZONE	SURFACE	0.0	0.6	0.0
		BOTTOM	0.0	0.8	0.7
	MIXING ZONE	SURFACE	1.6	0.0	0.8
		BOTTOM	0.7	0.7	0.6
	THERMALLY AFFECTED ZONE	SURFACE	0.0	0.7	0.6
		BOTTOM	1.5	0.0	0.7
16MAY	AMBIENT ZONE	SURFACE	0.5	0.0	0.0
		BOTTOM	0.0	0.5	0.0
	MIXING ZONE	SURFACE	0.0	0.0	0.0
		BOTTOM	0.0	0.0	0.5
	THERMALLY AFFECTED ZONE	SURFACE	0.0	0.0	0.0
		BOTTOM	0.5	0.0	0.7

10 May 11/18 contained larvae

16 May 5/18 contained larvae.

There was no evidence that temperature influenced the distribution of yellow perch larvae. Temperatures on the two dates when yellow perch larvae were present were all within the range 12.9-14.7°C except for a single observation at 17.1°C (near the surface on the west side of the mixing zone on 16 May). Samples containing yellow perch larvae occurred throughout the observed temperature range. There were no yellow perch larvae in the sample from the 17.1°C water, but there were also samples without yellow perch larvae throughout the entire range of temperatures. There was no discernable difference in the abundance of yellow perch larvae between higher temperatures and lower temperatures, and a linear regression analysis of these data was not significant ($F=0.44$; $p>0.05$).

3.2 ADULT FISH

3.2.1 Yellow Perch Population

Both total catch and standardized CPUE of yellow perch in the 1994-1995 fyke net sampling were the lowest observed in 11 years of sampling (Table 3-3). The reduced total catch in 1994-1995 was probably influenced by low catches during the winter. However, CPUE of yellow perch in 1994-1995 was also the lowest observed when data are standardized for the June through September period common to most previous years.

Standardized CPUE of yellow perch in fyke nets decreased significantly during the 12-year period between 1967 and 1978 (Stetson-Harza 1992). The low 1994-1995 standardized CPUE data were consistent with a continuing decreasing trend in CPUE. However, with a 17-year gap between 1978 and 1995, it is not possible to determine if the low CPUE in June through September of 1995 is a continuation of the previous consistent decreasing trend, or if there had been significant variation in yellow perch CPUE during the period when no sampling was conducted.

TABLE 3-3. ABUNDANCE OF TARGET SPECIES IN FYKE NET CATCHES IN HOOKSETT POOL[a].

TOTAL CATCH (NUMBER) AND CATCH PER UNIT EFFORT (CPUE) FOR FYKE NET SAMPLING

			SMALLMOUTH BASS		LARGEMOUTH BASS		PUMPKINSEED		YELLOW PERCH	
YEAR[a]	EFFORT	MONTHS SAMPLED	NUMBER	CPUE[b]	NUMBER	CPUE[b]	NUMBER	CPUE[b]	NUMBER	CPUE[b]
1967	354	Jun-Sep	376	1.06	0	0.00	5243	14.81	3478	9.82
1968	425	Jun-Sep	172	0.40	2	0.00	2418	5.69	2245	5.28
1969	168	Jun-Sep	140	0.83	10	0.06	621	3.70	662	3.94
1972	48	Aug-Oct	150	3.13	4	0.08	279	5.81	302	6.29
1973	80	Jun-Oct	201	2.51	1	0.01	406	5.08	302	3.78
1974	96	May-Oct	119	1.24	3	0.03	563	5.86	271	2.82
1975	96	May-Oct	128	1.33	16	0.17	569	5.93	282	2.94
1976	96	May-Oct	83	0.86	2	0.02	274	2.85	213	2.22
1977	80	May-Sep	71	0.89	3	0.04	142	1.78	90	1.13
1978	96	May-Oct	146	1.52	0	0.00	369	3.84	158	1.65
1994-1995	210	Oct 94-Sep 95	47	0.22	10	0.05	312	1.49	22	0.10

[a]Catch data does not include any samples from the canal.

(continued)

TABLE 3-3. (Continued)

TOTAL CATCH (NUMBER) AND CATCH PER UNIT EFFORT (CPUE) FOR FYKE NET SAMPLING

			SMALLMOUTH BASS		LARGEMOUTH BASS		PUMPKINSEED		YELLOW PERCH	
YEAR[b]	EFFORT	MONTHS SAMPLED	NUMBER	CPUE[c]	NUMBER	CPUE[c]	NUMBER	CPUE[c]	NUMBER	CPUE[c]
1967	354	Jun-Sep	376	1.06	0	0.00	5243	14.81	3478	9.82
1968	425	Jun-Sep	172	0.40	2	0.00	2418	5.69	2245	5.28
1969	168	Jun-Sep	140	0.83	10	0.06	621	3.70	662	3.94
1972	32	Aug-Sep	insufficient data							
1973	64	Jun-Sep	173	2.70	0	0.00	301	4.70	253	3.95
1974	64	Jun-Sep	110	1.72	3	0.05	429	6.70	151	2.36
1975	64	Jun-Sep	109	1.70	15	0.23	404	6.31	178	2.78
1976	64	Jun-Sep	77	1.20	2	0.03	251	3.92	73	1.14
1977	64	Jun-Sep	57	0.89	3	0.05	111	1.73	56	0.88
1978	64	Jun-Sep	112	1.75	0	0.00	226	3.53	158	2.47
1995	96	Jun-Sep	38	0.40	8	0.08	13	0.13	6	0.06

[b]1967-1978 from Stetson-Harza (1992).
[c]CPUE = catch per 48-hour sample.

3.2.2 Discharge Canal Populations of Target Species

Largemouth bass, smallmouth bass and pumpkinseed were found in fyke net samples in the canal, while yellow perch were not found in the canal at any time (Table 3-4). Largemouth bass were present in the canal during October, May, June and September. Smallmouth bass and pumpkinseed were present more often and were found in October, December, and April through September. Bluegills were found in the canal in October, December, April, May, June, August and September.

The canal population of smallmouth bass, pumpkinseed, and bluegill sampled by fyke netting represented a significant portion of the overall Hooksett Pool population of these species on an annual basis (Table 3-4). An index of the relative standing crop found in each segment of Hooksett Pool (ambient, canal, thermally affected) was calculated following the method of Stetson-Harza (1992). The mean CPUE of target species in each segment of Hooksett Pool was weighted by the centerline length of the segment to develop an index of the standing crop in each segment (Table 3-4). If a species had an even distribution over all segments, then the index of standing crop would be similar to the length of the segment. For example, the canal represents 11% (1.2 km/10.8 km) of the total length of Hooksett Pool. If a significant portion of the Hooksett Pool population was found in the canal, then the weighted mean index of standing crop would be greater than 11%.

The weighted index of standing crop in the canal exceeded 11% for all target species except yellow perch and largemouth bass. No yellow perch were found in fyke net samples in the canal area. Although catches were relatively light, the index for yellow perch was greater in the ambient (56.24%) than in the thermally affected segment (43.75%) . The index of standing crop for largemouth bass was close to 11%, indicating no special preference for the canal segment. The index was highest in the thermally affected segment (88.79%), indicating that a significant portion of the Hooksett Pool largemouth bass population was found downstream of the discharge. However, the total 1994-1995 catch of largemouth bass was relatively low (17 fish) and the index could be significantly affected by the capture of a few fish.

The indices for smallmouth bass (47.09%), pumpkinseed (73.84%), and bluegill (48.00%) in the canal exceeded 11%, indicating a significant portion of the population of each of these species was found in this segment. Catches of all three species in the canal were highest in September.

TABLE 3-4. CATCH PER UNIT EFFORT (NUMBER PER 24-HOUR SET) AND WEIGHTED INDEX OF STANDING CROP FOR TARGET SPECIES CAPTURED IN FYKE NET SAMPLES IN HOOKSETT POOL, 1994-1995.

MONTH	LARGEMOUTH BASS			SMALLMOUTH BASS			PUMPKINSEED			YELLOW PERCH			BLUEGILL		
	AMBIENT	CANAL	THERMALLY AFFECTED	AMBIENT	CANAL	THERMALLY AFFECTED	AMBIENT	CANAL	THERMALLY AFFECTED	AMBIENT	CANAL	THERMALLY AFFECTED	AMBIENT	CANAL	THERMALLY AFFECTED
Oct	0.0	0.2	0.2	0.0	1.3	0.3	0.5	5.4	1.0	0.5	0.0	0.3	0.5	0.6	0.6
Nov[a]															
Dec	0.0	0.0	0.0	0.2	1.0	0.0	0.2	0.7	0.0	0.0	0.0	0.0	0.3	2.0	0.0
Jan[a]															
Feb[a]															
Mar[a]															
Apr	0.0	0.0	0.0	0.0	0.3	0.0	0.0	1.0	0.0	0.1	0.0	0.3	0.0	0.5	0.0
May	0.0	0.1	0.0	0.3	1.0	0.5	0.0	0.8	0.4	0.4	0.0	0.5	0.0	0.6	0.1
Jun	0.0	0.1	0.0	0.6	0.4	1.0	0.0	1.5	0.3	0.0	0.0	0.3	0.0	0.5	0.3
Jul	0.0	0.0	0.0	0.1	1.4	0.8	0.0	1.4	0.4	0.1	0.0	0.0	0.2	0.0	0.1
Aug	0.0	0.0	0.4	0.6	0.4	0.7	0.0	0.4	0.4	0.1	0.0	0.1	0.1	0.1	0.2
Sep	0.0	0.1	0.6	0.0	14.0	0.9	0.1	26.9	0.5	0.1	0.0	0.0	0.1	5.9	0.4
CPUE[b]	0.00	0.06	0.15	0.23	2.48	0.53	0.10	4.76	0.38	0.16	0.00	0.19	0.15	1.28	0.21
Weighing Factor (%)[c]	5.8 (53.7)	1.2 (11.11)	3.8 (35.19)	5.8 (53.7)	1.2 (11.11)	3.8 (35.19)	5.8 (53.7)	1.2 (11.11)	3.8 (35.19)	5.8 (53.7)	1.2 (11.11)	3.8 (35.19)	5.8 (53.7)	1.2 (11.11)	3.8 (35.19)
Weighted Index of Standing Crop (%)[d]	0.00	11.12	88.79	21.03	47.09	31.87	7.50	73.84	18.67	56.24	0.00	43.75	27.15	48.00	24.94

[a]No samples were scheduled to be collected in November and January through March.

[b]CPUE=catch per 24-hour soak.

[c]Weighting factor (WF)=Segment length in km.

[d]Weighted index of standing crop = $CPUE_i \times \frac{WF_i}{\sum_{i=1}^{3} (CPUE_i \times WF_i)} \times 100$, where i = segment.

The canal population of largemouth bass, smallmouth bass, pumpkinseed, yellow perch, and bluegill sampled by electrofishing represented a significant portion of the overall Hooksett Pool population of these species on an annual basis (Table 3-5). The weighted index of standing crop for bluegill (15.87%) was slightly larger than the percentage length of the canal (11.11%), indicating that this fish showed a weak preference for the canal.

Catches of largemouth bass were highest in the canal in June, while smallmouth bass catches were highest in May. Pumpkinseed were found in the canal in the greatest numbers in October and yellow perch catches were highest in March.

Centrarchids, primarily bluegill, largemouth bass, and redbreast sunfish, were observed on spawning nests in the canal in May at water temperatures between 19.4 and 23.2°C. These fishes generally begin spawning around 20°C (Smith 1985), but this temperatures is typically reached later in the year. Water temperature in the ambient segment during May ranged from 12.6-13.1°C., and did not reach 20°C until June or July.

3.2.3 Relationship Between Water Temperature and Relative Abundance

Regression techniques were used to investigate the relationship between water temperature and fish relative abundance. Mean monthly bottom water temperatures during fish sampling ranged from 0.9°C in the thermally affected section in December to 40.8°C in the canal segment in July (Table 3-6). Catch per unit effort of target species in the fyke net and electrofish samples (dependent variable) was regressed on water temperature (independent variable) for each segment of Hooksett Pool and for all segments combined.

3.2.3.1 Fyke Net Sampling

There was no significant relationship between water temperature and CPUE for any of the target species captured in fyke net samples in the ambient or canal segments. In these segments catches of target species were generally lowest at the coldest water temperatures and appeared to vary randomly as temperatures increased. In the thermally affected segment, CPUE

TABLE 3-5. CATCH PER UNIT EFFORT (NUMBER PER 1000-FT TRANSECT) AND WEIGHTED INDEX OF STANDING CROP FOR TARGET SPECIES CAPTURED IN ELECTROFISHING SAMPLES IN HOOKSETT POOL, 1994-1995.

MONTH	LARGEMOUTH BASS				SMALLMOUTH BASS				PUMPKINSEED				YELLOW PERCH				BLUEGILL			
	AMBI-ENT	CANAL	MIXING ZONE	THERMALLY AFFECTED	AMBI-ENT	CANAL	MIXING ZONE	THERMALLY AFFECTED	AMBIENT	CANAL	MIXING ZONE	THERMALLY AFFECTED	AMBI-ENT	CANAL	MIXING ZONE	THERMAL Y AFFECTED	AMBIENT	CANAL	MIXING ZONE	THERMALLY AFFECTED
Oct	2.00	31.48	2.25	2.00	0.50	1.50	3.00	0.00	0.00	62 .97	0.75	0.00	0.25	0.00	0.00	0.00	0.50	64.47	3.75	0.00
Nov[a]																	0.00	28.49	0.25	0.00
Dec	0.25	52.47	3.25	0.00	0.00	6.00	0.50	0.00	0.00	17.99	0.00	0.00	0.00	1.50	0.25	0.00				
Jan[a]																				
Feb[a]																				
Mar	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	16.49	0.25	0.00	0.00	65.97	0.25	0.00	0.00	3.00	0.00	0.00
Apr																				
May	0.00	1.50	0.00	0.00	0.25	16.49	1.00	1.00	0.00	17.99	2.00	0.50	0.00	1.50	0.00	0.00	0.00	4.50	0.00	0.00
Jun	0.00	85.46	1.25	0.00	0.75	4.50	2.25	0.50	0.25	4.50	1.25	1.50	0.00	0.00	0.25	0.00	0.25	4.50	0.25	1.00
Jul	0.75	0.00	5.75	1.00	0.00	0.00	2.25	12.50	0.00	3.00	1.25	2.00	0.00	0.00	0.00	0.00	0.50	3.00	71.25	49.00
Aug	4.50	10.49	8.25	5.50	0.25	0.00	2.00	2.50	0.00	0.00	1.25	0.00	0.25	0.00	0.00	0.50	15.50	6.00	94.50	89.50
Sep	1.75	7.50	5.75	14.50	1.25	0.00	2.25	0.00	0.00	1.50	2.50	2.00	0.25	0.00	0.00	0.50	16.75	74.96	35.50	141.50
AVE. CPUE	1.16	23.61	3.31	2.88	0.38	3.56	1.78	2.06	0.03	15.56	1.16	0.75	0.09	8.62	0.09	0.13	4.19	23.61	25.69	35.13
Weighting Factor (%)[b]	5.8 (53.70)	1.2 (11.11)	0.8 (7.41)	3.0 (27.78)	5.8 (53.70)	1.2 (11.11)	0.8 (7.41)	3.0 (27.78)	5.8 (53.70)	1.2 (11.11)	0.8 (7.41)	3.0 (27.78)	5.8 (53.70)	1.2 (11.11)	0.8 (7.41)	3.0 (27.78)	5.8 (53.70)	1.2 (11.11)	0.8 (7.41)	3.0 (27.78)
Weighted Index of Standing Crop (%)[c]	14.48	61.23	5.72	18.62	15.58	30.61	10.21	44.32	0.82	84.76	4.21	10.22	4.80	91.24	0.66	3.21	13.60	15.87	59.02	11.51

[a]No samples were scheduled to be collected in November, January, February and April.
[b]Weighting Factor (WF)=Segment length in km

[c]Weighted index of standing crop = $CPUE_i \times \frac{WF_i}{\sum_{i=1}^{4} (CPUE_i \times WF_i)} \times 100$, where i = segment.

TABLE 3-6. MEAN MONTHLY BOTTOM WATER TEMPERATURES (°C) AND RANGES COLLECTED DURING FYKE NET AND ELECTROFISH SAMPLING FOR EACH RIVER SEGMENT IN HOOKSETT POOL DURING 1994-1995.

	SEGMENT							
	AMBIENT		CANAL		MIXING ZONE		THERMALLY AFFECTED	
MONTH	MEAN	RANGE	MEAN	RANGE	MEAN	RANGE	MEAN	RANGE
October	12.2	11.2-12.6	16.8	12.9-18.4	13.3	12.2-14.2	13.4	12.2-16.0
December	1.5	1.0-2.4	14.2	7.3-16.5	3.6	1.5-5.8	3.2	0.9-7.3
March	5.5	5.3-5.7	15.9	12.8-17.8	7.1	5.4-9.2	5.8	4.8-6.8
April	3.5	2.7-4.4	16.2	15.0-17.2	–	–	5.7	2.7-8.6
May	13.1	12.6-13.5	21.2	15.2-25.4	13.2	12.8-13.6	13.3	12.2-14.4
June	19.5	18.0-20.7	30.3	26.6-33.4	23.8	21.5-27.5	20.2	18.2-23.1
July	23.9	23.0-24.6	36.1	31.9-40.8	28.6	27.8-29.1	26.8	25.6-29.4
August	24.8	24.1-25.9	35.3	32.4-39.9	30.1	29.4-31.3	26.1	24.9-27.7
September	18.2	17.5-18.8	30.6	27.9-34.6	25.1	24.5-25.8	21.2	19.9-23.9

was also lowest at the coldest water temperatures for all target species. There was no significant relationships between temperature and CPUE for any of the target species in the thermally affected segment, with the exception of smallmouth bass where CPUE increased significantly with temperature (Table 3-7). The highest CPUE of 2.7 fish per 24-hour set occurred at the highest water temperature in this segment of 29.4 °C. There was no evidence of decreasing CPUE of smallmouth bass at higher water temperatures.

Data from all segments were combined to investigate the relationship between water temperature and CPUE in Hooksett Pool. With the increased sample size and water temperature ranges, regressions were significant for bluegill, pumpkinseed, and smallmouth bass (Table 3-7). The highest CPUE for bluegill occurred at water temperatures between 28.9°C and 34.9°C in the canal segment. No bluegills were captured in the five samples with water temperatures above 35.0°C, possibly indicating a decreased CPUE at the highest water temperatures. The highest CPUE for pumpkinseed and smallmouth bass occurred between 28.9°C and 34.6°C in the canal. No pumpkinseed or smallmouth bass were captured in the three samples with water temperature above 37.0°C.

If CPUE decreased with increasing temperature, the relationship between CPUE and temperature might be better described by a parabola (second order equation) than a straight line. To investigate this possibility, a parabola was fitted to the CPUE and temperature data for each of the target species in each segment, and for all segments combined. The second order equation was significant only for pumpkinseed and smallmouth bass in all segments combined. Even though the parabolic model was significant, the overall fit of the model was reduced compared to the straight line model.

3.2.3.2 Electrofish Sampling

The relationship between electrofish CPUE (catch per 1000 ft transect) data and water temperature was also investigated using regression techniques (Table 3-8). There were no significant relationships between CPUE of the selected species and water temperatures in the ambient segment at water temperatures between 1.2°C and 24.8°C. In the canal, CPUE of pumpkinseed decreased significantly with increasing water temperatures between 7.3°C and

TABLE 3-7. REGRESSION RELATIONSHIP BETWEEN WATER TEMPERATURE (°C) AND FYKE NET CATCH PER UNIT EFFORT (CATCH PER 24-HOUR SET) IN HOOKSETT POOL, 1994-1995.

SPECIES	SEGMENT	Pr>F	RELATIONSHIP	TEMPERATURE RANGE OF SAMPLING (°C)
Smallmouth bass	Thermally affected	0.0062	Positive	1.1-29.4
Bluegill	All combined	0.0451	Positive	1.0-40.8
Pumpkinseed	All combined	0.0082	Positive	1.0-40.8
Smallmouth bass	All combined	0.0062	Positive	1.0-40.8

TABLE 3-8. REGRESSION RELATIONSHIP BETWEEN WATER TEMPERATURE (°C) AND ELECTROFISH CATCH PER UNIT EFFORT (CATCH PER 1000 FT SEGMENT) IN HOOKSETT POOL, 1994-1995.

SPECIES	SEGMENT	Pr>F	RELATIONSHIP	TEMPERATURE RANGE OF SAMPLING (°C)
Pumpkinseed	Canal	0.0407	Negative	7.3-38.0
Bluegill	Mixing zone	0.0001	Positive	1.5-31.3
Largemouth bass	Mixing zone	0.0016	Positive	1.5-31.3
Bluegill	Thermally affected	0.0223	Positive	0.9-27.7
Smallmouth bass	Thermally affected	0.0477	Positive	0.9-27.7
Bluegill	All combined	0.0107	Positive	0.9-38.0

38.0°C. The significant negative regression was heavily influenced by one very high catch of 61 pumpkinseed at 12.9°C. No pumpkinseed were captured above 33.1°C.

In the mixing zone there was a significant positive relationship for both bluegill and largemouth bass. Bluegill were captured between 5.8°C and the maximum water temperature in the canal of 31.3°C. Largemouth bass were captured between 1.5°C and the maximum water temperature of 31.3°C. In the thermally affected segment bluegill and smallmouth bass had significant positive relationships between water temperature and CPUE. Both these fishes were captured at the highest water temperatures of 27.7°C in the segment.

When data from all segments were combined there was a significant positive relationship between water temperature and CPUE only for bluegill. The highest CPUE occurred at a water temperature of 21.1°C in the thermally affected segment. No bluegill were captured at above 33.1°C.

A parabola was fitted to the water temperature and CPUE data to determine if CPUE decreased at high water temperatures. The parabola was only significant for bluegill in all segments combined, and the fit of the model was reduced compared to the straight line model.

4.0 DISCUSSION

4.1 ICHTHYOPLANKTON

Based on the results of the 1995 ichthyoplankton sampling program, yellow perch larvae do become entrained in the thermal plume of Merrimack Station. The proportion of the Hooksett Pool population of yellow perch larvae subjected to the plume appears to be approximately the same as the proportion of Hookset Pool water that is contained by the plume. This is because the densities of yellow perch larvae in the plume area are similar to those elsewhere in Hookset Pool. There was no indication that the larvae were especially vulnerable to plume entrainment by being concentrated in near-surface water (although only a very substantial depth preference could have been detected with the small numbers of larvae that were collected in this study).

Although yellow perch larvae do occur in the Merrimack Station thermal plume, this does not occur at times when temperatures are potentially lethal. Wismer and Christie (1987) reported thermal tolerances of yellow perch larvae as high as 33.7°C and preferred temperatures of 12-25°C. Temperatures at the time of year when yellow perch larvae were present in 1995 were well within these limits. It is unlikely that substantially higher temperatures than those observed in 1995 would occur when larval yellow perch are present in other years, because the high rate of flow typical for the Merrimack River in May greatly dilutes the warm water discharge from Merrimack Station.

4.2 ADULT FISH

CPUE of yellow perch in fyke nets decreased significantly between 1967 and 1978 (Table 5-2 in Stetson-Harza 1992) and catches of yellow perch decreased in electrofish samples between 1972 and 1976 (Table 6-1 in Stetson-Harza 1992). The decrease in abundance of yellow perch in both fyke nets and electrofish samples appeared to occur in both the upstream ambient, and the downstream thermally affected sections of Hooksett Pool, and presently is at its lowest level (Table 4-1). However, with a 17-year gap in fyke net data, and a 19-year gap in electrofish data, it is not possible to determine if yellow perch abundance has been consistently

TABLE 4-1. HISTORICAL SUMMER CATCH PER UNIT EFFORT OF YELLOW PERCH IN FYKE NETS (NUMBER PER 24-HOUR SET) AND ELECTROFISH (NUMBER PER 1000 FOOT TRANSECT) IN HOOKSETT POOL.

		CPUE		
YEAR	GEAR	NORTH	SOUTH	MIXING
1973	Fyke net	1.40	1.84	–
1974	Fyke Net	0.40	1.50	–
1975	Fyke net	1.78	0.45	–
1976	Fyke net	0.19	0.73	–
1977	Fyke net	0.16	0.54	–
1978	Fyke net	0.53	0.61	–
1995	Fyke net	0.04	0.04	–
1972	Electrofish	12.33	6.50	2.83
1973	Electrofish	8.58	6.00	4.00
1974	Electrofish	3.25	2.92	3.83
1975	Electrofish	5.25	5.00	1.67
1976	Electrofish	2.50	1.50	0.00
1995	Electrofish	0.75	1.00	0.75

decreasing since the 1970s, or if there is a natural periodicity in yellow perch abundance. The decrease in yellow perch abundance is probably not due to the thermal discharge from Merrimack Station because it also occurred in the ambient segment that is beyond the thermal influence of the station.

interesting conclusion

The second major change in the adult fish community of Hooksett Pool since the 1970s has been the increase in abundance of bluegill. Bluegill have become a major portion of the Hooksett Pool fish community at some point between the 1978 and 1994-1995 sampling. Prior to 1978, bluegill were only reported occasionally in both fyke net and electrofish samples.

The decrease in yellow perch abundance and increase in the abundance of bluegill may be related, although the fisheries literature does not document direct competition between these two species. Competition between yellow perch and bluegill may be possible because competition has been documented between yellow perch and other fishes. White perch and yellow perch were demonstrated to have a high potential for competition for food items, and the invasion of Lake Erie by white perch adversely affected yellow perch (Parrish and Margraf 1990). Both bluegill and yellow perch feed on benthic and pelagic organisms. Mittelbach (1984) found small bluegills fed on vegetation dwelling prey, and large bluegills foraged primarily on open water zooplankton such as *Daphnia*. Small bluegill in a thermally stressed reservoir fed on planktonic prey, but depended more on benthic prey (Taylor et al. 1991). Yellow perch also fed on benthos in Lake Erie, especially in the spring and fall (Parrish and Margraf 1990). Due to the common preference for benthic food items, during at least part of the year, there is a potential for food competition between bluegill and yellow perch. If food items are limiting, competition for benthic food resources may partially explain the reduction in yellow perch abundance.

The risk to target species of exposure to high water temperatures in the canal can be assessed by determining if a significant portion of the Hooksett Pool population is found in the canal, and through analysis of CPUE and temperature data for the segments of the river. The canal population of smallmouth bass, pumpkinseed, and bluegill sampled by fyke nets and largemouth bass, smallmouth bass, pumpkinseed, yellow perch and possibly bluegill sampled by electrofishing represented a significant portion of the overall Hooksett Pool population of these species. A pattern of decreasing CPUE of these species in the canal during periods of highest

water temperature (July and August), and increasing CPUE in the other segments during the same period, may indicate that these fishes are leaving the canal and seeking refuge in the cooler waters of Hooksett Pool.

A significant portion of the Hooksett Pool population of largemouth bass were found in the canal by electrofishing gear. Largemouth bass were most numerous in electrofish sampling in June. Largemouth bass were captured at temperatures as high as 33.4°C, although only a few were captured at temperatures above 31.0°C. The preferred water temperature range for largemouth bass is 25°C to 32°C (Stetson-Harza 1992), and the upper median tolerance limit was 36.4°C for fish acclimated to 30°C. It is possible that at temperatures above 31.0°C largemouth bass move out of the canal and seek cooler water in the main stem of the river. The electrofish data may indicate a decrease in CPUE in the canal during July and August when water temperatures were above 30°C, and an increase in CPUE in the other segments (Table 3-5). A behavioral response to high temperatures, where largemouth bass avoid extremely high temperatures and seek deeper, cooler waters, has been documented by Block (1984).

The canal population of smallmouth bass was a significant portion of the overall Hooksett Pool population as sampled by both fyke nets and electrofishing. Smallmouth bass were most common in fyke net samples during September and were common in electrofish samples in May. Few smallmouth bass were captured in the canal at temperatures above 34.6°C. The upper preferred temperature range for smallmouth bass is approximately 34°C (NAI 1979), and water temperatures were greater than 34°C in the canal during July and August. Electrofish data indicate a decrease in CPUE in the canal during July and August and an increase in the other segments, although this pattern is not apparent in fyke net data. Smallmouth bass may have moved out of the canal during periods of warm water temperatures and sought cooler temperatures in other segments of Hooksett Pool.

A significant portion of the pumpkinseed population of Hooksett Pool was found in the canal, particularly in September and October. Pumpkinseed were captured at temperatures as high as 37.0°C (fyke net, July), but were not common above 30.0°C. The upper limit of the preferred temperature range for pumpkinseed is approximately 31.5°C for juveniles and 32.2°C for adults (NAI 1990). Temperatures above the preferred range were commonly reached in July and August. Both fyke net and electrofish data indicate a drop in CPUE during July and August,

but CPUE did not greatly increase in the other segments. Pumpkinseed may have moved out of the canal in July and August, but mortality is not suspected because the highest CPUE in the canal for both gears occurred in the following months of September and October. Pumpkinseed may have re-entered the canal in September and October when water temperature declined.

A significant portion of the total bluegill population as sampled by fyke nets occurred in the canal, and the highest CPUE occurred in September. Bluegill were captured at temperatures as high as 34.9°C (September), but were uncommon above 32°C. Bluegill have a final temperature preferendum (FTP) of about 31°C (Wismer and Christie 1987). The FTP is the temperature around which fish will ultimately congregate in an infinite temperature gradient (Giattinna and Garton 1982). Bluegill CPUE was lowest in the canal in July and August when temperatures were highest. There was no apparent significant increase in CPUE in other segments of Hooksett Pool during these months, but mortality is not suspected because the highest CPUE observed occurred in September as temperatures generally dropped below 30°C.

The canal population of yellow perch comprised a significant portion of the total Hooksett Pool population as sampled by electrofishing, primarily due to a single high catch in March. Yellow perch were captured at temperatures as high as 27°C, but catches were low above 20.1°C. The FTP for yellow perch is variable, but appears to range between 14 and 24°C. Other than the single high catch in March, yellow perch were not abundant in any segment of Hooksett Pool at any time of the year, and no yellow perch were found in the canal during the warmest water temperatures in July and August.

The target fishes were exposed to higher water temperatures than occurred in the rest of Hooksett Pool, but they appeared to be at little risk of exposure to lethal temperatures. Fishes appeared to avoid high temperatures in the canal by seeking thermal refuge in the main body of Hooksett Pool. This was evidenced either by (1) opposite trends in CPUE between the canal and other segments during July and August; or (2) increasing CPUE in the canal during September and October as fish returned to the relatively warm waters of the canal as water temperatures decrease in the main body of Hooksett Pool.

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APPENDIX

APPENDIX TABLE 1. SCIENTIFIC AND COMMON NAMES OF FISH SPECIES COLLECTED IN THE 1994-1995 MERRIMACK STATION FISHERY STUDY.

SCIENTIFIC NAME	COMMON NAME	ICHTHYO-PLANKTON	ELECTRO-FISHING	FYKE NETS
Anguillidae	freshwater eels			
Anguilla rostrata	American eel		X	X
Cyprinidae	carps and minnows			
Luxilus cornutus	common shiner	X	X	
Notemigonus crysoleucas	golden shiner	X	X	X
Notropis atherinoides	emerald shiner		X	
Notropis hudsonius	spottail shiner	X	X	X
Semotilus atromaculatus	creek chub		X	
Semotilus corporalis	fallfish	X	X	X
Catostomidae	suckers			
Catostomus commersoni	white sucker	X	X	X
Ictaluridae	bullhead catfishes			
Ameiurus natalis	yellow bullhead		X	X
Ameiurus nebulosus	brown bullhead		X	X
Noturus insignis	margined madtom		X	
Esocidae	pikes			
Esox niger	chain pickerel		X	X
Osmeridae	smelts			
Osmerus mordax	rainbow smelt	X		
Salmonidae	trouts			
Oncorhynchus mykiss	rainbow trout			X
Percichthyidae	temperate basses			
Morone americana	white perch	X	X	X
Centrarchidae	sunfishes			
Ambloplites rupestris	rock bass	X	X	X
Lepomis auritus	redbreast sunfish	X	X	X
Lepomis gibbosus	pumpkinseed	X	X	X
Lepomis macrochirus	bluegill	X	X	X
Micropterus dolomieu	smallmouth bass		X	X
Micropterus salmoides	largemouth bass		X	X
Percidae	perches			
Etheostoma olmstedi	tessellated darter	X	X	
Perca flavescens	yellow perch	X	X	X
Stizostedion vitreum	walleye			X

APPENDIX TABLE 2. FYKE NET CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

19-23 OCTOBER 1994

STATION	Pumpkinseed	Rock bass	Bluegill	Smallmouth bass	White sucker	Yellow perch	Largemouth bass	Chain pickerel	Redbreast sunfish	Fallfish	TOTAL
N-9 West					1	3		1			5
N-9 East	3	2	3								8
S-2 West	4			1			2				7
S-4 East	4	3	5	1	5	2		2	1	2	25
Upstream from PSM in new discharge canal	2	4	1	1							8
Downstream from PSM in new discharge canal	42	6	4	9	1		2		2		66
TOTAL	55	15	13	12	7	5	4	3	3	2	119

APPENDIX TABLE 2. FYKE NET CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

3-7 DECEMBER 1994

STATION	Pumpkinseed	Rock bass	Bluegill	Smallmouth bass	White sucker	Yellow perch	Chain pickerel	Redbreast sunfish	Fallfish	Spottail shiner	White perch	TOTAL
N-9 West									1			1
N-9 East	1	1	2	1	1					2		8
S-2 West					1	1						2
S-4 East Upstream from PSM in new discharge canal		1	1				2	1				5
Downstream from PSM in new discharge canal	6	13	15	8	4		4	3			1	54
TOTAL	7	15	18	9	6	1	6	4	1	2	1	70

APPENDIX TABLE 2. FYKE NET CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

3-6 APRIL 1995

STATION	Pumpkinseed	Rock bass	Bluegill	Smallmouth bass	White sucker	Yellow perch	Chain pickerel	Fallfish	Rainbow trout	Walleye	TOTAL
N-9 West		1			2			2			5
N-9 East					2	1		7			10
S-2 West		11				2			1		14
S-4 East						1					1
Upstream from PSM in new discharge canal	2		2		1		2				7
Downstream from PSM in new discharge canal	8	3	3	2						1	17
TOTAL	10	15	5	2	5	4	2	9	1	1	54

APPENDIX TABLE 2. FYKE NET CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

15-17 MAY 1995

STATION	Pumpkinseed	Rock bass	Bluegill	Smallmouth bass	White sucker	Yellow perch	Largemouth bass	Chain pickerel	Redbreast sunfish	Fallfish	White perch	Brown bullhead	TOTAL
N-9 West				1	1								2
N-9 East		3		1		3							7
S-2 West	3	4	1	2	1	2							13
S-4 East		2		2	1	2		1		1			9
Upstream from PSM in new discharge canal			1		7						1	2	11
Downstream from PSM in new discharge canal	6	13	4	8	11		1	1	2			4	50
TOTAL	9	22	6	14	21	7	1	2	2	1	1	6	92

APPENDIX TABLE 2. FYKE NET CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

12-14 JUNE 1995

STATION	Pumpkinseed	Rock bass	Bluegill	Smallmouth bass	White sucker	Yellow perch	Largemouth bass	Redbreast sunfish	TOTAL
N-9 West		5		5	7			2	19
N-9 East									
S-2 West	1		1	3		2			7
S-4 East	1	16	1	5	4			8	35
Upstream from PSM in new discharge canal	10	1	4	3			1	2	21
Downstream from PSM in new discharge canal	2				5				7
TOTAL	14	22	6	16	16	2	1	12	89

APPENDIX TABLE 2. FYKE NET CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

12-14 JULY 1995

STATION	Pumpkinseed	Rock bass	Bluegill	Smallmouth bass	White sucker	Yellow perch	Redbreast sunfish	Fallfish	Brown bullhead	Yellow bullhead	TOTAL
N-9 West					5			1			6
N-9 East		22	2	1		1					26
S-2 West				1							1
S-4 East	3	2	1	5			7			1	19
Upstream from PSM in new discharge canal											
Downstream from PSM in new discharge canal	11			10			5		1		27
TOTAL	14	24	3	17	5	1	12	1	1	1	79

APPENDIX TABLE 2. FYKE NET CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

16-18 AUGUST 1995

STATION	Pumpkinseed	Rock bass	Bluegill	Smallmouth bass	White sucker	Yellow perch	Largemouth bass	Chain pickerel	Redbreast sunfish	American eel	TOTAL
N-9 West		5	1	5	12	1		1			25
N-9 East	1					1	3			1	1
S-2 West	2	9	2	6					5		5
S-4 East											24
Upstream from PSM in new discharge canal											55
Downstream from PSM in new discharge canal	3		1	3							7
TOTAL	6	14	4	14	12	2	3	1	5	1	62

APPENDIX TABLE 2. FYKE NET CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

13-15 SEPTEMBER 1995

STATION	Pumpkinseed	Rock bass	Bluegill	Smallmouth bass	White sucker	Yellow perch	Largemouth bass	Chain pickerel	Redbreast sunfish	Brown bullhead	Golden shiner	TOTAL
N-9 West					6	1						7
N-9 East	1	2	1		8				5	1		18
S-2 West	3		1	6			3					13
S-4 East	1	13	2	1	3		2	3	2			27
Upstream from PSM in new discharge canal	146	13	36	49					15		2	261
Downstream from PSM in new discharge canal	69	21	11	63			3		7	6		180
TOTAL	220	49	51	119	17	1	8	3	29	7	2	506

APPENDIX TABLE 2. FYKE NET CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

. DATES COMBINED

TATION	Pumpkinseed	Rock bass	Bluegill	Smallmouth bass	White sucker	Yellow perch	Largemouth bass	Chain pickerel	Redbreast sunfish	Fallfish	Spottail shiner	White perch	Rainbow trout
		11	1	11	34	5		2	2	4			
I-9 West	5	30	8	3	11	5			5	7	2		1
I-9 East	12	15	3	13	2	8	8						
S-2 West	11	45	11	20	13	5	2	6	23	3			
S-4 East												1	
Upstream from PSM in new discharge canal	160	19	45	53	8		1	4	18				
Downstream from PSM in new discharge canal	147	56	38	103	21		6	5	19			1	
TOTAL	335	176	106	203	89	23	17	17	67	14	2	2	1

ALL DATES COMBINED

STATION	Walleye	Brown bullhead	Yellow bullhead	American eel	Golden shiner	TOTAL
N-9 West						70
N-9 East		1		1		78
S-2 West						62
S-4 East			1			140
Upstream from PSM in new discharge canal					2	313
Downstream from PSM in new discharge canal		2				
TOTAL	1	11				408
	1	14	1	1	2	1071

APPENDIX TABLE 3. ELECTROFISHING CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

21-22 OCTOBER 1994

STATION	Bluegill	Pumpkinseed	Largemouth bass	Smallmouth bass	Redbreast sunfish	Fallfish	American eel	Spottail shiner	Tessellated darter	Rock bass	White sucker	Chain pickerel	Yellow perch
N-9 to N-10 West			1			2		2	2			1	1
N-9 to N-10 East	1		2	2		1		1					
N-8 to N-9 West	1		5										
N-8 to N-9 East													
Zero to S-2 West	9	3	2	6							1		
Zero to S-2 East	1		1										
S-4 to S-5 West	2		1	1	1	1							
S-4 to S-5 East	3		5	5	5								
S-13 to S-15 West			2						1		1		
S-13 to S-15 East			2										
Upstream from PSM in new discharge canal			4	1									
Downstream from PSM in new discharge canal		1	1										
Old canal	43	41	16				3			2			
TOTAL	60	45	42	15	6	4	3	3	3	2	2	1	1

21-22 OCTOBER 1994

STATION	TOTAL
N-9 to N-10 West	9
N-9 to N-10 East	7
N-8 to N-9 West	6
N-8 to N-9 East	
Zero to S-2 West	20
Zero to S-2 East	3
S-4 to S-5 West	6
S-4 to S-5 East	18
S-13 to S-15 West	4
S-13 to S-15 East	2
Upstream from PSM in new discharge canal	5
Downstream from PSM in new discharge canal	2
Old canal	105
TOTAL	187

APPENDIX TABLE 3. ELECTROFISHING CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

1 DECEMBER 1994

STATION	Bluegill	Pumpkinseed	Largemouth bass	Smallmouth bass	Redbreast sunfish	Fallfish	Spottail shiner	Rock bass	White sucker	Yellow perch	White perch	Golden shiner	TOTAL
N-9 to N-10 West									1				1
N-9 to N-10 East			1				2					1	4
N-8 to N-9 West							1						1
N-8 to N-9 East													
Zero to S-2 West	1		11	2	2		2			1			19
Zero to S-2 East			2				1						3
S-4 to S-5 West													
S-4 to S-5 East						2							2
S-13 to S-15 West							14						14
S-13 to S-15 East													
Upstream from PSM in new discharge canal	1	5	3	2	1			2					14
Downstream from PSM in new discharge canal	2	5	12	2			1				4		26
Old canal	16	2	20				2			1			41
TOTAL	20	12	49	6	3	2	23	2	1	2	4	1	125

APPENDIX TABLE 3. ELECTROFISHING CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

28 MARCH 1995

STATION	Bluegill	Pumpkinseed	Smallmouth bass	Fallfish	Spottail shiner	Tessellated darter	Rock bass	White sucker	Yellow perch	Golden shiner	Brown bullhead	Creek chub	Emerald shiner
N-9 to N-10 West				1	1								
N-9 to N-10 East													1
N-8 to N-9 West					1								
N-8 to N-9 East													
Zero to S-2 West			3		103								
Zero to S-2 East			1		6						1		
S-4 to S-5 West					5	8			1	1		1	
S-4 to S-5 East		1		1	5					1			
S-13 to S-15 West					2								
S-13 to S-15 East													
Upstream from PSM in new discharge canal	2	7					1						
Downstream from PSM in new discharge canal		1											
Old canal		3						1	44				
TOTAL	2	12	4	2	123	8	1	1	45	2	1	1	1

28 MARCH 1995

STATION	TOTAL
N-9 to N-10 West	2
N-9 to N-10 East	1
N-8 to N-9 West	1
N-8 to N-9 East	
Zero to S-2 West	106
Zero to S-2 East	8
S-4 to S-5 West	16
S-4 to S-5 East	8
S-13 to S-15 West	2
S-13 to S-15 East	
Upstream from PSM in new discharge canal	10
Downstream from PSM in new discharge canal	1
Old canal	48
TOTAL	203

APPENDIX TABLE 3. ELECTROFISHING CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

9 MAY 1995

STATION	Bluegill	Pumpkinseed	Largemouth bass	Smallmouth bass	Redbreast sunfish	Fallfish	American eel	Spottail shiner	Tessellated darter	Rock bass	Chain pickerel	Yellow perch	Margined madtom
N-9 to N-10 West							1	3	9				
N-9 to N-10 East									1		1		
N-8 to N-9 West								2	10				
N-8 to N-9 East				1					10				
Zero to S-2 West		4		1			4	1		3			1
Zero to S-2 East							2		3				
S-4 to S-5 West							1	16	2				
S-4 to S-5 East		4		3		1		8	4				1
S-13 to S-15 West		1		2			1		2				
S-13 to S-15 East									2				
Upstream from PSM in new discharge canal	1	2		11									
Downstream from PSM in new discharge canal		2	1		1		1						
Old canal	2	8					3			11		1	
TOTAL	3	21	1	18	1	1	13	30	43	14	1	1	2

9 MAY 1995

STATION	Sunfish family	TOTAL
N-9 to N-10 West	1	14
N-9 to N-10 East		2
N-8 to N-9 West		12
N-8 to N-9 East		11
Zero to S-2 West		14
Zero to S-2 East		5
S-4 to S-5 West		19
S-4 to S-5 East		21
S-13 to S-15 West		6
S-13 to S-15 East		2
Upstream from PSM in new discharge canal		14
Downstream from PSM in new discharge canal		5
Old canal		25
TOTAL	1	150

APPENDIX TABLE 3. ELECTROFISHING CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

8 JUNE 1995

STATION	Bluegill	Pumpkinseed	Largemouth bass	Smallmouth bass	Redbreast sunfish	Fallfish	Spottail shiner	Tessellated darter	Rock bass	White sucker	Yellow perch	Golden shiner	Brown bullhead
N-9 to N-10 West	1			1									
N-9 to N-10 East				1	2	2	16		2	1			
N-8 to N-9 West				1		5	77	2		1			
N-8 to N-9 East		1			2				1				
Zero to S-2 West	1	1	5	3	6				1				
Zero to S-2 East		1											
S-4 to S-5 West				4									
S-4 to S-5 East		3		2	8	2					1		
S-13 to S-15 West				1									
S-13 to S-15 East	2	3											1
Upstream from PSM in new discharge canal			1	1	1								
Downstream from PSM in new discharge canal	1	2	10	1									
Old canal	2	1	46	1								1	
TOTAL	7	12	62	16	19	9	93	2	4	2	1	1	1

8 JUNE 1995

STATION	Margined madtom	Common shiner	TOTAL
N-9 to N-10 West			2
N-9 to N-10 East		9	33
N-8 to N-9 West		59	145
N-8 to N-9 East			4
Zero to S-2 West	1		18
Zero to S-2 East			1
S-4 to S-5 West			4
S-4 to S-5 East			16
S-13 to S-15 West			1
S-13 to S-15 East			6
Upstream from PSM in new discharge canal			3
Downstream from PSM in new discharge canal			15
Old canal			51
TOTAL	1	68	299

APPENDIX TABLE 3. ELECTROFISHING CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

18 JULY 1995

STATION	Bluegill	Pumpkinseed	Largemouth bass	Smallmouth bass	Redbreast sunfish	Fallfish	Spottail shiner	Tessellated darter	Rock bass	White sucker	Chain pickerel	Golden shiner	Common shiner
N-9 to N-10 West	2		1		2	17	327		1	12	1		29
N-9 to N-10 East					3				3				
N-8 to N-9 West			1			3	58	2					131
N-8 to N-9 East			1		2								
Zero to S-2 West	58		8	3	1				2				
Zero to S-2 East	63	2	6	2	18				1				
S-4 to S-5 West	106	3	4	1	3							1	
S-4 to S-5 East	58		5	3	19				3				
S-13 to S-15 West	18		1	9	6								
S-13 to S-15 East	80	4	1	16	23		4						
Upstream from PSM in new discharge canal													
Downstream from PSM in new discharge canal													
Old canal	2	2											
TOTAL	387	11	28	34	77	20	389	2	10	12	1	1	160

18 JULY 1995

STATION	Yellow bullhead	TOTAL
N-9 to N-10 West		392
N-9 to N-10 East		6
N-8 to N-9 West		195
N-8 to N-9 East		3
Zero to S-2 West		72
Zero to S-2 East	2	94
S-4 to S-5 West		118
S-4 to S-5 East		88
S-13 to S-15 West		34
S-13 to S-15 East		128
Upstream from PSM in new discharge canal		
Downstream from PSM in new discharge canal		
Old canal		4
TOTAL	2	1134

APPENDIX TABLE 3. ELECTROFISHING CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

22 AUGUST 1995

STATION	Bluegill	Pumpkinseed	Largemouth bass	Smallmouth bass	Redbreast sunfish	Fallfish	Spottail shiner	Tessellated darter	Rock bass	White sucker	Chain pickerel	Yellow perch	Golden shiner
N-9 to N-10 West	59		11		3	5	1131	1	1	1			
N-9 to N-10 East					1								
N-8 to N-9 West	3		6			4	17			1		1	
N-8 to N-9 East			1	1	1								
Zero to S-2 West	65	3	11	2	3								
Zero to S-2 East	135	1	9	3	11								
S-4 to S-5 West	124	1	3	1	3								
S-4 to S-5 East	54		10	2	21								
S-13 to S-15 West	121		5	2	10							1	
S-13 to S-15 East	58		6	3	12						1		4
Upstream from PSM in new discharge canal													
Downstream from PSM in new discharge canal			5										
Old canal	4		2		1								
TOTAL	623	5	69	14	66	9	1148	1	1	2	1	2	4

22 AUGUST 1995

STATION	Common shiner	TOTAL
N-9 to N-10 West	66	1278
N-9 to N-10 East		1
N-8 to N-9 West		32
N-8 to N-9 East	2	5
Zero to S-2 West		84
Zero to S-2 East		159
S-4 to S-5 West		132
S-4 to S-5 East	1	88
S-13 to S-15 West		139
S-13 to S-15 East		84
Upstream from PSM in new discharge canal		
Downstream from PSM in new discharge canal		5
Old canal		7
TOTAL	69	2014

APPENDIX TABLE 3. ELECTROFISHING CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

19 SEPTEMBER 1995

STATION	Bluegill	Pumpkinseed	Largemouth bass	Smallmouth bass	Redbreast sunfish	Spottail shiner	Tessellated darter	Rock bass	White sucker	Chain pickerel	Yellow perch	Common shiner	TOTAL
N-9 to N-10 West	64		2			1						1	68
N-9 to N-10 East			1	3	2	12		1					19
N-8 to N-9 West	2		4						2		1		9
N-8 to N-9 East	1			2									3
Zero to S-2 West	67	6	10		3			5					91
Zero to S-2 East	23	1	3		4								31
S-4 to S-5 West	17	3	6	1	1								28
S-4 to S-5 East	35		4	8	32			3					82
S-13 to S-15 West	147	2	18										167
S-13 to S-15 East	136	2	11		11		1			1	1		163
Upstream from PSM in new discharge canal					1								1
Downstream from PSM in new discharge canal			3										3
Old canal	50	1	2										53
TOTAL	542	15	64	14	54	13	1	9	2	1	2	1	718

APPENDIX TABLE 3. ELECTROFISHING CATCH DATA BY STATION AND SAMPLING DATE DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

ALL DATES COMBINED

STATION	Bluegill	Pumpkinseed	Largemouth bass	Smallmouth bass	Redbreast sunfish	Fallfish	American eel	Spottail shiner	Tessellated darter	Rock bass	White sucker	Chain pickerel	Yellow perch
N-9 to N-10 West	126		15	1	5	25	1	1465	12	2	14	2	1
N-9 to N-10 East	1		4	6	8	3		31	1	6	1	1	
N-8 to N-9 West	6		16	1		12		156	14		4		2
N-8 to N-9 East	1	1	2	4	5				10	1			
Zero to S-2 West	201	17	47	20	15		4	106		11			
Zero to S-2 East	222	5	21	6	33		2	7	3	1	1		
S-4 to S-5 West	249	7	14	8	8	1	1	21	10				
S-4 to S-5 East	150	8	24	23	85	6		13	4	6			
S-13 to S-15 West	286	3	26	14	16		1	16	3		1		
S-13 to S-15 East	276	9	20	19	46			4	3			2	
Upstream from PSM in new discharge canal	4	14	8	15	3					3			
Downstream from PSM in new discharge canal	3	11	32	3	1		1	1					
Old canal	119	58	86	1	1		6	2		13	1		4
TOTAL	1644	133	315	121	226	47	16	1822	60	43	22	5	5

ALL DATES COMBINED

STATION	White perch	Golden shiner	Brown bullhead	Creek chub	Emerald shiner	Margined madtom	Sunfish family	Common shiner	Yellow bullhead	TOTAL
N-9 to N-10 West							1	96		1766
N-9 to N-10 East		1			1			9		73
N-8 to N-9 West								190		401
N-8 to N-9 East								2		26
Zero to S-2 West						2				424
Zero to S-2 East			1						2	304
S-4 to S-5 West		2		1						323
S-4 to S-5 East		1				1		1		323
S-13 to S-15 West										367
S-13 to S-15 East		4	1							385
Upstream from PSM in new discharge canal										47
Downstream from PSM in new discharge canal	4		1							57
Old canal		1								334
TOTAL	4	9	3	1	1	3	1	298	2	4830

APPENDIX TABLE 4. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ICHTHYOPLANKTON SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

10 MAY 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-11 West	13.8	13.8	13.8	9.2	9.1	9.2
N-9 to N-11 Mid	14.7	13.7	14.2	8.8	9.1	9.0
N-9 to N-11 East	14.0	14.0	14.0	8.8	8.7	8.8
N-1 to S-3 West	13.8	13.8	13.8	8.7	8.8	8.8
N-1 to S-3 Mid	14.1	13.4	13.8	8.4	8.4	8.4
N-1 to S-3 East	13.9	13.8	13.9	8.6	8.7	8.7
S-15 to S-19 West	13.7	13.7	13.7	9.2	9.2	9.2
S-15 to S-19 Mid	13.5	13.2	13.4	8.9	8.9	8.9
S-15 to S-19 East	13.8	13.6	13.7	8.6	8.6	8.6

APPENDIX TABLE 4. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ICHTHYOPLANKTON SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

16 MAY 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-11 West	13.5	13.4	13.5	8.8	8.8	8.8
N-9 to N-11 Mid	17.1	13.3	15.2	8.0	8.7	8.4
N-9 to N-11 East	13.4	13.4	13.4	8.6	8.5	8.6
N-1 to S-3 West	13.4	13.3	13.4	8.7	8.8	8.8
N-1 to S-3 Mid	13.2	13.1	13.2	8.8	8.0	8.4
N-1 to S-3 East	13.1	13.1	13.1	8.2	8.3	8.3
S-15 to S-19 West	13.4	13.4	13.4	8.9	8.8	8.9
S-15 to S-19 Mid	13.0	12.9	13.0	8.9	8.9	8.9
S-15 to S-19 East	13.3	13.0	13.2	8.4	8.5	8.5

APPENDIX TABLE 4. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ICHTHYOPLANKTON SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

23 MAY 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-11 West	16.3	16.2	16.3	9.6	9.6	9.6
N-9 to N-11 Mid	18.6	16.6	17.6	9.2	9.5	9.4
N-9 to N-11 East	16.2	16.1	16.2	9.4	9.4	9.4
N-1 to S-3 West	16.3	16.2	16.3	9.6	9.6	9.6
N-1 to S-3 Mid	16.2	16.2	16.2	9.6	9.6	9.6
N-1 to S-3 East	16.1	16.0	16.1	9.4	9.4	9.4
S-15 to S-19 West	16.3	16.2	16.3	9.6	9.7	9.7
S-15 to S-19 Mid	17.4	15.9	16.7	9.3	9.5	9.4
S-15 to S-19 East	16.1	15.9	16.0	9.5	9.4	9.5

APPENDIX TABLE 4. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ICHTHYOPLANKTON SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

30 MAY 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-11 West	17.7	17.6	17.7	8.6	8.6	8.6
N-9 to N-11 Mid	19.1	17.6	18.4	8.0	8.3	8.2
N-9 to N-11 East	18.0	17.9	18.0	8.2	8.1	8.2
N-1 to S-3 West	17.7	17.6	17.7	8.6	8.6	8.6
N-1 to S-3 Mid	17.4	17.3	17.4	8.4	8.4	8.4
N-1 to S-3 East	18.0	17.9	18.0	8.1	8.2	8.2
S-15 to S-19 West	17.6	17.5	17.6	8.8	8.7	8.8
S-15 to S-19 Mid	17.4	17.2	17.3	8.6	8.4	8.5
S-15 to S-19 East	17.8	17.8	17.8	8.3	8.1	8.2

APPENDIX TABLE 4. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ICHTHYOPLANKTON SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

06 JUNE 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-11 West	21.6	21.5	21.6	8.7	8.7	8.7
N-9 to N-11 Mid	22.3	21.3	21.8	8.8	8.4	8.6
N-9 to N-11 East	22.6	21.5	22.1	7.7	7.8	7.8
N-1 to S-3 West	21.6	21.4	21.5	8.7	8.7	8.7
N-1 to S-3 Mid	24.9	21.0	23.0	7.9	8.4	8.2
N-1 to S-3 East	22.2	21.7	22.0	7.7	7.6	7.7
S-15 to S-19 West	21.5	21.3	21.4	8.6	8.6	8.6
S-15 to S-19 Mid	27.3	20.9	24.1	7.5	8.3	7.9
S-15 to S-19 East	21.6	21.1	21.4	7.6	7.4	7.5

APPENDIX TABLE 4. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ICHTHYOPLANKTON SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

13 JUNE 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-11 West	19.4	19.3	19.4	8.3	8.3	8.3
N-9 to N-11 Mid	22.4	19.2	20.8	7.9	8.1	8.0
N-9 to N-11 East	21.2	20.6	20.9	8.0	7.9	8.0
N-1 to S-3 West	19.4	19.2	19.3	8.4	8.3	8.4
N-1 to S-3 Mid	24.0	19.3	21.7	7.6	8.0	7.8
N-1 to S-3 East	21.0	20.0	20.5	8.0	7.6	7.8
S-15 to S-19 West	19.3	19.2	19.3	8.5	8.4	8.5
S-15 to S-19 Mid	26.2	19.1	22.7	7.4	8.0	7.7
S-15 to S-19 East	20.4	19.8	20.1	8.0	7.6	7.8

APPENDIX TABLE 4. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ICHTHYOPLANKTON SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

20 JUNE 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-11 West	24.6	24.5	24.6	8.9	8.8	8.9
N-9 to N-11 Mid	30.5	24.5	27.5	7.2	8.2	7.7
N-9 to N-11 East	27.9	25.3	26.6	7.8	8.0	7.9
N-1 to S-3 West	24.4	24.3	24.4	8.9	8.7	8.8
N-1 to S-3 Mid	31.2	24.3	27.8	7.2	8.2	7.7
N-1 to S-3 East	27.1	24.4	25.8	7.6	7.7	7.7
S-15 to S-19 West	24.3	24.1	24.2	8.6	8.6	8.6
S-15 to S-19 Mid	30.6	24.2	27.4	6.8	8.1	7.5
S-15 to S-19 East	26.2	23.9	25.1	8.1	7.9	8.0

APPENDIX TABLE 4. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ICHTHYOPLANKTON SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

27 JUNE 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-11 West	24.4	24.3	24.4	8.2	8.2	8.2
N-9 to N-11 Mid	29.6	24.6	27.1	6.9	7.3	7.1
N-9 to N-11 East	27.4	25.3	26.4	7.2	7.4	7.3
N-1 to S-3 West	24.4	24.4	24.4	8.0	8.0	8.0
N-1 to S-3 Mid	30.5	24.3	27.4	6.8	7.1	7.0
N-1 to S-3 East	27.1	25.3	26.2	7.1	6.9	7.0
S-15 to S-19 West	24.4	24.4	24.4	8.1	8.0	8.1
S-15 to S-19 Mid	31.1	24.2	27.7	6.7	7.0	6.9
S-15 to S-19 East	26.9	24.9	25.9	6.8	6.3	6.6

APPENDIX TABLE 4. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ICHTHYOPLANKTON SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

ALL DATES COMBINED

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-11 West	18.9	18.8	18.9	8.8	8.8	8.8
N-9 to N-11 Mid	21.8	18.9	20.3	8.1	8.5	8.3
N-9 to N-11 East	20.1	19.3	19.7	8.2	8.2	8.2
N-1 to S-3 West	18.9	18.8	18.8	8.7	8.7	8.7
N-1 to S-3 Mid	21.4	18.6	20.0	8.1	8.3	8.2
N-1 to S-3 East	19.8	19.0	19.4	8.1	8.1	8.1
S-15 to S-19 West	18.8	18.7	18.8	8.8	8.8	8.8
S-15 to S-19 Mid	22.1	18.5	20.3	8.0	8.4	8.2
S-15 to S-19 East	19.5	18.8	19.1	8.2	8.0	8.1

APPENDIX TABLE 5. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH FYKE NET SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

19-23 OCTOBER 1994

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 West	12.1	11.8	11.9	10.2	10.2	10.2
N-9 East	12.2	11.9	12.0	10.1	10.2	10.1
S-2 West	14.5	14.3	14.4	9.6	9.8	9.7
S-4 East	14.1	13.4	13.7	9.5	9.9	9.7
Upstream from PSM in new discharge canal	17.9	17.6	17.7	8.9	9.0	8.9
Downstream from PSM in new discharge canal	17.2	17.0	17.1	8.9	8.9	8.9

APPENDIX TABLE 5. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH FYKE NET SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

3-7 DECEMBER 1994

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 West	1.9	1.9	1.9	13.7	13.6	13.6
N-9 East	1.9	1.8	1.8	13.8	13.7	13.7
S-2 West	7.5	7.5	7.5	12.7	12.6	12.6
S-4 East	2.0	1.9	1.9	13.6	13.6	13.6
Upstream from PSM in new discharge canal	15.9	16.0	15.9	11.7	11.6	11.6
Downstream from PSM in new discharge canal	15.5	15.5	15.5	11.6	11.6	11.6

APPENDIX TABLE 5. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH FYKE NET SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

3-6 APRIL 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 West	3.5	3.6	3.5	12.8	12.8	12.8
N-9 East	3.4	3.5	3.5	12.6	12.9	12.7
S-2 West	7.7	7.8	7.7	12.1	12.0	12.1
S-4 East	3.7	3.6	3.6	12.7	12.7	12.7
Upstream from PSM in new discharge canal	16.5	16.5	16.5	10.8	10.9	10.9
Downstream from PSM in new discharge canal	15.9	15.9	15.9	10.9	11.0	10.9

APPENDIX TABLE 5. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH FYKE NET SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

15-17 MAY 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 West	12.9	12.9	12.9	8.8	8.7	8.7
N-9 East	12.8	12.9	12.8	8.8	8.8	8.8
S-2 West	14.5	14.5	14.4	8.5	8.5	8.5
S-4 East	13.1	13.1	13.1	9.1	9.0	9.0
Upstream from PSM in new discharge canal	23.8	23.2	23.5	7.0	6.9	7.0
Downstream from PSM in new discharge canal	22.0	17.3	19.7	7.1	7.8	7.4

APPENDIX TABLE 5. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH FYKE NET SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

12-14 JUNE 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 West	18.4	18.4	18.4	8.5	8.5	8.5
N-9 East	18.5	18.5	18.5	8.4	8.2	8.3
S-2 West	18.8	18.7	18.7	8.4	8.5	8.4
S-4 East	19.6	19.1	19.3	8.3	8.3	8.3
Upstream from PSM in new discharge canal	32.0	31.7	31.8	7.3	7.4	7.3
Downstream from PSM in new discharge canal	27.9	27.6	27.7	7.4	7.5	7.4

APPENDIX TABLE 5. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH FYKE NET SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

18 JULY 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 West	23.9	23.8	23.9	6.8	6.8	6.8
N-9 East	23.8	23.8	23.8	6.6	6.5	6.5
S-2 West	29.9	27.1	28.5	6.4	7.1	6.7
S-4 East	30.5	27.5	29.0	6.4	6.3	6.3
Upstream from PSM in new discharge canal	39.4	39.2	39.3	6.0	6.1	6.0
Downstream from PSM in new discharge canal	34.6	34.5	34.5	6.4	6.4	6.4

APPENDIX TABLE 5. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH FYKE NET SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

19 SEPTEMBER 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 West	18.7	18.6	18.6	8.0	8.2	8.1
N-9 East	18.6	18.5	18.5	7.7	7.6	7.6
S-2 West	24.4	22.7	23.5	7.1	7.1	7.1
S-4 East	24.4	20.4	22.4	7.5	8.2	7.8
Upstream from PSM in new discharge canal	33.5	33.2	33.3	6.0	6.0	6.0
Downstream from PSM in new discharge canal	30.5	30.3	30.4	6.0	5.9	5.9

APPENDIX TABLE 5. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH FYKE NET SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

ALL DATES COMBINED

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 West	14.6	14.5	14.5	9.4	9.5	9.5
N-9 East	14.5	14.5	14.5	9.3	9.3	9.3
S-2 West	18.4	17.2	17.8	8.9	9.0	8.9
S-4 East	17.1	15.5	16.3	9.2	9.3	9.2
Upstream from PSM in new discharge canal	27.2	26.9	27.0	7.9	7.9	7.9
Downstream from PSM in new discharge canal	24.7	24.0	24.4	8.1	8.2	8.2

APPENDIX TABLE 6. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ELECTROFISH SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

21-22 OCTOBER 1994

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-10 West	12.3	12.3	12.3	9.4	9.5	9.5
N-9 to N-10 East	12.4	12.4	12.4	9.8	9.8	9.8
N-8 to N-9 West	12.4	12.4	12.4	9.7	9.7	9.7
N-8 to N-9 East	12.4	12.3	12.4	9.9	9.6	9.8
Zero to S-2 West	13.0	12.8	12.9	10.0	9.9	10.0
Zero to S-2 East	15.2	14.2	14.7	8.9	9.4	9.2
S-4 to S-5 West	12.6	12.2	12.4	9.6	9.9	9.8
S-4 to S-5 East	14.2	13.9	14.1	9.7	9.7	9.7
S-13 to S-15 West	12.8	12.8	12.8	9.4	9.5	9.5
S-13 to S-15 East	12.3	12.2	12.3	9.4	9.6	9.5
Upstream from PSM in new discharge canal	18.6	18.4	18.5	8.6	8.6	8.6
Downstream from PSM in new discharge canal	17.7	17.6	17.7	8.7	8.6	8.7
Old canal	15.2	12.9	14.1	8.7	9.3	9.0

APPENDIX TABLE 6. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ELECTROFISH SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

1 DECEMBER 1994

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-10 West	1.2	1.2	1.2	13.2	13.2	13.2
N-9 to N-10 East	1.8	1.8	1.8	13.9	13.8	13.9
N-8 to N-9 West	1.3	1.3	1.3	13.4	13.4	13.4
N-8 to N-9 East	1.7	1.7	1.7	14.0	14.0	14.0
Zero to S-2 West	7.3	5.8	6.6	12.2	12.6	12.4
Zero to S-2 East	1.7	1.5	1.6	13.4	13.5	13.5
S-4 to S-5 West	5.5	5.6	5.6	12.6	12.6	12.6
S-4 to S-5 East	1.6	1.6	1.6	13.4	13.4	13.4
S-13 to S-15 West	4.1	4.1	4.1	12.2	12.2	12.2
S-13 to S-15 East	1.0	0.9	1.0	13.2	13.2	13.2
Upstream from PSM in new discharge canal	14.1	13.8	14.0	11.7	11.8	11.8
Downstream from PSM in new discharge canal	15.1	15.1	15.1	11.4	11.4	11.4
Old canal	7.3	7.3	7.3	12.3	12.3	12.3

APPENDIX TABLE 6. WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ELECTROFISH SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

28 MARCH 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-10 West	5.7	5.4	5.6	13.1	13.0	13.1
N-9 to N-10 East	5.7	5.7	5.7	13.0	12.9	13.0
N-8 to N-9 West	5.3	5.3	5.3	13.0	13.0	13.0
N-8 to N-9 East	5.6	5.6	5.6	13.0	12.9	13.0
Zero to S-2 West	9.4	9.2	9.3	12.4	12.3	12.4
Zero to S-2 East	5.9	5.7	5.8	13.1	13.1	13.1
S-4 to S-5 West	8.0	7.9	8.0	12.3	12.2	12.3
S-4 to S-5 East	5.6	5.4	5.5	13.0	13.0	13.0
S-13 to S-15 West	6.9	6.8	6.9	12.2	12.2	12.2
S-13 to S-15 East	4.8	4.8	4.8	12.2	12.2	12.2
Upstream from PSM in new discharge canal	17.8	17.8	17.8	11.2	11.3	11.3
Downstream from PSM in new discharge canal	17.1	17.1	17.1	11.0	10.9	11.0
Old canal	15.7	12.8	14.3	11.2	11.1	11.2

APPENDIX TABLE 6. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ELECTROFISH SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

9 MAY 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-10 West	13.2	13.1	13.2	10.3	10.1	10.2
N-9 to N-10 East	13.5	13.5	13.5	10.4	10.5	10.4
N-8 to N-9 West	12.9	12.9	12.9	10.3	10.2	10.3
N-8 to N-9 East	13.6	13.5	13.6	10.6	10.4	10.5
Zero to S-2 West	13.7	13.6	13.7	9.9	9.8	9.9
Zero to S-2 East	13.1	13.2	13.2	10.0	10.0	10.0
S-4 to S-5 West	13.1	12.8	13.0	10.0	9.9	10.0
S-4 to S-5 East	13.0	13.0	13.0	10.0	10.0	10.0
S-13 to S-15 West	13.0	12.9	13.0	9.8	9.8	9.8
S-13 to S-15 East	12.2	12.2	12.2	10.1	9.8	10.0
Upstream from PSM in new discharge canal	25.5	25.4	25.5	8.0	7.9	8.0
Downstream from PSM in new discharge canal	24.1	24.0	24.1	7.8	7.9	7.9
Old canal	19.5	17.9	18.7	9.1	9.6	9.4

APPENDIX TABLE 6. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ELECTROFISH SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

8 JUNE 1995

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-10 West		20.7	20.7		7.9	7.9
N-9 to N-10 East		20.5	20.5		7.7	7.7
N-8 to N-9 West		20.7	20.7		8.0	8.0
N-8 to N-9 East		20.5	20.5		7.6	7.6
Zero to S-2 West		21.5	21.5		8.2	8.2
Zero to S-2 East		27.5	27.5		7.3	7.3
S-4 to S-5 West		22.6	22.6		7.7	7.7
S-4 to S-5 East	23.8	23.6	23.7	7.6	7.6	7.6
S-13 to S-15 West		23.1	23.1		7.1	7.1
S-13 to S-15 East		22.5	22.5		7.3	7.3
Upstream from PSM in new discharge canal		33.4	33.4		6.9	6.9
Downstream from PSM in new discharge canal		31.0	31.0		6.8	6.8
Old canal		29.0	29.0		6.9	6.9

APPENDIX TABLE 6. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ELECTROFISH SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

12-14 JULY 1995

STATION	TEMP		D_O	
	BOTTOM	DEPTHS COMBINED	BOTTOM	DEPTHS COMBINED
N-9 to N-10 West	23.8	23.8	8.0	8.0
N-9 to N-10 East	24.0	24.0	8.4	8.4
N-8 to N-9 West	23.9	23.9	7.9	7.9
N-8 to N-9 East	24.0	24.0	8.3	8.3
Zero to S-2 West	28.9	28.9	7.2	7.2
Zero to S-2 East	29.1	29.1	7.1	7.1
S-4 to S-5 West	28.4	28.4	7.1	7.1
S-4 to S-5 East	27.8	27.8	7.0	7.0
S-13 to S-15 West	26.2	26.2	6.5	6.5
S-13 to S-15 East	25.7	25.7	6.8	6.8
Upstream from PSM in new discharge canal	38.0	38.0	7.0	7.0
Downstream from PSM in new discharge canal	34.4	34.4	6.8	6.8
Old canal	32.8	32.8	7.0	7.0

APPENDIX TABLE 6. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ELECTROFISH SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

16-18 AUGUST 1995

STATION	TEMP		D_O	
	BOTTOM	DEPTHS COMBINED	BOTTOM	DEPTHS COMBINED
N-9 to N-10 West	24.1	24.1	8.4	8.4
N-9 to N-10 East	24.8	24.8	8.6	8.6
N-8 to N-9 West	24.2	24.2	8.6	8.6
N-8 to N-9 East	24.6	24.6	8.8	8.8
Zero to S-2 West	29.4	29.4	7.5	7.5
Zero to S-2 East	31.3	31.3	6.9	6.9
S-4 to S-5 West	29.9	29.9	6.9	6.9
S-4 to S-5 East	29.7	29.7	6.7	6.7
S-13 to S-15 West	27.7	27.7	6.8	6.8
S-13 to S-15 East	26.5	26.5	6.7	6.7
Upstream from PSM in new discharge canal	37.8	37.8	7.3	7.3
Downstream from PSM in new discharge canal	33.1	33.1	6.7	6.7
Old canal	32.4	32.4	6.3	6.3

APPENDIX TABLE 6. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ELECTROFISH SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

13-15 SEPTEMBER 1995

STATION	TEMP		D_O	
	BOTTOM	DEPTHS COMBINED	BOTTOM	DEPTHS COMBINED
N-9 to N-10 West	17.8	17.8	8.5	8.5
N-9 to N-10 East	18.3	18.3	8.4	8.4
N-8 to N-9 West	17.5	17.5	8.5	8.5
N-8 to N-9 East	18.1	18.1	8.6	8.6
Zero to S-2 West	25.2	25.2	7.4	7.4
Zero to S-2 East	25.8	25.8	7.7	7.7
S-4 to S-5 West	24.8	24.8	7.8	7.8
S-4 to S-5 East	24.5	24.5	7.7	7.7
S-13 to S-15 West	21.1	21.1	7.9	7.9
S-13 to S-15 East	20.1	20.1	7.8	7.8
Upstream from PSM in new discharge canal	31.5	31.5	7.3	7.3
Downstream from PSM in new discharge canal	28.1	28.1	6.9	6.9
Old canal	27.9	27.9	7.4	7.4

APPENDIX TABLE 6. MEAN WATER TEMPERATURE (°C) AND DISSOLVED OXYGEN (mg/l) DATA ASSOCIATED WITH ELECTROFISH SAMPLING DURING THE 1994-95 MERRIMACK STATION FISHERIES SURVEY.

ALL DATES COMBINED

STATION	TEMP			D_O		
	SURFACE	BOTTOM	DEPTHS COMBINED	SURFACE	BOTTOM	DEPTHS COMBINED
N-9 to N-10 West	8.1	14.8	12.6	11.5	9.8	10.4
N-9 to N-10 East	8.4	15.1	12.9	11.8	10.0	10.6
N-8 to N-9 West	8.0	14.8	12.5	11.6	9.9	10.5
N-8 to N-9 East	8.3	15.0	12.8	11.9	10.0	10.6
Zero to S-2 West	10.9	18.3	15.8	11.1	9.4	10.0
Zero to S-2 East	9.0	18.5	15.4	11.4	9.4	10.0
S-4 to S-5 West	9.8	18.0	15.3	11.1	9.3	9.9
S-4 to S-5 East	11.6	17.4	15.2	10.7	9.4	9.9
S-13 to S-15 West	9.2	16.8	14.3	10.9	9.0	9.6
S-13 to S-15 East	7.6	15.6	12.9	11.2	9.2	9.9
Upstream from PSM in new discharge canal	19.0	27.0	24.3	9.9	8.5	9.0
Downstream from PSM in new discharge canal	18.5	25.1	22.9	9.7	8.3	8.7
Old canal	14.4	21.6	19.2	10.3	8.7	9.3