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# SUMMARY REPORT ON THE 1986-1997 ECOLOGICAL STUDIES OF THE CONNECTICUT RIVER, VERNON, VERMONT

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## 1.0 INTRODUCTION AND BACKGROUND

This report summarizes nine years (1986, 1988, and 1990-1997) of historical data collected during required environmental monitoring under Part III of Vermont Yankee Nuclear Power Corporation's NPDES Permit (Permit No.VT0000264). Specific categories of data summarized and reviewed were macroinvertebrate, larval fish, fish, anadromous fish, fish impingement, and water quality collections. Macroinvertebrate data from 1986 and annual reports for 1987 and 1989 were not available at the time this review was conducted. A similar review was conducted for data collected through 1989 and presented as part of a 316 Demonstration (Aquatec 1990).

## 2.0 MACROINVERTEBRATES

Macroinvertebrates were routinely sampled during 1988-1997 as part of the NPDES monitoring requirements. The sampling effort occurs in June, August, and October at four locations (Stations 2, 3, 4, and 5; Figure 1). Samples are collected by dredge (three times per year) and rock basket (two times per year). Methods of collection and processing have remained the same and are provided in the NPDES annual reports.

During the eight sample years we reviewed, a total of 93,295 macroinvertebrates was collected, representing nine invertebrate phyla (Table 1). Organisms collected by dredge and basket samples comprised 66% and 34% of the total, respectively. Greater than one third of all organisms were collected at Station 4. The proportions collected by each gear type upstream and downstream of Vernon Dam were similar. Macroinvertebrate data by year and gear type are presented in Appendices A and B. Macroinvertebrate data in the NPDES annual reports have been presented as collections upstream and downstream of Vernon Dam. However we believe it was more appropriate for this review to summarize the data by combining Stations 2-4 and isolating Station 5 as a control since it is the only station upstream of the plant discharge, and out of it's potential influence. Comparisons were made of the percent abundance of upstream vs. downstream collections to ascertain trends in abundance over time.

The composition of macroinvertebrates over the eight-year period at all stations consisted primarily of dipterans (39%), oligochaetes (21%), and pelecypods (10%). These trends were similar for upstream and downstream locations, with some minor variations, at each of the monitoring stations. The annual abundance for each of the nine phyla varied throughout the eight years and was likely due to natural yearly and seasonal fluctuations and a relatively small number of samples per year (Figure 2 and Appendices A and B). A comparison of macroinvertebrate abundance collected by both gear types upstream (Station 5 only) and downstream of the discharge shows a random distribution for each of the phyla present (Figure 3). These findings were similar to those reported in the 316 Demonstration (Aquatec 1990) and indicate there has been no adverse trends in the macroinvertebrate populations resulting from the operation of Vermont Yankee.

## 3.0 FISH

The fish community was routinely sampled during 1986-1997 as part of the NPDES monitoring requirements. The sampling effort occurs during four months per year (May, June, September, and October) at eight stations (Figure 1). Fish were collected with trap nets and electrofishing gear. Methods of collection and processing are provided in the NPDES annual reports.

During the nine sample years we investigated (1986, 1988, 1990-1997), a total 30,202 fish representing 30 species was collected (Table 2). Fish collected by electrofishing and trap netting comprised 54% and 46% of the total, respectively. The proportions collected by each gear type upstream and downstream were similar. Fish collection data by year and gear type are presented in Appendices C and D.

The most common fishes collected over the nine-year period at all stations combined were yellow perch (26%), rock bass (11%), pumpkinseed (10%), spottail shiner (9%), and white sucker (9%). Upstream collections (reservoir habitat) accounted for 66% of the fish caught. Yellow perch (36%), pumpkinseed (14%) and white sucker (9%) were the most abundant fish in the upstream collections. The most

abundant fishes captured downstream of Vernon Dam (riverine and flowing pool habitat) were rock bass (21%), smallmouth bass (14%), and spottail shiner (11%).

The annual abundance for each of the species, which comprised approximately 95% of the total catch (n=13), varied throughout the period and was likely due to natural yearly and seasonal fluctuations and recruitment success (Appendices C and D). A comparison of abundance of the dominant species by both gear types upstream and downstream of Vernon Dam showed a random distribution (Figure 4). These findings were similar to those reported in Aquatec (1990) and indicate there has been no adverse trends in the populations resulting in the operation of Vermont Yankee.

A cursory review of the fish collection data indicated there was overlap (similarities in relative abundance) in the fish sampling methods employed. To further evaluate this overlap we analyzed the data by the Spearman rank correlation ($r_s$) test to determine if the ranks of the percent abundance by gear type changed, and by computing an index of percent similarity ($PS_c$) in species between gear types (Zar 1974). The Spearman rank test is expressed as follows:

$$r_s = \frac{1 - 6\sum_{i=1}^{n} d_{i^2}}{N^3 - N} .$$

The percent similarity index is expressed as follows:

$$PS_c = 100 - 0.5\sum_{i=1}^{n} |a - b| = \sum_{i=1}^{n} \min(a,b)$$

where $PS_c$ is the percent similarity and a and b are the percentage of a species in Sample A (trap net) and B (electrofishing). The $PS_c$ is an empirical measure and is not an estimate of a statistical parameter of the population from which the samples are drawn. The values of $PS_c$ can range from 0 to 100. A value of zero indicates that the species composition in the two samples is entirely different and a value of 100 indicates complete similarity. For this evaluation, we removed anadromous fishes and minnows from the data set due to gear selectivity of these species (i.e., minnows are rarely adequately sampled with trap nets).

Results of these tests indicated there was overlap in collections upstream of Vernon Dam (Table 3). There were strong correlations $r_{(s)} > (r_s)_{0.05}$ within each year as well as high percent similarity. In contrast significant differences $r_{(s)} < (r_s)_{0.05}$ in collection by gear type downstream of the dam were observed. The $r_s$ values and percent similarities were much lower. This difference may be a function of the habitat sampled as opposed to gear efficiencies. The area downstream of Vernon Dam is riverine and likely not conducive to efficient trap net sampling.

## 4.0 ANADROMOUS FISH SAMPLING

Juvenile shad sampling occurred routinely since1991 as part of the NPDES monitoring requirements. The sampling effort occurs twice monthly from July-October at three locations: 0.1 mi. below Vernon Dam, Station 3, and Stebbin Island. Fish were collected with electrofishing gear. Methods of collection and processing are provided in the NPDES annual reports. Although sampling has occurred since 1991 data prior to 1996 were not available for this review. The numbers of shad collected in 1996 and 1997 were 142 and 321, respectively (Table 4). The catch by month varied between the two years reviewed. In 1996 the greatest number (n=103) of shad were collected in September. In 1997 most (n=179) were collected in August. Limited data for the total sampling efforts (1991-1997) precludes further investigation of abundance trends.

## 5.0 POTENTIAL FISH ENTRAINMENT

Ichthyoplankton sampling was conducted in the Connecticut River in the vicinity of the Vermont Yankee intakes. The numbers of larval fish reported in the review of data for 1988 and 1990-1997 represent fish

that may have become entrained by the operation of Vermont Yankee, not those that necessarily were entrained. Larval fish would have to be collected directly from the intake structure forebay to determine the actual number and taxa of fish entrained.

Ichthyoplankton samples are collected weekly between 1 May and 15 July at the surface, mid-depth, and near bottom from the Connecticut River in the vicinity of the Vermont Yankee intakes during 1988 and 1990 through 1997 (Table 5). Specific methods of collection are outlined in each NPDES annual report.

The review of nine years of data indicates that 5,747 larval fish were collected, representing 14 fish taxa (Table 6 and Appendix E). Minnows and white perch were the most abundant ichthyoplankters; comprising 84% of the larvae collected during the nine years in review (Table 6). Sunfishes, yellow perch, common carp, walleye, and largemouth bass contributed 15.6% to the catch while 0.2% of the catch was unidentifiable. A total of four largemouth bass and one American shad was collected during the review period.

As reported in earlier summaries of Vermont Yankee ichthyoplankton data (Aquatec 1990), yellow perch continued to be the first larvae encountered, usually in early to late May (Table 7). White perch were collected in early May in 1996 and 1997 but not until mid to late-May during all other years in the current review and in earlier reports (Aquatec 1990). Walleye have been consistently collected during mid-May (Table 7). Minnows were usually collected beginning in early June through mid-July and were the single principal component of ichthyoplankton collections during June and July (Table 7).

The review of 1982-1989 entrainment data conducted by Aquatec (1990) indicated that densities of the abundant taxa were relatively low in intake water and were comparable to densities observed in river samples. Because of the low densities in the intake samples observed during the 1990 review and the concomitant and subsequent lack of data indicating that relative abundance and community composition had changed, the effect of larval fish entrainment on the fish community was determined to be minimal (Aquatec 1990). Continued low larval fish entrainment density, reported in the current review (particularly of the seven representative important species identified by the Environmental Advisory Committee), also support earlier findings that the operation of Vermont Yankee results in no adverse impact to the fish community for all species and particularly for American shad.

## 6.0 FISH IMPINGEMENT

Impingement sampling was conducted weekly at the Vermont Yankee circulating water travelling screens at the cooling water intake structure for the periods of 1 April through 15 June and 1 August through 31 October of each year, except during refueling outages, when the circulating water is not in use.

The maximum number of Atlantic salmon and American shad that can be impinged at the Vermont Yankee intake structure is determined each year, prior to sampling, as outlined in the NPDES permit.

Each weekly impingement sample consists of a 6-day backwash sample and a 24-hour sample. The 6-day backwash sample is examined for anadromous fish and the 24-hour sample is examined for all fish. Therefore, a total census of anadromous fish impingement is obtained for the periods of 1 April through 15 June and 1 August through 31 October of each year. All examined fish are identified to the lowest possible taxon, weighed to the nearest g (wet weight), and total length is measured to the nearest mm.

Nearly 15,000 fish were collected during routine spring and fall impingement sampling between 1988 and 1990-1997 (Table 8). The number of years included in this summary varies for each month presented in Table 8. This is most likely due to refueling outages.

The most abundant fish collected over the summarized years were *Lepomis* sp. (46%), including pumpkinseed and bluegill, followed by yellow perch (15%), rock bass (11%), and spottail shiner (8%); (Table 8). Totals of 387 American shad and 202 Atlantic salmon were impinged during the nine years in review, comprising 3% and 1%, respectively, of the total fish impinged over nine years.

During the nine years in review, the NPDES permit limits for anadromous fish were never exceeded.

## 7.0 WATER QUALITY

Under current NPDES Permit guidelines (which began in April 1996), monthly grab samples of Connecticut River water from Stations 3, 7, and the plant discharge are analyzed for copper, iron, and zinc. Prior to 1996 additional parameters evaluated were sodium, total solids content, alkalinity to pH4.5, pH aqueous, sulfate, chloride, total suspended solids, and turbidity. Review of the annual reports from 1989 to 1997 indicated no adverse effects of water quality from the operation of Vermont Yankee.

## 8.0 LITERATURE CITED

Aquatec. 1990. 316 demonstration. Biological, hydrological, and engineering information and environment impact assessment. Prepared for Vermont Yankee Nuclear Power Corporation, Brattleboro, VT. 71 pp.

Zar, J. H. 1974. Biostatisical analysis. Prentice-Hall, Inc., Englewood Cliffs, NJ. 620 pp.

# TABLES

Table 1

Summary of macroivertebrates collected in the vicinity of the Vermont Yankee Nuclear Power Plant, 1988-1997.

| | Upstream* | | Downstream* | | | | | | | | Upstream and Downstream Combined | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Station 5 | | Station 2 | | Station 3 | | Station 4 | | Combined | | | |
| | Number | Percent | Number | Percent | Number | Percent | Number | Percent | Number | Percent | Number | Percent |
| Crustacea | 770 | 2.90 | 746 | 3.84 | 765 | 5.33 | 2,905 | 8.80 | 4,416 | 6.62 | 5,186 | 5.56 |
| Diptera | 10,468 | 39.45 | 7,772 | 40.02 | 6,211 | 43.31 | 11,647 | 35.30 | 25,630 | 38.39 | 36,098 | 38.69 |
| Ephemeroptera | 1,530 | 5.77 | 1,073 | 5.53 | 494 | 3.44 | 1,548 | 4.69 | 3,115 | 4.67 | 4,645 | 4.98 |
| Gastropoda | 648 | 2.44 | 1,931 | 9.94 | 339 | 2.36 | 844 | 2.56 | 3,114 | 4.66 | 3,762 | 4.03 |
| Hydrozoa | 99 | 0.37 | 224 | 1.15 | 638 | 4.45 | 43 | 0.13 | 905 | 1.36 | 1,004 | 1.08 |
| Oligochaeta | 7,123 | 26.84 | 1,677 | 8.64 | 1,704 | 11.88 | 8,778 | 26.60 | 12,159 | 18.21 | 19,282 | 20.67 |
| Other | 1,006 | 3.79 | 431 | 2.22 | 874 | 6.09 | 799 | 2.42 | 2,104 | 3.15 | 3,110 | 3.33 |
| Pelecypoda | 2,915 | 10.98 | 1,144 | 5.89 | 790 | 5.51 | 4,726 | 14.32 | 6,660 | 9.98 | 9,575 | 10.26 |
| Trichoptera | 1,449 | 5.46 | 2,884 | 14.85 | 1,737 | 12.11 | 1,542 | 4.67 | 6,163 | 9.23 | 7,612 | 8.16 |
| Tricladida | 530 | 2.00 | 1,536 | 7.91 | 789 | 5.50 | 166 | 0.50 | 2,491 | 3.73 | 3,021 | 3.24 |
| **Total** | **26,538** | **100.00** | **19,418** | **100.00** | **14,341** | **100.00** | **32,998** | **100.00** | **66,757** | **100.00** | **93,295** | **100.00** |

*Upstream and downstream of the plant discharge.

**Table 2**

**Summary of fish collected in the vicinity of the Vermont Yankee Nuclear Power Plant, 1986-1997.**

| | Upstream | | | | | | Downstream | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Electrofishing | | Trap netting | | Total | | Electrofishing | | Trap netting | | Total | | Combined Total | |
| Species | Number | Percent | Number | Percent | Number | Percent | Number | Percent | Number | Percent | Number | Percent | Number | Percent |
| Sea lamprey | 15 | 0.13 | 0 | 0.00 | 15 | 0.07 | 15 | 0.30 | 18 | 0.35 | 33 | 0.33 | 48 | 0.16 |
| American eel | 42 | 0.37 | 7 | 0.08 | 49 | 0.24 | 59 | 1.19 | 32 | 0.62 | 91 | 0.90 | 140 | 0.46 |
| Atlantic salmon | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.02 | 2 | 0.04 | 3 | 0.03 | 3 | 0.01 |
| Brook trout | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Rainbow smelt | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Clupeidae | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 5 | 0.10 | 5 | 0.05 | 5 | 0.02 |
| Blueback herring | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 6 | 0.12 | 8 | 0.15 | 14 | 0.14 | 14 | 0.05 |
| American shad | 82 | 0.73 | 4 | 0.05 | 86 | 0.43 | 828 | 16.72 | 78 | 1.50 | 906 | 8.93 | 992 | 3.28 |
| Gizzard shad | 1 | 0.01 | 0 | 0.00 | 1 | 0.00 | 3 | 0.06 | 0 | 0.00 | 3 | 0.03 | 4 | 0.01 |
| Brown trout | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.02 | 0 | 0.00 | 1 | 0.01 | 1 | 0.00 |
| Esocidae | 1 | 0.01 | 0 | 0.00 | 1 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.00 |
| Northern Pike | 44 | 0.39 | 18 | 0.20 | 62 | 0.31 | 35 | 0.71 | 8 | 0.15 | 43 | 0.42 | 105 | 0.35 |
| Chain Pickerel | 91 | 0.81 | 139 | 1.58 | 230 | 1.15 | 25 | 0.50 | 38 | 0.73 | 63 | 0.62 | 293 | 0.97 |
| Cyprinidae | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 2 | 0.04 | 0 | 0.00 | 2 | 0.02 | 2 | 0.01 |
| Common carp | 102 | 0.91 | 69 | 0.78 | 171 | 0.85 | 34 | 0.69 | 19 | 0.37 | 53 | 0.52 | 224 | 0.74 |
| Eastern silvery minnow | 3 | 0.03 | 1 | 0.01 | 4 | 0.02 | 7 | 0.14 | 26 | 0.50 | 33 | 0.33 | 37 | 0.12 |
| Longnose dace | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Golden shiner | 423 | 3.76 | 263 | 2.99 | 686 | 3.42 | 42 | 0.85 | 35 | 0.67 | 77 | 0.76 | 763 | 2.53 |
| Notropis sp. | 1 | 0.01 | 0 | 0.00 | 1 | 0.00 | 8 | 0.16 | 0 | 0.00 | 8 | 0.08 | 9 | 0.03 |
| Common shiner | 1 | 0.01 | 0 | 0.00 | 1 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.00 |
| Spottail shiner | 1,269 | 11.27 | 246 | 2.79 | 1,515 | 7.55 | 935 | 18.89 | 168 | 3.24 | 1,103 | 10.88 | 2,618 | 8.67 |
| Mimic shiner | 134 | 1.19 | 1 | 0.01 | 135 | 0.67 | 213 | 4.30 | 1 | 0.02 | 214 | 2.11 | 349 | 1.16 |
| Fallfish | 2 | 0.02 | 0 | 0.00 | 2 | 0.01 | 204 | 4.12 | 17 | 0.33 | 221 | 2.18 | 223 | 0.74 |
| White sucker | 1,139 | 10.12 | 597 | 6.78 | 1,736 | 8.65 | 580 | 11.71 | 271 | 5.22 | 851 | 8.39 | 2,587 | 8.57 |
| Yellow bullhead | 32 | 0.28 | 35 | 0.40 | 67 | 0.33 | 2 | 0.04 | 6 | 0.12 | 8 | 0.08 | 75 | 0.25 |
| Brown bullhead | 124 | 1.10 | 196 | 2.23 | 320 | 1.60 | 11 | 0.22 | 547 | 10.54 | 558 | 5.50 | 878 | 2.91 |
| Banded killifish | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| White perch | 273 | 2.43 | 436 | 4.95 | 709 | 3.53 | 19 | 0.38 | 52 | 1.00 | 71 | 0.70 | 780 | 2.58 |
| Rock bass | 294 | 2.61 | 807 | 9.17 | 1,101 | 5.49 | 285 | 5.76 | 1,855 | 35.74 | 2,140 | 21.10 | 3,241 | 10.73 |
| Lepomis sp. | 46 | 0.41 | 5 | 0.06 | 51 | 0.25 | 10 | 0.20 | 23 | 0.44 | 33 | 0.33 | 84 | 0.28 |
| Pumpkinseed | 1,157 | 10.28 | 1,636 | 18.58 | 2,793 | 13.92 | 66 | 1.33 | 301 | 5.80 | 367 | 3.62 | 3,160 | 10.46 |
| Bluegill | 1,132 | 10.06 | 558 | 6.34 | 1,690 | 8.42 | 207 | 4.18 | 508 | 9.79 | 715 | 7.05 | 2,405 | 7.96 |

**Table 2**

**Continued.**

| | Upstream | | | | | | Downstream | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Electrofishing | | Trap netting | | Total | | Electrofishing | | Trap netting | | Total | | Combined Total | |
| Species | Number | Percent | Number | Percent | Number | Percent | Number | Percent | Number | Percent | Number | Percent | Number | Percent |
| Smallmouth bass | 177 | 1.57 | 265 | 3.01 | 442 | 2.20 | 952 | 19.23 | 426 | 8.21 | 1,378 | 13.59 | 1,820 | 6.03 |
| Largemouth bass | 746 | 6.63 | 93 | 1.06 | 839 | 4.18 | 69 | 1.39 | 23 | 0.44 | 92 | 0.91 | 931 | 3.08 |
| Tesselated darter | 6 | 0.05 | 1 | 0.01 | 7 | 0.03 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 7 | 0.02 |
| Black crappie | 8 | 0.07 | 20 | 0.23 | 28 | 0.14 | 0 | 0.00 | 6 | 0.12 | 6 | 0.06 | 34 | 0.11 |
| Yellow perch | 3,819 | 33.93 | 3,312 | 37.62 | 7,131 | 35.55 | 242 | 4.89 | 608 | 11.71 | 850 | 8.38 | 7,981 | 26.43 |
| Walleye | 93 | 0.83 | 95 | 1.08 | 188 | 0.94 | 90 | 1.82 | 109 | 2.10 | 199 | 1.96 | 387 | 1.28 |
| Etheostoma sp. | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Totals | 11,257 | 100.00 | 8,804 | 100.00 | 20,061 | 100.00 | 4,951 | 100.00 | 5,190 | 100.00 | 10,141 | 100.00 | 30,202 | 100.00 |

**Table 3**

**Percent similarities and Spearman Rank correlations of fish collected by trapnet and eletrofishing upstream and downstream of Vernon Dam, 1986-1997.**

| | 1986 | 1988 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Downstream Sampling (Trap net versus Electrofishing)* | | | | | |
| $PS_C$ | 41.846 | 55.708 | 42.007 | 41.537 | 39.823 | 39.482 | 44.598 | 51.648 | 65.094 | 59.346 |
| $r_{(s)}$ | 0.645 | 0.725 | 0.666 | 0.374 | 0.473 | 0.389 | 0.712 | 0.515 | 0.698 | 0.752 |
| $(r_s)_{0.05}$ | 0.738 | 0.700 | 0.700 | 0.700 | 0.700 | 0.700 | 0.738 | 0.738 | 0.700 | 0.700 |
| | | | | | *Upstream Sampling (Trap net versus Electrofishing)* | | | | | |
| $PS_C$ | 69.268 | 74.815 | 77.795 | 74.344 | 69.517 | 74.263 | 78.246 | 74.061 | 64.012 | 77.600 |
| $r_{(s)}$ | 0.76544 | 0.83272 | 0.85338 | 0.7763 | 0.61249 | 0.76096 | 0.61094 | 0.69693 | 0.69774 | 0.57105 |
| $(r_s)_{0.05}$ | 0.538 | 0.521 | 0.472 | 0.46 | 0.503 | 0.485 | 0.503 | 0.485 | 0.472 | 0.472 |

**Table 4**

**Summary of anadromous fish collections in the vicinity of Vermont Yankee Nuclear Power Station , 1991-1997.**

| Month | Station | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | Percent by Month | 1997 | Percent by Month |
|---|---|---|---|---|---|---|---|---|---|---|
| July | Station 3 | * | * | * | * | * | 0 | 0.0 | 0 | 0.0 |
| | Stebbin Island | * | * | * | * | * | 0 | 0.0 | 17 | 100.0 |
| | 0.1 mi. south of Vernon Dam | * | * | * | * | * | 0 | 0.0 | 0 | 0.0 |
| *Total* | | | | | | | *0* | *0.0* | *17* | *100.0* |
| August | Station 3 | * | * | * | * | * | 13 | 46.4 | 49 | 27.4 |
| | Stebbin Island | * | * | * | * | * | 10 | 35.7 | 83 | 46.4 |
| | 0.1 mi. south of Vernon Dam | * | * | * | * | * | 5 | 17.9 | 47 | 26.3 |
| *Total* | | | | | | | *28* | *100.0* | *179* | *100.0* |
| September | Station 3 | * | * | * | * | * | 15 | 14.6 | 28 | 25.5 |
| | Stebbin Island | * | * | * | * | * | 30 | 29.1 | 51 | 46.4 |
| | 0.1 mi. south of Vernon Dam | * | * | * | * | * | 58 | 56.3 | 31 | 28.2 |
| *Total* | | | | | | | *103* | *100.0* | *110* | *100.0* |
| October | Station 3 | * | * | * | * | * | N/A | 0.0 | 1 | 6.7 |
| | Stebbin Island | * | * | * | * | * | 8 | 72.7 | 11 | 73.3 |
| | 0.1 mi. south of Vernon Dam | * | * | * | * | * | 3 | 27.3 | 3 | 20.0 |
| *Total* | | | | | | | *11* | *100.0* | *15* | *100.0* |
| **Total** | | | | | | | **142** | | **321** | |

* Sampling occurred but data were not available for summarization.

**Table 5**

**Vermont Yankee icthyoplankton sampling conducted in the Connecticut River in the vicinity of the intake structure. Summary of 1988 and 1990-1997.**

| Year | Depth (meters) | Number of Collections | | | |
|---|---|---|---|---|---|
| | | May | June | July | Total |
| 1998 | 0.3 | 4 | 5 | 2 | 11 |
| | 1.5 | 3 | 5 | 2 | 10 |
| | 3.0 | 3 | 5 | 2 | 10 |
| 1990 | 0.3 | 5 | 4 | 2 | 11 |
| | 1.8 | 5 | 4 | 2 | 11 |
| | 3.7 | 5 | 4 | 2 | 11 |
| 1991 | 0.3 | 5 | 4 | 3 | 12 |
| | 1.8 | 5 | 4 | 3 | 12 |
| | 3.7 | 5 | 4 | 3 | 12 |
| 1992 | 0.3 | 5 | 4 | 2 | 11 |
| | 1.8 | 5 | 4 | 2 | 11 |
| | 3.7 | 5 | 4 | 2 | 11 |
| 1993 | 0.3 | 5 | 4 | 2 | 11 |
| | 1.8 | 5 | 4 | 2 | 11 |
| | 3.7 | 5 | 4 | 2 | 11 |
| 1994 | 0.3 | 4 | 5 | 2 | 11 |
| | 1.8 | 4 | 5 | 2 | 11 |
| | 3.7 | 4 | 5 | 2 | 11 |
| 1995 | 0.3 | 4 | 4 | 2 | 10 |
| | 1.8 | 4 | 4 | 2 | 10 |
| | 3.7 | 4 | 4 | 2 | 10 |
| 1996 | 0.3 | 4 | 4 | 3 | 11 |
| | 1.8 | 4 | 4 | 3 | 11 |
| | 3.7 | 4 | 4 | 3 | 11 |
| 1997 | 0.3 | 4 | 4 | 3 | 11 |
| | 1.8 | 4 | 4 | 3 | 11 |
| | 3.7 | 4 | 4 | 3 | 11 |
| **Total** | | | | | **295** |

**Table 6**

**Relative abundance of ichthyoplankton collected in the vicinity of the Vermont Yankee intakes during 1988 and 1990-1997. Numbers of fish reported were obtained from 295 samples.**

| | Number | Percent |
|---|---|---|
| Common carp | 18 | 0.31 |
| Notropis sp. | 2,850 | 49.59 |
| White perch | 1,191 | 20.72 |
| Lepomis sp. | 628 | 10.93 |
| Yellow perch | 244 | 4.25 |
| Cyprinidae | 788 | 13.71 |
| Walleye | 8 | 0.14 |
| American shad | 1 | 0.02 |
| Spottail shiner | 2 | 0.03 |
| Bluegill | 2 | 0.03 |
| Fallfish | 1 | 0.02 |
| White sucker | 1 | 0.02 |
| Largemouth bass | 4 | 0.07 |
| Unknown | 9 | 0.16 |
| Total | 5,747 | 100.0 |

**Table 7**

**Earliest and latest dates of capture of ichthyoplankton for four game fish species, 1988 and 1990-1997.**

| | Largemouth bass | | White perch | | Walleye | | Yellow perch | |
|---|---|---|---|---|---|---|---|---|
| Year | Earliest | Latest | Earliest | Latest | Earliest | Latest | Earliest | Latest |
| 1988 | - | - | 16 May | 13 Jul | - | - | 10 May | 24 May |
| 1990 | - | - | 25 May | 12 Jul | - | - | 01 May | 25 May |
| 1991 | - | - | 21 May | 25 Jun | 14 May | 14 May | 02 May | 14 May |
| 1992 | - | - | 20 May | 23 Jun | 20 May | 20 May | 05 May | 20 May |
| 1993 | - | - | 19 May | 28 Jun | - | - | 10 May | 19 May |
| 1994 | - | - | 25 May | 06 Jul | 25 May | 01 Jun | 11 May | 25 May |
| 1995 | - | - | 12 May | 27 Jun | 12 May | 12 May | 12 May | 25 May |
| 1996 | - | - | 08 May | 03 Jul | - | - | 08 May | 20 May |
| 1997 | 02 Jul | 02 Jul | 05 Jun | 18 Jun | - | - | 10 May | 18 Jun |

Table 8

**Summary of monthly impingement of fish on Vermont Yankee's circulating water traveling screens. Number of years vary by month because not all months were sampled during each of the nine years summarized (usually due to refueling outages).**

| | April | May | June | August | September | October | |
|---|---|---|---|---|---|---|---|
| *Number of Years in Summary:* | *8* | *9* | *9* | *9* | *7* | *8* | **Total** |
| Sea lamprey | 100 | 14 | 4 | 2 | 1 | 9 | 130 |
| American eel | 0 | 1 | 0 | 2 | 0 | 7 | 10 |
| American shad | 0 | 0 | 1 | 23 | 19 | 344 | 387 |
| Blueback herring | | | | | 2 | 31 | 33 |
| Gizzard shad | 0 | 0 | 0 | 1 | 1 | 7 | 9 |
| Atlantic salmon | 43 | 147 | 12 | 0 | 0 | 0 | 202 |
| Brook trout | 1 | 1 | 1 | 0 | 0 | 3 | 6 |
| Brown trout | 4 | 1 | 0 | 0 | 0 | 2 | 7 |
| Rainbow trout | 0 | 8 | 0 | 0 | 0 | 0 | 8 |
| Rainbow smelt | 3 | 1 | 0 | 0 | 0 | 0 | 4 |
| Chain pickerel | 25 | 1 | 1 | 0 | 1 | 3 | 31 |
| Northern pike | 4 | 0 | 1 | 0 | 0 | 0 | 5 |
| Common carp | 2 | 0 | 0 | 0 | 0 | 6 | 8 |
| Cyprinidae | 6 | 12 | 0 | 0 | 0 | 0 | 18 |
| Common shiner | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| Eastern silvery minnow | 5 | 13 | 0 | 0 | 0 | 0 | 18 |
| Golden shiner | 117 | 15 | 5 | 8 | 0 | 16 | 161 |
| Spottail shiner | 959 | 94 | 15 | 33 | 1 | 37 | 1,139 |
| Mimic shiner | 12 | 10 | 0 | 4 | 0 | 2 | 28 |
| Longnose dace | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| Notropis sp. | 113 | 1 | 1 | 0 | 2 | 0 | 117 |
| White sucker | 23 | 20 | 3 | 5 | 2 | 3 | 56 |
| Yellow bullhead | 121 | 12 | 2 | 0 | 4 | 88 | 227 |
| Brown bullhead | 105 | 355 | 10 | 37 | 3 | 58 | 568 |
| Banded killifish | | 1 | 0 | 0 | 0 | 0 | 1 |
| White perch | 17 | 23 | 6 | 145 | 22 | 235 | 448 |
| Rock bass | 795 | 210 | 141 | 41 | 65 | 347 | 1,599 |
| Lepomis sp. | 189 | 106 | 14 | 777 | 18 | 1,863 | 2,967 |
| Pumpkinseed | 79 | 99 | 27 | 12 | 7 | 629 | 853 |
| Bluegill | 1,074 | 95 | 63 | 118 | 30 | 1,557 | 2,937 |
| Smallmouth bass | 89 | 15 | 12 | 61 | 13 | 89 | 279 |
| Largemouth bass | 9 | 4 | 0 | 67 | 4 | 50 | 134 |
| Black crappie | | | 1 | 0 | 0 | 0 | 1 |
| Tessellated darter | 17 | 11 | 0 | 3 | 1 | 1 | 33 |
| Yellow perch | 1,243 | 423 | 138 | 289 | 13 | 141 | 2,247 |
| Walleye | 10 | 2 | 1 | 30 | 14 | 48 | 105 |
| Total | 5,166 | 1,696 | 459 | 1,658 | 223 | 5,576 | 14,778 |

# FIGURES

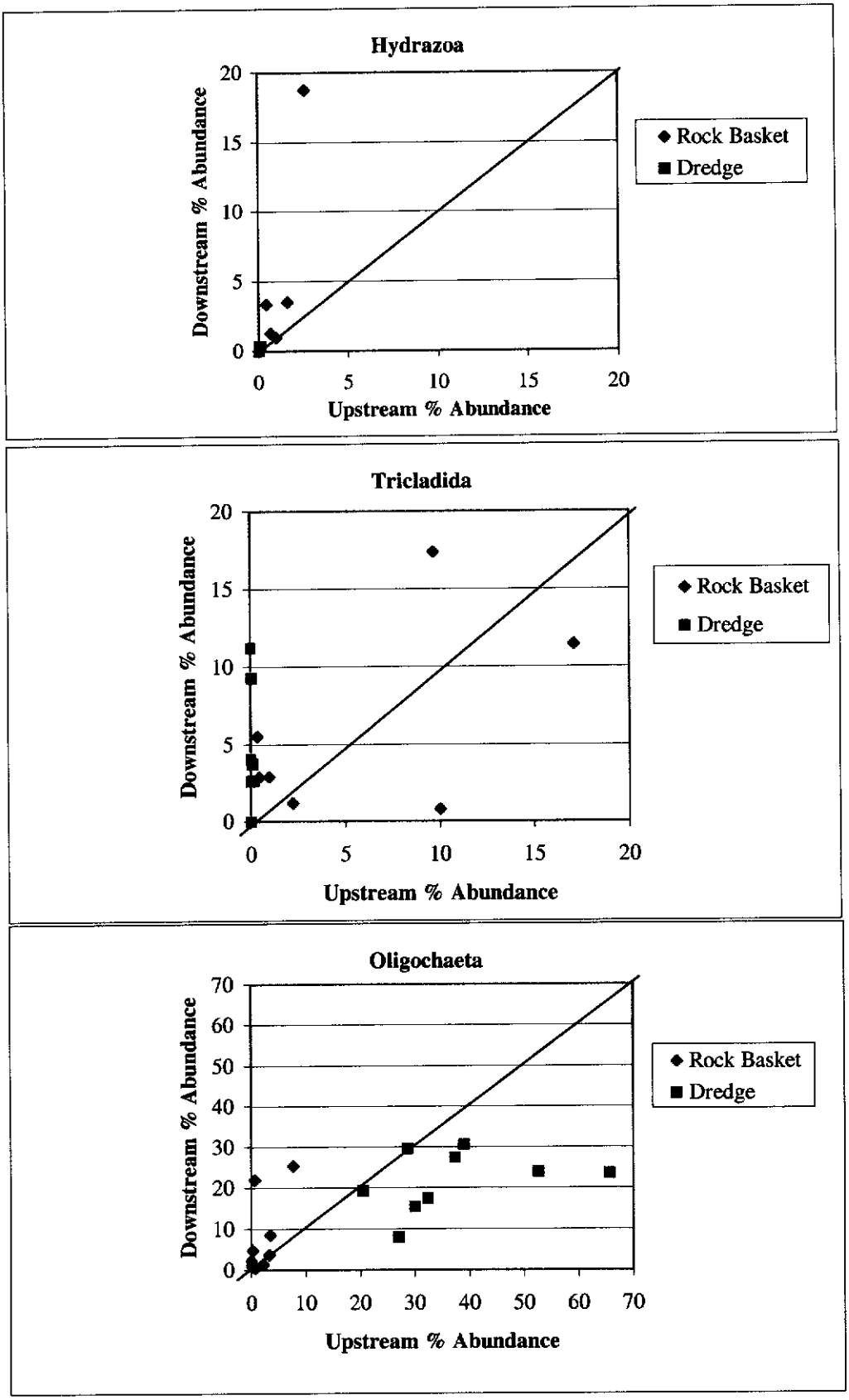



**Figure 2**

**Comparison of upstream and downstream abundance of nine macroinvertebrate phyla collected in the vicinity of the Vermont Yankee discharge, 1988-1997.**

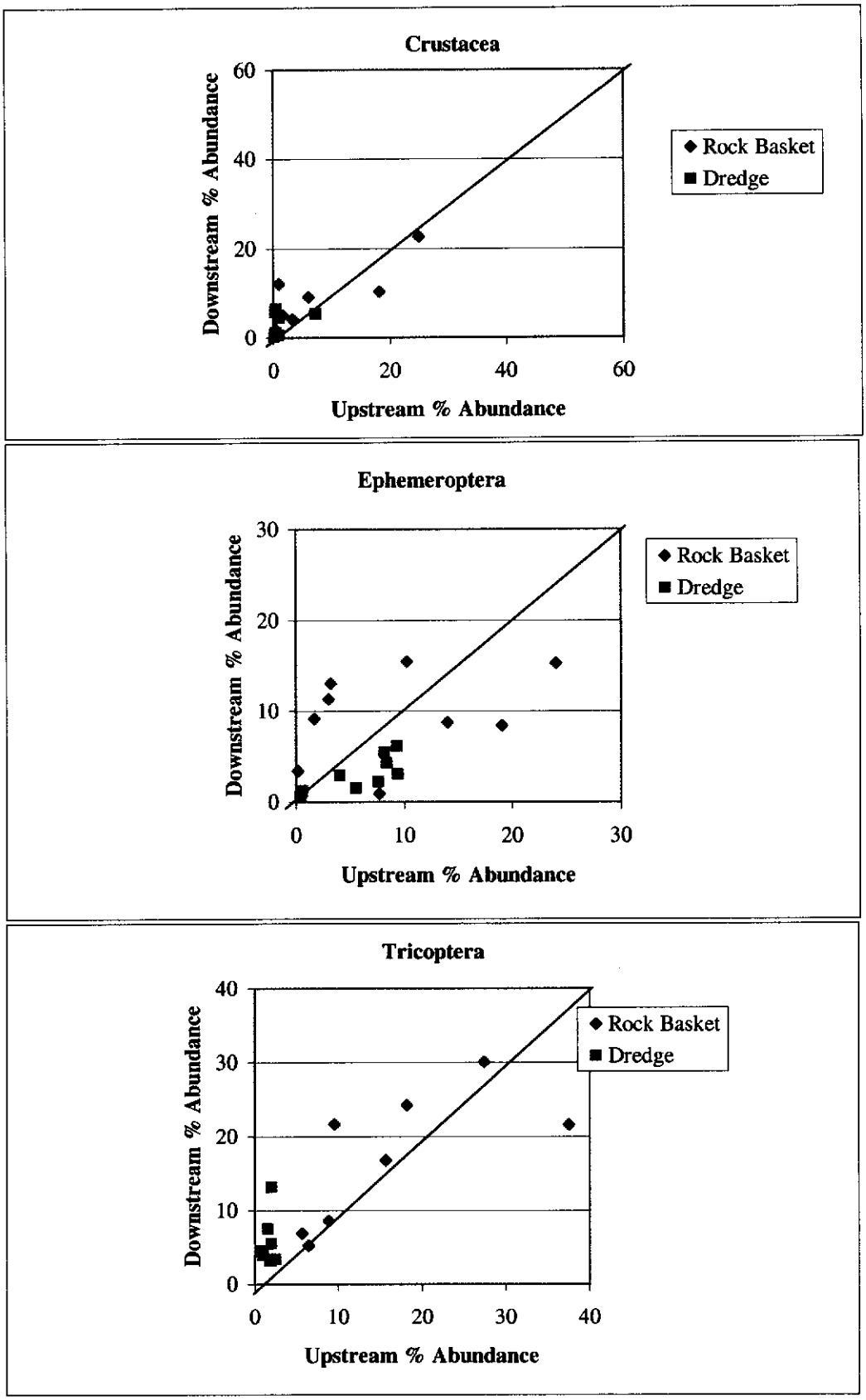



**Figure 2**

**Continued.**

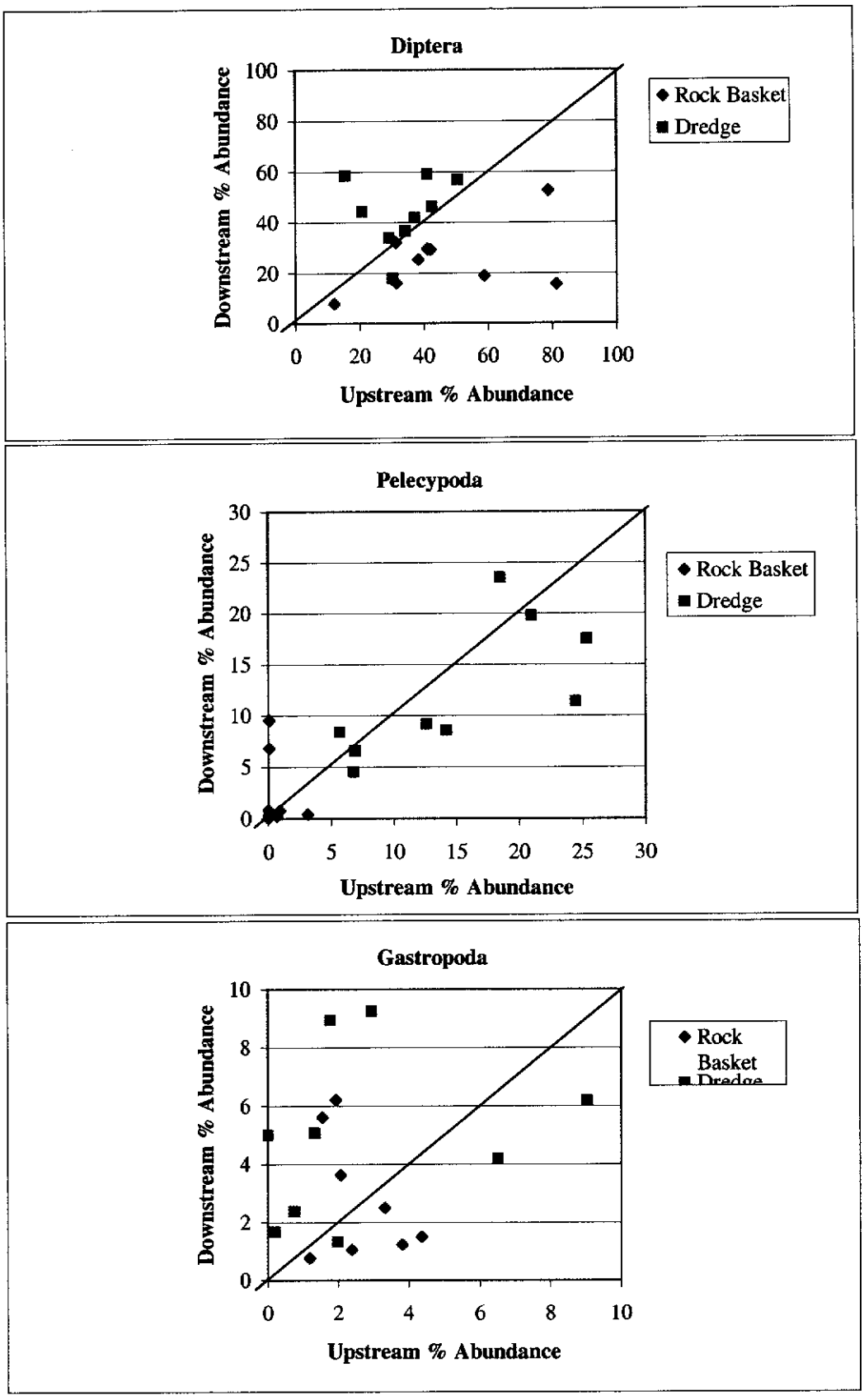



**Figure 2**

**Continued.**

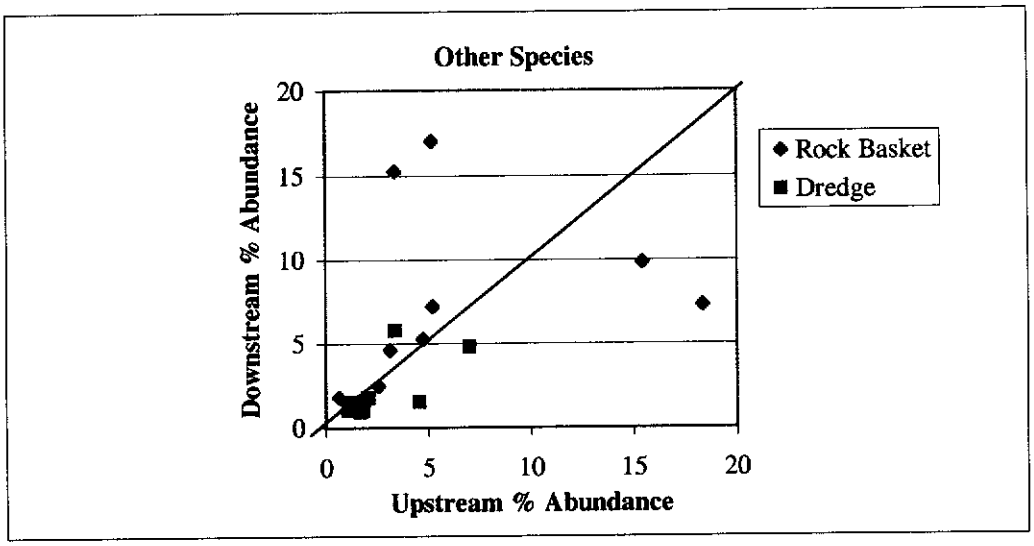



**Figure 2**

**Continued.**

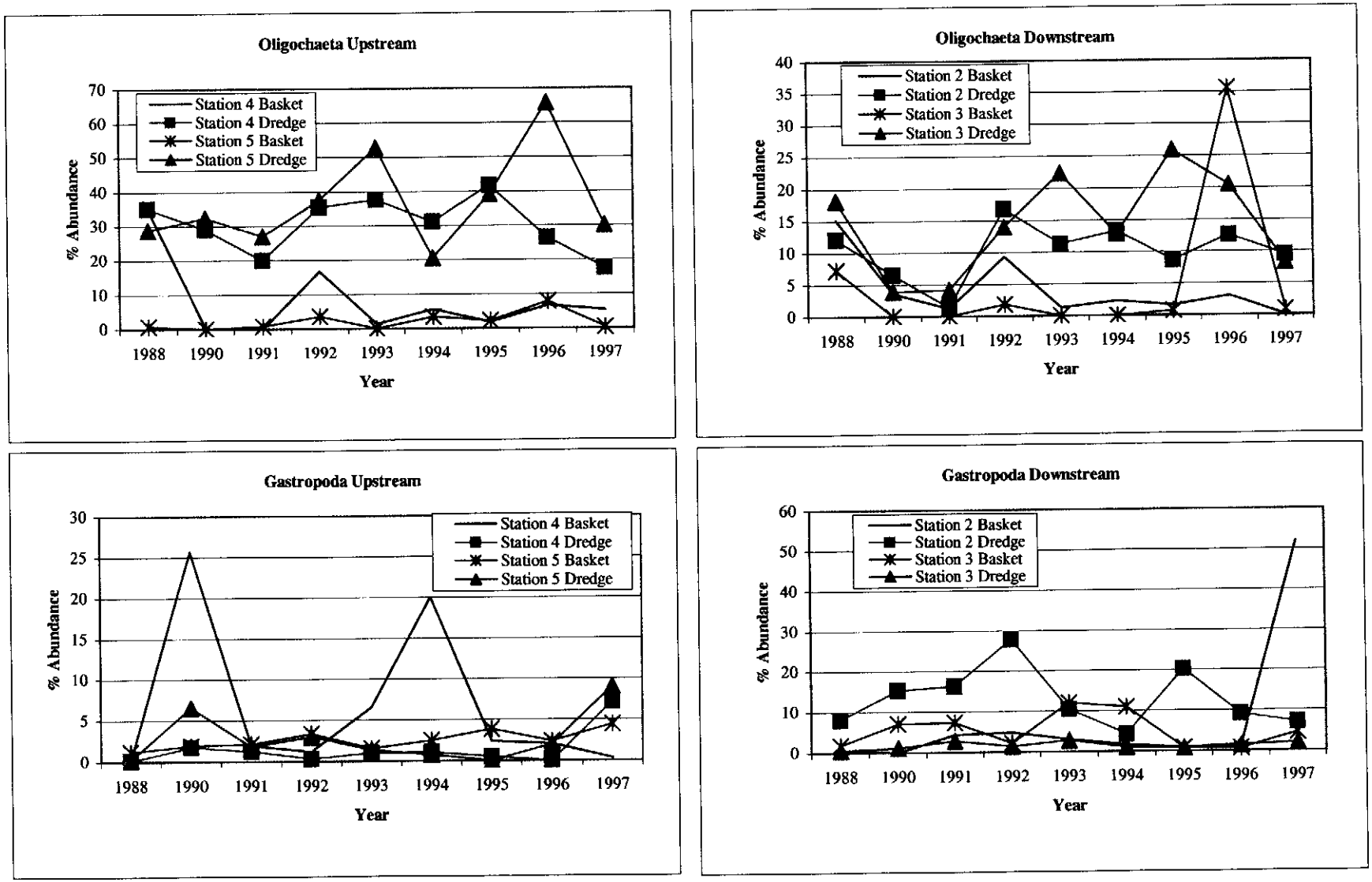



**Figure 3**

**Comparison of annual upstream and downstream abundance of nine macroinvertebrate phyla collected by dredge and rockbasket in the vicinity of Vermont Yankee, 1988-1997.**

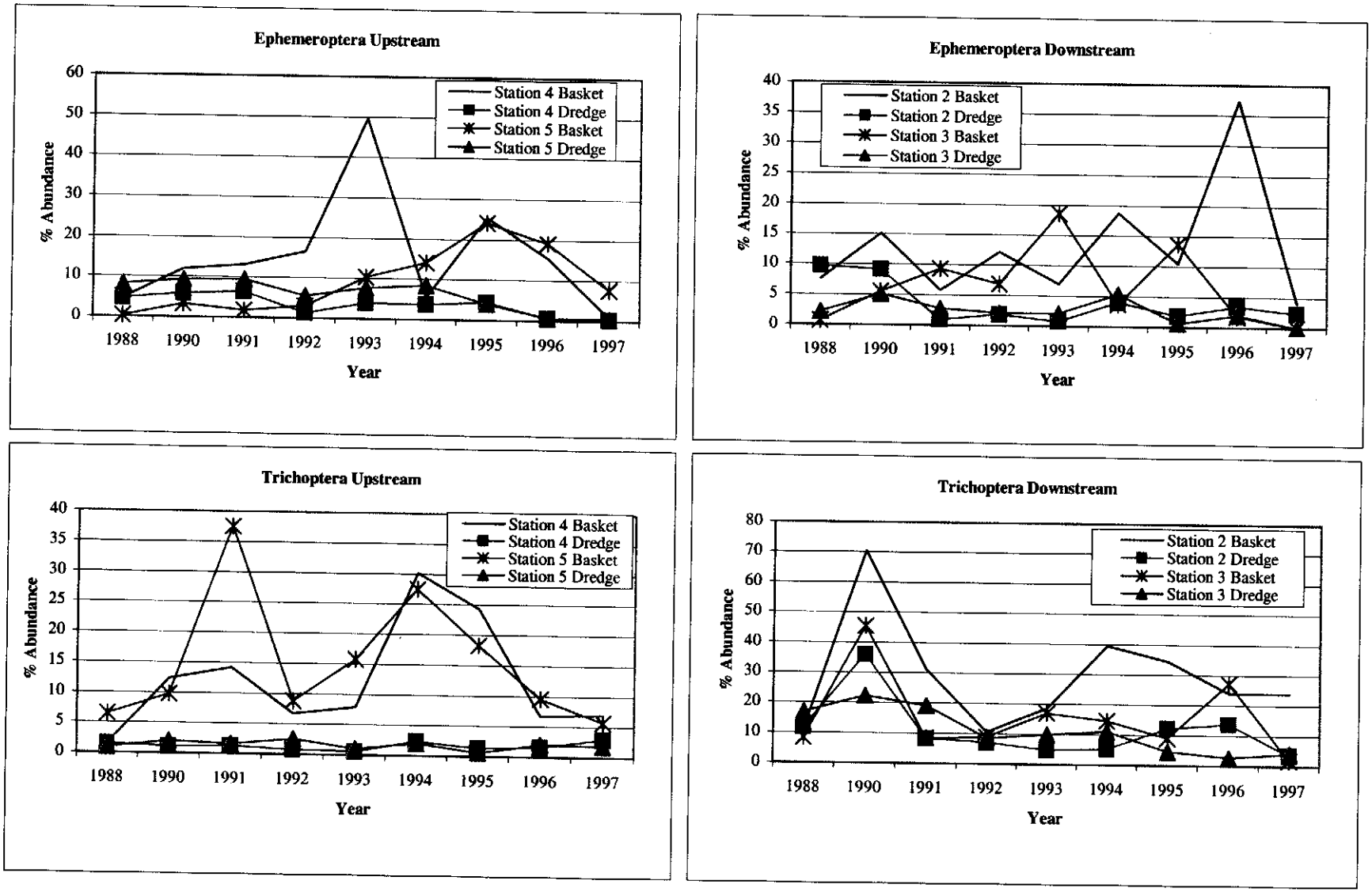
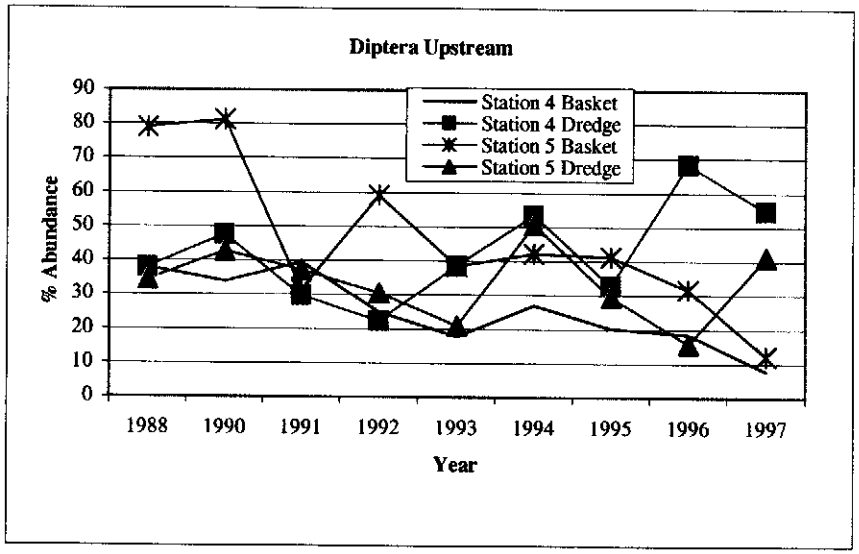
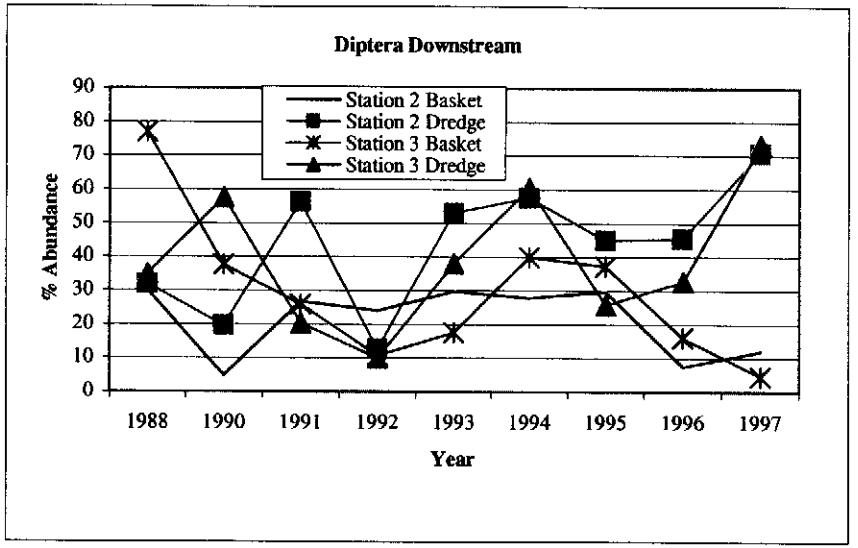
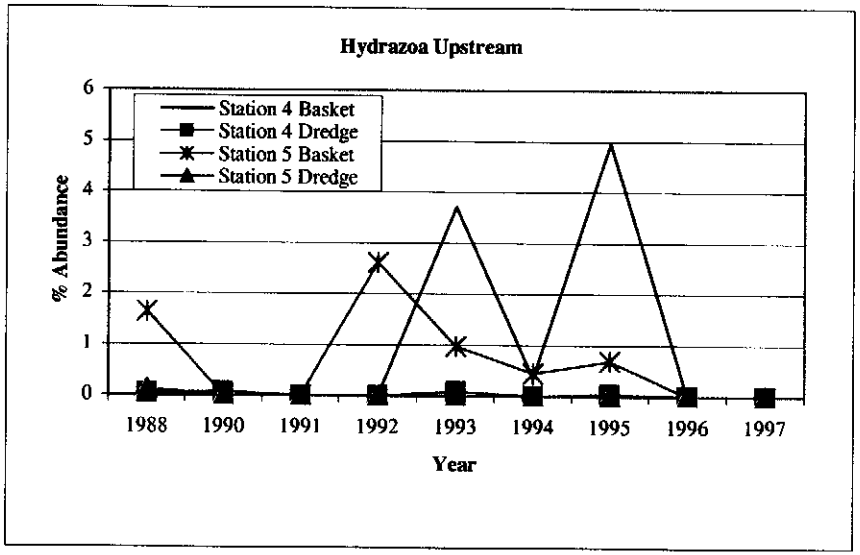



**Figure 3**

**Continued.**



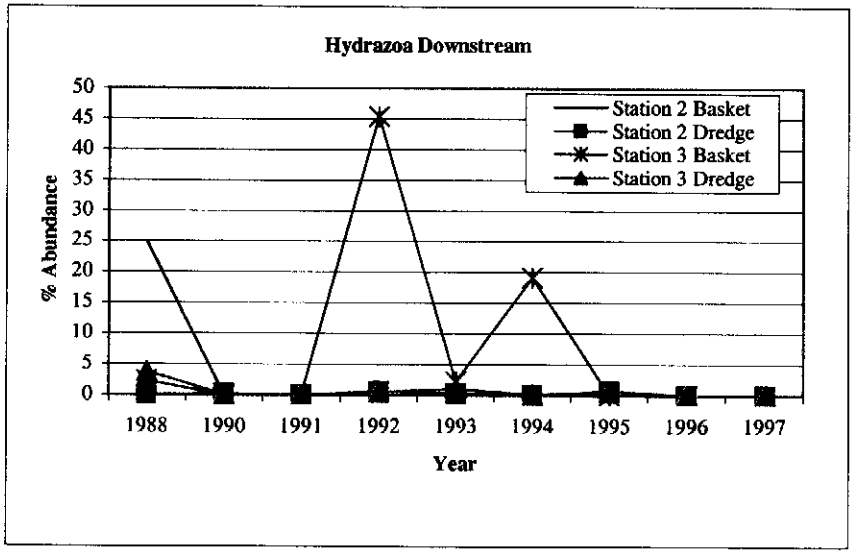
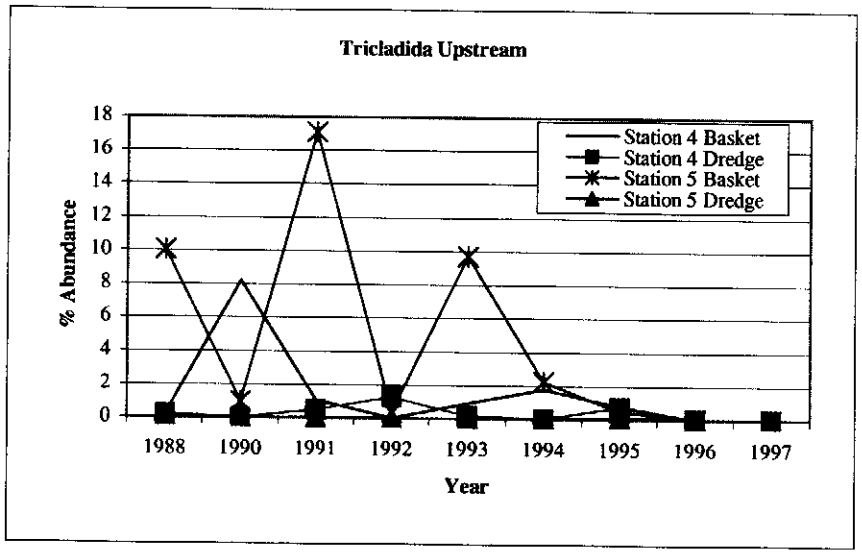
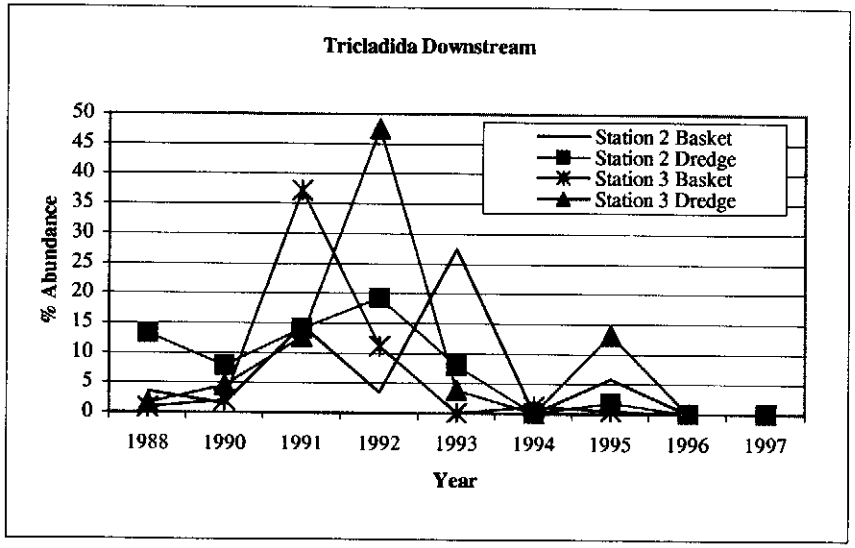
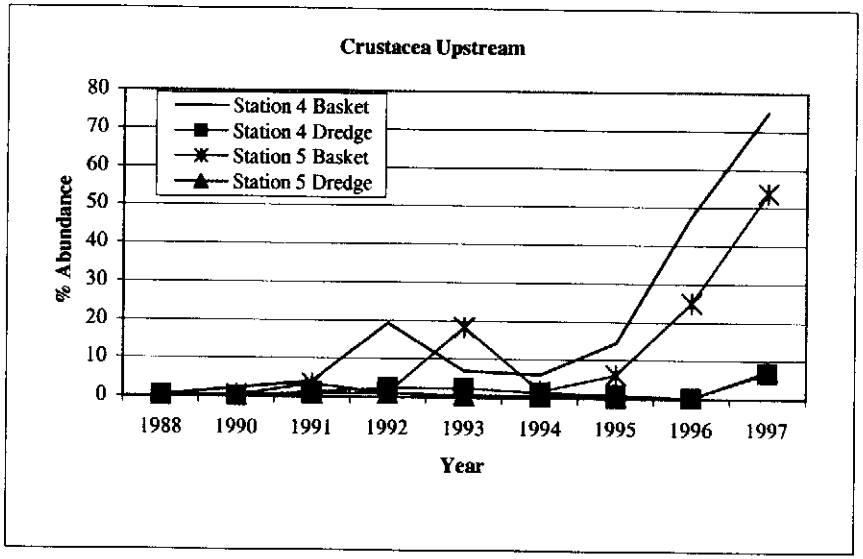




**Figure 3**

**Continued.**



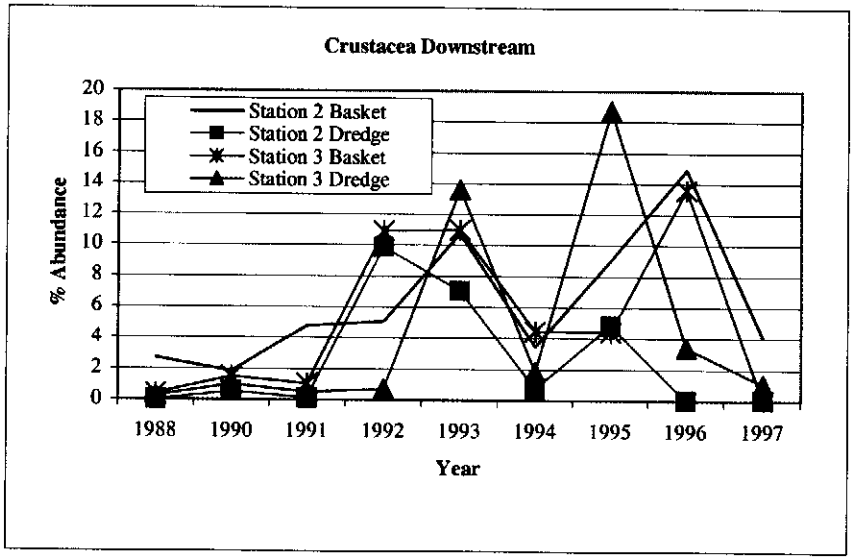
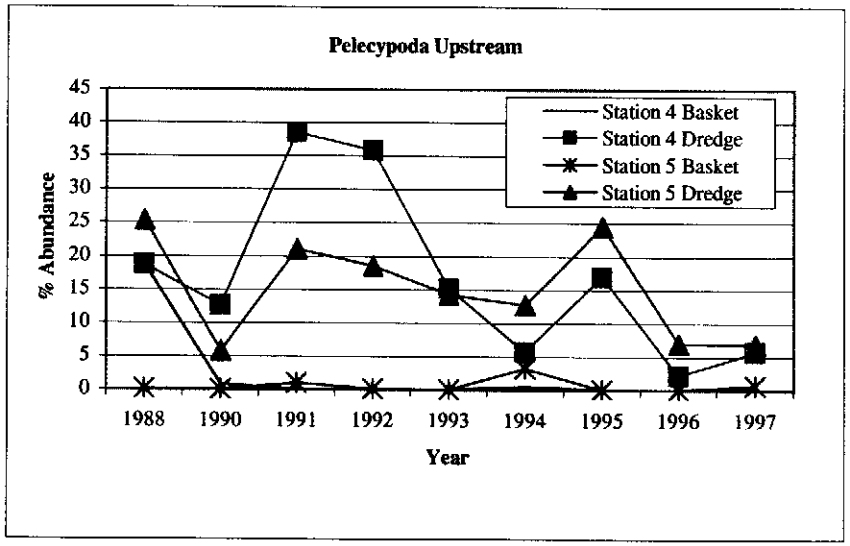
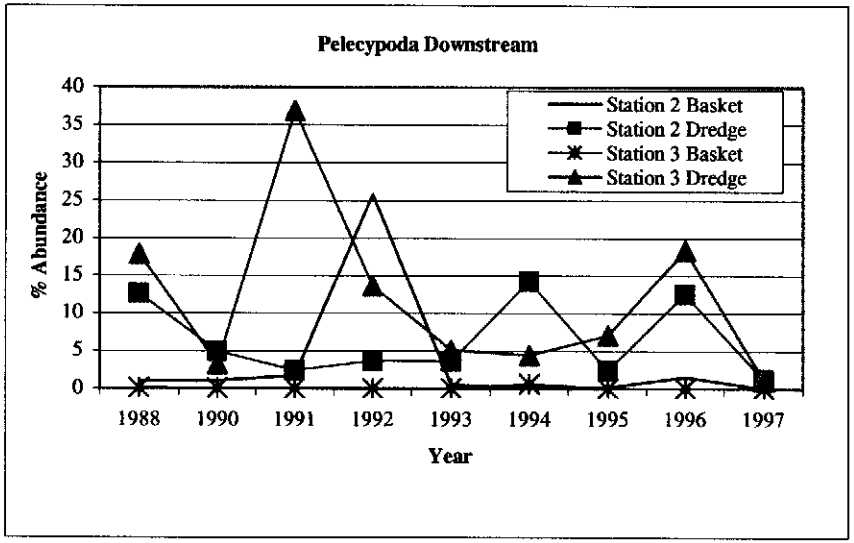
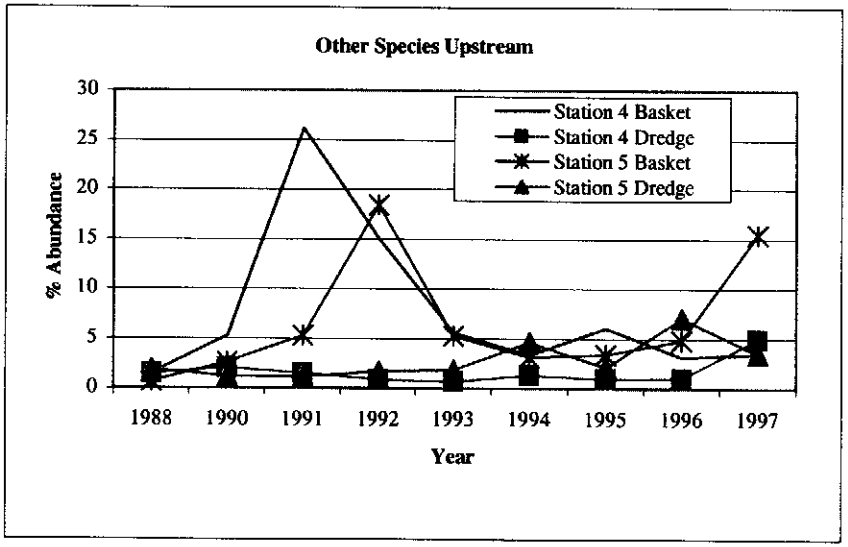




**Figure 3**

**Continued.**



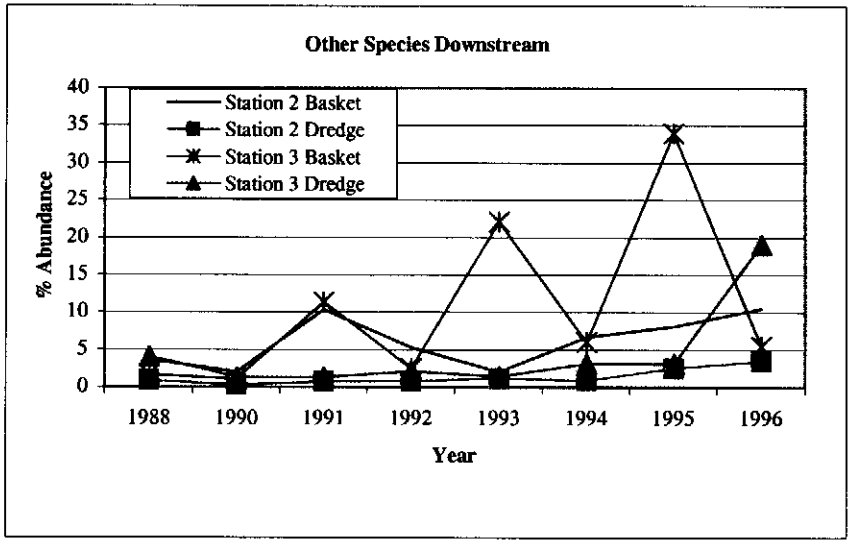
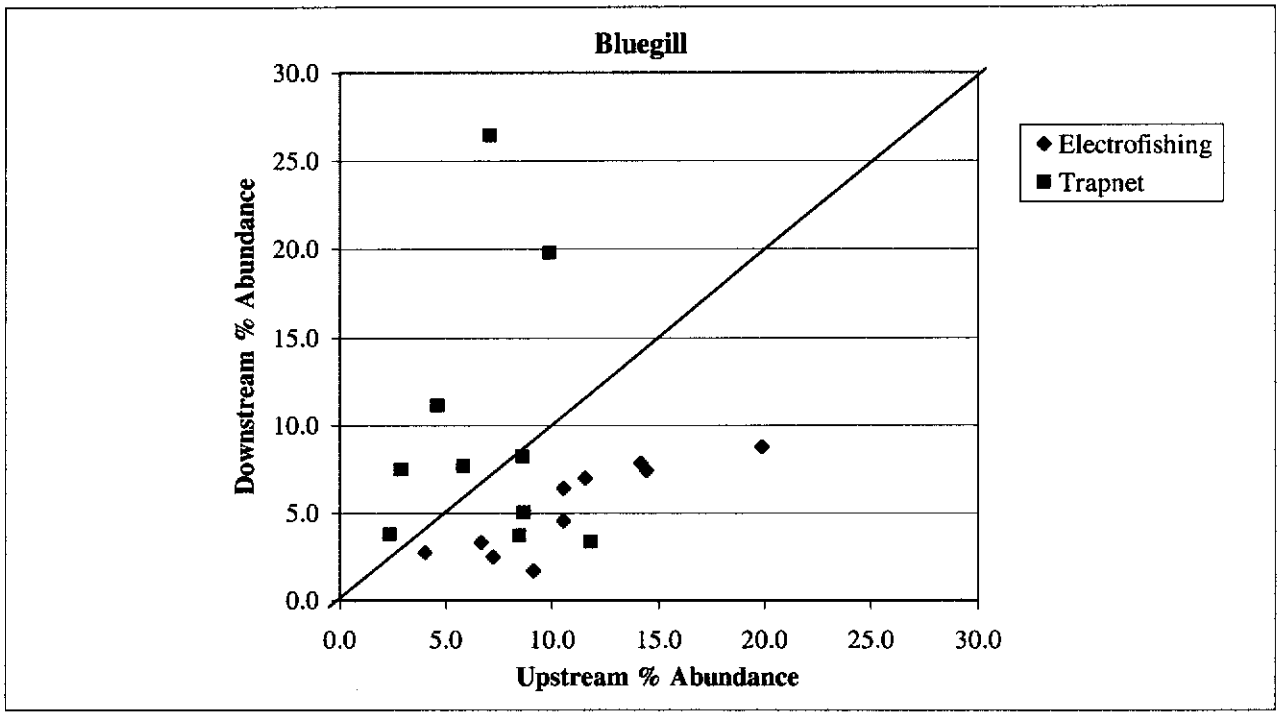




**Figure 3**

**Continued.**



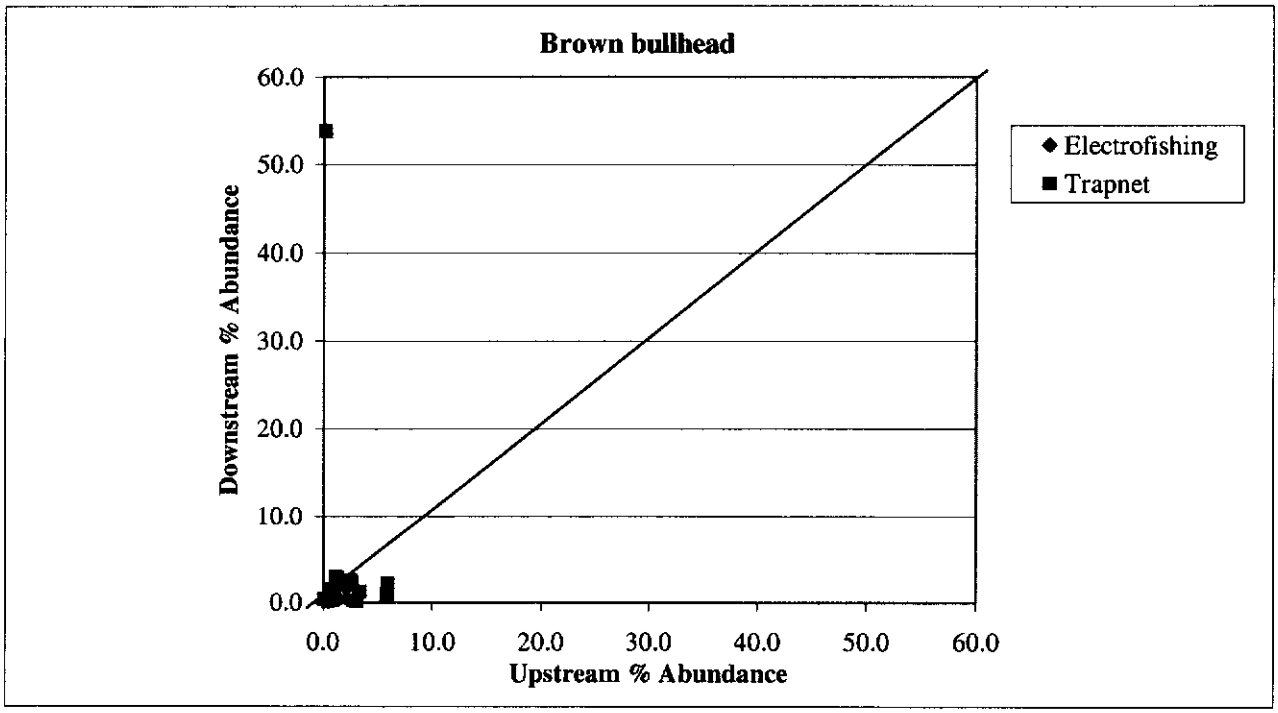
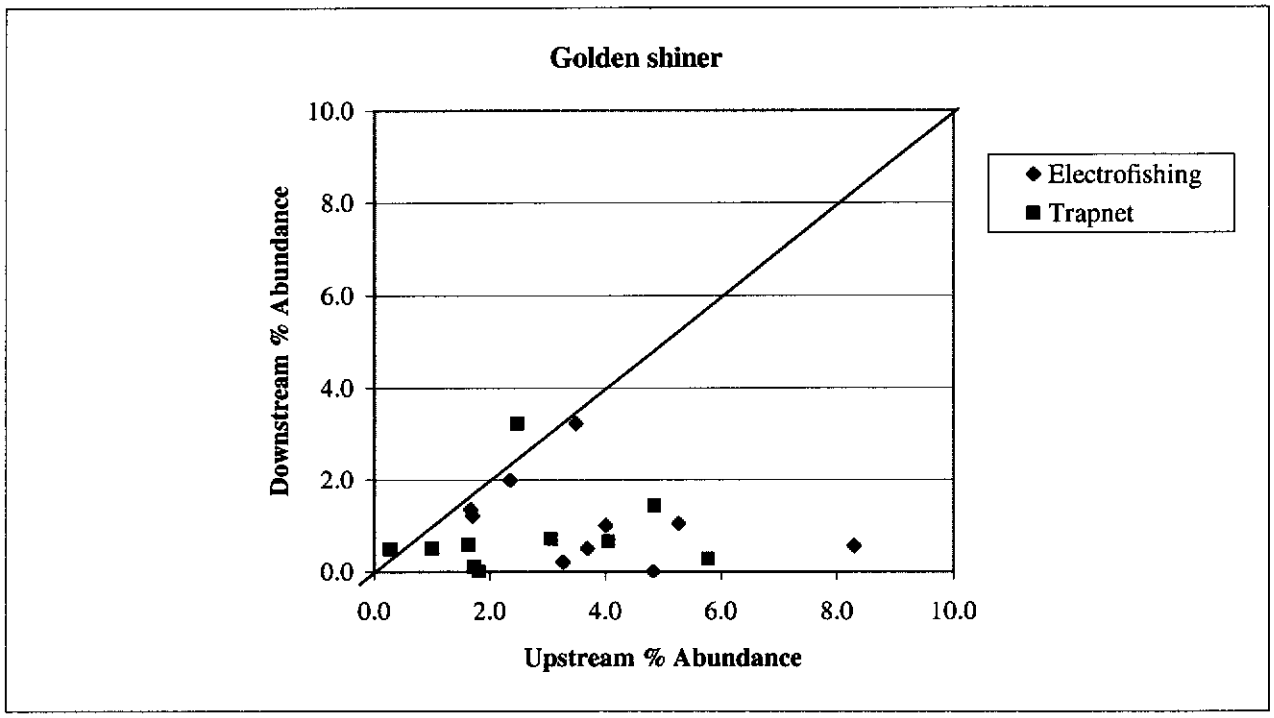




**Figure 4**

**Comparison of upstream and downstream abundance of 13 species of fish collected in the vicinity of Vernon Dam, 1986-1997.**



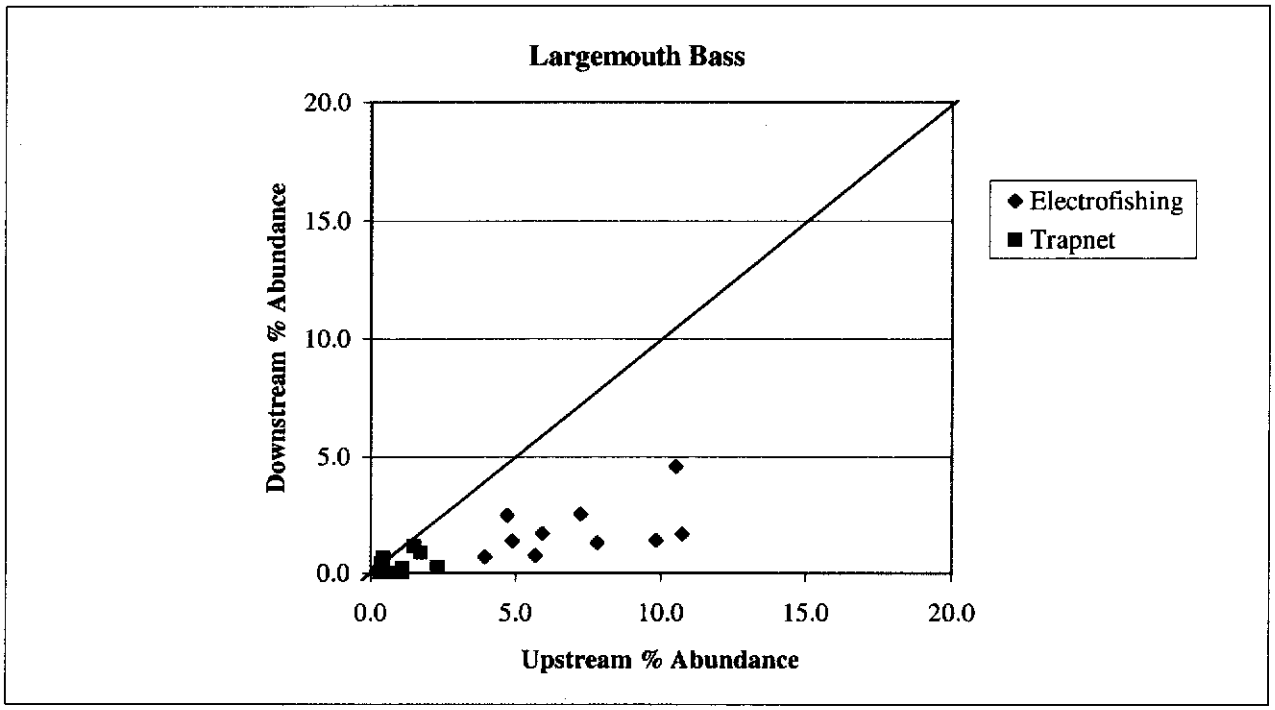
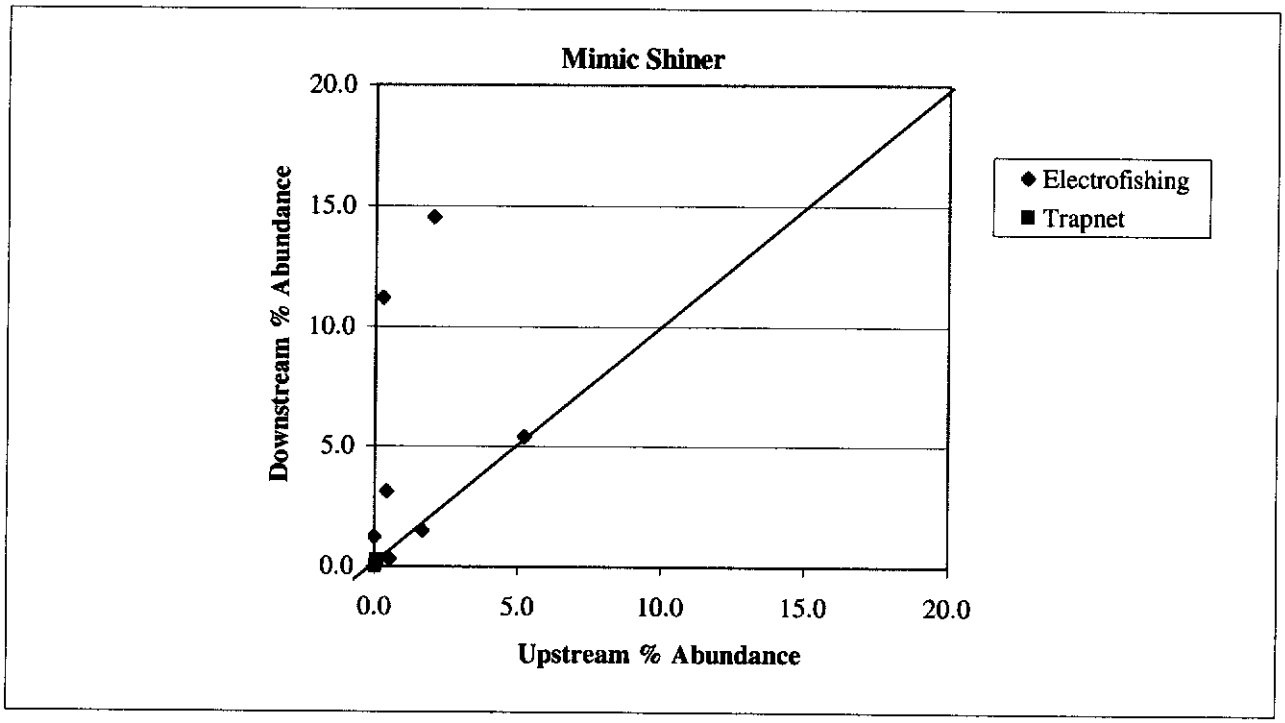




**Figure 4**

**Continued.**



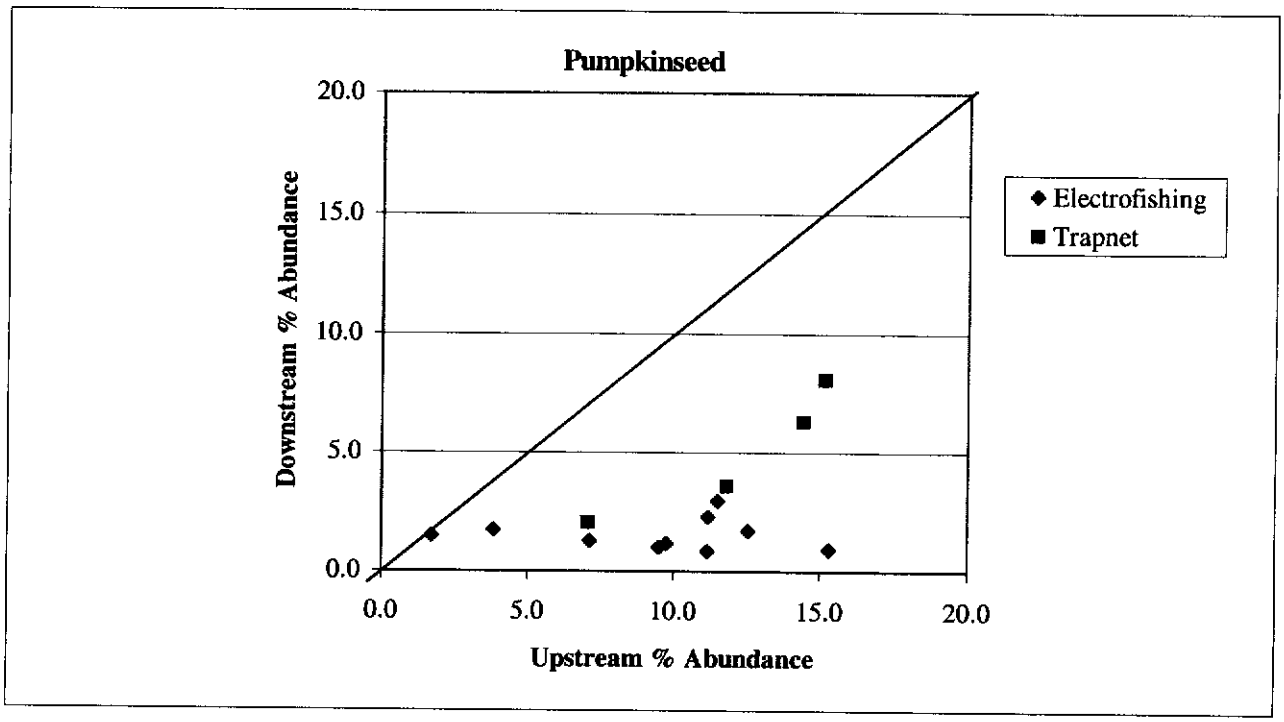
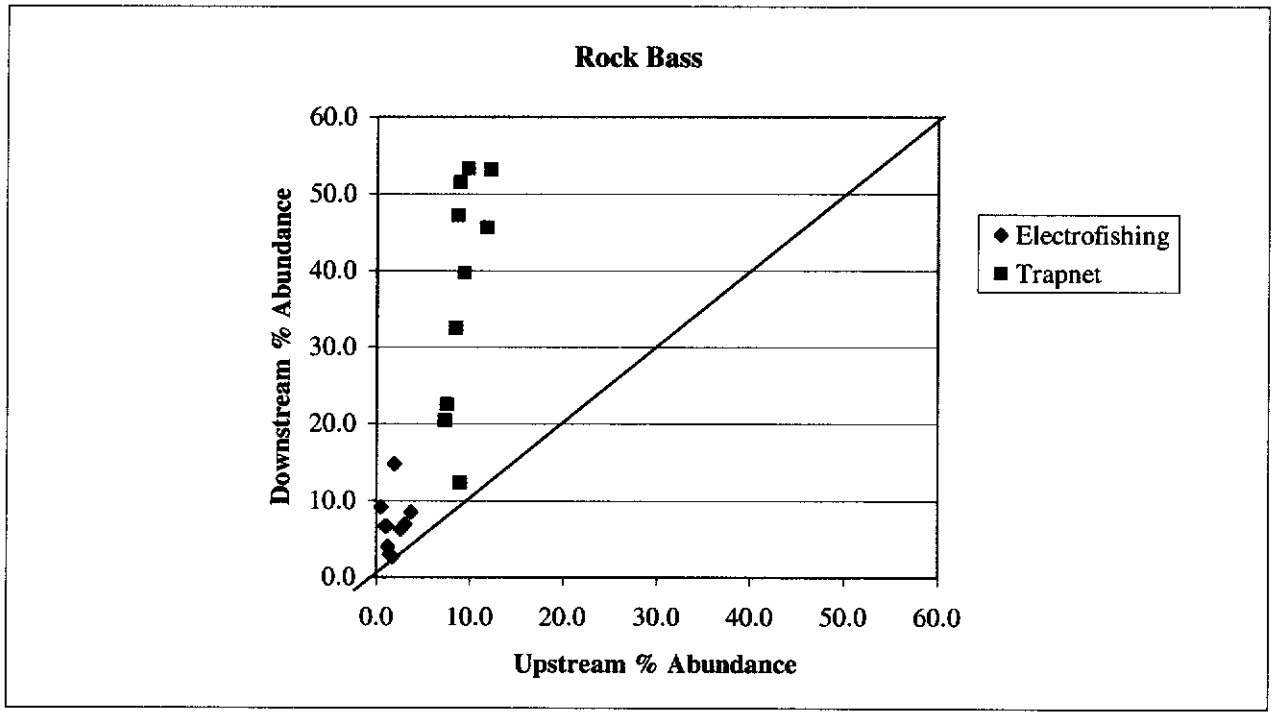




**Figure 4**

**Continued.**



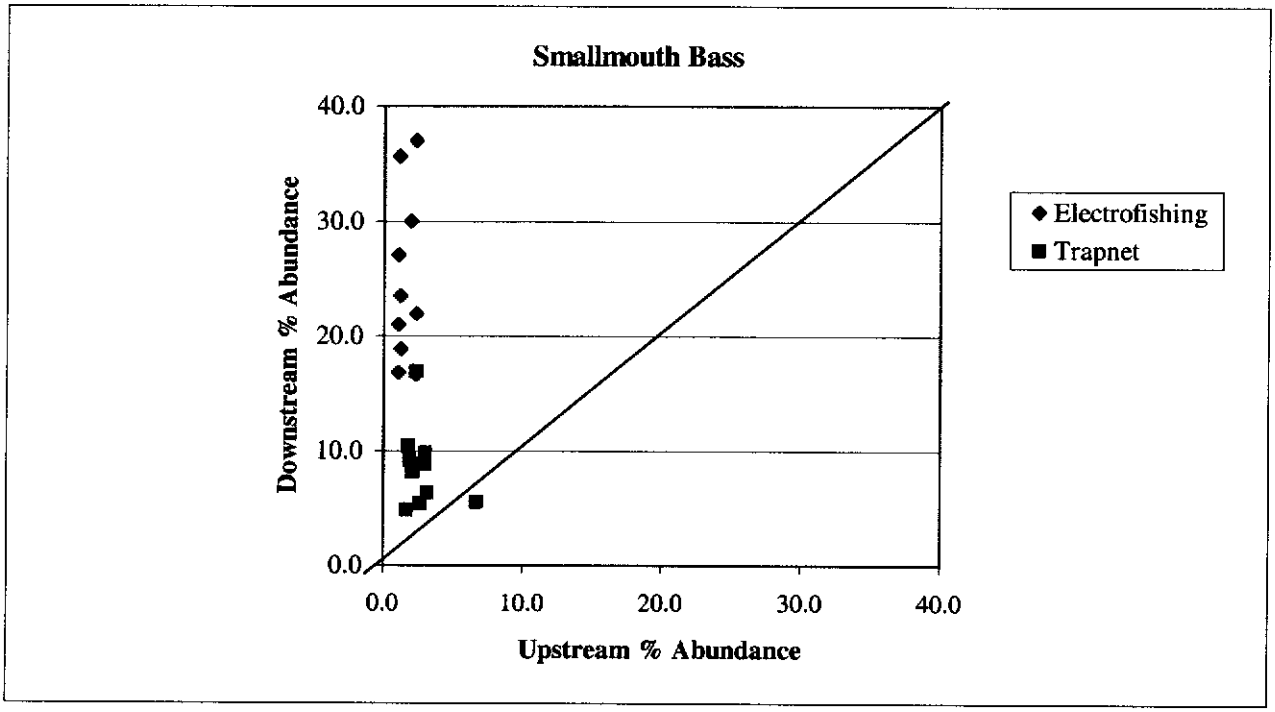
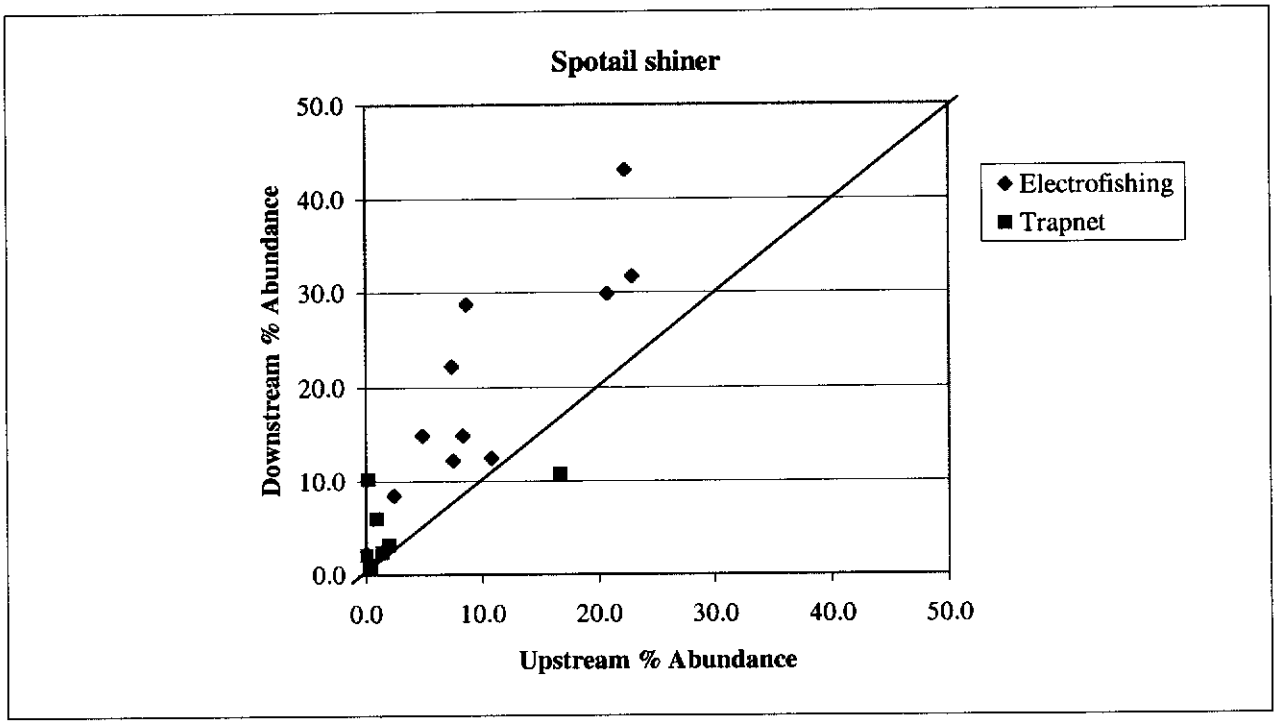




**Figure 4**

**Continued.**



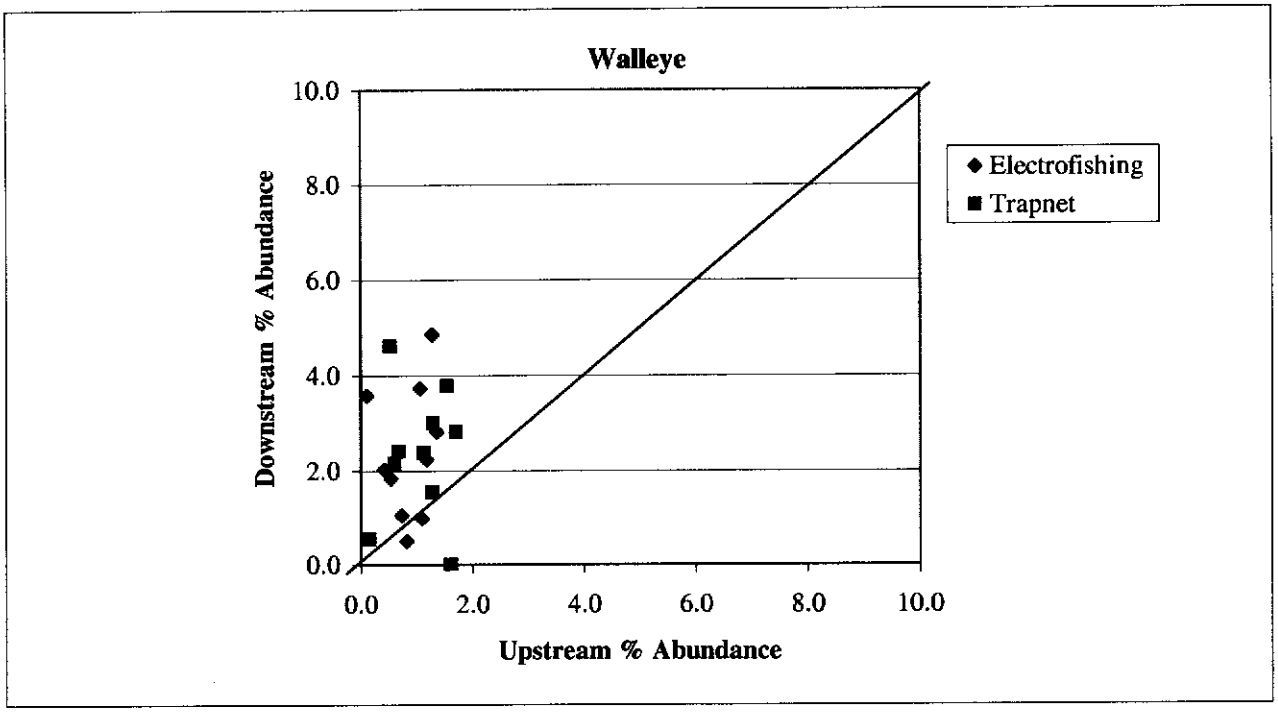
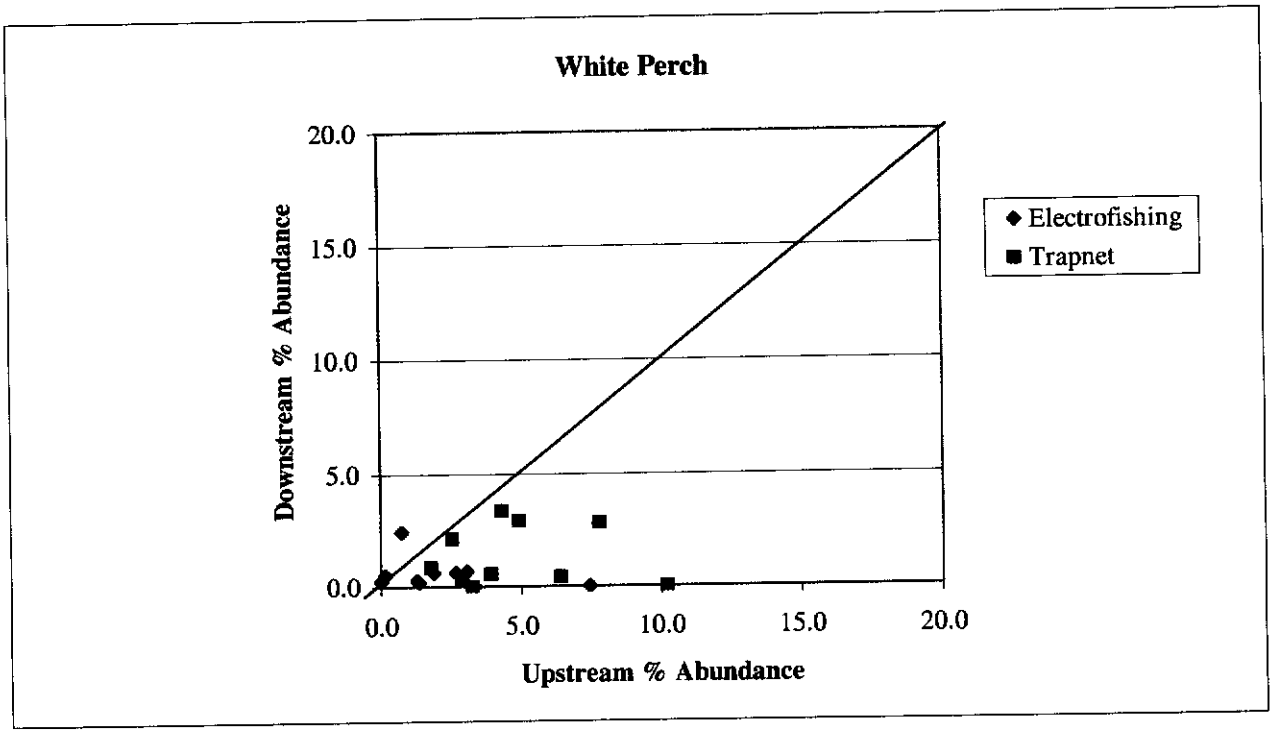




**Figure 4**

**Continued.**



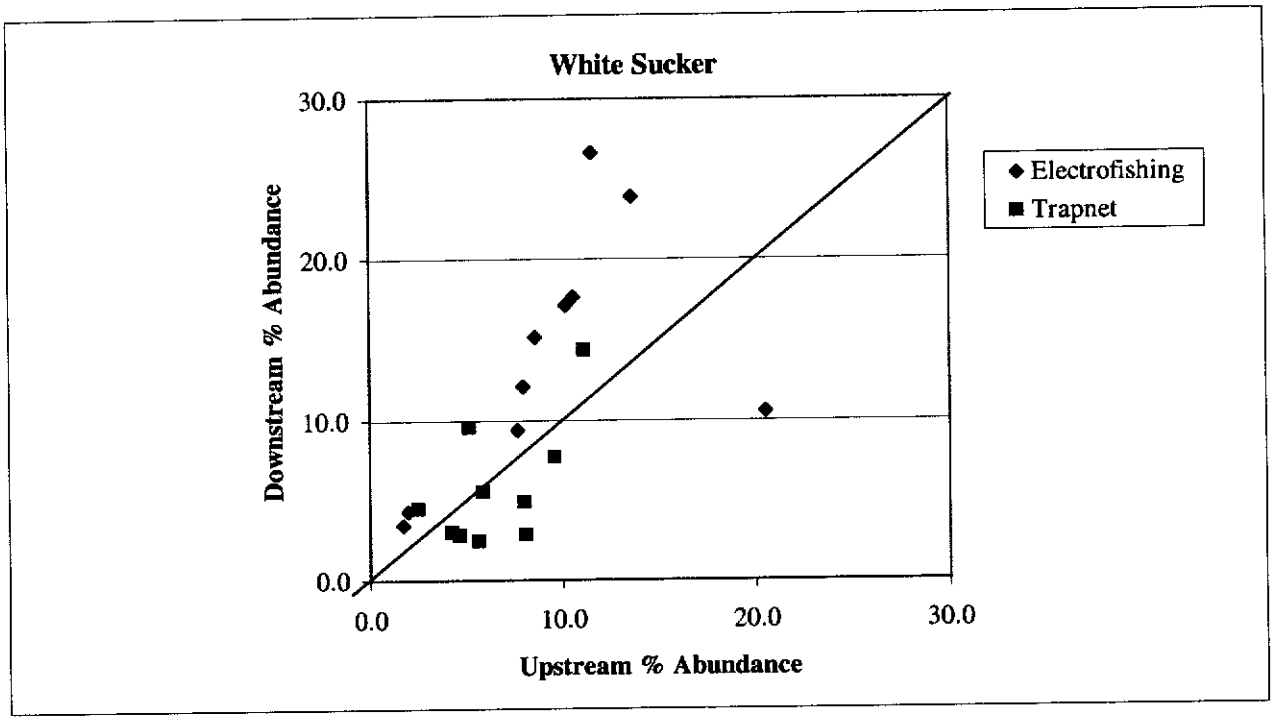




**Figure 4**

**Continued.**

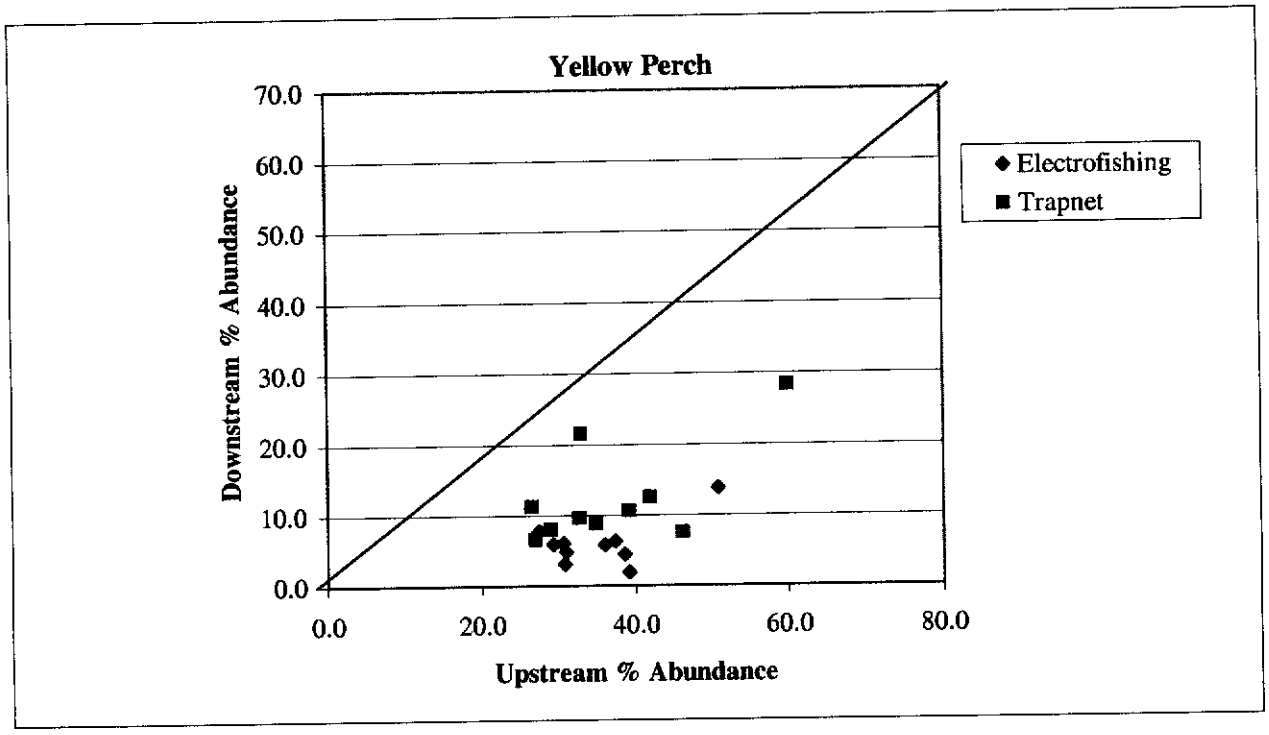



**Figure 4**

**Continued.**

# APPENDIX A -

# MACROINVERTEBRATES BASKET SAMPLES

**Appendix A**

**Macroinvertebrates, basket samples.**

| | 1988 | | 1990 | | 1991 | | 1992 | | 1993 | | 1994 | | 1995 | | 1996 | | 1997 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| | | | | | | | | | *Station 2* | | | | | | | | | |
| Crustacea | 21 | 2.68 | 16 | 1.83 | 20 | 4.77 | 28 | 5.07 | 107 | 10.71 | 38 | 3.43 | 58 | 9.02 | 20 | 14.93 | 2 | 4.00 |
| Diptera | 236 | 30.06 | 41 | 4.70 | 111 | 26.49 | 132 | 23.91 | 296 | 29.63 | 307 | 27.73 | 191 | 29.70 | 10 | 7.46 | 6 | 12.00 |
| Ephemeroptera | 59 | 7.52 | 132 | 15.12 | 24 | 5.73 | 67 | 12.14 | 69 | 6.91 | 207 | 18.70 | 67 | 10.42 | 50 | 37.31 | 2 | 4.00 |
| Gastropoda | 4 | 0.51 | 0 | 0.00 | 18 | 4.30 | 26 | 4.71 | 30 | 3.00 | 18 | 1.63 | 6 | 0.93 | 2 | 1.49 | 26 | 52.00 |
| Hydrozoa | 195 | 24.84 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.09 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Oligochaeta | 119 | 15.16 | 31 | 3.55 | 5 | 1.19 | 51 | 9.24 | 13 | 1.30 | 25 | 2.26 | 10 | 1.56 | 4 | 2.99 | 0 | 0.00 |
| Other | 28 | 3.57 | 17 | 1.95 | 43 | 10.26 | 29 | 5.25 | 20 | 2.00 | 73 | 6.59 | 52 | 8.09 | 14 | 10.45 | 2 | 4.00 |
| Pelecypoda | 8 | 1.02 | 9 | 1.03 | 7 | 1.67 | 142 | 25.72 | 5 | 0.50 | 1 | 0.09 | 1 | 0.16 | 2 | 1.49 | 0 | 0.00 |
| Trichoptera | 87 | 11.08 | 614 | 70.33 | 130 | 31.03 | 58 | 10.51 | 185 | 18.52 | 437 | 39.48 | 221 | 34.37 | 32 | 23.88 | 12 | 24.00 |
| Tricladida | 28 | 3.57 | 13 | 1.49 | 61 | 14.56 | 19 | 3.44 | 274 | 27.43 | | 0.00 | 37 | 5.75 | 0 | 0.00 | 0 | 0.00 |
| Total | 785 | 100.00 | 873 | 100.00 | 419 | 100.00 | 552 | 100.00 | 999 | 100.00 | 1,107 | 100.00 | 643 | 100.00 | 134 | 100.00 | 50 | 100.00 |
| | | | | | | | | | *Station 3* | | | | | | | | | |
| Crustacea | 12 | 0.40 | 3 | 1.51 | 1 | 1.03 | 94 | 10.90 | 41 | 10.99 | 30 | 4.41 | 19 | 4.39 | 136 | 13.57 | 0 | 0.00 |
| Diptera | 2,326 | 76.87 | 75 | 37.69 | 25 | 25.77 | 91 | 10.56 | 65 | 17.43 | 271 | 39.85 | 161 | 37.18 | 160 | 15.97 | 10 | 4.55 |
| Ephemeroptera | 19 | 0.63 | 11 | 5.53 | 9 | 9.28 | 59 | 6.84 | 69 | 18.50 | 25 | 3.68 | 59 | 13.63 | 18 | 1.80 | 0 | 0.00 |
| Gastropoda | 52 | 1.72 | 14 | 7.04 | 7 | 7.22 | 18 | 2.09 | 45 | 12.06 | 74 | 10.88 | 3 | 0.69 | 6 | 0.60 | 10 | 4.55 |
| Hydrozoa | 71 | 2.35 | 0 | 0.00 | 0 | 0.00 | 391 | 45.36 | 8 | 2.14 | 130 | 19.12 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Oligochaeta | 218 | 7.20 | 0 | 0.00 | 0 | 0.00 | 16 | 1.86 | 0 | 0.00 | 0 | 0.00 | 3 | 0.69 | 356 | 35.53 | 2 | 0.91 |
| Other | 50 | 1.65 | 2 | 1.01 | 11 | 11.34 | 21 | 2.44 | 82 | 21.98 | 40 | 5.88 | 147 | 33.95 | 54 | 5.39 | 194 | 88.18 |
| Pelecypoda | 3 | 0.10 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 4 | 0.59 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Trichoptera | 250 | 8.26 | 90 | 45.23 | 8 | 8.25 | 76 | 8.82 | 63 | 16.89 | 98 | 14.41 | 39 | 9.01 | 272 | 27.15 | 4 | 1.82 |
| Tricladida | 25 | 0.83 | 4 | 2.01 | 36 | 37.11 | 96 | 11.14 | 0 | 0.00 | 8 | 1.18 | 2 | 0.46 | 0 | 0.00 | 0 | 0.00 |
| Total | 3,026 | 100.00 | 199 | 100.00 | 97 | 100.00 | 862 | 100.00 | 373 | 100.00 | 680 | 100.00 | 433 | 100.00 | 1,002 | 100.00 | 220 | 100.00 |
| | | | | | | | | | *Station 4* | | | | | | | | | |
| Crustacea | 10 | 0.26 | 6 | 2.23 | 15 | 4.09 | 129 | 19.23 | 15 | 6.94 | 142 | 5.97 | 55 | 14.36 | 186 | 47.69 | 2,002 | 75.04 |
| Diptera | 1,454 | 37.96 | 91 | 33.83 | 145 | 39.51 | 166 | 24.74 | 38 | 17.59 | 641 | 26.94 | 77 | 20.10 | 72 | 18.46 | 208 | 7.80 |
| Ephemeroptera | 179 | 4.67 | 32 | 11.90 | 48 | 13.08 | 110 | 16.39 | 107 | 49.54 | 131 | 5.51 | 97 | 25.33 | 60 | 15.38 | 24 | 0.90 |
| Gastropoda | 2 | 0.05 | 69 | 25.65 | 7 | 1.91 | 8 | 1.19 | 14 | 6.48 | 476 | 20.01 | 9 | 2.35 | 8 | 2.05 | 8 | 0.30 |
| Hydrozoa | 2 | 0.05 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 8 | 3.70 | 8 | 0.34 | 19 | 4.96 | 0 | 0.00 | 0 | 0.00 |
| Oligochaeta | 1,344 | 35.09 | 0 | 0.00 | 0 | 0.00 | 112 | 16.69 | 3 | 1.39 | 132 | 5.55 | 7 | 1.83 | 26 | 6.67 | 140 | 5.25 |

**Appendix A**

**Continued.**

| | 1988 | | 1990 | | 1991 | | 1992 | | 1993 | | 1994 | | 1995 | | 1996 | | 1997 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| | | | | | | | | | | *Station 4, continued* | | | | | | | | |
| Other | 57 | 1.49 | 14 | 5.20 | 96 | 26.16 | 101 | 15.05 | 12 | 5.56 | 78 | 3.28 | 23 | 6.01 | 12 | 3.08 | 92 | 3.45 |
| Pelecypoda | 717 | 18.72 | 2 | 0.74 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 12 | 0.50 | 0 | 0.00 | 0 | 0.00 | 8 | 0.30 |
| Trichoptera | 58 | 1.51 | 33 | 12.27 | 52 | 14.17 | 45 | 6.71 | 17 | 7.87 | 717 | 30.14 | 93 | 24.28 | 26 | 6.67 | 186 | 6.97 |
| Tricladida | 7 | 0.18 | 22 | 8.18 | 4 | 1.09 | 0 | 0.00 | 2 | 0.93 | 42 | 1.77 | 3 | 0.78 | 0 | 0.00 | 0 | 0.00 |
| Total | 3,830 | 100.00 | 269 | 100.00 | 367 | 100.00 | 671 | 100.00 | 216 | 100.00 | 2,379 | 100.00 | 383 | 100.00 | 390 | 100.00 | 2,668 | 100.00 |
| | | | | | | | | | | *Station 5* | | | | | | | | |
| Crustacea | 7 | 0.24 | 1 | 0.32 | 29 | 3.35 | 14 | 1.01 | 94 | 18.22 | 15 | 1.67 | 27 | 6.07 | 84 | 25.00 | 320 | 53.69 |
| Diptera | 2,320 | 78.83 | 251 | 81.23 | 271 | 31.29 | 815 | 58.93 | 198 | 38.37 | 378 | 42.14 | 183 | 41.12 | 106 | 31.55 | 72 | 12.08 |
| Ephemeroptera | 6 | 0.20 | 10 | 3.24 | 15 | 1.73 | 42 | 3.04 | 53 | 10.27 | 126 | 14.05 | 107 | 24.04 | 64 | 19.05 | 46 | 7.72 |
| Gastropoda | 35 | 1.19 | 6 | 1.94 | 18 | 2.08 | 46 | 3.33 | 8 | 1.55 | 22 | 2.45 | 17 | 3.82 | 8 | 2.38 | 26 | 4.36 |
| Hydrozoa | 48 | 1.63 | 0 | 0.00 | 0 | 0.00 | 36 | 2.60 | 5 | 0.97 | 4 | 0.45 | 3 | 0.67 | 0 | 0.00 | 0 | 0.00 |
| Oligochaeta | 21 | 0.71 | 0 | 0.00 | 7 | 0.81 | 48 | 3.47 | 0 | 0.00 | 30 | 3.34 | 10 | 2.25 | 26 | 7.74 | 2 | 0.34 |
| Other | 19 | 0.65 | 8 | 2.59 | 45 | 5.20 | 254 | 18.37 | 27 | 5.23 | 28 | 3.12 | 15 | 3.37 | 16 | 4.76 | 92 | 15.44 |
| Pelecypoda | 2 | 0.07 | 0 | 0.00 | 8 | 0.92 | 1 | 0.07 | 0 | 0.00 | 28 | 3.12 | 0 | 0.00 | 0 | 0.00 | 4 | 0.67 |
| Trichoptera | 190 | 6.46 | 30 | 9.71 | 325 | 37.53 | 122 | 8.82 | 81 | 15.70 | 246 | 27.42 | 81 | 18.20 | 32 | 9.52 | 34 | 5.70 |
| Tricladida | 295 | 10.02 | 3 | 0.97 | 148 | 17.09 | 5 | 0.36 | 50 | 9.69 | 20 | 2.23 | 2 | 0.45 | 0 | 0.00 | 0 | 0.00 |
| Total | 2,943 | 100.00 | 309 | 100.00 | 866 | 100.00 | 1,383 | 100.00 | 516 | 100.00 | 897 | 100.00 | 445 | 100.00 | 336 | 100.00 | 596 | 100.00 |

# APPENDIX B -

# MACROINVERTEBRATES DREDGE SAMPLES

**Appendix B**

**Macroinvertebrates, dredge samples.**

| | 1988 | | 1990 | | 1991 | | 1992 | | 1993 | | 1994 | | 1995 | | 1996 | | 1997 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| | | | | | | | | | *Station 2* | | | | | | | | | |
| Crustacea | 0 | 0.00 | 2 | 0.52 | 4 | 0.14 | 185 | 9.86 | 158 | 7.06 | 29 | 0.74 | 58 | 4.81 | 0 | 0.00 | 0 | 0.00 |
| Diptera | 300 | 31.91 | 75 | 19.48 | 1,570 | 56.15 | 234 | 12.47 | 1,185 | 52.93 | 2,237 | 57.46 | 541 | 44.82 | 120 | 45.45 | 180 | 70.59 |
| Ephemeroptera | 91 | 9.68 | 35 | 9.09 | 26 | 0.93 | 35 | 1.86 | 16 | 0.71 | 156 | 4.01 | 22 | 1.82 | 9 | 3.41 | 6 | 2.35 |
| Gastropoda | 75 | 7.98 | 59 | 15.32 | 456 | 16.31 | 522 | 27.81 | 234 | 10.45 | 168 | 4.32 | 245 | 20.30 | 24 | 9.09 | 18 | 7.06 |
| Hydrazoa | 1 | 0.11 | 1 | 0.26 | 0 | 0.00 | 11 | 0.59 | 6 | 0.27 | 0 | 0.00 | 9 | 0.75 | 0 | 0.00 | 0 | 0.00 |
| Oligochaeta | 113 | 12.02 | 25 | 6.49 | 37 | 1.32 | 315 | 16.78 | 252 | 11.26 | 516 | 13.25 | 104 | 8.62 | 33 | 12.50 | 24 | 9.41 |
| Other | 8 | 0.85 | 1 | 0.26 | 18 | 0.64 | 14 | 0.75 | 25 | 1.12 | 33 | 0.85 | 30 | 2.49 | 9 | 3.41 | 15 | 5.88 |
| Pelecypoda | 118 | 12.55 | 19 | 4.94 | 67 | 2.40 | 68 | 3.62 | 80 | 3.57 | 552 | 14.18 | 29 | 2.40 | 33 | 12.50 | 3 | 1.18 |
| Trichoptera | 110 | 11.70 | 138 | 35.84 | 227 | 8.12 | 134 | 7.14 | 105 | 4.69 | 202 | 5.19 | 147 | 12.18 | 36 | 13.64 | 9 | 3.53 |
| Tricladida | 124 | 13.19 | 30 | 7.79 | 391 | 13.98 | 359 | 19.13 | 178 | 7.95 | 0 | 0.00 | 22 | 1.82 | 0 | 0.00 | 0 | 0.00 |
| Total | 940 | 100.00 | 385 | 100.00 | 2,796 | 100.00 | 1,877 | 100.00 | 2,239 | 100.00 | 3,893 | 100.00 | 1,207 | 100.00 | 264 | 100.00 | 255 | 100.00 |
| | | | | | | | | | *Station 3* | | | | | | | | | |
| Crustacea | 1 | 0.27 | 8 | 1.00 | 4 | 0.48 | 4 | 0.69 | 135 | 13.58 | 35 | 1.81 | 224 | 18.73 | 15 | 3.40 | 3 | 1.03 |
| Diptera | 131 | 34.93 | 461 | 57.55 | 168 | 20.17 | 57 | 9.81 | 378 | 38.03 | 1,169 | 60.35 | 306 | 25.59 | 144 | 32.65 | 213 | 73.20 |
| Ephemeroptera | 8 | 2.13 | 41 | 5.12 | 23 | 2.76 | 12 | 2.07 | 21 | 2.11 | 104 | 5.37 | 7 | 0.59 | 9 | 2.04 | 0 | 0.00 |
| Gastropoda | 2 | 0.53 | 9 | 1.12 | 23 | 2.76 | 8 | 1.38 | 28 | 2.82 | 19 | 0.98 | 9 | 0.75 | 6 | 1.36 | 6 | 2.06 |
| Hydrazoa | 14 | 3.73 | 1 | 0.12 | | 0.00 | 3 | 0.52 | 10 | 1.01 | 3 | 0.15 | 7 | 0.59 | 0 | 0.00 | 0 | 0.00 |
| Oligochaeta | 68 | 18.13 | 31 | 3.87 | 34 | 4.08 | 81 | 13.94 | 222 | 22.33 | 249 | 12.85 | 310 | 25.92 | 90 | 20.41 | 24 | 8.25 |
| Other | 15 | 4.00 | 10 | 1.25 | 11 | 1.32 | 12 | 2.07 | 14 | 1.41 | 60 | 3.10 | 37 | 3.09 | 84 | 19.05 | 30 | 10.31 |
| Pelecypoda | 67 | 17.87 | 26 | 3.25 | 307 | 36.85 | 79 | 13.60 | 51 | 5.13 | 85 | 4.39 | 84 | 7.02 | 81 | 18.37 | 3 | 1.03 |
| Trichoptera | 63 | 16.80 | 178 | 22.22 | 158 | 18.97 | 49 | 8.43 | 97 | 9.76 | 213 | 11.00 | 55 | 4.60 | 12 | 2.72 | 12 | 4.12 |
| Tricladida | 6 | 1.60 | 36 | 4.49 | 105 | 12.61 | 276 | 47.50 | 38 | 3.82 | | 0.00 | 157 | 13.13 | 0 | 0.00 | 0 | 0.00 |
| Total | 375 | 100.00 | 801 | 100.00 | 833 | 100.00 | 581 | 100.00 | 994 | 100.00 | 1,937 | 100.00 | 1,196 | 100.00 | 441 | 100.00 | 291 | 100.00 |
| | | | | | | | | | *Station 4* | | | | | | | | | |
| Crustacea | 10 | 0.26 | | 0.00 | 20 | 1.09 | 85 | 2.37 | 51 | 2.34 | 41 | 1.38 | 24 | 0.82 | 3 | 0.19 | 111 | 6.75 |
| Diptera | 1,454 | 37.96 | 626 | 47.53 | 544 | 29.69 | 794 | 22.14 | 839 | 38.54 | 1,589 | 53.36 | 953 | 32.72 | 1,056 | 68.22 | 900 | 54.74 |
| Ephemeroptera | 179 | 4.67 | 78 | 5.92 | 117 | 6.39 | 46 | 1.28 | 84 | 3.86 | 114 | 3.83 | 127 | 4.36 | 9 | 0.58 | 6 | 0.36 |
| Gastropoda | 2 | 0.05 | 23 | 1.75 | 23 | 1.26 | 10 | 0.28 | 21 | 0.96 | 32 | 1.07 | 15 | 0.51 | 0 | 0.00 | 117 | 7.12 |
| Hydrazoa | 2 | 0.05 | 1 | 0.08 | | 0.00 | | 0.00 | 2 | 0.09 | | 0.00 | 1 | 0.03 | 0 | 0.00 | 0 | 0.00 |
| Oligochaeta | 1,344 | 35.09 | 383 | 29.08 | 365 | 19.92 | 1,267 | 35.33 | 819 | 37.62 | 925 | 31.06 | 1,215 | 41.71 | 408 | 26.36 | 288 | 17.52 |

**Appendix B**

**Continued.**

| | 1988 | | 1990 | | 1991 | | 1992 | | 1993 | | 1994 | | 1995 | | 1996 | | 1997 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| *Station 4, continued* | | | | | | | | | | | | | | | | | | |
| Other | 57 | 1.49 | 26 | 1.97 | 27 | 1.47 | 29 | 0.81 | 14 | 0.64 | 39 | 1.31 | 26 | 0.89 | 15 | 0.97 | 81 | 4.93 |
| Pelecypoda | 717 | 18.72 | 166 | 12.60 | 704 | 38.43 | 1,283 | 35.78 | 331 | 15.20 | 169 | 5.67 | 491 | 16.86 | 33 | 2.13 | 93 | 5.66 |
| Trichoptera | 58 | 1.51 | 14 | 1.06 | 23 | 1.26 | 26 | 0.73 | 13 | 0.60 | 69 | 2.32 | 40 | 1.37 | 24 | 1.55 | 48 | 2.92 |
| Tricladida | 7 | 0.18 | | 0.00 | 9 | 0.49 | 46 | 1.28 | 3 | 0.14 | | 0.00 | 21 | 0.72 | 0 | 0.00 | 0 | 0.00 |
| Total | 3,830 | 100.00 | 1,317 | 100.00 | 1,832 | 100.00 | 3,586 | 100.00 | 2,177 | 100.00 | 2,978 | 100.00 | 2,913 | 100.00 | 1,548 | 100.00 | 1,644 | 100.00 |
| *Station 5* | | | | | | | | | | | | | | | | | | |
| Crustacea | 3 | 0.13 | 2 | 0.12 | 17 | 0.91 | 36 | 0.96 | 6 | 0.42 | 7 | 0.48 | 6 | 0.34 | 6 | 0.23 | 96 | 7.24 |
| Diptera | 810 | 34.31 | 732 | 42.66 | 693 | 37.14 | 1,145 | 30.40 | 295 | 20.83 | 734 | 50.62 | 520 | 29.25 | 399 | 15.54 | 546 | 41.18 |
| Ephemeroptera | 193 | 8.17 | 160 | 9.32 | 176 | 9.43 | 209 | 5.55 | 108 | 7.63 | 122 | 8.41 | 72 | 4.05 | 15 | 0.58 | 6 | 0.45 |
| Gastropoda | 5 | 0.21 | 112 | 6.53 | 33 | 1.77 | 111 | 2.95 | 19 | 1.34 | 11 | 0.76 | | 0.00 | 51 | 1.99 | 120 | 9.05 |
| Hydrazoa | 3 | 0.13 | 0 | 0.00 | 0 | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Oligochaeta | 680 | 28.80 | 557 | 32.46 | 504 | 27.01 | 1,410 | 37.44 | 747 | 52.75 | 298 | 20.55 | 695 | 39.09 | 1,689 | 65.77 | 399 | 30.09 |
| Other | 44 | 1.86 | 20 | 1.17 | 20 | 1.07 | 64 | 1.70 | 26 | 1.84 | 66 | 4.55 | 37 | 2.08 | 180 | 7.01 | 45 | 3.39 |
| Pelecypoda | 598 | 25.33 | 98 | 5.71 | 392 | 21.01 | 698 | 18.53 | 201 | 14.19 | 183 | 12.62 | 435 | 24.47 | 177 | 6.89 | 90 | 6.79 |
| Trichoptera | 21 | 0.89 | 35 | 2.04 | 30 | 1.61 | 93 | 2.47 | 14 | 0.99 | 29 | 2.00 | 11 | 0.62 | 51 | 1.99 | 24 | 1.81 |
| Tricladida | 4 | 0.17 | 0 | 0.00 | 1 | 0.05 | | 0.00 | | 0.00 | | 0.00 | 2 | 0.11 | 0 | 0.00 | 0 | 0.00 |
| Total | 2,361 | 100.00 | 1,716 | 100.00 | 1,866 | 100.00 | 3,766 | 100.00 | 1,416 | 100.00 | 1,450 | 100.00 | 1,778 | 100.00 | 2,568 | 100.00 | 1,326 | 100.00 |

# APPENDIX C –

# UPSTREAM FISHERIES

**Appendix C**

**Upstream fisheries**

| Species | 1986 | | 1988 | | 1990 | | 1991 | | 1992 | | 1993 | | 1994 | | 1995 | | 1996 | | 1997 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| | | | | | | | | | | | *Electrofishing* | | | | | | | | | | | |
| Sea lamprey | 0 | 0.00 | 0 | 0.00 | 2 | 0.14 | 2 | 0.14 | 0 | 0.00 | 1 | 0.11 | 0 | 0.00 | 0 | 0.00 | 1 | 0.09 | 9 | 1.41 | 15 | 0.13 |
| American eel | 7 | 0.53 | 9 | 0.60 | 3 | 0.21 | 7 | 0.49 | 2 | 0.23 | 8 | 0.85 | 4 | 0.39 | 2 | 0.20 | 0 | 0.00 | 0 | 0.00 | 42 | 0.37 |
| Atlantic salmon | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Brook trout | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Rainbow smelt | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Clupeidae | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Blueback herring | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| American shad | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 19 | 1.33 | 29 | 3.33 | 5 | 0.53 | 2 | 0.20 | 24 | 2.46 | 3 | 0.27 | 0 | 0.00 | 82 | 0.73 |
| Gizzard shad | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.10 | 0 | 0.00 | 0 | 0.00 | 1 | 0.01 |
| Brown trout | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Esocidae | 0 | 0.00 | 0 | 0.00 | 1 | 0.07 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.01 |
| Northern pike | 0 | 0.00 | 4 | 0.27 | 4 | 0.28 | 7 | 0.49 | 11 | 1.26 | 6 | 0.63 | 2 | 0.20 | 6 | 0.61 | 4 | 0.36 | 0 | 0.00 | 44 | 0.39 |
| Chain pickerel | 0 | 0.00 | 1 | 0.07 | 4 | 0.28 | 17 | 1.19 | 29 | 3.33 | 5 | 0.53 | 4 | 0.39 | 5 | 0.51 | 12 | 1.07 | 14 | 2.20 | 91 | 0.81 |
| Cyprinidae | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Common carp | 4 | 0.30 | 41 | 2.74 | 11 | 0.77 | 11 | 0.77 | 6 | 0.69 | 8 | 0.85 | 7 | 0.68 | 11 | 1.13 | 2 | 0.18 | 1 | 0.16 | 102 | 0.91 |
| Eastern silvery minnow | 0 | 0.00 | 3 | 0.20 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 3 | 0.03 |
| Longnose dace | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Golden shiner | 49 | 3.69 | 49 | 3.28 | 24 | 1.67 | 74 | 5.20 | 70 | 8.03 | 16 | 1.69 | 41 | 4.01 | 46 | 4.71 | 39 | 3.48 | 15 | 2.35 | 423 | 3.76 |
| Notropis sp. | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.11 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.01 |
| Common shiner | 0 | 0.00 | 1 | 0.07 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.01 |
| Spottail shiner | 276 | 20.77 | 112 | 7.49 | 155 | 10.81 | 104 | 7.30 | 73 | 8.37 | 46 | 4.86 | 85 | 8.31 | 23 | 2.36 | 249 | 22.23 | 146 | 22.92 | 1,269 | 11.27 |
| Mimic shiner | 27 | 2.03 | 4 | 0.27 | 75 | 5.23 | 6 | 0.42 | 0 | 0.00 | 0 | 0.00 | 17 | 1.66 | 5 | 0.51 | 0 | 0.00 | 0 | 0.00 | 134 | 1.19 |
| Fallfish | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.07 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.10 | 0 | 0.00 | 0 | 0.00 | 2 | 0.02 |
| White sucker | 273 | 20.54 | 204 | 13.64 | 166 | 11.58 | 121 | 8.50 | 86 | 9.86 | 75 | 7.93 | 108 | 10.56 | 73 | 7.48 | 22 | 1.96 | 11 | 1.73 | 1,139 | 10.12 |
| Yellow bullhead | 0 | 0.00 | 3 | 0.20 | 2 | 0.14 | 5 | 0.35 | 4 | 0.46 | 5 | 0.53 | 4 | 0.39 | 7 | 0.72 | 2 | 0.18 | 0 | 0.00 | 32 | 0.28 |
| Brown bullhead | 1 | 0.08 | 5 | 0.33 | 20 | 1.39 | 19 | 1.33 | 19 | 2.18 | 29 | 3.07 | 8 | 0.78 | 20 | 2.05 | 1 | 0.09 | 2 | 0.31 | 124 | 1.10 |
| Banded killifish | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| White perch | 99 | 7.45 | 40 | 2.67 | 44 | 3.07 | 19 | 1.33 | 11 | 1.26 | 7 | 0.74 | 34 | 3.32 | 18 | 1.84 | 0 | 0.00 | 1 | 0.16 | 273 | 2.43 |
| Rock bass | 13 | 0.98 | 18 | 1.20 | 25 | 1.74 | 37 | 2.60 | 26 | 2.98 | 10 | 1.06 | 5 | 0.49 | 110 | 11.27 | 41 | 3.66 | 9 | 1.41 | 294 | 2.61 |
| Lepomis sp. | 1 | 0.08 | 12 | 0.80 | 18 | 1.26 | 0 | 0.00 | 1 | 0.11 | 1 | 0.11 | 12 | 1.17 | 0 | 0.00 | 0 | 0.00 | 1 | 0.16 | 46 | 0.41 |
| Pumpkinseed | 51 | 3.84 | 172 | 11.50 | 180 | 12.55 | 157 | 11.03 | 94 | 10.78 | 144 | 15.22 | 97 | 9.48 | 142 | 14.55 | 109 | 9.73 | 11 | 1.73 | 1,157 | 10.28 |
| Bluegill | 53 | 3.99 | 216 | 14.44 | 151 | 10.53 | 128 | 8.99 | 56 | 6.42 | 99 | 10.47 | 118 | 11.53 | 43 | 4.41 | 222 | 19.82 | 46 | 7.22 | 1,132 | 10.06 |
| Smallmouth bass | 31 | 2.33 | 35 | 2.34 | 18 | 1.26 | 15 | 1.05 | 10 | 1.15 | 18 | 1.90 | 11 | 1.08 | 20 | 2.05 | 12 | 1.07 | 7 | 1.10 | 177 | 1.57 |
| Largemouth bass | 65 | 4.89 | 117 | 7.82 | 85 | 5.93 | 151 | 10.60 | 83 | 9.52 | 99 | 10.47 | 58 | 5.67 | 14 | 1.43 | 44 | 3.93 | 30 | 4.71 | 746 | 6.63 |
| Tessellated darter | 3 | 0.23 | 0 | 0.00 | 1 | 0.07 | 2 | 0.14 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 6 | 0.05 |
| Black crappie | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 5 | 0.45 | 3 | 0.47 | 8 | 0.07 |

**Appendix C**

**Continued.**

| Species | 1986 | | 1988 | | 1990 | | 1991 | | 1992 | | 1993 | | 1994 | | 1995 | | 1996 | | 1997 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| *Electrofishing, continued* | | | | | | | | | | | | | | | | | | | | | | |
| Yellow perch | 365 | 27.46 | 439 | 29.34 | 439 | 30.61 | 507 | 35.60 | 260 | 29.82 | 352 | 37.21 | 394 | 38.51 | 393 | 40.27 | 346 | 30.89 | 324 | 50.86 | 3,819 | 33.93 |
| Walleye | 11 | 0.83 | 11 | 0.74 | 6 | 0.42 | 15 | 1.05 | 1 | 0.11 | 12 | 1.27 | 12 | 1.17 | 12 | 1.23 | 6 | 0.54 | 7 | 1.10 | 93 | 0.83 |
| Etheostoma sp. | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | | 0.00 | | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Total | 1,329 | 100 | 1,496 | 100 | 1,434 | 100 | 1,424 | 100 | 872 | 100 | 946 | 100 | 1,023 | 100 | 976 | 100 | 1,120 | 100 | 637 | 100 | 11,257 | 100 |
| *Trapnet* | | | | | | | | | | | | | | | | | | | | | | |
| Sea lamprey | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| American eel | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 2 | 0.31 | 1 | 0.18 | 0 | 0.00 | 1 | 0.11 | 1 | 0.11 | 1 | 0.17 | 1 | 0.09 | 7 | 0.08 |
| Atlantic salmon | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Brook trout | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Rainbow smelt | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Clupeidae | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Blueback herring | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| American shad | 1 | 0.08 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 3 | 0.32 | 0 | 0.00 | 0 | 0.00 | 4 | 0.05 |
| Gizzard shad | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Brown trout | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Esocidae | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Northern pike | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 7 | 1.10 | 0 | 0.00 | 0 | 0.00 | 2 | 0.23 | 4 | 0.43 | 1 | 0.17 | 4 | 0.36 | 18 | 0.20 |
| Chain pickerel | 0 | 0.00 | 1 | 0.07 | 5 | 0.68 | 9 | 1.42 | 15 | 2.65 | 23 | 3.31 | 28 | 3.16 | 19 | 2.02 | 26 | 4.42 | 13 | 1.18 | 139 | 1.58 |
| Cyprinidae | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Common carp | 6 | 0.51 | 18 | 1.21 | 9 | 1.23 | 10 | 1.57 | 8 | 1.42 | 9 | 1.30 | 5 | 0.56 | 2 | 0.21 | 1 | 0.17 | 1 | 0.09 | 69 | 0.78 |
| Eastern silvery minnow | 1 | 0.08 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.01 |
| Longnose dace | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Golden shiner | 68 | 5.77 | 72 | 4.85 | 2 | 0.27 | 11 | 1.73 | 14 | 2.48 | 7 | 1.01 | 36 | 4.06 | 17 | 1.81 | 18 | 3.06 | 18 | 1.63 | 263 | 2.99 |
| Notropis sp. | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Common shiner | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Spottail shiner | 197 | 16.72 | 14 | 0.94 | 3 | 0.41 | 2 | 0.31 | 11 | 1.95 | 10 | 1.44 | 2 | 0.23 | 3 | 0.32 | 0 | 0.00 | 4 | 0.36 | 246 | 2.79 |
| Mimic shiner | 1 | 0.08 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.01 |
| Fallfish | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| White sucker | 66 | 5.60 | 165 | 11.12 | 70 | 9.58 | 16 | 2.52 | 24 | 4.25 | 56 | 8.07 | 41 | 4.62 | 55 | 5.85 | 47 | 7.99 | 57 | 5.17 | 597 | 6.78 |
| Yellow bullhead | 0 | 0.00 | 0 | 0.00 | 2 | 0.27 | 0 | 0.00 | 0 | 0.00 | 2 | 0.29 | 7 | 0.79 | 18 | 1.91 | 2 | 0.34 | 4 | 0.36 | 35 | 0.40 |
| Brown bullhead | 1 | 0.08 | 13 | 0.88 | 10 | 1.37 | 1 | 0.16 | 7 | 1.24 | 41 | 5.91 | 27 | 3.04 | 24 | 2.55 | 35 | 5.95 | 37 | 3.36 | 196 | 2.23 |
| Banded killifish | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| White perch | 120 | 10.19 | 64 | 4.31 | 36 | 4.92 | 25 | 3.94 | 44 | 7.79 | 20 | 2.88 | 16 | 1.80 | 60 | 6.38 | 15 | 2.55 | 36 | 3.27 | 436 | 4.95 |
| Rock bass | 115 | 9.76 | 112 | 7.55 | 89 | 12.18 | 57 | 8.98 | 49 | 8.67 | 65 | 9.37 | 79 | 8.91 | 110 | 11.70 | 50 | 8.50 | 81 | 7.35 | 807 | 9.17 |
| Lepomis sp. | 0 | 0.00 | 2 | 0.13 | 0 | 0.00 | 1 | 0.16 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.17 | 1 | 0.09 | 5 | 0.06 |

**Continued.**

| Species | 1986 | | 1988 | | 1990 | | 1991 | | 1992 | | 1993 | | 1994 | | 1995 | | 1996 | | 1997 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| | | | | | | | | | | | | *Trapnet, continued* | | | | | | | | | | |
| Pumpkinseed | 139 | 11.80 | 385 | 25.94 | 179 | 24.49 | 143 | 22.52 | 126 | 22.30 | 164 | 23.63 | 128 | 14.43 | 142 | 15.11 | 152 | 25.85 | 78 | 7.08 | 1,636 | 18.58 |
| Bluegill | 34 | 2.89 | 86 | 5.80 | 63 | 8.62 | 75 | 11.81 | 49 | 8.67 | 49 | 7.06 | 75 | 8.46 | 43 | 4.57 | 58 | 9.86 | 26 | 2.36 | 558 | 6.34 |
| Smallmouth bass | 79 | 6.71 | 45 | 3.03 | 12 | 1.64 | 19 | 2.99 | 15 | 2.65 | 22 | 3.17 | 16 | 1.80 | 20 | 2.13 | 11 | 1.87 | 26 | 2.36 | 265 | 3.01 |
| Largemouth bass | 13 | 1.10 | 9 | 0.61 | 7 | 0.96 | 7 | 1.10 | 2 | 0.35 | 16 | 2.31 | 4 | 0.45 | 14 | 1.49 | 2 | 0.34 | 19 | 1.72 | 93 | 1.06 |
| Tessellated darter | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.09 | 1 | 0.01 |
| Black crappie | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 2 | 0.34 | 18 | 1.63 | 20 | 0.23 |
| Yellow perch | 318 | 26.99 | 489 | 32.95 | 239 | 32.69 | 249 | 39.21 | 197 | 34.87 | 201 | 28.96 | 410 | 46.22 | 393 | 41.81 | 156 | 26.53 | 660 | 59.89 | 3,312 | 37.62 |
| Walleye | 19 | 1.61 | 9 | 0.61 | 5 | 0.68 | 1 | 0.16 | 3 | 0.53 | 9 | 1.30 | 10 | 1.13 | 12 | 1.28 | 10 | 1.70 | 17 | 1.54 | 95 | 1.08 |
| Etheostoma sp. | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Total | 1,178 | 100.00 | 1,484 | 100.00 | 731 | 100.00 | 635 | 100.00 | 565 | 100.00 | 694 | 100.00 | 887 | 100.00 | 940 | 100.00 | 588 | 100.00 | 1,102 | 100.00 | 8,804 | 100.00 |

# APPENDIX D –

# DOWNSTREAM FISHERIES

**Appendix D**

**Downstream fisheries**

| Species | 1986 | | 1988 | | 1990 | | 1991 | | 1992 | | 1993 | | 1994 | | 1995 | | 1996 | | 1997 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| | | | | | | | | | | | *Electrofishing* | | | | | | | | | | | |
| Sea lamprey | 1 | 0.10 | 2 | 0.34 | 1 | 0.27 | 0 | 0.00 | 1 | 0.25 | 3 | 0.72 | 0 | 0.00 | 0 | 0.00 | 7 | 1.50 | 0 | 0.00 | 15 | 0.30 |
| American eel | 13 | 1.34 | 8 | 1.37 | 4 | 1.08 | 13 | 1.99 | 1 | 0.25 | 10 | 2.42 | 7 | 1.57 | 1 | 0.26 | 1 | 0.21 | 1 | 0.38 | 59 | 1.19 |
| Atlantic salmon | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.26 | 0 | 0.00 | 0 | 0.00 | 1 | 0.02 |
| Brook trout | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Rainbow smelt | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Clupeidae | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Blueback herring | 3 | 0.31 | 1 | 0.17 | 0 | 0.00 | 0 | 0.00 | 2 | 0.50 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 6 | 0.12 |
| American shad | 156 | 16.07 | 110 | 18.80 | 72 | 19.51 | 171 | 26.19 | 37 | 9.23 | 84 | 20.29 | 44 | 9.84 | 60 | 15.79 | 33 | 7.05 | 61 | 23.19 | 828 | 16.72 |
| Gizzard shad | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.26 | 2 | 0.43 | 0 | 0.00 | 3 | 0.06 |
| Brown trout | 1 | 0.10 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.02 |
| Esocidae | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Northern pike | 1 | 0.10 | 0 | 0.00 | 5 | 1.36 | 2 | 0.31 | 7 | 1.75 | 0 | 0.00 | 6 | 1.34 | 10 | 2.63 | 3 | 0.64 | 1 | 0.38 | 35 | 0.71 |
| Chain pickerel | 4 | 0.41 | 0 | 0.00 | 0 | 0.00 | 3 | 0.46 | 6 | 1.50 | 4 | 0.97 | 2 | 0.45 | 0 | 0.00 | 3 | 0.64 | 3 | 1.14 | 25 | 0.50 |
| Cyprinidae | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 2 | 0.53 | 0 | 0.00 | 0 | 0.00 | 2 | 0.04 |
| Common carp | 3 | 0.31 | 5 | 0.85 | 3 | 0.81 | 3 | 0.46 | 1 | 0.25 | 3 | 0.72 | 4 | 0.89 | 7 | 1.84 | 5 | 1.07 | 0 | 0.00 | 34 | 0.69 |
| Eastern silvery minnow | 1 | 0.10 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 6 | 1.58 | 0 | 0.00 | 0 | 0.00 | 7 | 0.14 |
| Longnose dace | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Golden shiner | 4 | 0.41 | 1 | 0.17 | 4 | 1.08 | 5 | 0.77 | 2 | 0.50 | 4 | 0.97 | 4 | 0.89 | 0 | 0.00 | 14 | 2.99 | 4 | 1.52 | 42 | 0.85 |
| Notropis sp. | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 8 | 1.79 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 8 | 0.16 |
| Common shiner | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Spottail shiner | 242 | 24.92 | 58 | 9.91 | 37 | 10.03 | 107 | 16.39 | 104 | 25.94 | 49 | 11.84 | 60 | 13.42 | 27 | 7.11 | 187 | 39.96 | 64 | 24.33 | 935 | 18.89 |
| Mimic shiner | 118 | 12.15 | 53 | 9.06 | 16 | 4.34 | 15 | 2.30 | 0 | 0.00 | 4 | 0.97 | 6 | 1.34 | 1 | 0.26 | 0 | 0.00 | 0 | 0.00 | 213 | 4.30 |
| Fallfish | 34 | 3.50 | 17 | 2.91 | 27 | 7.32 | 49 | 7.50 | 22 | 5.49 | 11 | 2.66 | 27 | 6.04 | 9 | 2.37 | 8 | 1.71 | 0 | 0.00 | 204 | 4.12 |
| White sucker | 86 | 8.86 | 113 | 19.32 | 79 | 21.41 | 73 | 11.18 | 62 | 15.46 | 40 | 9.66 | 71 | 15.88 | 30 | 7.89 | 19 | 4.06 | 7 | 2.66 | 580 | 11.71 |
| Yellow bullhead | 0 | 0.00 | 0 | 0.00 | 1 | 0.27 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.26 | 0 | 0.00 | 0 | 0.00 | 2 | 0.04 |
| Brown bullhead | 1 | 0.10 | 0 | 0.00 | 1 | 0.27 | 1 | 0.15 | 1 | 0.25 | 2 | 0.48 | 0 | 0.00 | 5 | 1.32 | 0 | 0.00 | 0 | 0.00 | 11 | 0.22 |
| Banded killifish | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| White perch | 0 | 0.00 | 3 | 0.51 | 2 | 0.54 | 1 | 0.15 | 1 | 0.25 | 8 | 1.93 | 0 | 0.00 | 2 | 0.53 | 1 | 0.21 | 1 | 0.38 | 19 | 0.38 |
| Rock bass | 54 | 5.56 | 19 | 3.25 | 8 | 2.17 | 30 | 4.59 | 25 | 6.23 | 22 | 5.31 | 37 | 8.28 | 47 | 12.37 | 37 | 7.91 | 6 | 2.28 | 285 | 5.76 |
| Lepomis sp. | 0 | 0.00 | 3 | 0.51 | 0 | 0.00 | 6 | 0.92 | 0 | 0.00 | 1 | 0.24 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 10 | 0.20 |
| Pumpkinseed | 14 | 1.44 | 14 | 2.39 | 5 | 1.36 | 11 | 1.68 | 3 | 0.75 | 3 | 0.72 | 4 | 0.89 | 4 | 1.05 | 5 | 1.07 | 3 | 1.14 | 66 | 1.33 |
| Bluegill | 22 | 2.27 | 35 | 5.98 | 19 | 5.15 | 8 | 1.23 | 12 | 2.99 | 15 | 3.62 | 28 | 6.26 | 25 | 6.58 | 38 | 8.12 | 5 | 1.90 | 207 | 4.18 |
| Smallmouth bass | 135 | 13.90 | 104 | 17.78 | 56 | 15.18 | 101 | 15.47 | 85 | 21.20 | 99 | 23.91 | 109 | 24.38 | 118 | 31.05 | 73 | 15.60 | 72 | 27.38 | 952 | 19.23 |
| Largemouth bass | 11 | 1.13 | 6 | 1.03 | 5 | 1.36 | 8 | 1.23 | 5 | 1.25 | 15 | 3.62 | 3 | 0.67 | 8 | 2.11 | 3 | 0.64 | 5 | 1.90 | 69 | 1.39 |
| Tessellated darter | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Black crappie | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |

**Continued.**

| Species | 1986 | | 1988 | | 1990 | | 1991 | | 1992 | | 1993 | | 1994 | | 1995 | | 1996 | | 1997 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| *Electrofishing, continued* | | | | | | | | | | | | | | | | | | | | | | |
| Yellow perch | 63 | 6.49 | 28 | 4.79 | 18 | 4.88 | 28 | 4.29 | 11 | 2.74 | 21 | 5.07 | 18 | 4.03 | 6 | 1.58 | 21 | 4.49 | 28 | 10.65 | 242 | 4.89 |
| Walleye | 4 | 0.41 | 5 | 0.85 | 6 | 1.63 | 18 | 2.76 | 13 | 3.24 | 16 | 3.86 | 9 | 2.01 | 9 | 2.37 | 8 | 1.71 | 2 | 0.76 | 90 | 1.82 |
| Etheostoma sp. | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Total | 971 | 100.00 | 585 | 100.00 | 369 | 100.00 | 653 | 100.00 | 401 | 100.00 | 414 | 100.00 | 447 | 100.00 | 380 | 100.00 | 468 | 100.00 | 263 | 100.00 | 4,951 | 100.00 |
| *Trapnet* | | | | | | | | | | | | | | | | | | | | | | |
| Sea lamprey | 1 | 0.27 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 10 | 1.95 | 0 | 0.00 | 1 | 0.22 | 1 | 0.10 | 0 | 0.00 | 5 | 1.40 | 18 | 0.35 |
| American eel | 1 | 0.27 | 0 | 0.00 | 0 | 0.00 | 2 | 0.22 | 1 | 0.19 | 1 | 0.12 | 2 | 0.43 | 9 | 0.93 | 0 | 0.00 | 16 | 4.47 | 32 | 0.62 |
| Atlantic salmon | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 2 | 0.22 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 2 | 0.04 |
| Brook trout | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Rainbow smelt | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Clupeidae | 5 | 1.36 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 5 | 0.10 |
| Blueback herring | 1 | 0.27 | 2 | 0.47 | 2 | 0.95 | 0 | 0.00 | 3 | 0.58 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 8 | 0.15 |
| American shad | 0 | 0.00 | 9 | 2.10 | 1 | 0.48 | 4 | 0.44 | 12 | 2.34 | 32 | 3.85 | 4 | 0.86 | 1 | 0.10 | 0 | 0.00 | 15 | 4.19 | 78 | 1.50 |
| Gizzard shad | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Brown trout | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Esocidae | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Northern pike | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.11 | 1 | 0.19 | 1 | 0.12 | 1 | 0.22 | 4 | 0.41 | 0 | 0.00 | 0 | 0.00 | 8 | 0.15 |
| Chain pickerel | 1 | 0.27 | 0 | 0.00 | 4 | 1.90 | 5 | 0.55 | 15 | 2.92 | 1 | 0.12 | 6 | 1.29 | 2 | 0.21 | 2 | 1.41 | 2 | 0.56 | 38 | 0.73 |
| Cyprinidae | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Common carp | 6 | 1.63 | 1 | 0.23 | 0 | 0.00 | 2 | 0.22 | 1 | 0.19 | 3 | 0.36 | 2 | 0.43 | 3 | 0.31 | 0 | 0.00 | 1 | 0.28 | 19 | 0.37 |
| Eastern silvery minnow | 25 | 6.79 | 1 | 0.23 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 26 | 0.50 |
| Longnose dace | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Golden shiner | 1 | 0.27 | 6 | 1.40 | 1 | 0.48 | 1 | 0.11 | 16 | 3.12 | 4 | 0.48 | 3 | 0.65 | 0 | 0.00 | 1 | 0.70 | 2 | 0.56 | 35 | 0.67 |
| Notropis sp. | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Common shiner | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Spottail shiner | 39 | 10.60 | 25 | 5.83 | 2 | 0.95 | 8 | 0.88 | 16 | 3.12 | 19 | 2.29 | 47 | 10.13 | 6 | 0.62 | 3 | 2.11 | 3 | 0.84 | 168 | 3.24 |
| Mimic shiner | 1 | 0.27 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.02 |
| Fallfish | 0 | 0.00 | 2 | 0.47 | 7 | 3.33 | 0 | 0.00 | 1 | 0.19 | 2 | 0.24 | 1 | 0.22 | 1 | 0.10 | 0 | 0.00 | 3 | 0.84 | 17 | 0.33 |
| White sucker | 9 | 2.45 | 60 | 13.99 | 16 | 7.62 | 41 | 4.53 | 15 | 2.92 | 23 | 2.77 | 13 | 2.80 | 54 | 5.57 | 7 | 4.93 | 33 | 9.22 | 271 | 5.22 |
| Yellow bullhead | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.19 | 0 | 0.00 | 0 | 0.00 | 5 | 0.52 | 0 | 0.00 | 0 | 0.00 | 6 | 0.12 |
| Brown bullhead | 1 | 0.27 | 6 | 1.40 | 4 | 1.90 | 484 | 53.48 | 14 | 2.73 | 7 | 0.84 | 0 | 0.00 | 24 | 2.47 | 3 | 2.11 | 4 | 1.12 | 547 | 10.54 |
| Banded killifish | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| White perch | 0 | 0.00 | 14 | 3.26 | 6 | 2.86 | 5 | 0.55 | 14 | 2.73 | 2 | 0.24 | 4 | 0.86 | 4 | 0.41 | 3 | 2.11 | 0 | 0.00 | 52 | 1.00 |
| Rock bass | 193 | 52.45 | 94 | 21.91 | 110 | 52.38 | 111 | 12.27 | 235 | 45.81 | 317 | 38.15 | 237 | 51.08 | 442 | 45.57 | 46 | 32.39 | 70 | 19.55 | 1,855 | 35.74 |
| Lepomis sp. | 0 | 0.00 | 2 | 0.47 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 11 | 1.32 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 10 | 2.79 | 23 | 0.44 |

**Continued.**

| Species | 1986 | | 1988 | | 1990 | | 1991 | | 1992 | | 1993 | | 1994 | | 1995 | | 1996 | | 1997 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| *Trapnet, continued* | | | | | | | | | | | | | | | | | | | | | | |
| Pumpkinseed | 13 | 3.53 | 35 | 8.16 | 5 | 2.38 | 27 | 2.98 | 37 | 7.21 | 56 | 6.74 | 29 | 6.25 | 78 | 8.04 | 14 | 9.86 | 7 | 1.96 | 301 | 5.80 |
| Bluegill | 27 | 7.34 | 32 | 7.46 | 17 | 8.10 | 30 | 3.31 | 25 | 4.87 | 211 | 25.39 | 17 | 3.66 | 108 | 11.13 | 28 | 19.72 | 13 | 3.63 | 508 | 9.79 |
| Smallmouth bass | 20 | 5.43 | 41 | 9.56 | 10 | 4.76 | 79 | 8.73 | 27 | 5.26 | 51 | 6.14 | 48 | 10.34 | 79 | 8.14 | 13 | 9.15 | 58 | 16.20 | 426 | 8.21 |
| Largemouth bass | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 2 | 0.22 | 2 | 0.39 | 2 | 0.24 | 3 | 0.65 | 11 | 1.13 | 0 | 0.00 | 3 | 0.84 | 23 | 0.44 |
| Tessellated darter | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Black crappie | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 0.10 | 2 | 1.41 | 3 | 0.84 | 6 | 0.12 |
| Yellow perch | 24 | 6.52 | 90 | 20.98 | 20 | 9.52 | 96 | 10.61 | 44 | 8.58 | 64 | 7.70 | 35 | 7.54 | 122 | 12.58 | 16 | 11.27 | 97 | 27.09 | 608 | 11.71 |
| Walleye | 0 | 0.00 | 9 | 2.10 | 5 | 2.38 | 5 | 0.55 | 23 | 4.48 | 24 | 2.89 | 11 | 2.37 | 15 | 1.55 | 4 | 2.82 | 13 | 3.63 | 109 | 2.10 |
| Etheostoma sp. | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Total | 368 | 100.00 | 429 | 100.00 | 210 | 100.00 | 905 | 100.00 | 513 | 100.00 | 831 | 100.00 | 464 | 100.00 | 970 | 100.00 | 142 | 100.00 | 358 | 100.00 | 5,190 | 100.00 |

# APPENDIX E –

# SUMMARY OF TOTAL NUMBER AND PERCENT CATCH, BY SPECIES

**Appendix E**

**Summary of total number and percent catch, by species, collected during the years 1988 and 1990-1997 in the Vermont Yankee icthyoplankton program.**

| Species | Year | Number Collected | Percent of Catch for Each Year | Relative Abundance |
|---|---|---|---|---|
| Common carp | 1988 | 1 | 0.3 | 0 |
| | 1990 | 2 | 1.0 | 0 |
| | 1991 | 1 | 0.1 | 0 |
| | 1992 | 3 | 0.3 | 0 |
| | 1993 | 6 | 1.2 | 0 |
| | 1994 | 1 | 0.1 | 0 |
| | 1996 | 3 | 1.0 | 0 |
| | 1997 | 1 | 0.5 | 0 |
| Notropis sp. | 1988 | 145 | 37.4 | 3 |
| | 1990 | 66 | 31.4 | 1 |
| | 1992 | 515 | 59.4 | 9 |
| | 1993 | 174 | 35.4 | 3 |
| | 1994 | 1,658 | 90.5 | 29 |
| | 1996 | 129 | 43.1 | 2 |
| | 1997 | 163 | 83.6 | 3 |
| White perch | 1988 | 110 | 28.4 | 2 |
| | 1990 | 84 | 40.0 | 1 |
| | 1991 | 174 | 18.8 | 3 |
| | 1992 | 212 | 24.5 | 4 |
| | 1993 | 248 | 50.5 | 4 |
| | 1994 | 109 | 5.9 | 2 |
| | 1995 | 90 | 20.4 | 2 |
| | 1996 | 149 | 49.8 | 3 |
| | 1997 | 15 | 7.7 | 0 |
| Lepomis sp. | 1988 | 129 | 33.2 | 2 |
| | 1990 | 13 | 6.2 | 0 |
| | 1991 | 219 | 23.7 | 4 |
| | 1992 | 121 | 14.0 | 2 |
| | 1993 | 56 | 11.4 | 1 |
| | 1994 | 28 | 1.5 | 0 |
| | 1995 | 52 | 11.8 | 1 |
| | 1996 | 7 | 2.3 | 0 |
| | 1997 | 3 | 1.5 | 0 |

**Appendix E**

**Continued.**

| Species | Year | Number Collected | Percent of Catch for Each Year | Relative Abundance |
|---|---|---|---|---|
| Yellow perch | 1988 | 3 | 0.8 | 0 |
| | 1990 | 44 | 21.0 | 1 |
| | 1991 | 110 | 11.9 | 2 |
| | 1992 | 11 | 1.3 | 0 |
| | 1993 | 4 | 0.8 | 0 |
| | 1994 | 27 | 1.5 | 0 |
| | 1995 | 25 | 5.7 | 0 |
| | 1996 | 8 | 2.7 | 0 |
| | 1997 | 12 | 6.2 | 0 |
| Cyprinidae | 1991 | 516 | 55.8 | 9 |
| | 1995 | 272 | 61.5 | 5 |
| Walleye | 1991 | 4 | 0.4 | 0 |
| | 1992 | 1 | 0.1 | 0 |
| | 1994 | 2 | 0.1 | 0 |
| | 1995 | 1 | 0.2 | 0 |
| American shad | 1992 | 1 | 0.1 | 0 |
| Spottail shiner | 1993 | 1 | 0.2 | 0 |
| | 1994 | 1 | 0.1 | 0 |
| Bluegill | 1996 | 2 | 0.7 | 0 |
| Fallfish | 1996 | 1 | 0.3 | 0 |
| White sucker | 1997 | 1 | 0.5 | 0 |
| Largemout bass | 1990 | 1 | 0.5 | 0 |
| | 1992 | 3 | 0.3 | 0 |
| Unknown | 1993 | 2 | 0.4 | 0 |
| | 1994 | 6 | 0.3 | 0 |
| | 1995 | 1 | 0.2 | 0 |
| Total (all species, all 9 years) | | 5,747 | | 100 |