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**VERMONT YANKEE/CONNECTICUT RIVER SYSTEM
ANALYTICAL BULLETIN 82**

**ABUNDANCE OF JUVENILE AMERICAN SHAD
IN THE VERNON POOL DURING 2004**

MAY 2005

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IN THE VERNON POOL DURING 2004**

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ABSTRACT

A fifth year of sampling was conducted to estimate an index of abundance of juvenile American shad and other fish taxa found in Vernon Pool of the Connecticut River (between Vernon and Brattleboro, VT) during July through October 2004. The program began during 2000 and was continued during 2001 through 2003 using the same sampling design, gear and deployment techniques. A 30.5 m (100 ft.) beach seine was deployed to sample the shore zone (water less than 3 m [10 ft.] deep) during the day, and a 1.8 m x 1.2 m (6 ft. x 4 ft.) midwater trawl was used to sample pelagic waters (greater than 3 m [10 ft.] deep) at night. Twenty randomly selected beaches were sampled with the seine and twelve randomly selected midwater trawl tows were taken during each of eight surveys scheduled on alternating weeks in each year 2000 through 2003. The midwater trawl program was discontinued in 2004 because it has been ineffective in capturing juvenile shad in the pelagic zone of Vernon Pool during each of the previous four surveys. Instead, an extra 12 beach seine samples were collected in each of the eight surveys scheduled during 2004 to replace the sampling effort lost by terminating the midwater trawl program. The catch of fish in each sample was identified to species, enumerated, and measured. The beach seine survey caught an annual total of 3125 fish in Vernon Pool during 2004, and the catch comprised 16 fish taxa. Bluegill (1208 fish), black crappie (566 fish), yellow perch (451 fish), and golden shiner (393 fish) were the most abundant fish species caught by seines, collectively comprising 84% of the total seine catch in 2004. Juvenile American shad ranked seventh in abundance (82 fish) among the 16 fish species caught by seines during 2004. The juvenile American shad were caught in the two surveys in August (8-14 August and 21-28 August), one survey in early September (5-11 September), and the first survey in October 2004 (3-9 October). Juvenile American shad were primarily caught in the Vernon Region during the two surveys in August (23 fish and 16 fish) and during the first survey in October (39 fish), but the Brattleboro Region (1 fish during 5-11 September) and Cersosimo Region (2 fish during 8-14 August) also contributed fish during the 2004. The mean length of the 25 American shad caught by seine during the week of 8-14 August 2004 was 75 mm total length (S.E. = 1.0 mm), the mean length of the 16 American shad caught by seine during the week of 21-28 August 2004 was 86 mm total length (S.E. = 1.4 mm), the mean length of the 2 American shad caught by seine during the week of 5-11 September 2004 was 86 mm total length (S.E. = 8.5 mm), and the mean length of the 39 American shad caught by seine during the week of 3-9 October 2004 was 95 mm total length (S.E. = 0.9 mm). The difference in mean lengths between first and last collection weeks suggest that juvenile American shad in Vernon Pool exhibited a growth rate of about 2.5 mm per week during 2004. When the weekly mean catch/seine haul of American shad were weighted by the area of beach habitat in each region and summed across regions, the resulting combined standing crop index of juvenile American shad abundance in Vernon Pool was between 0 fish and 7915 fish among the eight survey weeks of 2004. The average of the eight weekly standing crops produced a combined standing crop index of 2066 juvenile American shad in Vernon Pool during 2004. This 2004 index was highly variable among weeks and regions, with a standard error of ± 2041 fish. The juvenile American shad standing crop index of 2066 fish for Vernon Pool in 2004 was intermediate among the five-year annual time series of index values (31,244 fish in 2000, 2433 fish in 2001, 10,528 fish in 2002, and 723 fish in 2003).

1.0 INTRODUCTION

One of the stated objectives by the Shad Studies Subcommittee of the Connecticut River Atlantic Salmon Commission in "A Management Plan for American Shad in the Connecticut River Basin" (prepared February 1992) is that population monitoring is required to support the achievement of the management goal of sustaining 1.5 to 2 million shad in the Connecticut River system. Entergy Nuclear Vermont Yankee LLC (Vermont Yankee) has participated in the long-term population monitoring in previous years (e.g., Vermont Yankee Analytical Bulletin Nos. 40, 42, and 71), and in 1997 agreed to evaluate beach seining and electrofishing at locations that could be used to develop a juvenile shad index of relative abundance (Normandeau 1998, Bulletin No. 71). Sampling via electrofishing and beach seine continued in 1998 and 1999 (Normandeau 1999, Bulletin No. 73; Normandeau 2000, Bulletin No. 75).

The juvenile shad program first conducted during 2000 was significantly modified and expanded from the 1999 and previous programs (Normandeau 2001, Bulletin No. 76). Based on three consecutive years of effort with little success (1997, 1998, and 1999), electrofishing for young-of-the-year (YOY or juvenile) shad was judged ineffective and was not conducted above the Vernon Dam in 2000. Furthermore, beach seine sampling in the West River near Brattleboro, VT (Retreat Meadows) was not conducted in 2000 because efforts in 1998 and 1999 failed to capture any YOY shad (Normandeau 2000, Bulletin No. 75). Cost savings from these changes and from terminating monthly fish sampling with trap nets in the Connecticut River to provide protection for bald eagles nesting in our sampling area allowed for an expansion of fishing effort for YOY shad in the 2000 study. The sampling design conducted during July through October 2000 replaced approximately 7 beach seine samples and electrofishing samples collected twice per month with a standard design of 20 beach seine samples and 12 midwater trawl samples collected twice per month at randomly selected locations.

The sampling design first implemented in 2000, and continued in 2001 through 2003, obtained sufficient data to calculate a juvenile shad index of relative abundance in Vernon Pool for all four years (Normandeau 2001, 2002, 2003 and 2004a; Bulletins No. 76, 78, 79, and 81). The abundance index for Vernon Pool was defined in terms of the mean catch per unit of effort (CPUE) and standing crop of juvenile shad collected in bimonthly samples from a set of randomly selected sampling stations during a consistent time period (July through October) and region (Vernon Dam upstream for 11.6 km [7.2 mi.] to the confluence with the West River). The sampling design for Vernon Pool was similar to one used to estimate for juvenile shad year class strength in the lower Connecticut River (Essex, CT [kilometer 11.3] to Northampton, MA [kilometer 138]) based on CPUE from a bag seine and a midwater trawl survey conducted at 12 sampling stations (Marcy 1976; Crecco et al. 1981; Savoy et al. 2004a).

The goal of the 2004 program was to continue the juvenile shad sampling program conducted during 2000 through 2003. However the midwater trawl program was discontinued in 2004 at the recommendation of Vermont Yankee's Environmental Advisory Committee because it has been ineffective in capturing juvenile shad in the pelagic zone of Vernon Pool during each of the previous four surveys. Instead, an extra 12 beach seine samples were scheduled for collection in each of the eight surveys during 2004 to replace the sampling effort lost by terminating the midwater trawl program. Use of the same beach seine sampling design and sampling procedures consistently across

years will develop a time series of relative abundance indices to measure inter-annual variations in year class strength of juvenile American shad in Vernon Pool.

2.0 MATERIALS AND METHODS

2.1 STUDY AREA

The proposed study area referred to as "Vernon Pool" was defined as the mainstem Connecticut River extending from the Vernon Hydroelectric Dam in Vernon, VT upstream approximately 11.6 km (7.2 mi.) to the confluence of the West River in Brattleboro, VT (Figure 1). The study area included the "Cersosimo Lake" backwater area of the Connecticut River but not the Retreat Meadows area of the West River or other West River habitat. Vernon Pool was partitioned into the following four regions or strata based on a habitat survey of the shoreline and bathymetry conducted during the 2000 survey (Normandeau 2001, Bulletin No. 76): Vernon, Cersosimo, Brattleboro, and Cersosimo Lake (Figure 2). Surface area of the beach zone of each stratum was calculated for use to "weight" the abundance index of YOY shad (Table 1). The beach zone was defined as water from the shoreline out to the 3 m (10 ft) depth contour. By using these weighting factors, a "combined standing crop" index based on the proportion of the shore zone habitat sampled in each region, the total amount of that shore zone habitat in the study area, and the catch of YOY shad in each habitat and week could be calculated for each week.

A total of 131 beaches were identified as candidate sampling sites in Vernon Pool during the 2000 survey (Normandeau 2001, Bulletin No. 76). However, 10 of these original 131 beaches were found to be inaccessible for sampling in 2002 and 2003 due to obstructions. Therefore, 121 beaches were considered potential sampling sites in 2004, with 39 beaches in the Vernon Region, 25 beaches in the Cersosimo Region, 52 beaches in the Brattleboro Region, and 5 beaches in the Cersosimo Lake backwater (Figure 2, Table 2).

2.2 SAMPLING DESIGN

Eight beach seine surveys were conducted in the Vernon Pool study area during July through October 2004 to determine the abundance and catch per unit of effort of YOY American shad and other fish species. The first survey was during the week beginning Sunday, 11 July 2004, and beach seine sampling continued every other week through Saturday, 23 October 2004, for a total of eight surveys. The actual number and allocation of 32 seine hauls for each survey was determined based on random selection of available beaches using a proportional allocation scheme (in direct proportion to the amount of habitat in each region or stratum, Cochran, 1977). Each beach was randomly selected for sampling in each survey (without replacement) from among all available sampling locations in each region. For example, in the Brattleboro Region of the Connecticut River, we identified 52 beaches that were potentially available for beach seine sampling based on the shoreline, slope, substrate and absence of large obstructions, and then randomly selected four of these beaches for sampling in each weekly survey. Two alternate sites were also randomly selected for sampling with each gear in each week and region in case it was not possible to sample the primary site due to obstructions or extensive weed beds. Complete inventories of the station names and GPS coordinates of all beaches that were available for sampling during 2004 are presented in this bulletin as Table 2.

2.3 BEACH SEINE SURVEY

The beach seining conducted in Vernon Pool since 1997 established the effectiveness of this gear for capturing YOY American shad, and the same sampling design conducted during 2000-2003 was repeated during 2004. However, an additional 12 beaches were added to the sampling effort in 2004 to replace the sampling effort lost by terminating the midwater trawl program, resulting in a total of 32 beaches sampled in each weekly survey. For each survey, the 32 beaches were randomly selected from all 121 available beaches and sampled during the day (one hour after sunrise to one hour before sunset) with a 100 ft x 8 ft x 3/8 in. delta mesh beach seine (30.5 m long) using standardized deployment practices. One additional beach was sampled in each of the Brattleboro and Cersosimo regions, two additional beaches were sampled in the Cersosimo Lake region, and eight additional beaches were added to the Vernon region during 2004 compared to the previous four years of beach seine surveys. Habitat weighting resulted in the random selection and sampling of 4 beaches in the Brattleboro Region, 4 beaches in the Cersosimo Region, 20 beaches in the Vernon Region, and 4 beaches in the Cersosimo Lake Region of Vernon Pool during each survey (Table 1).

The entire catch of fish in each beach seine sample was identified to species, enumerated, and measured to the nearest mm total length (TL). All American shad caught were identified, enumerated, measured to the nearest mm TL, and weighed to the nearest gram. Unusually large catches of American shad or other fish species were randomly subsampled so that at least 50 individuals of each species in the sample were measured for length and weight, and the remaining portion of the sample was counted. All field sampling was performed in strict accordance with Standard Operating Procedures (Normandeau 2004b).

2.4 ANALYTICAL METHODS

Catch-Per-Unit-Effort

Catches from the beach seines were reported as number caught per seine haul (catch-per-unit-effort [CPUE]) by life stage and species. The average CPUE for seines in a region and its standard error were calculated using Equations 1 and 2:

$$C_{rw} = \frac{1}{n_{rw}} \sum_{i=1}^{n_{rw}} C_{irw} \quad (1)$$

C_{rw} = Average CPUE in region r during week w.

C_{irw} = CPUE for sample in region r during week w.

n_{rw} = Number of samples taken in region r during week w.

$$SE(C_{rw}) = \frac{\sum_{i=1}^{n_{rw}} (C_{irw} - C_{rw})^2}{n_{rw} (n_{rw} - 1)} \quad (2)$$

where

$SE(C_{rw})$ = Standard error of average CPUE in region r during week w.

C_{rw} = Average regional CPUE calculated in Equation 1.

Standing Crop Estimates

An index of regional standing crop (and standard error) for the beach seines was obtained by multiplying CPUE and the surface area of the shore zone and dividing by the empirically derived estimate of the area sampled by the 100 ft (30.5-m) beach seine (Equations 3 and 4). The weekly index of standing crop for the shore zone was calculated as the sum of the 4 regional standing crops (Equations 5 and 6).

$$SC_{rw} = (C_{rw}A_r)/A \quad (3)$$

SC_{rw} = Standing crop index for the shore zone in region r during week w.

C_{rw} = Average regional CPUE calculated in Equation 1.

A_r = Surface area (m²) of the shore zone in region r.

A = Surface area (m²) sampled by the beach seine (450 m²) (TI 1981).

$$SE(SC_{rw}) = \frac{[SE(C_{rw})](A_r)}{A} \quad (4)$$

where

$SE(SC_{rw})$ = Standard error of standing crop index for the shore zone in region r during week w.

$SE(C_{rw})$ = Standard error of average regional CPUE calculated in Equation 2.

$$SC_w = \sum_{r=1}^r SC_{rw} \quad (5)$$

where

$SC(SC_w)$ = Standing crop index for week w.

$SC(SC_{rw})$ = Regional standing crop index calculated in Equation 3.

$$SE(SC_w) = \sqrt{\sum_{r=1}^r [SE(SC_{rw})]^2} \quad (6)$$

where

$SE(SC_w)$ = Standard error of standing crop index for week w.

$SE(SC_{rw})$ = Standard error of regional standing crop index calculated in Equations 6.

3.0 RESULTS

3.1 SAMPLING EFFORT

A total of 32 beach seine samples were collected in Vernon Pool of the Connecticut River during each of the eight biweekly surveys, resulting in the collection of 256 beach seine samples in the July through October 2004 period.

3.2 CATCH AND SPECIES COMPOSITION

The beach seine survey caught an annual total of 3125 fish in Vernon Pool, and the total catch comprised 16 fish taxa during 2004 (Tables 3 and 4). At least two fish were caught in each region and week that the beach seine was fished in Vernon Pool. Bluegill (1208 fish) was the most abundant fish species caught by seines during 2004. Black crappie (566 fish) ranked second in total abundance, yellow perch (451 fish) ranked third in total abundance, golden shiner was fourth (393 fish), largemouth bass (137 fish) was fifth, pumpkinseed (92 fish) was sixth, and American shad (82 fish) was seventh in total abundance during 2004 (Table 4). These seven fish species collectively contributed 94% of the total catch by beach seine in 2004. The remaining nine fish species collectively contributed only 6% (196 fish) of the total beach seine catch during 2004.

Juvenile American shad was seventh in abundance ranking among the fish species caught by seines in Vernon Pool during 2004 (Table 4). A total of 82 juvenile American shad were caught by beach seine during four surveys in 2004, and the catch came from the two surveys in August (8-14 August and 21-28 August), one survey in early September (5-11 September), and the first survey in October 2004 (3-9 October, Table 4). American shad were primarily caught in the Vernon Region during the two surveys in August (23 fish and 16 fish) and during the first survey in October (39 fish), but the Brattleboro Region (1 fish during 5-11 September) and Cersosimo Region (2 fish during 8-14 August) also contributed fish during the 2004 (Table 4). The 23 juvenile shad caught in the Vernon Region during the week of 8-14 August 2004 were from one seine haul taken on 10 August at Beach Number 86 (Figure 2C). The 16 juvenile shad caught in the Vernon Region during the week of 21-28 August 2004 were from one seine haul taken on 25 August 2004 at Beach Number 114 (Figure 2D). One juvenile American shad was caught in one seine haul on 7 September 2004 at Beach Number 94 in the Vernon Region (Figure 2C). The 39 juvenile shad caught in the Vernon Region during the week of 3-9 October were from two seine hauls, one haul on 4 October at Beach Number 90 produced one fish, and the second haul produced 38 fish on 7 October at Beach Number 106. Station 25 sampled on 7 September 2004 in the Brattleboro Region produced one juvenile American shad from one seine haul (Figure 2A), and Station 60 in the Cersosimo Region sampled on 7 September 2004 produced two juvenile American shad from one seine haul (Figure 2B).

Juvenile American shad caught during four weeks in the 2004 beach seine survey in Vernon Pool exhibited weekly changes in length-frequency distributions and mean length demonstrate growth during the 2004 program (Figure 3). The mean length of the 25 American shad caught by seine during the week of 8-14 August 2004 was 75 mm total length (S.E. = 1.0 mm), with a range in length from 66 mm to 85 mm. The mean length of the 16 American shad caught by seine during the week of 21-28 August 2004 was 86 mm total length (S.E. = 1.4 mm), with a range in length from 71 mm to 95 mm. The mean length of the 2 American shad caught by seine during the week of 5-11 September 2004 was 86 mm total length (S.E. = 8.5 mm), with a range in length from 78 mm to 95 mm. The

mean length of the 39 American shad caught by seine during the week of 3-9 October 2004 was 95 mm total length (S.E. = 0.9 mm), with a range in length from 84 mm to 108 mm. The difference in mean lengths between first and last collection weeks suggest that juvenile American shad in Vernon Pool exhibited a growth rate of about 2.5 mm per week during 2004.

The beach seine catch of all fish species combined increased successively from the first through the seventh surveys in 2004, reaching a peak abundance of 633 fish during the week of 3-9 October 2004, and then declined in the last week of the survey (366 fish, 17-23 October, Table 4). The observed temporal pattern of increase was influenced most by corresponding changes in bluegill, black crappie, and golden shiner abundance in the Vernon and Cersosimo Lake Regions (Table 4). The Vernon Region contributed the most fish to the total catch (1622 fish or 52%) throughout 2004, but this was not surprising since this region also had most of the seine sampling effort. The Cersosimo Lake Region contributed the second most number of fish in 2004, with 1058 fish representing 34% of the total beach seine catch (Table 4).

3.2 CATCH PER UNIT EFFORT (CPUE)

The weekly mean CPUE for all fish taxa combined in the beach seine survey was between a low of 5.03 fish/haul among all sampling regions of Vernon Pool during the week of 11-17 July 2004 and a high of 19.78 fish/haul during the week of 3-9 October 2004 (Table 5). Bluegill (7.88 fish/haul), golden shiner (3.75 fish/haul), and black crappie (3.31 fish/haul) were the fish species contributing most to the seasonal peak in CPUE during the week of 3-9 October 2004 (Table 5). The highest regional mean CPUE for all fish taxa combined was 72.25 fish/haul observed in the Cersosimo Lake Region of Vernon Pool during the week of 3-9 October 2004 (Table 5). The Cersosimo Lake Region also exhibited a relatively high CPUE for all fish taxa combined of 42.50 fish/haul during the week of 21-28 August and a CPUE of 41.75 fish/haul during the week of 19-25 September 2004 (Table 5). Bluegill, black crappie, and golden shiner contributing most to this Cersosimo Lake Region peak in CPUE (Table 5).

The weekly mean CPUE for American shad in the beach seine survey was low throughout the 2004 survey compared to the CPUE for resident fish taxa, and was 0.00 fish/haul among all sampling regions of Vernon Pool during the first two surveys (July) and during the last survey in September (19-25 September) and last survey in October (17-23 October) of 2004 (Table 5). American shad were caught predominantly in the Vernon Region during four separate weeks of 2004. CPUE was 1.15 fish/haul during the week of 8-14 August, CPUE was 0.80 fish/haul during the week of 21-28 August, CPUE was 0.05 fish/haul during the week of 5-11 September, and CPUE was 1.95 fish/haul in the Vernon Region during the week of 3-9 October 2004 (Table 5). American shad were also caught in the Brattleboro Region during the week of 5-11 September 2004, with a CPUE of 0.25 fish/haul, and exhibited a CPUE of 0.50 in the Cersosimo Region during the week of 8-14 August 2004 (Table 5). No American shad were caught in the Cersosimo Lake Region in any week during the 2004 survey (Table 5). Sampling variability was also high, with the standard error of the mean CPUE equal to or nearly equal to the mean CPUE in each region (Table 5). The high variability is most likely a result of schooling behavior in juvenile American shad, which makes the probability of catching fish at any one beach low, but when they are present the CPUE will be high. For example, The CPUE of 1.95 juvenile American shad per haul from the Vernon Region during the week of 3-9 October 2004 had a standard error of 1.90 (Table 5), which was the result of a catch of 39 juvenile shad from just two seine hauls out of a total of 20 seine hauls in that week and region, one haul on 4

October at Beach Number 90 produced one fish, and the second haul produced 38 fish on 7 October at Beach Number 106 (Figure 2C).

3.3 JUVENILE AMERICAN SHAD STANDING CROP INDEX

The Brattleboro, Cersosimo and Vernon Regions in Vernon Pool all contributed juvenile American shad to the weekly combined standing crop index in 2004, and this contribution came from four out of the eight surveys, 8-14 August, 21-28 August, 5-11 September, and 3-9 October 2004 (Table 6). When the average was taken among all eight weeks in the 2004 survey, the standing crop index for Vernon Pool was 2066 juvenile American shad with a standard error of ± 2041 fish. The beach seine survey contributed all of the fish to the index in 2004, as it has in all past surveys except 2003.

4.0 DISCUSSION

The beach seine survey continues to be an effective program for sampling juvenile American shad and other fish taxa in Vernon Pool. Random allocation of the sampling effort among four geographic regions made the beach seine survey conducted during 2000 through 2004 was more robust and representative of the entire Vernon Pool compared with previous surveys. The random design was not subjected to variability associated with changes in fish distribution compared with a fixed location design such as sampling only in Cersosimo Lake.

All five annual surveys demonstrated that significant numbers of juvenile American shad are found in the Vernon Pool section of the Connecticut River (Table 7). The Vernon Region has consistently contributed most of the fish to the standing crop index among all five years (Table 7) compared to the other regions identified in Vernon Pool, and has a substantial amount of beach habitat (Table 1) that may represent a nursery area for juvenile American shad. The shallow, nearshore habitat along the east shore of lower Vernon Pool opposite Vermont Yankee in the New Hampshire setback area has consistently produced the highest seine catches of juvenile American shad among the five surveys.

The 2004 survey was begun one-week later in July than surveys performed during 2000 through 2002, and in the same Julian week as the 2003 survey in an attempt to synchronize the sampling period later in anticipation of a late adult spawning migration. Zero seine catches in all regions during the first two surveys of 2004 (July) reflected appropriate synchronization in the annual development cycle for juvenile American shad in Vernon Pool. In 2000, the highest weekly standing crop index for juvenile American shad was observed during the week of 7-11 August (Normandeau 2001, Bulletin no. 76), while during 2001, the peak standing crop index was observed nearly two months later during the week 1-5 October 2001 (Normandeau 2001, Bulletin No. 78). In 2002, juvenile American shad abundance reached a peak during the last two weeks of the 2002 survey (Normandeau 2003, Bulletin No. 79), and in 2003, juvenile American shad abundance reached a peak during the last week of September (Normandeau 2004a, Bulletin No. 81). The occurrence of the peak seine standing crop index during the middle four weeks of the 2004 survey indicates that starting in Mid July was effective in centering the survey effort coincident with the peak seasonal occurrence of juvenile shad in Vernon Pool.

Marcy (1976) considered year class strength of American shad in the Connecticut River to be dependent primarily on the following three factors: number of adults potentially available to spawn, water temperature, and discharge. A multiple linear regression model developed by Marcy (1976) revealed a highly significant relationship ($p < 0.05$) between year class strength (CPUE) and the

combination of available spawning adults, water temperature, and discharge. Marcy stated that this model can explain 86% of the variability in year class strength and could therefore be used to predict the production of juvenile shad in a particular year with a relatively high degree of success. However, with only five years (2000 through 2004) of annual standing crop indices, it is premature to develop a model to predict year class strength of juvenile American shad in Vernon Pool.

Examining the observed relationship between the number of adult American shad in Vernon Pool and the juvenile shad standing crop index for 2000 through 2004 (Table 8) suggests that the index may be better correlated with the number of adult females in Vernon Pool or the number of adult females passing upstream through the Vernon Dam fishway than the total adult spawning run. The Pearson product moment correlation coefficient (r^2) describing the relationship between the juvenile shad beach seine standing crop abundance index for Vernon Pool (Y) and the combined number of adult female American shad stocked or passed into Vernon Pool (X) was 0.44, compared to an r^2 of 0.28 for the relationship between the index and the total number of adult shad in Vernon Pool. This means that 44% of the year to year variation in the juvenile shad standing crop index over the past five years (2000-2004) is explained by the relationship with the number of adult female shad in Vernon Pool, compared to only 28% of the variation explained by the relationship with the total number of adult shad in Vernon Pool. The total number of adult shad in Vernon Pool was similar between 2000 (1,807 fish) and 2001 (1,737 fish), while the juvenile shad index was nearly 13 times higher in 2000 (31,244 juvenile fish) than in 2001 (2,433 fish). The total number of adult shad in Vernon Pool was also similar among the past three years (956 fish in 2002, 1137 fish in 2003, and 1005 fish in 2004), while the juvenile shad index was nearly 15 times higher in 2002 (10,528 juvenile fish) than in 2003 (723 fish), and was 5 times higher in 2002 compared to 2004 (2,066 fish). The estimated total number of adult female (roe) shad in Vernon Pool was 701 fish in 2000 and 168 fish in 2001 (Table 8). However, the lowest juvenile shad standing crop index was observed in 2003, while the total number of adult female shad in 2003 (525 females) was the second highest and similar to 2002 (402 females) and 2004 (469 females) compared to 2000 or 2001.

Other factors in addition to the number of adult female shad have been considered to be important drivers of the stock-recruitment relationship determining juvenile shad year class strength in the lower Connecticut River, including the timing of high rainfall and river flow events in June, which depress water temperatures, delay or compress spawning activity, and dilute the availability of zooplankton for first feeding of the shad larvae (Savoy et al. 2004a, 2004b). Dominant year classes of American shad in the lower Connecticut River (downstream from the Enfield Dam) were best correlated with lower than normal June flows coupled with a moderate abundance of the spawning adults (Savoy et al. 2004a). However, June average river discharge at Vernon Dam (Table 8) was poorly correlated with the juvenile shad beach seine standing crop abundance index for Vernon Pool over the past five years, with an r^2 of only 0.03. From the data available to date, it therefore appears that the number of spawning adult female American shad is the single factor most related to the inter-annual variation in juvenile shad abundance in Vernon Pool. A time series of ten or more years of juvenile American shad abundance index data will be needed before the statistical relationship between year class strength, adult populations, sex composition of the adult run, and environmental factors such as June river flows can be reliably described for Vernon Pool and compared to the lower river.

5.0 LITERATURE CITED

- Cochran, W.G. 1977. Sampling techniques, third edition. John Wiley and Sons, New York. 428 pp.
- Crecco, V.A., L. Gunn, and T. Savoy. 1981. The Connecticut River shad study, 1980. Final Report. Connecticut Dep. Environ. Prot. A.F.C. 12. 136 p.
- Marcy, B. C., Jr. 1976. Early life history studies of American shad in the lower Connecticut River and the effects of the Connecticut Yankee plant. In: Merriman, D. and L.M. Thorpe, eds. The Connecticut River Ecological Study. Am. Fish. Soc. Monogr. 1: 141-168. Washington D.C.
- Downey, P.C. and N.R. Staats. 1991. Composition of the adult American shad (*Alosa sapidissima* (Wilson)) at Vernon Dam Fishway and Turners Falls Fishway, 1990. Vermont Yankee/Connecticut River System Analytical Bulletin 40. Aquatec Inc., South Burlington VT.
- Downey, P.C. and M. P.Biercevicz. 1991. Relative density and growth of juvenile American shad in the Connecticut River near Vernon, Vermont, 1990. Yankee/Connecticut River System Analytical Bulletin 42. Aquatec Inc., South Burlington VT.
- Nelson, J. S., E. J. Crossman, H. Espinosa-Perez, L. T. Findley, C. R. Gilbert, R. N. Lea, and J. D. Williams. 2004. Common and scientific names of fishes from the United States, Canada, and Mexico. American Fisheries Society Special Publication 29, Bethesda, Maryland.
- Normandeau Associates, Inc. (Normandeau). 2004a. Abundance of juvenile American shad in the Vernon Pool during 2003. Vermont Yankee/Connecticut River System Analytical Bulletin 81. Prepared for Entergy Nuclear Vermont Yankee, LLC, Brattleboro, VT.
- Normandeau. 2004b. Standard Operating Procedures for juvenile American shad sampling in the Connecticut River during 2004. Revision 4. Prepared for Entergy Nuclear Vermont Yankee, LLC, Brattleboro, VT.
- Normandeau. 2003. Abundance of juvenile American shad in the Vernon Pool during 2002. Vermont Yankee/Connecticut River System Analytical Bulletin 79. Prepared for Vermont Yankee Nuclear Power Corporation, Brattleboro, VT.
- Normandeau. 2002. Abundance of juvenile American shad in the Vernon Pool during 2001. Vermont Yankee/Connecticut River System Analytical Bulletin 78. Prepared for Vermont Yankee Nuclear Power Corporation, Brattleboro, VT.
- Normandeau. 2002. Composition of adult American shad at the Vernon Hydroelectric Dam fishway during spring 2001. Vermont Yankee/Connecticut River System Analytical Bulletin 77. Prepared for Vermont Yankee Nuclear Power Corporation, Brattleboro, VT.
- Normandeau. 2001. Abundance of juvenile American shad in the Vernon Pool during 2000. Vermont Yankee/Connecticut River System Analytical Bulletin 76. Prepared for Vermont Yankee Nuclear Power Corporation, Brattleboro, VT.
- Normandeau. 2000. Abundance of juvenile American shad in the Vernon Pool during 1999. Vermont Yankee/Connecticut River System Analytical Bulletin 75. Prepared for Vermont Yankee Nuclear Power Corporation, Brattleboro, VT.
- Normandeau. 1999. Abundance of juvenile American shad in the Vernon Pool during 1998. Vermont Yankee/Connecticut River System Analytical Bulletin 73. Prepared for Vermont Yankee Nuclear Power Corporation, Brattleboro, VT.

NORMANDEAU ASSOCIATES INC.

- Normandeau. 1998. Abundance of juvenile American shad in the Vernon Pool during 1997. Vermont Yankee/Connecticut River System Analytical Bulletin 71. Prepared for Vermont Yankee Nuclear Power Corporation, Brattleboro, VT.
- Savoy, T.F., V.A. Crecco, and B.C. Marcy. 2004a. American shad early life history and recruitment in the Connecticut River: a 40-year summary. Am. Fish. Soc. Monogr. 9: 407-417.
- Savoy, T.F. and V.A. Crecco. 2004b. Factors affecting the recent decline of blueback herring and American shad in the Connecticut River. Am. Fish. Soc. Monogr. 9: 361-377.
- Texas Instruments, Inc. (TI). 1981. 1979 Year Class Report for the multiplant impact study of the Hudson River Estuary. Prepared for Consolidated Edison Company of New York, Inc.

**FIGURES AND TABLES FOR THE
2004 JUVENILE AMERICAN SHAD BULLETIN No. 82**

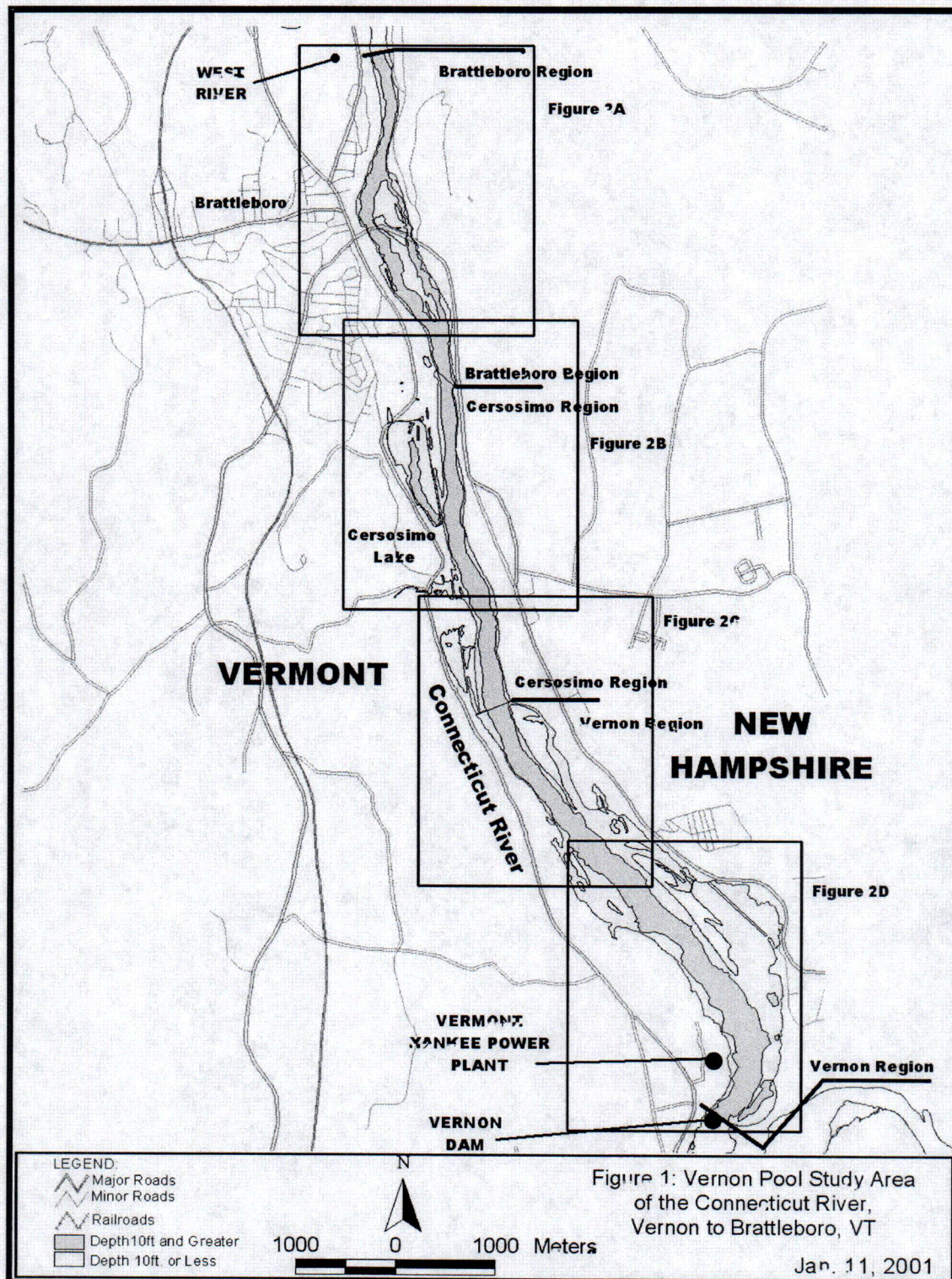


Figure 1. Vernon Pool Study Area of the Connecticut River, Vernon to Brattleboro, VT.

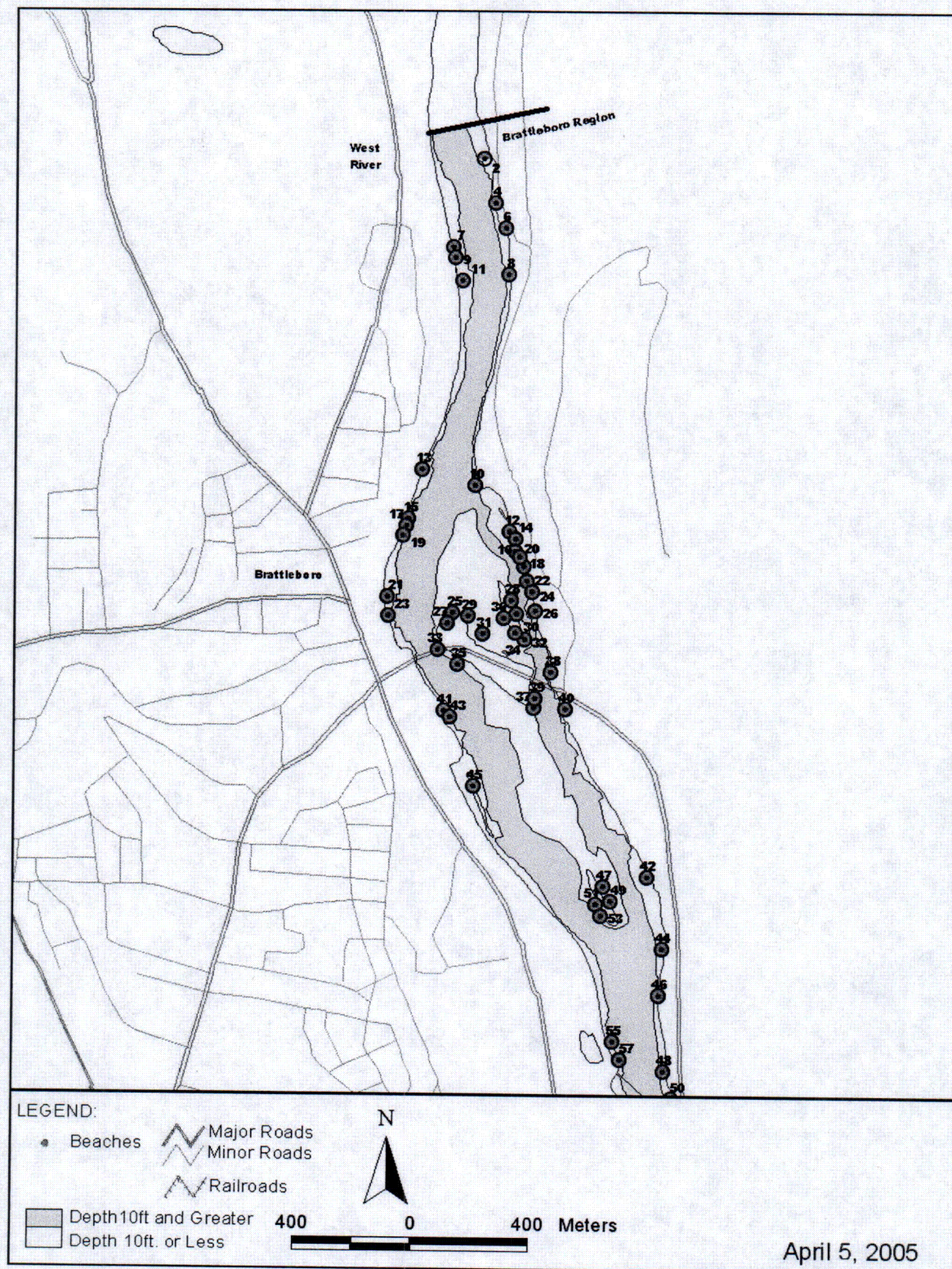


Figure 2a. Juvenile American Shad Study, Connecticut River, Vernon to Brattleboro, VT.

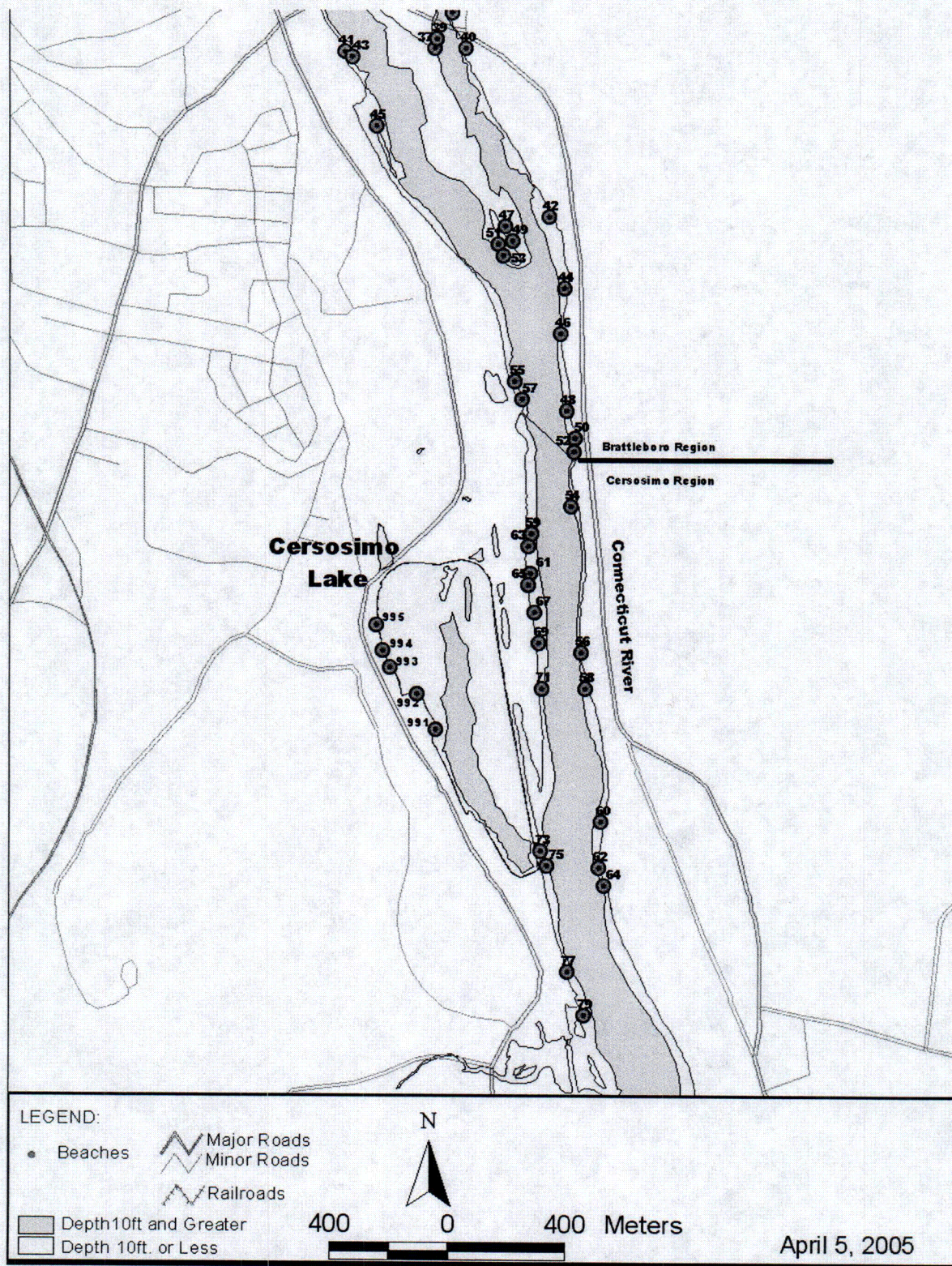


Figure 2b. Juvenile American Shad Study, Connecticut River, Vernon to Brattleboro, VT.

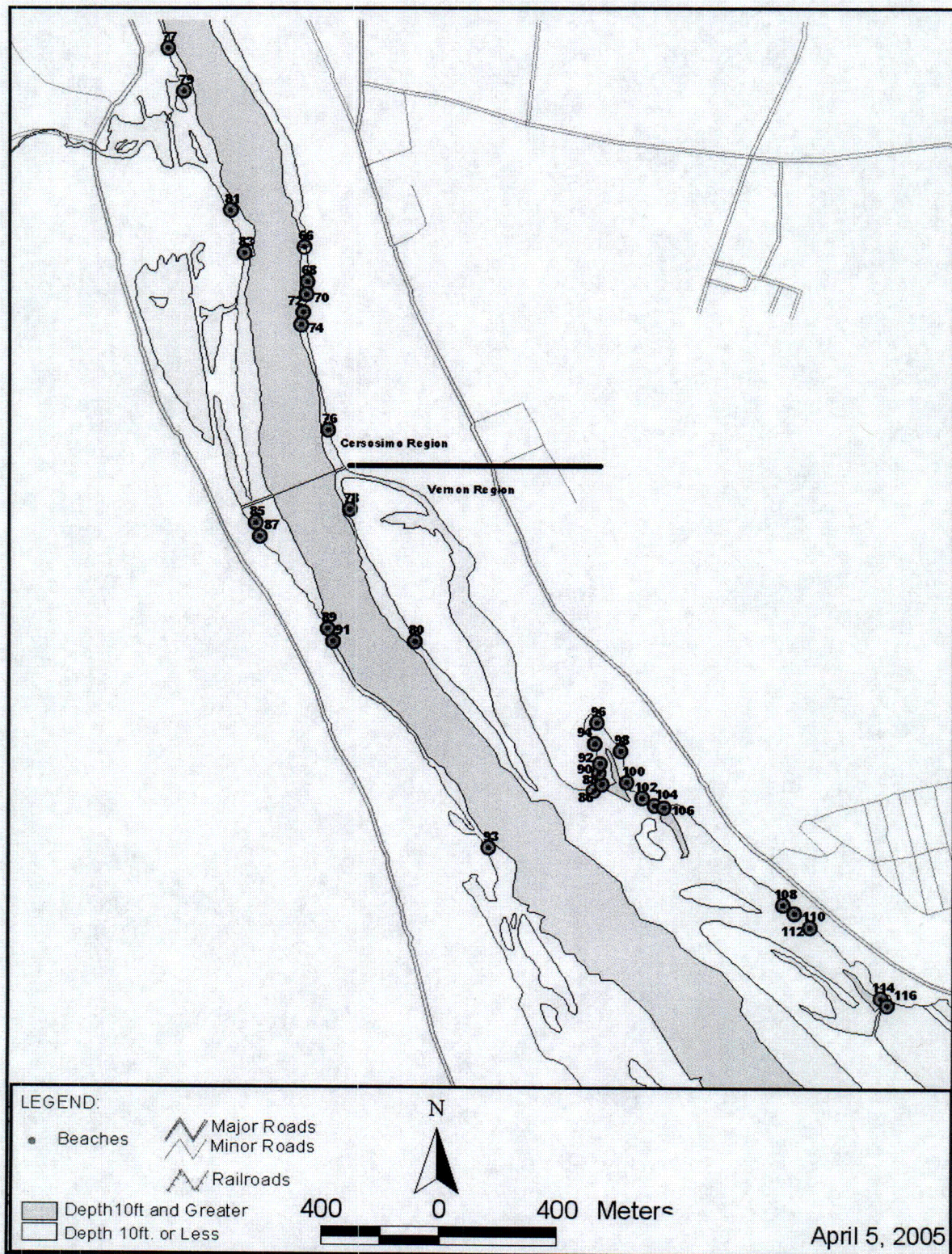


Figure 2c. Juvenile American Shad Study, Connecticut River, Vernon to Brattleboro, VT.

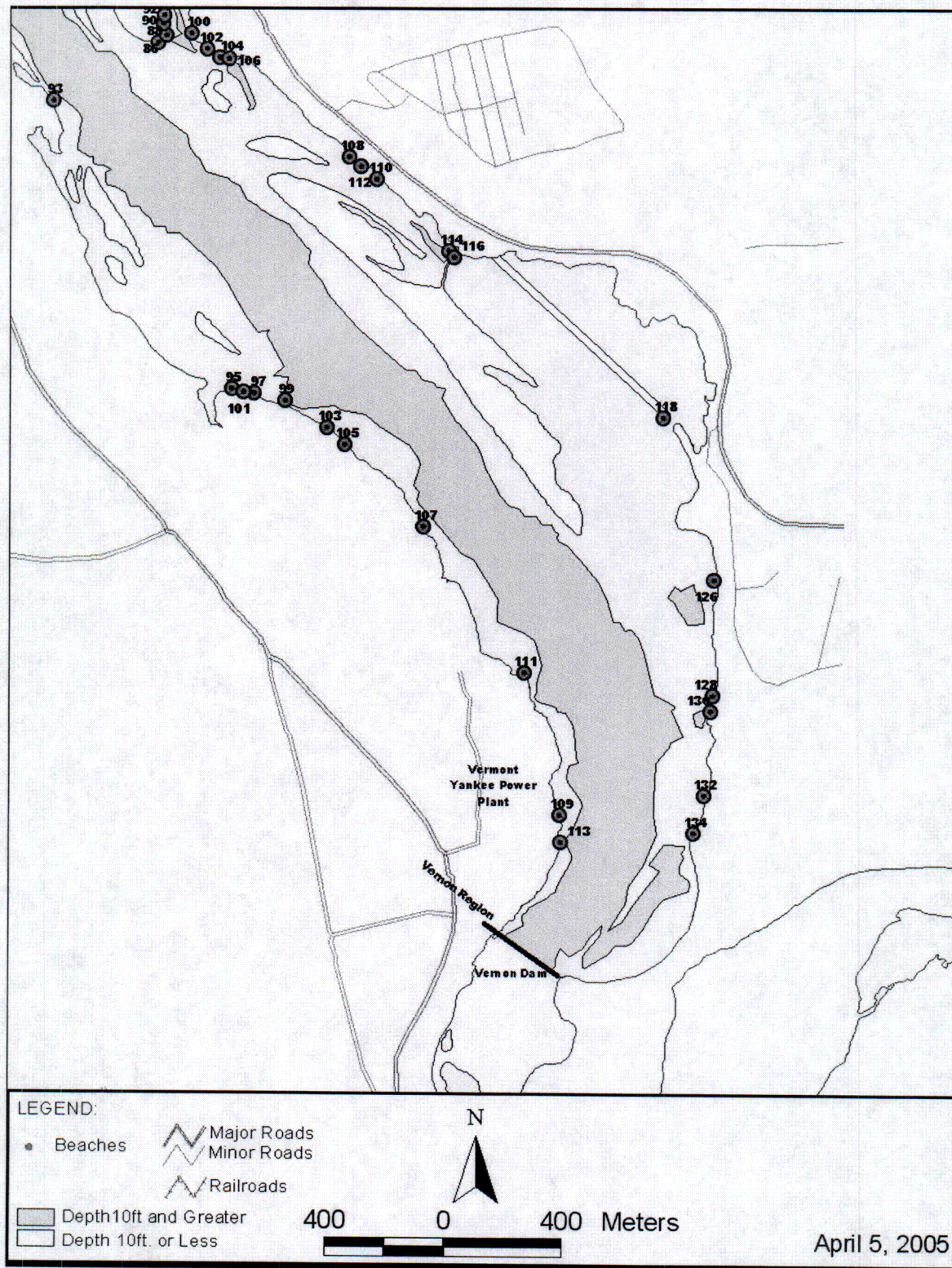


Figure 2d. Juvenile American Shad Study, Connecticut River, Vernon to Brattleboro, VT.

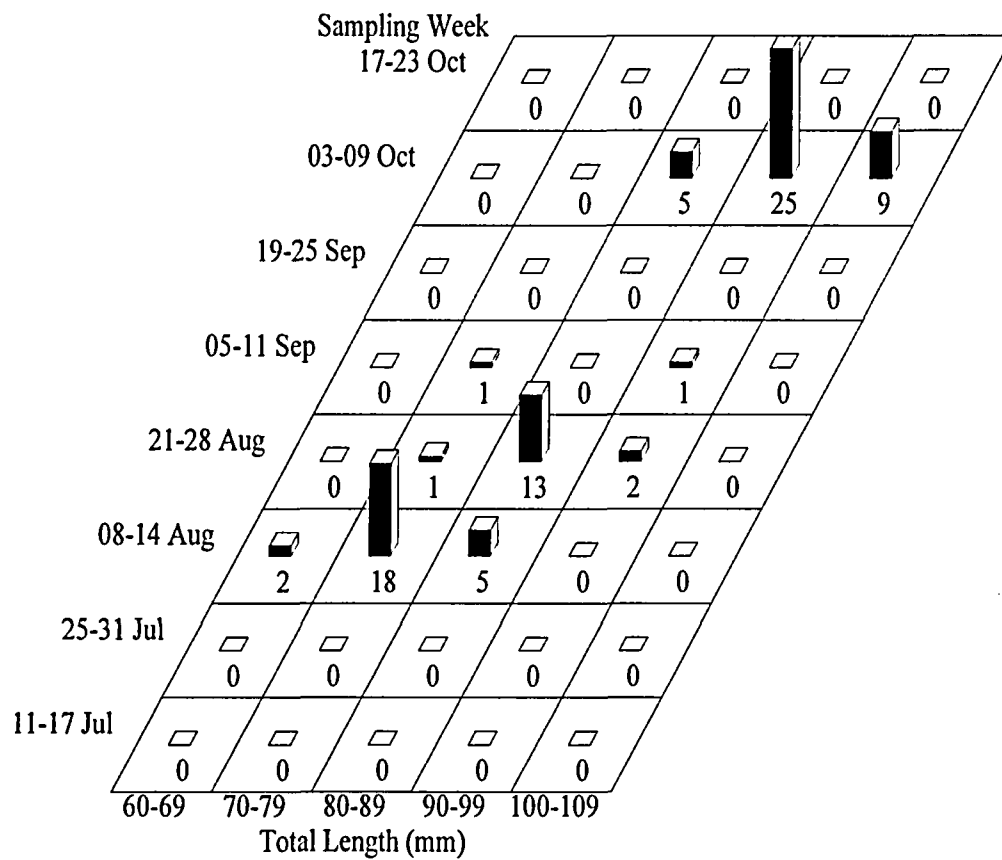


Figure 3. Weekly Length-Frequency of Juvenile American Shad Caught by Seine in Vernon Pool of the Connecticut River, July - October 2004.

Table 1. Area (Square Meters) of Sampling Regions and Weighting Factors Used to Calculate the Standing Crop Index for Juvenile American Shad in Vernon Pool of the Connecticut River, July - October 2004.

REGION	Total Water Surface Area (m ²)	Beach Surface Area (m ²)	Pelagic Surface Area (m ²)	Number of Seine Sample Units (450 m ²)	Beach Area Weighting Factor	Allocation Number of Seine Samples
Brattleboro	912,828	372,683	540,145	828	0.1392	4
Cersosimo	795,667	259,316	536,351	576	0.0969	4
Vernon	3,127,489	1,826,417	1,301,072	4,059	0.6821	20
Cersosimo Lake	292,504	219,084	73,420	487	0.0818	4
All Regions	5,128,488	2,677,500	2,450,988	5,950	1.0000	32

Table 2. Station Names and Latitude/Longitude Coordinates for Beach Seine Samples in Vernon Pool of the Connecticut River, July - October 2004.

River Region	Shore	Station (Beach Number)	Minutes of	
			Latitude N 42 Deg.	Longitude W 72 Deg.
Brattleboro	VT	1 ¹	51.9255	33.2941
Brattleboro	NH	2	51.9929	33.1879
Brattleboro	VT	3 ¹	51.8968	33.2822
Brattleboro	NH	4	51.9117	33.1598
Brattleboro	VT	5 ¹	51.8737	33.2727
Brattleboro	NH	6	51.8675	33.1341
Brattleboro	VT	7	51.8321	33.2630
Brattleboro	NH	8	51.7837	33.1249
Brattleboro	VT	9	51.8129	33.2584
Brattleboro	NH	10	51.4018	33.2066
Brattleboro	VT	11	51.7713	33.2397
Brattleboro	NH	12	51.3173	33.1191
Brattleboro	VT	13	51.4312	33.3382
Brattleboro	NH	14	51.3046	33.1035
Brattleboro	VT	15	51.3401	33.3706
Brattleboro	NH	16	51.2814	33.1059
Brattleboro	VT	17	51.3270	33.3766
Brattleboro	NH	18	51.2545	33.0841
Brattleboro	VT	19	51.3095	33.3840
Brattleboro	NH	20	51.2716	33.0954
Brattleboro	VT	21	51.1998	33.4244
Brattleboro	NH	22	51.2280	33.0760
Brattleboro	VT	23	51.1657	33.4202
Brattleboro	NH	24	51.2090	33.0628
Brattleboro	VT	25	51.1714	33.2593
Brattleboro	NH	26	51.1749	33.0550
Brattleboro	VT	27	51.1526	33.2741
Brattleboro	NH	28	51.1937	33.1158
Brattleboro	VT	29	51.1660	33.2216
Brattleboro	NH	30	51.1685	33.1021
Brattleboro	VT	31	51.1323	33.1857
Brattleboro	NH	32	51.1236	33.0806
Brattleboro	VT	33	51.1040	33.2952
Brattleboro	NH	34	51.1346	33.1047
Brattleboro	VT	35	51.0769	33.2470
Brattleboro	NH	36	51.1623	33.1327
Brattleboro	VT	37	50.9990	33.0589
Brattleboro	NH	38	51.0640	33.0155
Brattleboro	VT	39	51.0167	33.0551
Brattleboro	NH	40	50.9986	32.9806
Brattleboro	VT	41	50.9942	33.2817
Brattleboro	NH	42	50.6922	32.7754
Brattleboro	VT	43	50.9832	33.2651
Brattleboro	NH	44	50.5639	32.7361
Brattleboro	VT	45	50.8573	33.2048
Brattleboro	NH	46	50.4804	32.7448

Table 2. (Continued)

River Region	Shore	Station (Beach Number)	Minutes of	
			Latitude N 42 Deg.	Longitude W 72 Deg.
Brattleboro	VT	47	50.6755	32.8840
Brattleboro	NH	48	50.3419	32.7304
Brattleboro	VT	49	50.6485	32.8648
Brattleboro	NH	50	50.2923	32.7100
Brattleboro	VT	51	50.6439	32.9017
Brattleboro	NH	52	50.2676	32.7126
Brattleboro	VT	53	50.6221	32.8894
Brattleboro	VT	55	50.3951	32.8583
Brattleboro	VT	57	50.3634	32.8403
Cersosimo	NH	54	50.1685	32.7202
Cersosimo	NH	56	49.9046	32.6941
Cersosimo	NH	58	49.8384	32.6834
Cersosimo	VT	59	50.1186	32.8186
Cersosimo	NH	60	49.5969	32.6430
Cersosimo	VT	61	50.0469	32.8196
Cersosimo	NH	62	49.5126	32.6496
Cersosimo	VT	63	50.0960	32.8262
Cersosimo	NH	64	49.4802	32.6362
Cersosimo	VT	65	50.0257	32.8243
Cersosimo	NH	66	48.9618	32.3895
Cersosimo	VT	67	49.9757	32.8106
Cersosimo	NH	68	48.8995	32.3828
Cersosimo	VT	69	49.9204	32.7984
Cersosimo	NH	70	48.8769	32.3835
Cersosimo	VT	71	49.8398	32.7912
Cersosimo	NH	72	48.8442	32.3932
Cersosimo	VT	73	49.5438	32.7932
Cersosimo	NH	74	48.8215	32.3967
Cersosimo	VT	75	49.5173	32.7778
Cersosimo	NH	76	48.6312	32.3305
Cersosimo	VT	77	49.3245	32.7262
Cersosimo	VT	79	49.2461	32.6862
Cersosimo	VT	81	49.0282	32.5713
Cersosimo	VT	83	48.9513	32.5365
Vernon	NH	78	48.4866	32.2750
Vernon	NH	80	48.2457	32.1131
Vernon	NH	82 ¹	48.2104	31.8710
Vernon	NH	84 ¹	48.0319	31.7799
Vernon	VT	85	48.4618	32.5088
Vernon	NH	86	47.9749	31.6672
Vernon	VT	87	48.4355	32.4971
Vernon	NH	88	47.9872	31.6469
Vernon	VT	89	48.2695	32.3307
Vernon	NH	90	48.0080	31.6550
Vernon	VT	91	48.2456	32.3175
Vernon	NH	92	48.0240	31.6508
Vernon	VT	93	47.8682	31.9313

Table 2. (Continued)

River Region	Shore	Station (Beach Number)	Minutes of	
			Latitude N 42 Deg.	Longitude W 72 Deg.
Vernon	NH	94	48.0606	31.6635
Vernon	VT	95	47.3485	31.4840
Vernon	NH	96	48.0987	31.6603
Vernon	VT	97	47.3411	31.4301
Vernon	NH	98	48.0471	31.5997
Vernon	VT	99	47.3290	31.3525
Vernon	NH	100	47.9911	31.5845
Vernon	VT	101	47.3428	31.4538
Vernon	NH	102	47.9621	31.5452
Vernon	VT	103	47.2810	31.2483
Vernon	NH	104	47.9455	31.4903
Vernon	VT	105	47.2511	31.2035
Vernon	NH	106	47.9482	31.5137
Vernon	VT	107	47.1011	31.0094
Vernon	NH	108	47.7681	31.1934
Vernon	VT	109	46.8380	30.7601
Vernon	NH	110	47.7284	31.1257
Vernon	VT	111	46.5809	30.6698
Vernon	NH	112	47.7520	31.1641
Vernon	VT	113	46.5315	30.6682
Vernon	NH	114	47.5999	30.9487
Vernon	NH	116	47.5869	30.9346
Vernon	NH	118	47.3001	30.4170
Vernon	NH	120 ¹	47.1317	30.3791
Vernon	NH	122 ¹	47.0937	30.3818
Vernon	NH	124 ¹	47.0502	30.2996
Vernon	NH	126	47.0071	30.2895
Vernon	NH	128	46.7989	30.2935
Vernon	NH	130	46.7695	30.2993
Vernon	NH	132	46.6186	30.3132
Vernon	NH	134	46.5492	30.3401
Vernon	NH	136 ¹	46.5217	30.3546
Vernon	NH	138 ¹	46.3821	30.3575
Cersosimo Lake	VT	991	49.7639	33.0567
Cersosimo Lake	VT	992	49.8296	33.1013
Cersosimo Lake	VT	993	49.8778	33.1700
Cersosimo Lake	VT	994	49.9080	33.1873
Cersosimo Lake	VT	995	49.9531	33.2030

¹ Not sampled in 2004 due to shallow depth or heavy debris.

Table 3. Checklist of Fishes (Nelson et al. 2004) Collected by the Beach Seine Survey In Vernon Pool of the Connecticut River During 2004.

Scientific Name	Common Name
<i>Alosa sapidissima</i>	American shad
<i>Esox lucius</i>	Northern pike
<i>Esox niger</i>	Chain pickerel
<i>Notemigonus crysoleucas</i>	Golden shiner
<i>Notropis hudsonius</i>	Spottail shiner
<i>Catostomus commersoni</i>	White sucker
<i>Diaphanus fundulus</i>	Banded killifish
<i>Morone americana</i>	White perch
<i>Ambloplites rupestris</i>	Rock bass
<i>Lepomis gibbosus</i>	Pumpkinseed
<i>Lepomis macrochirus</i>	Bluegill
<i>Micropterus dolomieu</i>	Smallmouth bass
<i>Micropterus salmoides</i>	Largemouth bass
<i>Pomoxis nigromaculatus</i>	Black crappie
<i>Etheostoma olmstedii</i>	Tesselated darter
<i>Perca flavescens</i>	Yellow perch

Table 4. Weekly and Regional Number of Fish Caught by Beach Seine in Vernon Pool of the Connecticut River, July – October 2004.

Taxon	Region	Number of Fish Caught in Sampling Week								All Weeks
		11-17 Jul	25-31 Jul	08-14 Aug	21-28 Aug	05-11 Sep	19-25 Sep	03-09 Oct	17-23 Oct	
American shad	Brattleboro	0	0	0	0	1	0	0	0	1
	Cersosimo	0	0	2	0	0	0	0	0	2
	Vernon	0	0	23	16	1	0	39	0	79
	Cersosimo Lake	0	0	0	0	0	0	0	0	0
	All Regions	0	0	25	16	2	0	39	0	82
Bluegill	Brattleboro	0	0	0	2	2	4	2	5	15
	Cersosimo	1	3	0	3	23	21	4	5	60
	Vernon	24	26	36	102	172	210	157	138	865
	Cersosimo Lake	3	10	37	24	54	26	89	25	268
	All Regions	28	39	73	131	251	261	252	173	1208
Black crappie	Brattleboro	0	0	1	5	2	1	1	2	12
	Cersosimo	0	0	1	1	1	2	1	1	7
	Vernon	6	5	13	35	38	11	0	3	111
	Cersosimo Lake	29	33	55	82	19	62	104	52	436
	All Regions	35	38	70	123	60	76	106	58	566
Yellow perch	Brattleboro	1	0	0	14	11	33	4	8	71
	Cersosimo	2	15	11	9	5	4	2	4	52
	Vernon	43	27	54	15	14	26	46	30	255
	Cersosimo Lake	4	5	23	17	9	6	7	2	73
	All Regions	50	47	88	55	39	69	59	44	451
Golden shiner	Brattleboro	0	0	0	1	0	0	11	1	13
	Cersosimo	0	9	4	0	15	0	32	4	64
	Vernon	13	1	18	11	5	5	0	54	107
	Cersosimo Lake	0	6	7	33	18	59	77	9	209
	All Regions	13	16	29	45	38	64	120	68	393
Largemouth bass	Brattleboro	0	4	0	5	0	2	0	0	11
	Cersosimo	1	5	2	1	1	8	1	0	19
	Vernon	7	23	11	12	14	4	7	5	83
	Cersosimo Lake	1	6	7	2	3	3	2	0	24
	All Regions	9	38	20	20	18	17	10	5	137

(continued)

Table 4. (Continued)

Taxon	Region	Number of Fish Caught in Sampling Week								
		11-17 Jul	25-31 Jul	08-14 Aug	21-28 Aug	05-11 Sep	19-25 Sep	03-09 Oct	17-23 Oct	All Weeks
Pumpkinseed	Brattleboro	0	0	0	0	0	1	0	1	2
	Cersosimo	2	0	0	0	1	2	1	3	9
	Vernon	8	0	1	6	6	31	17	4	73
	Cersosimo Lake	3	2	1	2	0	0	0	0	8
	All Regions	13	2	2	8	7	34	18	8	92
Rock bass	Brattleboro	0	0	1	10	9	9	4	1	34
	Cersosimo	0	3	0	1	8	3	3	2	20
	Vernon	1	1	5	4	0	2	0	0	13
	Cersosimo Lake	0	0	1	3	3	0	1	0	8
	All Regions	1	4	7	18	20	14	8	3	75
Spottail shiner	Brattleboro	2	0	0	9	0	2	5	4	22
	Cersosimo	0	1	10	1	0	0	0	1	13
	Vernon	1	1	3	2	0	1	0	1	9
	Cersosimo Lake	0	2	0	0	0	9	3	0	14
	All Regions	3	4	13	12	0	12	8	6	58
Chain pickerel	Brattleboro	0	0	0	0	0	0	0	0	0
	Cersosimo	0	1	0	1	1	0	0	0	3
	Vernon	4	1	3	3	2	3	4	0	20
	Cersosimo Lake	0	0	0	0	0	0	0	0	0
	All Regions	4	2	3	4	3	3	4	0	23
Banded Killifish	Brattleboro	0	0	0	0	1	0	0	0	1
	Cersosimo	0	1	0	0	1	0	2	0	4
	Vernon	0	0	0	0	0	0	0	0	0
	Cersosimo Lake	0	0	0	0	0	0	4	0	4
	All Regions	0	1	0	0	2	0	6	0	9
Northern pike	Brattleboro	0	0	0	0	0	0	0	0	0
	Cersosimo	0	1	0	0	0	0	0	0	1
	Vernon	0	0	0	2	0	0	0	1	3
	Cersosimo Lake	0	2	0	0	0	0	2	0	4
	All Regions	0	3	0	2	0	0	2	1	8

(continued)

Table 4. (Continued)

Taxon	Region	Number of Fish Caught in Sampling Week								All Weeks
		11-17 Jul	25-31 Jul	08-14 Aug	21-28 Aug	05-11 Sep	19-25 Sep	03-09 Oct	17-23 Oct	
White sucker	Brattleboro	3	0	0	0	0	1	0	0	4
	Cersosimo	0	1	0	0	0	0	0	0	1
	Vernon	1	0	0	0	0	0	0	0	1
	Cersosimo Lake	0	0	0	0	0	2	0	0	2
	All Regions	4	1	0	0	0	3	0	0	8
White perch	Brattleboro	0	0	0	0	0	0	0	0	0
	Cersosimo	0	0	0	0	0	0	0	0	0
	Vernon	0	0	0	0	0	0	0	0	0
	Cersosimo Lake	0	1	0	7	0	0	0	0	8
	All Regions	0	1	0	7	0	0	0	0	8
Smallmouth bass	Brattleboro	0	0	0	1	1	0	0	0	2
	Cersosimo	0	1	0	0	0	0	0	0	1
	Vernon	0	0	0	2	0	0	0	0	2
	Cersosimo Lake	0	0	0	0	0	0	0	0	0
	All Regions	0	1	0	3	1	0	0	0	5
Tessellated darter	Brattleboro	1	0	0	0	0	0	0	0	1
	Cersosimo	0	0	0	0	0	0	0	0	0
	Vernon	0	0	0	0	0	0	1	0	1
	Cersosimo Lake	0	0	0	0	0	0	0	0	0
	All Regions	1	0	0	0	0	0	1	0	2
All Taxa Combined	Brattleboro	7	4	2	47	27	53	27	22	189
	Cersosimo	6	41	30	17	56	40	46	20	256
	Vernon	108	85	167	210	252	293	271	236	1622
	Cersosimo Lake	40	67	131	170	106	167	289	88	1058
	All Regions	161	197	330	444	441	553	633	366	3125

Table 5. Weekly and Regional Mean Catch Per Unit of Effort (CPUE) by Beach Seine in Vernon Pool of the Connecticut River, July – October 2004.

2004 Week and Taxon		VERNON POOL REGION				
American shad		Brattleboro	Cersosimo	Vernon	Cersosimo Lake	All Reaches
11-17 Jul	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
25-31 Jul	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
08-14 Aug	CPUE	0.00	0.50	1.15	0.00	0.78
	SE	0.00	0.50	1.15	0.00	0.72
	NO.HAULS	4	4	20	4	32
21-28 Aug	CPUE	0.00	0.00	0.80	0.00	0.50
	SE	0.00	0.00	0.80	0.00	0.50
	NO.HAULS	4	4	20	4	32
05-11 Sep	CPUE	0.25	0.00	0.05	0.00	0.06
	SE	0.25	0.00	0.05	0.00	0.04
	NO.HAULS	4	4	20	4	32
19-25 Sep	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
03-09 Oct	CPUE	0.00	0.00	1.95	0.00	1.22
	SE	0.00	0.00	1.90	0.00	1.19
	NO.HAULS	4	4	20	4	32
17-23 Oct	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32

(continued)

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Table 5. (Continued)

2004 Week and Taxon		VERNON POOL REGION				
Bluegill		Brattleboro	Cersosimo	Vernon	Cersosimo Lake	All Reaches
11-17 Jul	CPUE	0.00	0.25	1.20	0.75	0.88
	SE	0.00	0.25	0.70	0.48	0.44
	NO.HAULS	4	4	20	4	32
25-31 Jul	CPUE	0.00	0.75	1.30	2.50	1.22
	SE	0.00	0.75	0.81	2.18	0.57
	NO.HAULS	4	4	20	4	32
08-14 Aug	CPUE	0.00	0.00	1.80	9.25	2.28
	SE	0.00	0.00	0.61	4.01	0.76
	NO.HAULS	4	4	20	4	32
21-28 Aug	CPUE	0.50	0.75	5.10	6.00	4.09
	SE	0.50	0.75	2.37	1.96	1.53
	NO.HAULS	4	4	20	4	32
05-11 Sep	CPUE	0.50	5.75	8.60	13.50	7.84
	SE	0.50	2.25	2.43	10.71	2.02
	NO.HAULS	4	4	20	4	32
19-25 Sep	CPUE	1.00	5.25	10.50	6.50	8.16
	SE	0.41	3.68	4.16	4.48	2.72
	NO.HAULS	4	4	20	4	32
03-09 Oct	CPUE	0.50	1.00	7.85	22.25	7.88
	SE	0.50	0.71	2.11	11.83	2.16
	NO.HAULS	4	4	20	4	32
17-23 Oct	CPUE	1.25	1.25	6.90	6.25	5.41
	SE	1.25	0.95	2.89	5.92	1.96
	NO.HAULS	4	4	20	4	32

(continued)

Table 5. (Continued)

2004 Week and Taxon		VERNON POOL REGION				
Black crappie		Brattleboro	Cersosimo	Vernon	Cersosimo Lake	All Reaches
11-17 Jul	CPUE	0.00	0.00	0.30	7.25	1.09
	SE	0.00	0.00	0.18	4.42	0.65
	NO.HAULS	4	4	20	4	32
25-31 Jul	CPUE	0.00	0.00	0.25	8.25	1.19
	SE	0.00	0.00	0.18	4.97	0.74
	NO.HAULS	4	4	20	4	32
08-14 Aug	CPUE	0.25	0.25	0.65	13.75	2.19
	SE	0.25	0.25	0.26	12.45	1.59
	NO.HAULS	4	4	20	4	32
21-28 Aug	CPUE	1.25	0.25	1.75	20.50	3.84
	SE	1.25	0.25	0.77	13.73	1.95
	NO.HAULS	4	4	20	4	32
05-11 Sep	CPUE	0.50	0.25	1.90	4.75	1.88
	SE	0.50	0.25	0.81	4.75	0.76
	NO.HAULS	4	4	20	4	32
19-25 Sep	CPUE	0.25	0.50	0.55	15.50	2.38
	SE	0.25	0.29	0.31	8.96	1.34
	NO.HAULS	4	4	20	4	32
03-09 Oct	CPUE	0.25	0.25	0.00	26.00	3.31
	SE	0.25	0.25	0.00	15.03	2.26
	NO.HAULS	4	4	20	4	32
17-23 Oct	CPUE	0.50	0.25	0.15	13.00	1.81
	SE	0.50	0.25	0.08	13.00	1.62
	NO.HAULS	4	4	20	4	32

(continued)

NORMANDEAU ASSOCIATES INC.

Table 5. (Continued)

2004 Week and Taxon		VERNON POOL REGION				
Golden shiner		Brattleboro	Cersosimo	Vernon	Cersosimo Lake	All Reaches
11-17 Jul	CPUE	0.00	0.00	0.65	0.00	0.41
	SE	0.00	0.00	0.46	0.00	0.29
	NO.HAULS	4	4	20	4	32
25-31 Jul	CPUE	0.00	2.25	0.05	1.50	0.50
	SE	0.00	2.25	0.05	1.50	0.33
	NO.HAULS	4	4	20	4	32
08-14 Aug	CPUE	0.00	1.00	0.90	1.75	0.91
	SE	0.00	0.41	0.61	1.75	0.43
	NO.HAULS	4	4	20	4	32
21-28 Aug	CPUE	0.25	0.00	0.55	8.25	1.41
	SE	0.25	0.00	0.26	7.28	0.94
	NO.HAULS	4	4	20	4	32
05-11 Sep	CPUE	0.00	3.75	0.25	4.50	1.19
	SE	0.00	2.84	0.14	4.50	0.67
	NO.HAULS	4	4	20	4	32
19-25 Sep	CPUE	0.00	0.00	0.25	14.75	2.00
	SE	0.00	0.00	0.16	14.75	1.84
	NO.HAULS	4	4	20	4	32
03-09 Oct	CPUE	2.75	8.00	0.00	19.25	3.75
	SE	2.75	8.00	0.00	12.23	2.00
	NO.HAULS	4	4	20	4	32
17-23 Oct	CPUE	0.25	1.00	2.70	2.25	2.13
	SE	0.25	1.00	2.17	2.25	1.38
	NO.HAULS	4	4	20	4	32

(continued)

Table 5. (Continued)

2004 Week and Taxon		VERNON POOL REGION				
Yellow perch		Brattleboro	Cersosimo	Vernon	Cersosimo Lake	All Reaches
11-17 Jul	CPUE	0.25	0.50	2.15	1.00	1.56
	SE	0.25	0.29	0.89	0.41	0.57
	NO.HAULS	4	4	20	4	32
25-31 Jul	CPUE	0.00	3.75	1.35	1.25	1.47
	SE	0.00	2.25	0.62	0.95	0.50
	NO.HAULS	4	4	20	4	32
08-14 Aug	CPUE	0.00	2.75	2.70	5.75	2.75
	SE	0.00	2.75	1.32	4.09	1.02
	NO.HAULS	4	4	20	4	32
21-28 Aug	CPUE	3.50	2.25	0.75	4.25	1.72
	SE	2.53	2.25	0.32	1.65	0.52
	NO.HAULS	4	4	20	4	32
05-11 Sep	CPUE	2.75	1.25	0.70	2.25	1.22
	SE	1.11	0.75	0.45	1.65	0.39
	NO.HAULS	4	4	20	4	32
19-25 Sep	CPUE	8.25	1.00	1.30	1.50	2.16
	SE	3.47	0.00	0.67	0.87	0.70
	NO.HAULS	4	4	20	4	32
03-09 Oct	CPUE	1.00	0.50	2.30	1.75	1.84
	SE	1.00	0.29	1.58	1.03	1.00
	NO.HAULS	4	4	20	4	32
17-23 Oct	CPUE	2.00	1.00	1.50	0.50	1.38
	SE	0.82	0.41	0.49	0.50	0.34
	NO.HAULS	4	4	20	4	32

(continued)

Table 5. (Continued)

2004 Week and Taxon		VERNON POOL REGION				
Largemouth bass		Brattleboro	Cersosimo	Vernon	Cersosimo Lake	All Reaches
11-17 Jul	CPUE	0.00	0.25	0.35	0.25	0.28
	SE	0.00	0.25	0.15	0.25	0.10
	NO.HAULS	4	4	20	4	32
25-31 Jul	CPUE	1.00	1.25	1.15	1.50	1.19
	SE	1.00	1.25	0.65	1.19	0.46
	NO.HAULS	4	4	20	4	32
08-14 Aug	CPUE	0.00	0.50	0.55	1.75	0.63
	SE	0.00	0.29	0.18	1.44	0.21
	NO.HAULS	4	4	20	4	32
21-28 Aug	CPUE	1.25	0.25	0.60	0.50	0.63
	SE	1.25	0.25	0.23	0.29	0.21
	NO.HAULS	4	4	20	4	32
05-11 Sep	CPUE	0.00	0.25	0.70	0.75	0.56
	SE	0.00	0.25	0.26	0.48	0.18
	NO.HAULS	4	4	20	4	32
19-25 Sep	CPUE	0.50	2.00	0.20	0.75	0.53
	SE	0.50	1.68	0.09	0.48	0.23
	NO.HAULS	4	4	20	4	32
03-09 Oct	CPUE	0.00	0.25	0.35	0.50	0.31
	SE	0.00	0.25	0.13	0.29	0.09
	NO.HAULS	4	4	20	4	32
17-23 Oct	CPUE	0.00	0.00	0.25	0.00	0.16
	SE	0.00	0.00	0.12	0.00	0.08
	NO.HAULS	4	4	20	4	32

(continued)

Table 5. (Continued)

2004 Week and Taxon		VERNON POOL REGION				
Rock bass		Brattleboro	Cersosimo	Vernon	Cersosimo Lake	All Reaches
11-17 Jul	CPUE	0.00	0.00	0.05	0.00	0.03
	SE	0.00	0.00	0.05	0.00	0.03
	NO.HAULS	4	4	20	4	32
25-31 Jul	CPUE	0.00	0.75	0.05	0.00	0.13
	SE	0.00	0.25	0.05	0.00	0.06
	NO.HAULS	4	4	20	4	32
08-14 Aug	CPUE	0.25	0.00	0.25	0.25	0.22
	SE	0.25	0.00	0.16	0.25	0.11
	NO.HAULS	4	4	20	4	32
21-28 Aug	CPUE	2.50	0.25	0.20	0.75	0.56
	SE	1.89	0.25	0.16	0.48	0.27
	NO.HAULS	4	4	20	4	32
05-11 Sep	CPUE	2.25	2.00	0.00	0.75	0.63
	SE	1.93	1.08	0.00	0.75	0.30
	NO.HAULS	4	4	20	4	32
19-25 Sep	CPUE	2.25	0.75	0.10	0.00	0.44
	SE	1.31	0.48	0.07	0.00	0.21
	NO.HAULS	4	4	20	4	32
03-09 Oct	CPUE	1.00	0.75	0.00	0.25	0.25
	SE	1.00	0.48	0.00	0.25	0.14
	NO.HAULS	4	4	20	4	32
17-23 Oct	CPUE	0.25	0.50	0.00	0.00	0.09
	SE	0.25	0.50	0.00	0.00	0.07
	NO.HAULS	4	4	20	4	32

(continued)

Table 5. (Continued)

2004 Week and Taxon		VERNON POOL REGION				
Spottail shiner		Brattleboro	Cersosimo	Vernon	Cersosimo Lake	All Reaches
11-17 Jul	CPUE	0.50	0.00	0.05	0.00	0.09
	SE	0.50	0.00	0.05	0.00	0.07
	NO.HAULS	4	4	20	4	32
25-31 Jul	CPUE	0.00	0.25	0.05	0.50	0.13
	SE	0.00	0.25	0.05	0.50	0.07
	NO.HAULS	4	4	20	4	32
08-14 Aug	CPUE	0.00	2.50	0.15	0.00	0.41
	SE	0.00	2.18	0.15	0.00	0.29
	NO.HAULS	4	4	20	4	32
21-28 Aug	CPUE	2.25	0.25	0.10	0.00	0.38
	SE	1.93	0.25	0.10	0.00	0.26
	NO.HAULS	4	4	20	4	32
05-11 Sep	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
19-25 Sep	CPUE	0.50	0.00	0.05	2.25	0.38
	SE	0.50	0.00	0.05	2.25	0.29
	NO.HAULS	4	4	20	4	32
03-09 Oct	CPUE	1.25	0.00	0.00	0.75	0.25
	SE	0.75	0.00	0.00	0.48	0.13
	NO.HAULS	4	4	20	4	32
17-23 Oct	CPUE	1.00	0.25	0.05	0.00	0.19
	SE	0.71	0.25	0.05	0.00	0.10
	NO.HAULS	4	4	20	4	32

(continued)

Table 5. (Continued)

2004 Week and Taxon		VERNON POOL REGION				
Pumpkinseed		Brattleboro	Cersosimo	Vernon	Cersosimo Lake	All Reaches
11-17 Jul	CPUE	0.00	0.50	0.40	0.75	0.41
	SE	0.00	0.50	0.21	0.75	0.17
	NO.HAULS	4	4	20	4	32
25-31 Jul	CPUE	0.00	0.00	0.00	0.50	0.06
	SE	0.00	0.00	0.00	0.29	0.04
	NO.HAULS	4	4	20	4	32
08-14 Aug	CPUE	0.00	0.00	0.05	0.25	0.06
	SE	0.00	0.00	0.05	0.25	0.04
	NO.HAULS	4	4	20	4	32
21-28 Aug	CPUE	0.00	0.00	0.30	0.50	0.25
	SE	0.00	0.00	0.16	0.50	0.12
	NO.HAULS	4	4	20	4	32
05-11 Sep	CPUE	0.00	0.25	0.30	0.00	0.22
	SE	0.00	0.25	0.16	0.00	0.11
	NO.HAULS	4	4	20	4	32
19-25 Sep	CPUE	0.25	0.50	1.55	0.00	1.06
	SE	0.25	0.50	0.87	0.00	0.55
	NO.HAULS	4	4	20	4	32
03-09 Oct	CPUE	0.00	0.25	0.85	0.00	0.56
	SE	0.00	0.25	0.35	0.00	0.23
	NO.HAULS	4	4	20	4	32
17-23 Oct	CPUE	0.25	0.75	0.20	0.00	0.25
	SE	0.25	0.75	0.16	0.00	0.13
	NO.HAULS	4	4	20	4	32

(continued)

Table 5. (Continued)

2004 Week and Taxon		VERNON POOL REGION				
Banded killifish		Brattleboro	Cersosimo	Vernon	Cersosimo Lake	All Reaches
11-17 Jul	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
25-31 Jul	CPUE	0.00	0.25	0.00	0.00	0.03
	SE	0.00	0.25	0.00	0.00	0.03
	NO.HAULS	4	4	20	4	32
08-14 Aug	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
21-28 Aug	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
05-11 Sep	CPUE	0.25	0.25	0.00	0.00	0.06
	SE	0.25	0.25	0.00	0.00	0.04
	NO.HAULS	4	4	20	4	32
19-25 Sep	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
03-09 Oct	CPUE	0.00	0.50	0.00	1.00	0.19
	SE	0.00	0.50	0.00	1.00	0.14
	NO.HAULS	4	4	20	4	32
17-23 Oct	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32

(continued)

Table 5. (Continued)

2004 Week and Taxon		VERNON POOL REGION				
Chain pickerel		Brattleboro	Cersosimo	Vernon	Cersosimo Lake	All Reaches
11-17 Jul	CPUE	0.00	0.00	0.20	0.00	0.13
	SE	0.00	0.00	0.12	0.00	0.07
	NO.HAULS	4	4	20	4	32
25-31 Jul	CPUE	0.00	0.25	0.05	0.00	0.06
	SE	0.00	0.25	0.05	0.00	0.04
	NO.HAULS	4	4	20	4	32
08-14 Aug	CPUE	0.00	0.00	0.15	0.00	0.09
	SE	0.00	0.00	0.08	0.00	0.05
	NO.HAULS	4	4	20	4	32
21-28 Aug	CPUE	0.00	0.25	0.15	0.00	0.13
	SE	0.00	0.25	0.11	0.00	0.07
	NO.HAULS	4	4	20	4	32
05-11 Sep	CPUE	0.00	0.25	0.10	0.00	0.09
	SE	0.00	0.25	0.07	0.00	0.05
	NO.HAULS	4	4	20	4	32
19-25 Sep	CPUE	0.00	0.00	0.15	0.00	0.09
	SE	0.00	0.00	0.11	0.00	0.07
	NO.HAULS	4	4	20	4	32
03-09 Oct	CPUE	0.00	0.00	0.20	0.00	0.13
	SE	0.00	0.00	0.12	0.00	0.07
	NO.HAULS	4	4	20	4	32
17-23 Oct	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32

(continued)

Table 5. (Continued)

2004 Week and Taxon		VERNON POOL REGION				
White perch		Brattleboro	Cersosimo	Vernon	Cersosimo Lake	All Reaches
11-17 Jul	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
25-31 Jul	CPUE	0.00	0.00	0.00	0.25	0.03
	SE	0.00	0.00	0.00	0.25	0.03
	NO.HAULS	4	4	20	4	32
08-14 Aug	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
21-28 Aug	CPUE	0.00	0.00	0.00	1.75	0.22
	SE	0.00	0.00	0.00	1.18	0.17
	NO.HAULS	4	4	20	4	32
05-11 Sep	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
19-25 Sep	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
03-09 Oct	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
17-23 Oct	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32

(continued)

NORMANDEAU ASSOCIATES INC.

Table 5. (Continued)

2004 Week and Taxon		VERNON POOL REGION				
White sucker		Brattleboro	Cersosimo	Vernon	Cersosimo Lake	All Reaches
11-17 Jul	CPUE	0.75	0.00	0.05	0.00	0.13
	SE	0.75	0.00	0.05	0.00	0.10
	NO.HAULS	4	4	20	4	32
25-31 Jul	CPUE	0.00	0.25	0.00	0.00	0.03
	SE	0.00	0.25	0.00	0.00	0.03
	NO.HAULS	4	4	20	4	32
08-14 Aug	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
21-28 Aug	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
05-11 Sep	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
19-25 Sep	CPUE	0.25	0.00	0.00	0.50	0.09
	SE	0.25	0.00	0.00	0.50	0.07
	NO.HAULS	4	4	20	4	32
03-09 Oct	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
17-23 Oct	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32

(continued)

NORMANDEAU ASSOCIATES INC.

Table 5. (Continued)

2004 Week and Taxon		VERNON POOL REGION				
Northern pike		Brattleboro	Cersosimo	Vernon	Cersosimo Lake	All Reaches
11-17 Jul	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
25-31 Jul	CPUE	0.00	0.25	0.00	0.50	0.09
	SE	0.00	0.25	0.00	0.29	0.05
	NO.HAULS	4	4	20	4	32
08-14 Aug	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
21-28 Aug	CPUE	0.00	0.00	0.10	0.00	0.06
	SE	0.00	0.00	0.10	0.00	0.06
	NO.HAULS	4	4	20	4	32
05-11 Sep	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
19-25 Sep	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
03-09 Oct	CPUE	0.00	0.00	0.00	0.50	0.06
	SE	0.00	0.00	0.00	0.50	0.06
	NO.HAULS	4	4	20	4	32
17-23 Oct	CPUE	0.00	0.00	0.05	0.00	0.03
	SE	0.00	0.00	0.05	0.00	0.03
	NO.HAULS	4	4	20	4	32

(continued)

Table 5. (Continued)

2004 Week and Taxon		VERNON POOL REGION				
Smallmouth bass		Brattleboro	Cersosimo	Vernon	Cersosimo Lake	All Reaches
11-17 Jul	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
25-31 Jul	CPUE	0.00	0.25	0.00	0.00	0.03
	SE	0.00	0.25	0.00	0.00	0.03
	NO.HAULS	4	4	20	4	32
08-14 Aug	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
21-28 Aug	CPUE	0.25	0.00	0.10	0.00	0.09
	SE	0.25	0.00	0.10	0.00	0.07
	NO.HAULS	4	4	20	4	32
05-11 Sep	CPUE	0.25	0.00	0.00	0.00	0.03
	SE	0.25	0.00	0.00	0.00	0.03
	NO.HAULS	4	4	20	4	32
19-25 Sep	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
03-09 Oct	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
17-23 Oct	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32

(continued)

Table 5. (Continued)

2004 Week and Taxon		VERNON POOL REGION				
Tessellated darter		Brattleboro	Cersosimo	Vernon	Cersosimo Lake	All Reaches
11-17 Jul	CPUE	0.25	0.00	0.00	0.00	0.03
	SE	0.25	0.00	0.00	0.00	0.03
	NO.HAULS	4	4	20	4	32
25-31 Jul	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
08-14 Aug	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
21-28 Aug	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
05-11 Sep	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
19-25 Sep	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32
03-09 Oct	CPUE	0.00	0.00	0.05	0.00	0.03
	SE	0.00	0.00	0.05	0.00	0.03
	NO.HAULS	4	4	20	4	32
17-23 Oct	CPUE	0.00	0.00	0.00	0.00	0.00
	SE	0.00	0.00	0.00	0.00	0.00
	NO.HAULS	4	4	20	4	32

(continued)

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Table 5. (Continued)

2004 Week and Taxon		VERNON POOL REGION				
All Taxa		Brattleboro	Cersosimo	Vernon	Cersosimo Lake	All Reaches
11-17 Jul	CPUE	1.75	1.50	5.40	10.00	5.03
	SE	0.75	0.65	1.46	6.18	1.22
	NO.HAULS	4	4	20	4	32
25-31 Jul	CPUE	1.00	10.25	4.25	16.75	6.16
	SE	1.00	5.99	1.48	9.29	1.74
	NO.HAULS	4	4	20	4	32
08-14 Aug	CPUE	0.50	7.50	8.35	32.75	10.31
	SE	0.50	5.87	1.96	18.79	2.95
	NO.HAULS	4	4	20	4	32
21-28 Aug	CPUE	11.75	4.25	10.50	42.50	13.88
	SE	3.35	2.66	2.84	14.99	3.16
	NO.HAULS	4	4	20	4	32
05-11 Sep	CPUE	6.75	14.00	12.60	26.50	13.78
	SE	3.94	6.01	3.30	12.69	2.76
	NO.HAULS	4	4	20	4	32
19-25 Sep	CPUE	13.25	10.00	14.65	41.75	17.28
	SE	5.19	6.39	5.35	28.20	4.92
	NO.HAULS	4	4	20	4	32
03-09 Oct	CPUE	6.75	11.50	13.55	72.25	19.78
	SE	6.10	9.31	3.10	39.63	6.08
	NO.HAULS	4	4	20	4	32
17-23 Oct	CPUE	5.50	5.00	11.80	22.00	11.44
	SE	2.40	3.39	4.78	21.01	3.88
	NO.HAULS	4	4	20	4	32

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Table 6. Beach Seine Standing Crop Index (and Standard Error, SE) for Juvenile American Shad in Vernon Pool Regions of the Connecticut River, July - October 2004.

2004 Week	Brattleboro		Cersosimo		Vernon		Cersosimo Lake		All Regions	
	Index	SE	Index	SE	Index	SE	Index	SE	Index	SE
11 - 17 Jul	0	0	0	0	0	0	0	0	0	0
25 - 31 Jul	0	0	0	0	0	0	0	0	0	0
08 - 14 Aug	0	0	288	288	4668	4668	0	0	4956	4956
21 - 28 Aug	0	0	0	0	3247	3247	0	0	3247	3247
05 - 11 Sep	207	207	0	0	203	203	0	0	410	410
19 - 25 Sep	0	0	0	0	0	0	0	0	0	0
03 - 09 Oct	0	0	0	0	7915	7712	0	0	7915	7712
17 - 23 Oct	0	0	0	0	0	0	0	0	0	0
MEAN	26	26	36	36	2004	1979	0	0	2066	2041

NOTE: Standing Crop Index is the weekly mean estimated total number of juvenile American shad in each region.

Table 7. Comparison Standing Crop Index of Juvenile American Shad Abundance among Vernon Pool Regions of the Connecticut River during July – October 2000–2004.

Year	Beach Seine Standing Crop Index in Region				
	Brattleboro	Cersosimo	Cersosimo Lake	Vernon	Combined
2000	1,069	108	944	29,123	31,244
2001	0	216	61	2,156	2,433
2002	0	0	0	10,528	10,528
2003 ¹	0	48	0	675	723
2004	26	36	0	2004	2066

¹The standing crop index for 2003 is based on the beach seine catch only for comparability among years, even though some fish were caught by midwater trawl in the Brattleboro Region.

Table 8. Annual Juvenile American Shad Standing Crop Index and the Estimated Number of Adult Shad in Vernon Pool of the Connecticut River, 2000 through 2004.

Year	June Daily Average River Flow at Vernon Dam (CFS)	Juvenile Shad Beach Seine Abundance Index in Vernon Pool	Adult Shad Passed Upstream at Vernon Dam ¹			Adult Shad Trucked from Holyoke Lift and Stocked in Vernon Pool ²			Combined Number of Adult Shad in Vernon Pool		
			Males ¹	Females ¹	Total	Males ³	Females ³	Total	Males	Females	Total
2000	8892	31244	632	168	800	474	533	1007	1106	701	1807
2001	10124	2433	1538	128	1666	31	40	71	1569	168	1737
2002	16075	10528	281	75	356	273	327	600	554	402	956
2003 ⁴	6681	723	212	56	268	400	469	869	612	525	1137
2004	6852	2066	336	317	653	200	152	352	536	469	1005

¹American shad upstream passage at Vernon Dam as reported in Normandeau 2002 (Bulletin No. 77). A ten-year average of 79% males (1990-2001, 2000 excluded) was used to estimate the sex composition of the run during 2000, 2002 and 2003 because sex composition was not determined in those years. The shad run was also not sampled for biocharacteristics at Vernon Dam in 2004, so the percentage of females of 0.485 observed from the Cabot Station fishway during 2004 (Jan Rowan pers. Com. 22 Apr 05) was applied to the number passed at Vernon Dam in 2004.

²American shad numbers trucked as reported for 2000, 2001 and 2002 by Dr. Caleb Slater, Pers. Comm., 22 April 2002 and 14 April 2003, and by Mr. Ken Cox 6 April 2004 for 2003.

³Number of male and female adult American shad trucked were estimated from the overall sex ratio reported for the Holyoke lift in each year, Dr. Caleb Slater, Pers. Comm., 22 April 2002 (47.1% males in 2001), 14 April 2003 (45.5% males in 2002), 4 April 2004 (46% males in 2003), and 28 April 2005 (56.7% males in 2004).

⁴The standing crop index for 2003 is based on the beach seine catch only for comparability among years, even though some fish were caught by midwater trawl in the Brattleboro Region.