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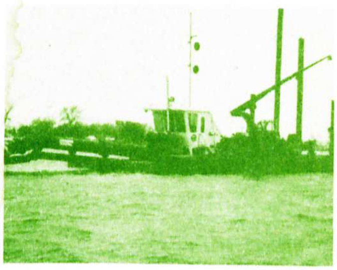

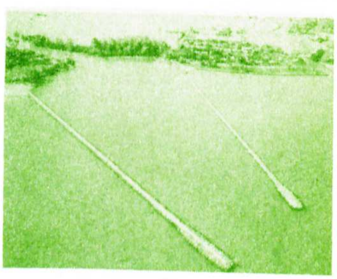

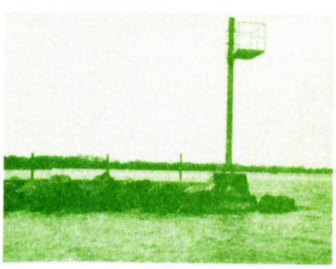

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ECOLOGICAL EFFECTS OF RUBBLE-MOUND BREAKWATER CONSTRUCTION AND CHANNEL DREDGING AT WEST HARBOR, OHIO (WESTERN LAKE ERIE)

by

Bruce A. Manny, Donald W. Schloesser,
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Great Lakes Fishery Laboratory
US Fish and Wildlife Service
Ann Arbor, Michigan 48105

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The investigation reported herein indicated that breakwater construction and associated channel dredging activities by the US Army Corps of Engineers in western Lake Erie at the entrance to West Harbor (Ohio) had no detectable adverse impacts on the distributions or abundances of macrozoobenthos and fishes. Rather, increases were noted in the number of fish eggs and larvae and in the density and biomass of periphyton and macrozoobenthos on and near

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the breakwaters. The area also served as a nursery ground for 20 species of fishes both during and after construction and dredging activities. Colonization of the breakwaters by periphyton, primarily a green alga (*Cladophora glomerata*), diatoms (*Gomphonema parvulum*), and a bluegreen alga (*Oscillatoria tenuis*), and by macrozoobenthos, primarily worms (Oligochaeta), amphipods (*Gammarus* spp.), and midge larvae (Chironomidae), was rapid and extensive, indicating that the breakwaters provided new, favorable habitat for primary and secondary producer organisms. Marked adverse changes in water quality, especially reduced dissolved oxygen concentrations (2-5 mg/ℓ), occurred around the entrance to West Harbor in 1983 following cessation of construction and dredging activities. These water quality changes, however, could not be ascribed with certainty to construction and dredging activities at West Harbor. Construction of additional breakwaters in the study area at that time by the State of Ohio served to confound determination of the responsible causal factors.

PREFACE

This report provides the results of a study on the ecological effects of rubble breakwater construction and channel dredging at the mouth of West Harbor, Ohio, in western Lake Erie. The work was accomplished by the US Fish and Wildlife Service (FWS), Great Lakes Fishery Laboratory, under the Environmental Impact Research Program (EIRP). The EIRP is sponsored by the Office, Chief of Engineers (OCE), US Army, and is assigned to the US Army Engineer Waterways Experiment Station (WES) under the purview of the Environmental Laboratory (EL). Technical Monitors were Dr. John Bushman and Mr. Earl Eiker of OCE and Mr. Dave Mathis, Water Resources Support Center. Dr. Roger T. Saucier, EL, was the Program Manager of the EIRP.

The report was prepared by Dr. Bruce A. Manny and Messrs. Donald W. Schloesser, Charles L. Brown, and John R. P. French III, Research Biologists, under the general supervision of Mr. Thomas A. Edsall, Project Officer for the FWS, Ann Arbor, Mich.

Mr. Arthur K. Hurme and Dr. Douglas G. Clarke served as contract monitors for this study under the general supervision of Mr. Edward J. Pullen, Chief, Coastal Ecology Group; Dr. C. J. Kirby, Chief, Environmental Resources Division; and Dr. John Harrison, Chief, EL.

During the study and preparation of this report, COL Tilford C. Creel, CE, and COL Robert C. Lee, CE, were the Commanders and Directors of WES and the Technical Director was Mr. F. R. Brown. At the time of publication, COL Allen F. Grum, USA, was Director and Dr. Robert W. Whalin was Technical Director.

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CONTENTS

ECOLOGICAL EFFECTS OF RUBBLE-MOUND BREAKWATER CONSTRUCTION AND CHANNEL DREDGING AT WEST HARBOR, OHIO (WESTERN LAKE ERIE)

PART I: INTRODUCTION

1. Because West Harbor is utilized by a growing number of small boats, the US Army Corps of Engineers conducted a recreation-navigation improvement project at West Harbor, Ohio, in western Lake Erie to facilitate the use of the area by such watercraft. Breakwater construction occurred at the entrance to West Harbor; dredging was performed to deepen an existing natural channel that extended from West Harbor offshore into Lake Erie. Dredging and breakwater construction began in the summer of 1981 and were completed by November 1982.

2. As part of the Corps' Environmental Impact Research Program, the US Fish and Wildlife Service Great Lakes Fishery Laboratory (GLFL) conducted a study, before, during, and after breakwater construction and channel dredging, at the West Harbor site. The study objectives were to (a) evaluate the effects of breakwater construction and channel dredging on local water quality, benthos, fish, and periphyton, and (b) evaluate the new habitat provided by the breakwater structures for benthos, periphyton, and fish. Study hypotheses were that fewer fish would frequent the construction site during construction than before and after construction and that the breakwaters would provide new habitat that would be rapidly colonized by periphyton and benthic macroinvertebrates (macrozoobenthos). Although the environmental effects on the ecology of marine, estuarine, and inland riverine areas as a result of constructing rubble-mound structures and dredging have received scientific attention in recent years (Osman 1977; Bingham 1982; Haynes and Makarewicz 1982; International Joint Commission 1982; Seelye, Hesselberg, and Mac 1982; Pennington, Baker, and Potter 1983; Knott, Van Dolah, and Calder 1984; Sanders and Baker 1984; Seelye and Mac 1984), this report is the first to identify and evaluate such effects in a coastal area of the Great Lakes.

PART II: METHODS AND MATERIALS

Description of the Study Area

3. The study area was located along a beach shoreline in shallow (0-4 m) water near the entrance to West Harbor on the northeast side of Marblehead Peninsula in southwestern Lake Erie (Figure 1). Sediments in the area are composed primarily of fine brown sand but patches of rock rubble are present on the gradually sloping lake bottom from shore out to the 4-m depth beginning about 1 km northwest of the harbor mouth. The shoreline is exposed to high-energy wave action, which has eroded portions of the beach southeast of the harbor mouth.

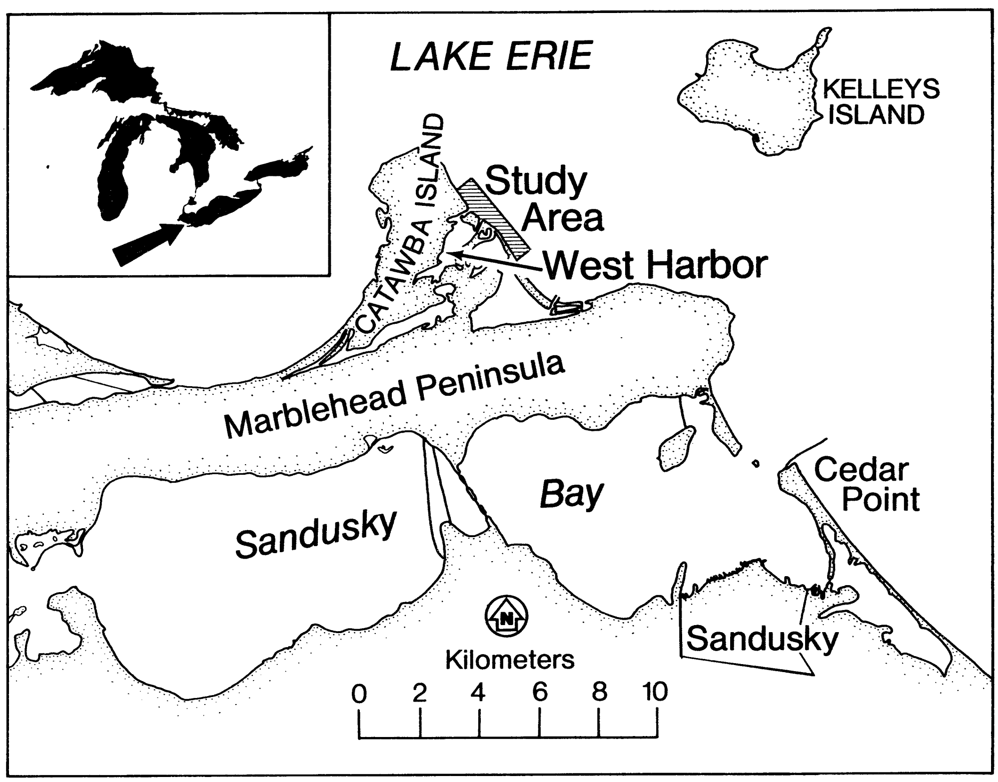

Figure 1. Southwestern Lake Erie showing the location of West Harbor, Ohio, and the study site

Construction Sequence

4. Breakwaters consisting of large (1-3 ton) limestone boulders

underlain by smaller (25-350 kg) stones were constructed on both sides of the channel (a natural stream mouth) to West Harbor (Figure 2). The channel between the breakwaters and into the harbor was then dredged to a uniform depth of 3 m. The east breakwater was connected to shore and extended 480 m offshore to water about 3.5 m deep. The west breakwater was not connected to shore and extended 412 m offshore to water about 3 m deep (Figures 2 and 3). Construction of the east breakwater, which began in July 1981 and ended in November 1981, required placement of a dike across the entrance of the harbor mouth and diversion of water from West Harbor north and around the west breakwater. This dike was in place from July through September 1982 and was removed in October 1982. The channel into West Harbor was dredged between July and November 1982, concurrent with construction of the west breakwater.

5. The Ohio Department of Natural Resources (ODNR) constructed four additional breakwaters parallel to the shoreline and about 250 m offshore, southeast of the entrance to West Harbor between transects IV and V (see Figure 2). Construction on these breakwaters, which were designed to protect the beach from erosion, began in October 1982 and ended in August 1983. The GLFL and the Corps received no advance notice of construction from the ODNR.

Sampling Locations

6. Sampling locations were selected to document changes in water quality, bottom sediments, benthic animal communities, and fish communities before, during, and after breakwater construction and channel dredging performed between August 1981 and November 1982 at West Harbor, Ohio. In August 1981, 1982, and 1983, limnological and fishery surveys were conducted on five transects extending lakeward from the shoreline to the 4-m depth contour (Figure 2). Three of these transects (II, III, and IV) were located near the proposed breakwater construction site; the remaining transects (I and V) were located 0.8 km northwest and 2.0 km southeast of the harbor entrance, in control or reference areas outside the construction site where the composition and slope of the lake bottom were determined from inspection of navigation maps and preliminary field surveys to be similar to those in the construction site.

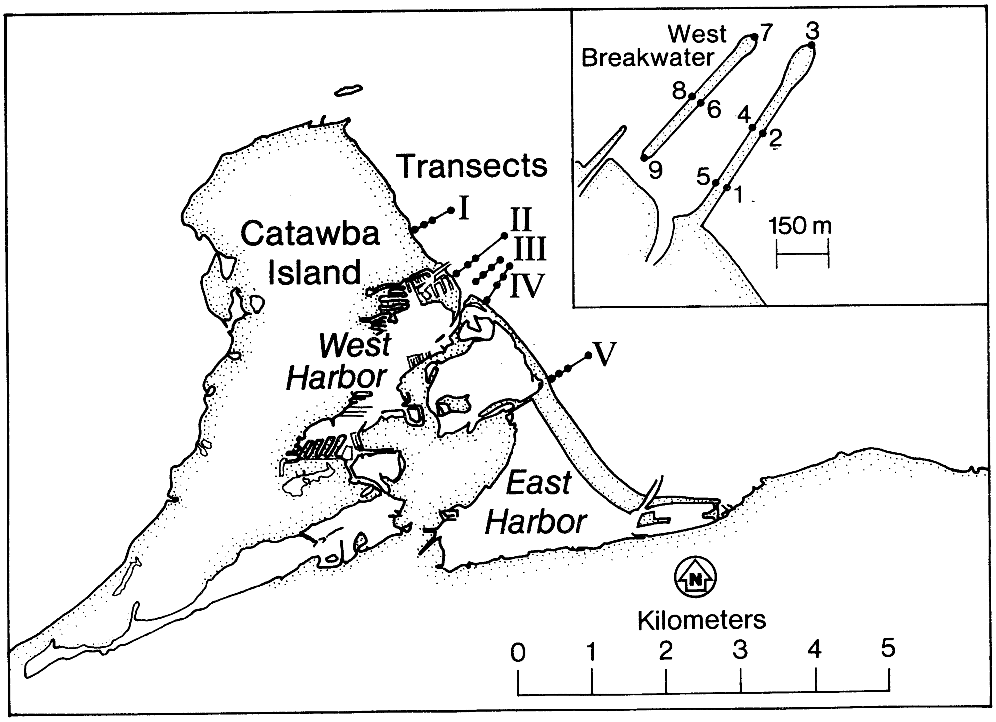

Figure 2. The study area at West Harbor, Ohio, showing sampling stations on transects I-V. Inset shows locations of limnological survey stations on the west and east breakwaters

7. Transect III, located in the channel to West Harbor, was included in the sampling design to assess changes in biota and water quality occurring as a direct result of deepening and extending that channel. The substratum along all five transects and throughout the construction site was determined by visual inspection of bottom samples collected with a ponar grab to be primarily fine brown sand.

8. Four "transect" stations were established by reference to water depth along each transect: station 1 was located on the 0.5-m depth contour, about 15 m from the shoreline in the surf zone; station 2 was located on the 2-m depth contour, about 150 m offshore and just lakeward of the surf zone; station 3 was located on the 3-m depth contour, about 300 m offshore; and station 4 was located on the 4-m depth contour, about 700 m offshore. Off- shore rubble-mound breakwater construction, performed by the State of Ohio during the summer of 1983, prevented sampling for fish at station 2 on tran- sect V in August 1983; therefore, sampling for fish at this station on this date was conducted in water 0.4 m deeper than in August 1981 and 1982.

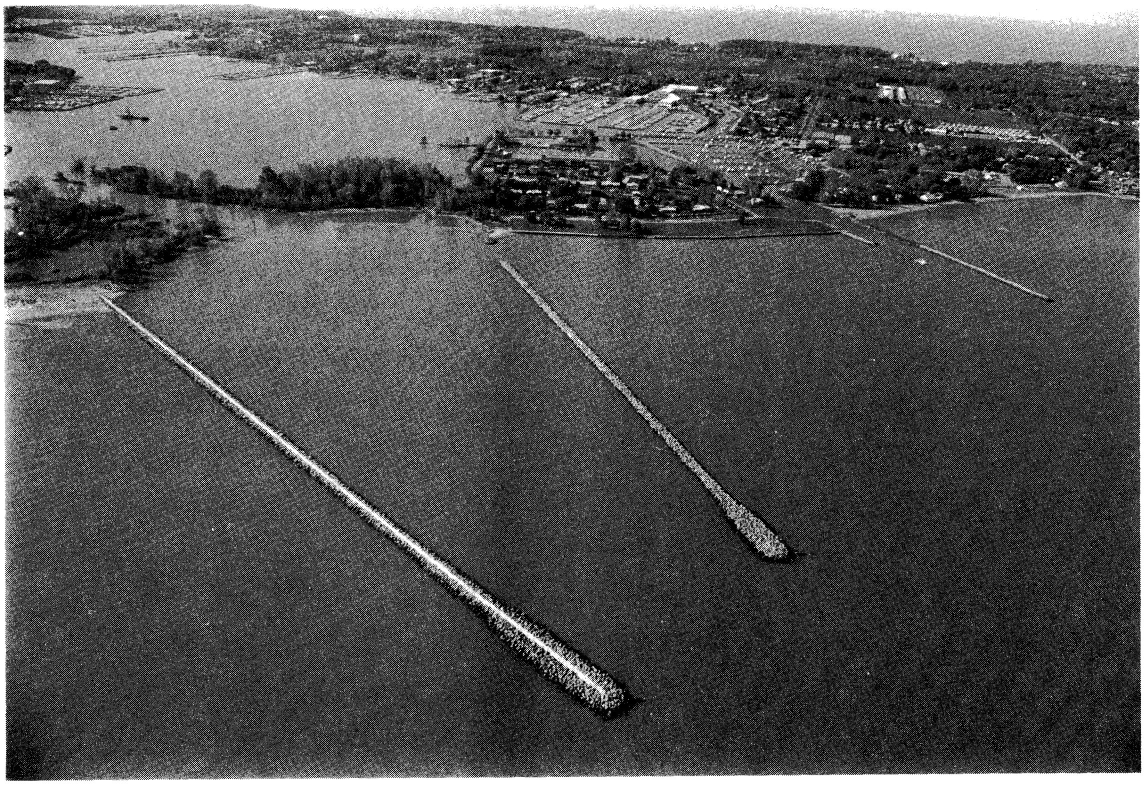

Figure 3. Aerial photograph of the study site at West Harbor, Ohio, showing the harbor entrance after completion of the project breakwaters

9. The locations of sampling stations 1-9 on the breakwaters were established at measured intervals by reference to the shoreward end of each breakwater (Figure 2). Each breakwater sampling station was marked with fluorescent paint sprayed on a rock above the waterline.

Sampling Schedule

10. Limnological and fishery surveys were conducted on the transects in August of 1981, 1982, and 1983, and on the breakwaters in April, July, and September of 1982 and 1983. Construction activity on the breakwaters prevented limnological sampling at breakwater stations 6-9 in April and July 1982 and trawling for fish between the breakwaters in July 1982.

Sampling Methods and Data Analysis

Water quality

11. Water temperatures and dissolved oxygen (DO) concentrations were measured with a temperature-DO meter at the surface and bottom of the water column at each station on each transect once annually (total of 240 measurements). Surface water samples for determination of turbidity and suspended solids were collected at each station on each transect once annually (total of 60 samples), stored on ice in an insulated container, and taken to the laboratory for analysis. Turbidity was measured with a nephelometric turbidimeter; suspended particulate matter (SPM) was determined by filtering a known volume of each water sample under vacuum on a tared glass fiber filter (porosity of 0.4 μm), then weighing the dried (105° C for 24 hr) filter.

12. On the breakwaters, water temperatures and DO concentrations were measured three times each year at each station with a DO meter within 10 cm of the surface and bottom of the water column and at the bottom of interstices between submersed stones, by personnel standing on the breakwater (total of 324 measurements). Surface water samples for determining turbidity and SPM were collected from the breakwater three times each year at all nine stations (total of 108 samples) and handled in the same manner as those collected at the transect stations.

Macrozoobenthos

13. Three replicate samples of macrozoobenthos were collected at each of 20 transect stations with a petite ponar grab (bottom coverage: 225 sq cm) in August 1981, 1982, and 1983. This is the minimum number of replicates recommended to describe benthic macroinvertebrate communities (EPA 1973; APHA 1980) and has been shown to adequately describe such communities throughout western Lake Erie (Carr and Hiltunen 1965). Three replicate pumped samples of macrozoobenthos were collected from interstices among submersed rocks at breakwater stations 1-5 in April and July 1982 and at breakwater stations 1-9 in September 1982 and April, July, and September 1983. No description of this procedure was found in the literature; three replicate samples were collected at each station so the sample size at each station on the breakwaters would be consistent with that for macrozoobenthos at each of the transect sampling stations. Water was pumped from the lake bottom through a screen head (9-mm openings) and 5-cm ID (inside diameter) hose attached to a gasoline-powered

centrifugal pump at the rate of 371 ℓ/min. Three replicate 3-min pumped samples were obtained at each station. Each sample was washed through a standard No. 30 sieve (mesh size, 0.65 mm). Macrozoobenthos, fish larvae, and fish eggs in the samples were preserved in 10-percent formalin and taken to the laboratory for sorting under 7X magnification, identified to the lowest possible taxonomic level, and enumerated. Colonial bryozoa were recorded as present or absent. For biomass determinations, mollusca and nonmollusca were filtered onto nylon netting (mesh size, 0.65 mm), transferred to aluminum weighing foils, dried in an oven at 105° C for 12 hr, and weighed to the nearest 0.1 mg of dry weight. The ash-free dry weight of mollusca was obtained by reheating the dried samples in a muffle furnace at 525° C for 6 hr, weighing to the nearest 0.1 mg, and substracting the ash weight from the dry weight to avoid interference from shells. This practice resulted in a small (1-3 percent) underestimate of dry mollusca tissue weight because a small proportion of the tissue was inorganic minerals included in the ash weight. The total biomass of macrozoobenthos is the summation of the dry weight of nonmollusca and ash-free dry weight of mollusca.

14. The mean density and biomass of macrozoobenthos per square meter at transect stations were calculated using a conversion factor (44.44) equal to the fraction of 1 sq m of lake bottom sampled by each grab of the ponar. The mean density and biomass of macrozoobenthos from breakwater stations were expressed, respectively, as numbers and weight per unit of effort (3 min of pumping) because the surface area of the substratum sampled could not be accurately measured.

Fish

15. Fishes were collected once on each sampling date at station 1 on transects I, II, IV, and V at night with a beach seine (10 m long, 1.8 m deep, with 13-mm mesh, stretched measure) and at stations 4 on these transects during the day with an 8-m semiballoon bottom trawl (7.9-m head-rope, 9.4-m foot-rope, with 38- and 13-mm mesh, stretched measure, in the body and cod end, respectively) towed parallel to shore. At stations 2 and 3 on transects I, II, IV, and V, fish were sampled once on each sampling date during the day with a 5-m semiballoon bottom trawl (4.25-m head-rope, 5.25-m foot-rope, with 35- and 10-mm mesh, stretched measure, in the body and cod end, respectively) towed parallel to shore. Trawls of 5 and 8 m with these specifications were selected for this study because they have been used successfully for many years to

assess fish stocks in the Great Lakes (Hartman 1980). Transect III was sampled once during the day on each sampling date by a single tow with the 5-m semiballoon trawl from station 1 to station 4 because a 10-min tow could not be made parallel with shore between the breakwaters at the various depth intervals. All trawls at all other transect stations were of 10-min duration. A previous investigation showed that this level of effort was sufficient to derive reliable estimates of relative abundance for most resident fishes in the West Harbor area (Haack and Muth 1980).

16. Fishes near the breakwaters were sampled during the day (1400-1600 hr) and night (2200-2400 hr) with a 5-m semiballoon bottom trawl towed once parallel to and within 33 m of either side of and once equidistant between the breakwaters. Each trawl tow lasted 7 minutes, the time required to trawl from the 0.5-m depth contour lakeward to the 4-m depth contour, the lakeward boundary of the study area.

17. Fish were identified to species and sorted by length into one of three age groups: young-of-the-year (YOY) or age group 0 fish were those that had hatched during the year of capture; yearlings or age group 1 fish were those that had hatched the year prior to capture; and 2+ fish were those in age groups 2 and older that had hatched 2 or more years prior to capture. The length ranges used to assign fish to the three age groups were non-overlapping and were obtained from unpublished age and growth studies conducted earlier in the vicinity of West Harbor by GLFL.

18. Lengths and weights of fish collected in 1981 and 1982 were estimated by age group from lengths and length-weight regressions of fish species in western Lake Erie which had been determined from annual fish surveys of western Lake Erie by GLFL from 1959 to 1981 (Tables 1 and 2). In 1983, all fish were sorted, weighed, and measured, with one exception: because of the large numbers of fish caught near the breakwaters in April 1983 (total estimated catch, 9,220 fish), only half of each trawl catch on that date was sorted, weighed, and measured; subsampling was accomplished by dipping fish randomly with a bucket from each trawl catch. The state of sexual maturity (spawning readiness) was determined by applying pressure to the abdomen of individual fish to see if eggs or sperm were expelled.

Periphyton

19. Periphyton was collected with a bottle-brush sampler (Douglass 1958); each sample covered 12.56 sq cm of rock surface. At each station,

periphyton colonizing the breakwater at the waterline was visually inspected, and a representative patch of growth was selected for sampling. Of the three samples collected at the waterline at each station, one was analyzed for chlorophyll *a* content, one was analyzed for biomass, and one was examined with a microscope to identify the algae present.

20. Chlorophyll and biomass samples were placed on ice and analyzed in the laboratory within 24 hr. Chlorophyll samples were filtered onto glass fiber filters (average porosity, 0.4 μm), the pigment was extracted in 90-percent aqueous acetone for at least 48 hr, and the absorbance of chlorophyll was measured on a ratio-recording spectrophotometer at 665 μm. The chlorophyll *a* concentration, corrected for phaeopigments, was calculated following the procedures in Wetzel and Westlake (1969).

21. Biomass samples were filtered onto precombusted (at 525° C), preweighed glass fiber filters, which were dried at 105° C for 24 hr and weighed to the nearest 0.1 mg of dry weight. The ash-free dry weight of periphyton was obtained by reheating the dried samples at 525° C for 8 hr, weighing to the nearest 0.1 mg, and subtracting the ash weight from the dry weight.

22. Samples for taxonomic identification were preserved in the field by adding 5 ml of a modified Lugol's solution (Meyer 1971). In the laboratory, samples were prepared for analysis by adjusting the sample volume to 500 ml, mixing the sample, settling a measured aliquot for 48 hr, and examining the periphyton with an inverted microscope at 400X until 500 cells were identified and enumerated.

Data analysis

23. Data on water quality, macrozoobenthos, fish, and periphyton were processed by computer. Transect data on water quality, macrozoobenthos, and fish collected in 1981, 1982, and 1983 were tested to verify that the data met requirements for normality and homogeneity of variance, then subjected to analyses of variance (ANOVA) to determine if values obtained before construction and dredging began were significantly different ($p = 0.05$) from values obtained after these activities were completed. ANOVA of the macrozoobenthos and fish data after transformation to natural logs yielded results no different from ANOVA of these data before transformation. Prior to construction and dredging, data on water quality, macrozoobenthos, and fish were gathered only at stations on the transects, not at sites where the breakwaters were subsequently constructed. Therefore, a statistical analysis could not be made of

the number of benthos, fish, and periphyton that were provided new habitat by construction of the breakwaters using data from the breakwater stations before and after construction. Colonization rates of each breakwater by periphyton and macrozoobenthos were analyzed using graphical procedures. Because water quality data were collected at different times on transects and breakwaters, they could not be analyzed statistically to describe differences between transect and breakwater stations. Tabulations of the fish data from the transects and breakwaters were compared by inspection to determine the effect of breakwater construction on fish community structure.

PART III: RESULTS

Water Quality

24. Water temperatures at the surface and bottom in August differed by less than 1° C throughout the study area and differences between water temperature on the various transects in 1981 (range, 24.0-25.0° C), 1982 (22.0-23.7° C), or 1983 (25.5-28.5° C) were also slight (Appendix A). However, statistical analysis (ANOVA) showed that DO in bottom waters was significantly lower on transects near the breakwaters (transects II, III and IV) and at one reference transect (V) in August 1983 (range, 2.2-7.6 mg/ℓ) than in August 1981 (9.2-11.6 mg/ℓ) or August 1982 (7.7-9.3 mg/ℓ). In August 1983, DO levels in bottom waters throughout much of the study area were below 5 mg/ℓ, the threshold below which adverse effects on fish (reduced fecundity and growth rate) begin to appear (Doudoroff and Shumway 1970; Davis et al. 1979). Turbidity and SPM were significantly higher on transects II and IV near the breakwaters (range, 16-39 Nephelometric Turbidity Units [NTU] and 22-61 mg/ℓ, respectively) than on transects I and V in the reference areas (13-25 NTU and 14-26 mg/ℓ, respectively) during construction in August 1982, and decreased significantly on all transects each year in August with increasing water depth (Appendix A).

25. DO near the west breakwater did not differ significantly from that near the east breakwater during the study, but DO near the breakwaters in July and September 1982 (range, 5.3 to 7.5 mg/ℓ) differed significantly ($p = 0.05$) from values measured in April 1982 and 1983 (range, 6.0 to 11.9 mg/ℓ; Appendix B). Interstitial DO and water temperature on the breakwaters were not different from values measured concurrently at the surface and bottom of the water column near the breakwaters. SPM and turbidity were not significantly different among stations on the breakwaters on any given date, and the level of these two variables was positively correlated with wind speed (Appendix B).

Macrozoobenthos

26. More than 38,900 organisms representing over 50 taxa were identified from the 288 benthos samples taken during the study (Tables 3-6; Appendices C, D, E, and F). Only a few of these taxa have previously been reported from the nearshore waters around West Harbor:

Class Oligochaeta	Class Insecta
Brachiura sowerbyi	Order Diptera
Limnodrilus cervix	*Chironomus* sp.
L. hoffmeisteri	*C. plumosus*
L. maumeensis	*Coelotanypus* sp.
Potamothrix vejdovskyi	*Polypedilum* sp.
	Tanypus sp.
	Cryptochironomus sp.
	Pseudochironomus sp.
	Procladius sp.

Source: Pliodzinskas 1979.

The most abundant taxa were Oligochaeta (worms) and Chironomidae (midge larvae) which made up 64 and 22 percent, respectively, of the total by number at transect stations (Table 3). We found relatively high densities (up to 10,000/sq m) of a polychaete worm (*Manayunkia speciosa*) not previously reported from the West Harbor area.

27. Analysis of variance among the densities of total macrozoobenthos on the five transects for the 3 years combined revealed that significantly fewer macrozoobenthos were found on control transects (I and V) than on transects near the breakwaters (II, III, and IV) during the study:

Transect		No. of Observations	Mean No. of Organisms/m^2
I	(Control)	36	4,219
II	near breakwaters	36	6,198
III		36	6,799
IV		36	7,366
V	(Control)	36	4,998

28. Each of these transect densities greatly exceeded the average density of all taxa combined (627/sq m) found in a 1977 survey of the West Harbor area area (Pliodzinskas 1979). Pliodzinskas (1979) reported that in 1977 the

benthic macroinvertebrate fauna near West Harbor consisted primarily of one species, the naidid oligochaete *Chaetogaster diaphanus*. Hence, between 1977 and 1981, the density and taxonomic diversity of macrozoobenthos in nearshore waters near the mouth of West Harbor apparently increased about ten-fold. The mean density of macrozoobenthos on transect III was considerably higher in 1983 (13,975/sq m) after the channel was dredged between the breakwaters than in 1981 (3,322/sq m) before the channel was dredged, or in 1982 (3,100/sq m) while the channel was being dredged. A similar increase in biomass in 1983 on transect III was also evident in the data (Table 4).

29. Analysis of variance showed that the density and biomass of macrozoobenthos increased significantly ($p = 0.05$) with increasing water depth on all transects (Figure 4) and that on transects I, II, IV, and V combined, an increase in biomass at the 4-m water depth explained nearly all of the significant increase in biomass from 1981 to 1983:

Year	No. of Observations	Mean Biomass (g/m^2)
1981	16	420
1982	16	601
1983	16	769

It is not known whether this trend was limited to the West Harbor area.

30. On the breakwaters, pumped sampling revealed that the most abundant taxa were Oligochaeta (worms), *Gammarus* spp. (amphipods), and Chironomidae (midge larvae), which made up 40, 27, and 15 percent, respectively, of the total number collected during the study (Table 5). Eleven more taxa were found on the breakwaters than on the transects. The mean biomass per sample of macrozoobenthos was higher on the breakwaters in 1983 (805 mg/sample) than in 1982 (491 mg/sample; Table 6). Colonization of the east break- water by macrozoobenthos during the first year of its existence (1982) was much more rapid and extensive than colonization of the west breakwater by macrozoobenthos during the first year of its existence (1983) (Figure 5). Year-to-year weather differences may partly explain this difference, because colonization rates on both breakwaters were slower in 1983 than the rate on the east breakwater in 1982.

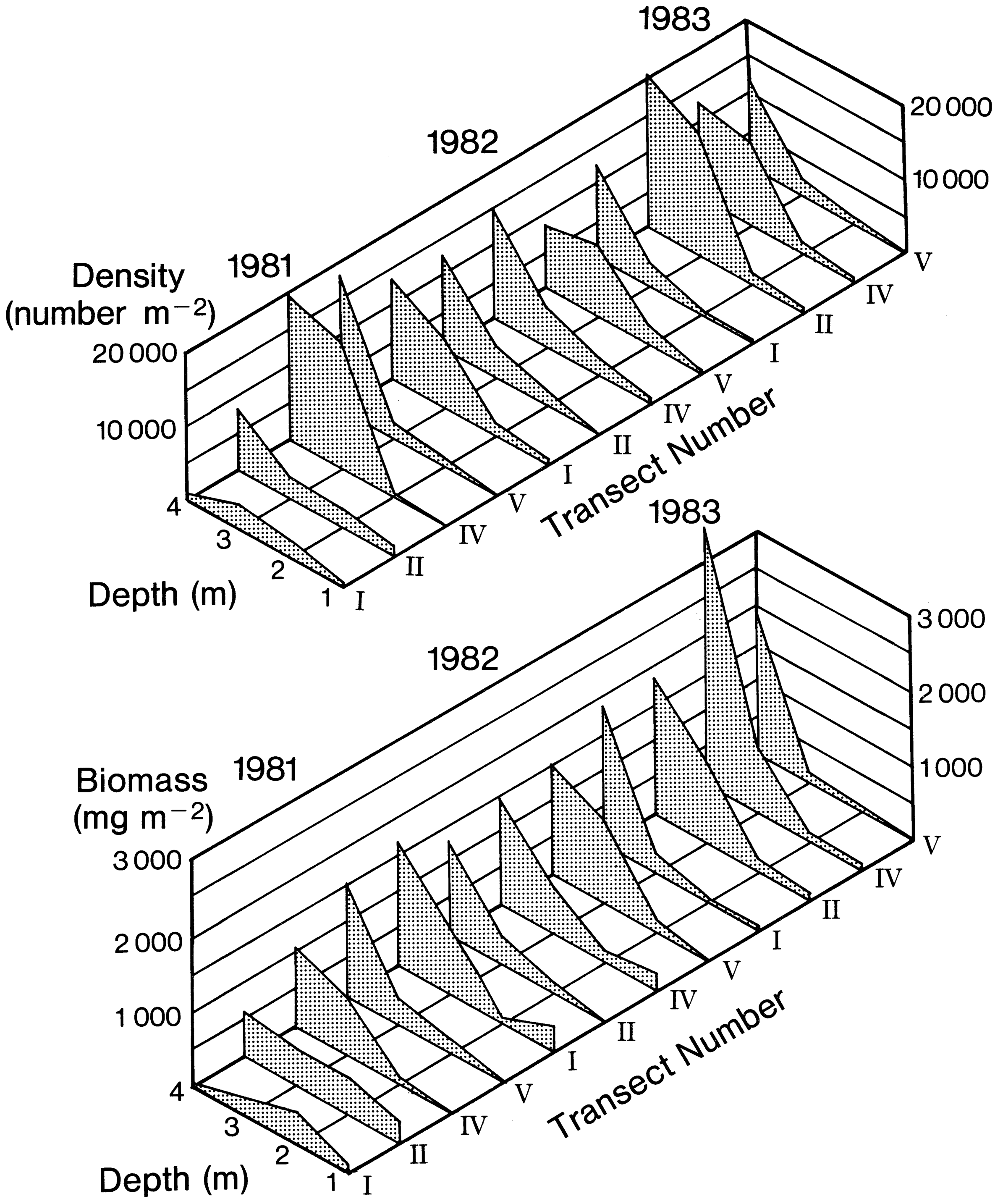

Figure 4. Changes in density and biomass of macrozoobenthos on transects I, II, IV, and V at West Harbor, Ohio, for preconstruction (1981), during construction (1982), and postconstruction (1983) sampling efforts

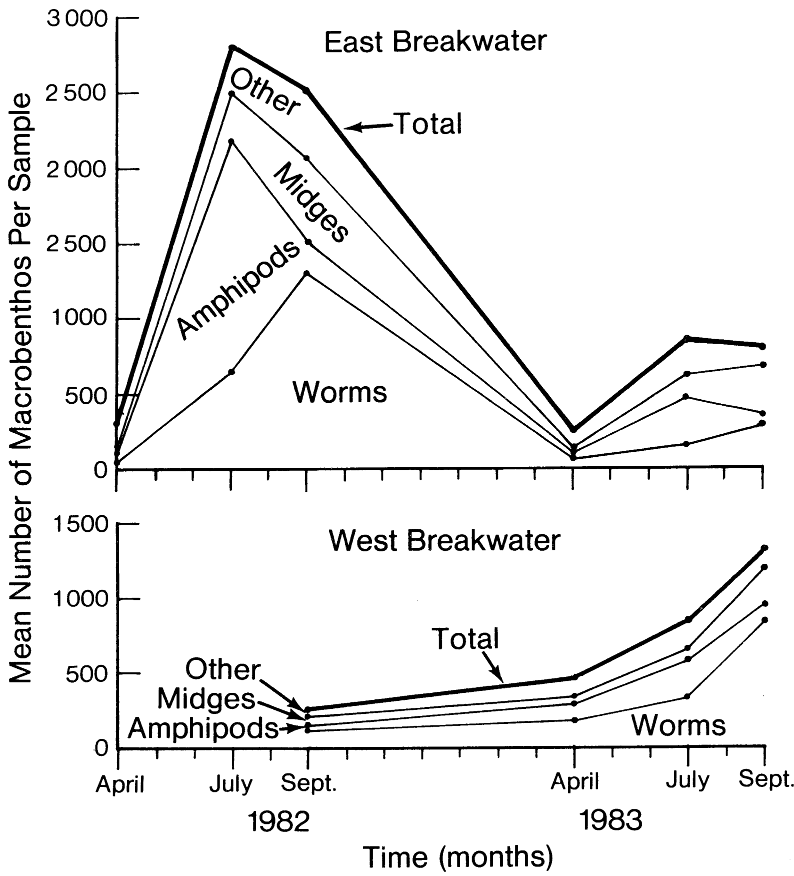

Figure 5. Colonization by macrozoobenthos on east and west breakwaters at West Harbor, Ohio, April 1982-September 1983

Fish

31. Seining and trawling on five transects in August 1981-1983 captured 20,893 fish representing 24 species (Tables 7 and 8): white bass, gizzard shad, and freshwater drum made up 74 percent of the catch; white perch, spottail shiner, yellow perch, and alewife made up 20 percent; and 17 other species each contributed less than 2 percent of the total (Appendix G). The total catch on transects was substantially (43 percent) lower in August 1982 than in August 1981, and substantially (76 percent) lower in August 1983 than in August 1982 as a result of decreases in the catches of white bass, gizzard shad, and spottail shiner. These decreases apparently were not an effect of breakwater construction or channel dredging because the abundance of forage fish stocks generally decreased concurrently throughout the western basin of Lake Erie

(Muth 1984). In 1982, more freshwater drum, white perch, yellow perch, trout perch, walleye, and rainbow smelt and fewer alewife and emerald shiner were captured than in 1981 and 1983 (Table 7). The number of fish species captured on the transects each sampling period between 1981 and 1983 varied between 17 and 21, due to changes in the occurrence of species representing less than 1 percent of the total catch (Table 7).

32. Analysis of variance revealed that the number of fish captured each year on control transects I and V was not significantly greater than that on transects II and IV near the breakwaters ($p = 0.05$). This finding supports the interpretation that breakwater construction and channel dredging had no lasting effect on the number of fish captured on transects in the West Harbor area. However, more than one collection of fish per year on the transects would have been needed to conclude that fish did not avoid the harbor area during construction in 1982.

33. The proportions of YOY, yearling, and age 2+ fish in the total catch made on the transects in August remained essentially unchanged between 1981 and 1983 (Table 9). The high proportion of YOY fish in the catch each year (more than 84 percent) indicates that the study area, like nearshore waters throughout the Great Lakes (Goodyear et al. 1982), serves as a nursery ground for fish. Recent analyses of fish withdrawn from nearshore areas by water intakes around the Great Lakes indicate that the majority of fish inhabiting these waters in late summer are YOY fish (Manny 1984).

34. A total of 12,761 fishes representing 24 species were captured adjacent to the breakwaters in April, July, and September of 1982 and 1983 (Table 10); spottail shiner, freshwater drum, and yellow perch made up 72 percent of the total catch; trout perch, white perch, and gizzard shad made up 23 percent; and 18 other species each made up 2 percent or less of the remaining total catch. The catch was much lower in 1982 (2,055 fish), while breakwaters were being constructed, than in 1983 (10,706 fish), after breakwater construction was completed, indicating that fishes (especially spottail shiner and yellow perch) may have avoided the harbor mouth during construction. In both years, the catch declined substantially from April to July and then increased in September (Table 10). The number of fish captured in September 1983 (958 fish) was about equal to the catch in September 1982. Nineteen species of fish were collected in 1982; 21 species, in 1983.

35. Comparison of trawl catches made during the day with those made at night revealed that 65 percent of the total number of fish and 65 percent of the total biomass of fish were taken at night (Table 11; Appendix H). This finding is consistent with results of day-night fish surveys made annually from 1959 to 1983 at transect V (GLFL, unpublished data). The higher catches at night probably indicate that not only are more fishes using the waters around the harbor mouth at night but also that they are up off the bottom and thus more vulnerable to the trawl at night. No particular species of fish accounted for the higher night catches; instead, a variety of species and age classes contributed to the high catches at night.

36. The age composition of the catch near the breakwaters in April and July 1982 during construction differed from that in April and July 1983 after construction, but in September 1982 it was almost identical to that in September 1983 (Table 12). The catch in April 1982 contained relatively fewer age 2+ fish and more yearling fish than the catch in April 1983. In July, fewer YOY and more age 2+ fish were caught in 1982 than 1983. Overall, the age composition of the catch near the breakwaters in September closely resembled that of the catch on transects nearby (Table 9) and month-to-month differences in age composition agreed with the expectation that the catch would consist primarily of older fish in April and younger fish in July and September.

37. A total of 360 fish eggs and 13 fish larvae (1 sunfish, 4 freshwater drum, 1 *Coregonus* sp., and 7 carp) were collected on the breakwaters in 1982 and 1983. Also, small numbers of gravid yellow perch were caught in April 1982, and large numbers of ripe spottail shiner, yellow perch, and trout perch ready for spawning were caught in 1983 adjacent to the breakwaters. Although these data are too few to prove that the breakwaters provided spawning habitat for fishes, some of the species captured were among those that prefer rocky substrata (Goodyear et al. 1982), and the data suggest that the breakwaters were used by fish for spawning, perhaps more extensively in 1983 than in 1982. The incidental capture of a coregonid larva--probably a lake herring (*Coregonus artedii*) or a lake whitefish (*Coregonus clupeaformis*)--in April 1983 was surprising, because coregonids are extremely rare in this portion of the lake (Goodyear et al. 1982).

Periphyton

38. Growth of periphyton was observed on both breakwaters within 2 weeks after rocks were placed in the water. In April 1982 there was no visible "periphyton zone" on the outermost, exposed surfaces of about 90 percent of the rocks on the east breakwater, and chlorophyll and biomass values were very low (Table 13). Periphyton were found only on interstitial rock surfaces that were protected during the winter from ice abrasion. An attached diatom (*Gomphonema olivaceum*) was the most abundant periphytic alga on the breakwater, and small spots of attached green algae (primarily *Ulothrix* spp.) were also visible on some of the rocks.

39. In July 1982, visual inspection of the east breakwater showed that a tremendous growth of periphyton had developed. Filaments of the green alga *Cladophora glomerata* up to 15 cm long had colonized a zone from 20 cm below the waterline to 30 cm above the waterline on nearly every rock. Average measurements of periphytic chlorophyll (2,384 mg/m^2) and biomass (302 g/m^2) were much higher than the corresponding measurements made in April (1 mg/m^2 and 2 g/m^2, respectively). Few attached epiphytic algae had colonized the filaments of *C. glomerata*; small numbers of diatoms such as *Gomphonema parvulum* and *Rhoicosphenia curvata* were found on some filaments (see Appendix I).

40. In September 1982, periphyton had begun to colonize the newly constructed west breakwater, but the standing crop there was significantly less (chlorophyll 119 mg/m^2, biomass 9 g/m^2) than that on the east breakwater (chlorophyll 206 mg/m^2, biomass 23 g/m^2). Blue-green algae, mostly *Oscillatoria tenuis*, were the principal taxa colonizing both breakwaters, although a stubble of *C. glomerata* remained on the rocks (Appendix J).

41. In April 1983, the periphyton standing crop was higher on the east breakwater (38 mg/m^2 chlorophyll and 11 g/m^2 biomass) than on the west breakwater (17 mg/m^2 and 4 g/m^2; Table 13). Periphyton composition on the east breakwater consisted of small amounts of filamentous blue-green algae (*Oscillatoria* spp.), green algae (*Ulothix* spp.), and the red alga *Bangia atropurpurea*, a recent invader to the Great Lakes. The west breakwater was colonized primarily by *Ulothix* spp. and pennate diatoms, such as *Diatoma hiemale*.

42. By July the standing crop had increased dramatically on both breakwaters (Table 13); *C. glomerata* had become the dominant alga and was responsible for the above-mentioned increases in chlorophyll and biomass, with only a

minor contribution by epiphytic diatoms (Appendixes I and J). By September 1983, periphyton standing crop had decreased on both breakwaters, owing to the seasonal decline of *C. glomerata*. Although patches of *C. glomerata* were still present on the breakwaters in September, *Oscillatoria agardhii* was numerically dominant, and the biomass was nearly the same on both breakwaters (Table 13).

43. Analysis of periphyton colonization rates on the two breakwaters, using standing crop biomass, revealed that colonization was more rapid and extensive on the east breakwater during its first year of existence (1982) than on the west breakwater during its first year of existence or on the east breakwater during its second year of existence (Figure 6). Colonization rate of the breakwaters by periphyton therefore closely resembled that by macrozoobenthos (Figure 5), both of which were more rapid in 1982 (during breakwater construction and channel dredging) than in 1983 (after construction and dredging).

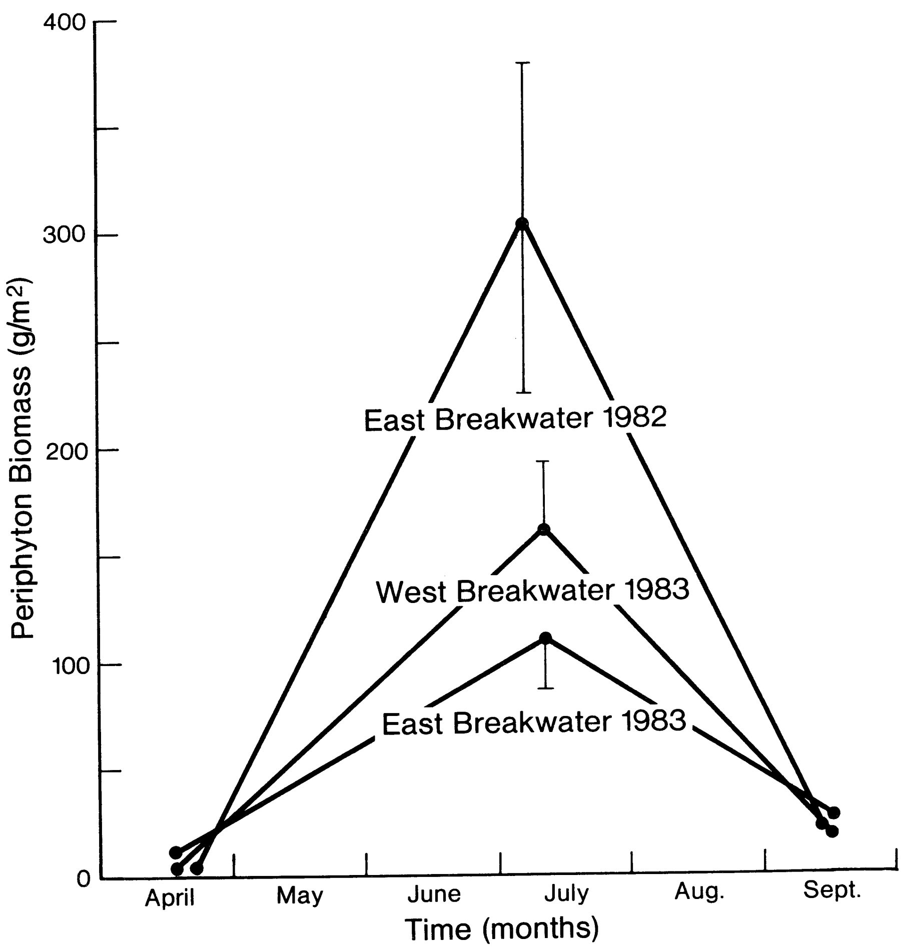

Figure 6. Mean dry weight biomass (g/m^2) of periphyton on the breakwaters at West Harbor, Ohio

PART IV: DISCUSSION

Water Quality

44. Water temperatures in the study area were typical for this portion of the lake in April-September (Cooper 1978). The decrease in DO concentrations to 5 mg/ℓ or less on transects near the harbor mouth and on one control transect (V) in August 1983 was probably not caused by construction of the two breakwaters because DO decreased to less than 6 mg/ℓ concurrently at the transect in the other reference area (I), 2.8 km west along the shore. This widespread occurrence of oxygen-deficient bottom waters in the study area was probably not caused by the improvement project at West Harbor because reduced DO levels were not detected in the study area around the breakwaters in July 1983, after construction was completed. However, the effect of construction of offshore breakwaters by the State of Ohio just prior to our sampling in August 1983 cannot be ruled out as a possible cause of oxygen-deficient bottom waters in the study area. Seasonally, lowest DO concentrations in nearshore waters of Lake Erie are typically found in August near the mouths of harbors and tributaries (Herdendorf and Cooper 1979).

45. Construction of the breakwaters and dredging of the channel in 1982 were accompanied by elevated levels of turbidity and SPM on transects near the harbor mouth, but postconstruction and dredging levels measured in 1983 were essentially the same as levels recorded in 1981 prior to construction. Therefore, it was concluded that higher levels of turbidity and SPM in 1982 at the time of breakwater construction and channel dredging had no lasting detrimental effect on biota near the mouth of West Harbor.

Macrozoobenthos

46. The increase noted in the density and biomass of macrozoobenthos with increasing depth (Figure 4) is unrelated to construction of the breakwaters because the relationship was found on control transects as well as transects at the construction site. The significantly lower density of macrozoobenthos on control transects I and V than on transects II, III, and IV and the higher density of macrozoobenthos on transect III after dredging than before

dredging support the conclusion that construction of the breakwaters and channel dredging had no adverse effect on macrozoöbenthos around the harbor mouth. Rather, the macrozoobenthos on transects near the breakwaters were more dense than on control transects because the breakwaters enhanced the suitability of the benthic habitat, largely by reducing wave energy and possibly by causing organic detritus (food) to accumulate on the lake bottom near the breakwaters.

47. Comparison of macrozoobenthos inhabiting the sediments of the study area (Table 3) with those inhabiting interstices on the breakwaters (Table 5) revealed that the sediment assemblage consisted almost entirely of three groups (Oligochaeta, the polychaete *Manayunkia speciosa*, and chironomidae), whereas the breakwater assemblage consisted of a lower percentage of Oligochaeta (40 percent versus 64 percent), practically no polychaetes, a lower percentage of Chironomidae (15 percent versus 22 percent), plus four other groups that contributed at least 2 percent of the total, including 27 percent *Gammarus*, a group that was largely absent among the sediment assemblage. Overall, the sediment assemblage (36 taxa) was less diverse than the breakwater assemblage (46 taxa), presumably because the breakwaters offered more protection from wave action and a wider variety of habitats for macrozoobenthos than the surrounding lake bottom.

Fish

48. The present study indicates that the fish community near West Harbor before (1981), during (1982), and after (1983) construction of the breakwaters was similar to that in other nearshore waters of western Lake Erie (Van Meter and Trautman 1970; Leach and Nepszy 1976; Busch, Davies, and Nepszy 1977; and Muth 1979). Fish species composing more than 1 percent of the total catch were the same species frequently caught as part of another investigation near East Harbor in August 1981-1983 (GLFL, unpublished data). In addition, the year-to-year decreases in the total size of the catch and changes in the composition of the catch at West Harbor are similar to the changes noted in catches made concurrently at East Harbor, except that relatively large numbers of YOY white bass were caught in 1981 at West Harbor but not at East Harbor. The large numbers of YOY white bass and gizzard shad caught in August 1981 near West Harbor account for the higher proportion of younger fish in that year than in 1982 or 1983 (Table 9). Such sporadic large catches of white

bass and gizzard shad often are made in nearshore waters of Lake Erie (GLFL, unpublished data; Jude, Mansfield, and Perrone 1983) and Lake Huron (Nester and Poe 1982).

49. The fewer fish captured in 1982 on transects near the breakwaters (II and IV) than on reference transects (I and V) (Table 8) suggests that fish avoided the mouth of West Harbor during construction of the breakwaters. However, factors other than construction of the breakwaters may have affected fish distributions in the study area. One such influence in 1983 may have been the higher frequency of disturbance from boat traffic near the West Harbor breakwaters than at reference transects after the channel was dredged to depth in fall 1982. It was concluded that construction of the breakwaters and channelization caused fish to avoid the construction site in April and July of 1982 but that construction and channelization had no lasting adverse effect on the distributions and abundances of fishes near the breakwaters.

50. The fish community immediately adjacent to the breakwaters in April, July, and September 1982 and 1983 was similar to that found on transects sampled in August and is typical of that in the nearshore waters of western Lake Erie (Barnes 1979). However, fewer fish were caught adjacent to the breakwaters in April and July in 1982 than in 1983 (Table 11); hence, fewer fish used the area during construction of the breakwaters in the spring and summer of 1982 than in 1983. Unfortunately, preconstruction fish collections were not made in the immediate area of the proposed breakwaters in April 1981, so it was not possible to compare the number of fish caught in April before, during, and after construction. However, the higher number of fish in April 1983 compared to 1982 may reflect a return to preconstruction (1981) levels or an increased attractiveness of the area resulting from new spawning substrata and forage for fishes provided by the breakwaters. Approximately 33 percent of the fish in the April 1983 fish collections were age 2+ spottail shiners, some of which were ripe for spawning.

51. The number of fish collected near the West Harbor breakwaters in September 1983 was expected to be substantially higher than in September 1982 when channel dredging was occurring between the breakwaters. Because the catch of fish was approximately the same in September in 1982 and 1983, dredging between the breakwaters apparently had little impact on the fish community at West Harbor.

Periphyton

52. Periphyton on the breakwaters at West Harbor was typical of that reported from other nearshore areas in Lake Erie. For example, at South Bass Island about 7 km southeast from West Harbor, species composition and seasonal succession was similar to that found at West Harbor, i.e., *Ulothrix* initially present in spring, *Cladophora* dominant in summer, and filamentous blue-greens present in September (Lorenz and Herdendorf 1982). *Ulothrix* develops on the rocks before *Cladophora* because *Ulothrix* has a lower temperature optimum for photosynthesis than *Cladophora* (Auer et al. 1983). Biomass of the dominant alga, *Cladophora*, in July on breakwaters at West Harbor (58-565 g/m^2; Appendix J) was generally similar to values for periphyton growing on rocks along the northeast shoreline of Lake Erie (Millner, Sweeney, and Frederick 1982; Neil and Jackson 1982).

53. The highest periphytic biomass and chlorophyll values of the study were recorded during July 1982, the first year the east breakwater was in place; during July 1983 the average biomass was much lower (Figure 6). These fluctuations in periphytic biomass are common on newly exposed substrata where growth is initially vigorous, but often decreases in subsequent years. Similar fluctuations will likely take place on the west breakwater because the biomass and chlorophyll values in July 1983 (the first full growing season that the west breakwater was in place) were higher than those on the east breakwater, which was in its second growing season (Figure 6). However, because seasonal changes in light, nutrients, grazing, and available substrata dramatically influence periphyton abundance (Roos 1983), the periphyton community on the breakwaters would need to stabilize over several seasons before comparisons of periphyton on the breakwaters near West Harbor could be made with confidence.

54. Construction of the West Harbor breakwaters provided suitable substratum for colonization by periphyton, especially *Cladophora*, the dominant alga. A beneficial aspect of *Cladophora* on the breakwaters is the large amount of surface area it provides for attachment by epiphytes (Stevenson and Stoermer 1982). These epiphytes are consumed by invertebrates which are eaten by fish and therefore may attract fish to the breakwater. However, a nuisance aspect of the *Cladophora* is that, in nearshore areas subject to phosphorus enrichment, it can proliferate, accumulate, and decompose on nearby beaches (Millner and

Sweeney 1982). Although phosphorus concentrations are sufficiently high to support luxurious *Cladophora* growth in the West Harbor area, proliferation will likely be limited by available light (Auer et al. 1983) and the breakwater will probably not contribute significantly to any nuisance created by *Cladophora* on nearby bathing beaches.

PART V: CONCLUSIONS AND RECOMMENDATIONS

55. This investigation showed that rubble-mound breakwater construction and channel dredging at the mouth of West Harbor had no detectable adverse impacts on the distributions or abundances of macrozoobenthos and fishes. Marked adverse changes in water quality, especially lowered dissolved oxygen concentrations, at the study site in 1983 following construction and dredging cannot be ascribed with certainty to construction and channel dredging activities at West Harbor because the State of Ohio was constructing offshore breakwaters in the study area at that time.

56. Additional study would be needed to determine (a) whether water quality near the mouth of West Harbor returned to preconstruction levels, (b) when colonization of the breakwaters by periphyton and macrozoobenthos reached equilibrium, and (c) to what extent the breakwaters provided spawning and nursery habitat for fish. It is therefore recommended that these questions be addressed in any future investigations of the breakwaters at West Harbor.

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Table 1

Mean Monthly Lengths (mm) of Young-of-the-Year (YOY) and Yearling Fishes in Western Lake Erie (1957-1981)*

Species	Age Group	April	May	June	July	Aug	Sept	Oct
Walleye	YOY			31.8	81.3	134.6	190.5	232.4
	Yearling	232.4	255.3	276.9	299.7	320.0	340.4	358.1
Yellow perch	YOY			19.1	38.1	57.2	76.2	92.7
	Yearling	92.7	104.1	116.8	129.5	141.0	152.4	165.1
White bass	YOY			21.6	43.2	67.3	87.6	109.2
	Yearling	109.2	123.2	139.7	156.2	174.0	189.2	201.9
Freshwater drum	YOY			21.6	36.8	43.2	74.9	92.7
	Yearling	92.7	102.9	115.6	128.3	142.2	154.9	166.4
Channel catfish	YOY			19.1	26.7	41.9	57.2	69.9
	Yearling	69.9	81.3	94.0	108.0	121.9	135.9	147.3
Rainbow smelt	YOY			31.8	39.4	47.0	55.9	64.8
	Yearling	64.8	72.4	82.6	94.0	105.4	115.6	124.5
Gizzard shad	YOY			22.0	45.7	69.9	94.0	116.8
	Yearling	116.8	130.8	149.9	168.9	188.0	205.7	221.0
Alewife	YOY			21.6	41.9	59.7	78.7	95.3
	Yearling	95.3	105.4	118.1	129.5	138.4	152.4	163.8
Trout-perch	YOY			21.6	33.0	47.0	61.0	72.4
	Yearling	72.4	76.2	80.0	85.1	90.0	94.0	97.8
Emerald shiner	YOY				19.1	31.8	44.5	55.9
	Yearling	55.9	58.4	63.5	68.6	73.7	78.7	82.6
Spottail shiner	YOY			20.3	30.5	43.2	53.3	62.2
	Yearling	62.2	64.8	69.9	76.2	82.6	88.9	94.0
Carp	YOY			25.4	41.9	63.5	86.4	108.0
	Yearling	108.0	118.1	130.8	143.5	156.2	168.9	179.1
Goldfish	YOY			21.6	40.6	61.0	87.6	104.1
	Yearling	104.1	113.0	124.5	137.2	149.9	160.0	167.6
Brown bullhead	YOY			27.9	39.4	52.1	64.8	76.2
	Yearling	76.2	83.8	91.4	100.3	109.2	118.1	125.7

* From unpublished data on file at the Great Lakes Fishery Laboratory in Ann Arbor, Mich.

Table 2

Length/Weight Regressions for Selected Fish Species in Western Lake Erie*

Species	L/W Regression	Sample Size
Spottail shiner	Log W = -5.0046 + 2.9931 Log L**	(N=2686)
Emerald shiner	Log W = -5.1508 + 3.0058 Log L	(N=2399)
Trout-perch	Log W = -4.8200 + 2.8922 Log L	(N=1805)
YOY† gizzard shad	Log W = -4.9491 + 2.9808 Log L	(N=1378)
Adult gizzard shad	Log W = -4.8177 + 3.0710 Log L	(N=1594)
YOY alewife	Log W = -4.6019 + 2.7698 Log L	(N=717)
Adult alewife	Log W = -3.4580 + 2.3450 Log L	(N=391)
Yellow perch	Log W = -5.2933 + 3.1610 Log L	(N=159)
Walleye	Log W = -5.8697 + 3.3284 Log L	(N=746)
White bass	Log W = -5.0606 + 3.0750 Log L	(N=234)
Freshwater drum	Log W = -5.5228 + 3.2329 Log L	(N=1426)
Rainbow smelt	Log W = -4.1403 + 2.4583 Log L	(N=238)
Brown bullhead	Log W = -5.0610 + 3.0650 Log L	(N=1634)
Carp	Log W = -4.2030 + 2.7460 Log L	(N=298)
Goldfish	Log W = -4.3420 + 2.7320 Log L	(N=132)
Channel catfish	Log W = -4.9100 + 2.9560 Log L	(N=145)
White perch	Log W = -6.2416 + 3.6192 Log L	(N=191)

* From unpublished data on file at the Great Lakes Fishery Laboratory in Ann Arbor, Mich.

** Logs are to the base 10.

† Young-of-the-year.

Table 3

Percent Composition of Various Macrozoobenthos Taxa Collected on Transects near West Harbor, Ohio (August 1981-1983)

Taxa*	Percent
Porifera (*Spongilla*)	0.01
Cnidaria (*Hydra*)	0.30
Rhabdocoela	0.35
Tricladida	0.16
Nemertinea	0.14
Nematoda	0.62
Oligochaeta	
Branchiura sowerbyi	0.05
Other	64.07
Polychaeta (*Manayunkia speciosa*)	10.68
Ostracoda	0.47
Amphipoda (*Gammarus* sp.)	0.60
Isopoda	
Asellus sp.	0.02
Other	0.01
Diptera	
Chironomidae	21.56
Ceratopogonidae	0.06
Empididae	0.01
Ephemeroptera	
Caenis sp.	0.01
Hexagenia sp.	0.01
Trichoptera	
Cheumatopsyche sp.	0.01
Hydroptila sp.	0.02
Mystacides sp.	0.01
Neureclipsis sp.	0.01
Oecetis sp.	0.01
Polycentropus sp.	0.01
Acarina	0.39
Gastropoda	
Amnicola sp.	0.11
Gyraulus sp.	0.01
Pleurocera acuta	0.02
Valvata sincera	0.07
Valvata sp.	0.01
Pelecypoda	
*Amblema plicata***	0.01
Pisidium spp.	0.14
Sphaerium spp.	0.04
Other	0.04
	100.00†

* Colonial Bryozoa were present but were not enumerated.
** Taxonomy follows Burch (1975).
† Total may not be exact due to rounding.

Table 4

Mean Total Density (Thousands of Individuals/m^2), Biomass (g/m^2) and Taxonomic Diversity (No. of Taxa/m^2) of Macrozoobenthos Collected on Transects I-V near West Harbor, Ohio (August 1981-1983)

Year	Density					Biomass					Diversity				
	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V
1981	2.0	3.8	3.3	9.3	5.7	0.2	0.5	0.3	0.5	0.6	10	13	10	18	11
1982	6.5	4.8	3.1	5.9	5.2	0.6	0.5	0.5	0.6	0.7	19	13	11	16	13
1983	4.2	9.8	13.9	6.9	4.0	0.6	0.8	4.0	1.1	0.6	15	9	16	15	9
Mean	4.2	6.1	6.8	7.4	5.0	0.5	0.6	1.6	0.7	0.6	15	12	12	16	11

Table 5

Taxonomic Composition of Various Macrozoobenthos Taxa Collected on Breakwaters at West Harbor, Ohio (April 1982-September 1983)

Taxa*	Percent
Cnidaria (*Hydra*)	5.98
Rhabdocoela	0.14
Tricladida	0.37
Nemertinea	0.11
Nematoda	0.23
Oligochaeta	39.95
Hirudinea	0.01
Polychaeta (*Manayunkia speciosa*)	0.06
Ostracoda	3.73
Amphipoda	
Gammarus sp.	27.44
Hyalella azteca	**
Isopoda	
Asellus sp.	0.03
Other	**
Brachiura	
Argulus sp.	**
Diptera	
Chironomidae	15.13
Ceratopogonidae	**
Empididae	0.15
Tipulidae	0.02
Ephemeroptera	**
Caenis sp.	0.13
Paraleptophlebia sp.	**
Parameletus sp.	**
Stenonema sp.	0.01
Coleoptera	
Curculionidae	**
Elmidae	**
Limnichidae	0.05
Trichoptera	
Ceraclea sp.	**
Cheumatopsyche sp.	0.75
Hydroptila sp.	2.03
Neureclipsis sp.	0.01
Oecetis sp.	0.05
Phylocentropus sp.	0.01
Polycentropus sp.	0.10
Hemiptera (Corixidae)	0.01
Acarina	2.77
Gastropoda	
Amnicola sp.	0.04
Ferrissia sp.	0.05
Gyraulus sp.	**
Lymnaea sp.	0.01
Physa sp.	0.49
Pleurocera acuta	0.04
Valvata sincera	0.02
Pelecypoda	
Pisidium spp.	**
Sphaerium spp.	**
Other (Unionidae)	**
Total	100.0

* Bryozoa were present but were not enumerated.
** Less than 0.01 percent.

Table 6

Mean Dry Weight Biomass of Macrozoobenthos (mg/3 min of Pumping) Collected on Breakwaters at West Harbor, Ohio (April 1982-September 1983)

Breakwater/Station	1982 April	1982 July	1982 September	1983 April	1983 July
East					
1	79.3	59.6	26.3	78.6	29.9
2	13.7	48.9	6.3	33.7	43.4
3	0.6	28.0	6.9	30.4	19.7
4	0.1	59.0	4.2	8.8	60.1
5	29.0	94.9	23.5	1.7	52.4
West					
6	*	*	2.5	113.1	19.0
7	*	*	1.6	51.0	16.7
8	*	*	2.5	2.2	13.0
9	*	*	4.2	65.9	8.1
Annual total		491.1		805.1	

* Breakwater construction was incomplete.

Table 7

Number and Taxonomic Composition of Fish Caught on Transects near West Harbor, Ohio (August 1981-1983)

Common Name	Scientific Name	1981		1982		1983		Total	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
White bass	*Morone chrysops*	6,052	50	389	6	93	5	6,534	31
Gizzard shad	*Dorosoma cepedianum*	4,241	35	337	5	574	34	5,152	25
Freshwater drum	*Aplodinotus grunniens*	178	1	3,502	50	127	7	3,807	18
White perch	*Morone americana*	359	3	1,249	18	302	18	1,910	9
Spottail shiner	*Notropis hudsonius*	632	5	309	4	133	8	1,074	5
Yellow perch	*Perca flavescens*	107	1	513	7	29	2	649	3
Alewife	*Alosa pseudoharengus*	303	2	2	1	230	14	535	3
Trout perch	*Percopsis omiscomaycus*	20	1	252	4	67	4	339	2
Walleye	*Stizostedion vitreum vitreum*	27	1	242	3	7	1	276	1
Emerald shiner	*Notropis atherinoides*	186	2	0	0	76	4	262	1
Rainbow smelt	*Osmerus mordax*	43	1	149	2	0	0	192	1
Carp	*Cyprinus carpio*	6	1	16	1	16	1	38	1
Channel catfish	*Ictalurus punctatus*	0	0	10	1	23	1	33	1
Brown bullhead	*Ictalurus nebulosus*	11	1	20	1	1	1	32	1
Quillback	*Carpiodes cyprinus*	4	1	4	1	6	1	14	1
White crappie	*Pomoxis annularis*	3	1	1	1	7	1	11	1
Logperch	*Percina caprodes*	8	1	3	1	0	0	11	1
Goldfish-carp hybrid	*Carassius* X *Cyprinus*	6	1	0	0	1	1	7	1
Goldfish	*Carassius auratus*	3	1	2	1	1	1	6	1
Spotfin shiner	*Notropis spilopterus*	0	0	0	0	6	1	6	1
Silver chub	*Hybopsis storeriana*	1	1	0	0	1	1	2	1
Brook silverside	*Labidesthes sicculus*	0	0	0	0	1	1	1	1
Johnny darter	*Etheostoma nigrum*	1	1	0	0	0	0	1	1
Unidentified redhorse	*Moxostoma* sp.	1	1	0	0	0	0	1	1
Total catch		12,192		7,000		1,701		20,893	
Total number of species		21		17		20		24	

Table 8

Total Number of Fish Caught on Transects near West Harbor, August 1981-1983

Transect	1981	1982	1983
I	2,458	2,403*	511
II	4,474	1,660	254
III	101	84**	1
IV	1,770	1,351†	339
V	3,389	1,501	596
Total	12,192	7,000	1,701

* Includes 1,756 freshwater drum and white perch.
** Includes 67 freshwater drum.
† Includes 711 freshwater drum and white perch.

Table 9

Age Composition (Percent) of Fish Caught on Transects near West Harbor, Ohio (August 1981-1983)

Age Class	1981	1982	1983
Young-of-the-year	96	87	84
Yearling	3	5	13
Age II and older	1	8	3

Table 10

Number and Taxonomic Composition of Fish Caught near the Breakwaters at West Harbor, Ohio (April 1982-September 1983)

Common Name	Scientific Name	1982 April	1982 July*	1982 September	1982 No.	1982 Percent	1983 April	1983 July	1983 September	1983 No.	1983 Percent	Total Number	Total Percent
Spottail shiner	*Notropis hudsonius*	322	3	113	438	21	3,350	116	83	3,549	33	3,987	31
Freshwater drum	*Aplodinotus grunniens*	57	13	342	412	20	2,184	58	247	2,489	23	2,901	23
Yellow perch	*Perca flavescens*	152	52	17	221	11	1,990	18	25	2,033	19	2,254	18
Trout perch	*Precopsis omiscomaycus*	144	0	30	174	8	1,065	33	17	1,115	10	1,289	10
White perch	*Morone americana*	27	15	330	372	18	196	231	447	874	8	1,246	10
Gizzard shad	*Dorosoma cepedianum*	0	0	59	59	3	352	0	17	369	3	428	3
Emerald shiner	*Notropis atherinoides*	225	0	18	243	12	0	0	0	0	0	243	2
White bass	*Morone chrysops*	16	2	44	62	3	3	19	66	88	1	150	1
Rainbow smelt	*Osmerus mordax*	23	0	5	28	1	51	0	1	52	1	80	1
Channel catfish	*Ictalurus punctatus*	0	2	0	2	1	5	27	36	68	1	70	1
Walleye	*Stizostedion vitreum vitreum*	1	2	13	16	1	17	4	0	21	1	37	1
Brown bullhead	*Ictalurus nebulosus*	0	0	8	8	1	1	11	9	21	1	29	1
Carp	*Cyprinus carpio*	0	0	5	5	1	0	8	1	9	1	14	1
White crappie	*Pomoxis annularis*	0	0	3	3	1	0	2	7	9	1	12	1
Logperch	*Percina caprodes*	4	0	1	5	1	1	0	0	1	1	6	1
Johnny darter	*Etheostoma nigrum*	0	0	4	4	1	0	0	0	0	1	4	1
Northern redhorse	*Moxostoma macrolepidotum*	0	0	0	0	0	2	0	0	2	1	2	1
Alewife	*Alosa pseudoharengus*	0	0	0	0	0	0	1	1	2	1	2	1
Quillback	*Carpiodes cyprinus*	0	0	1	1	1	1	0	0	1	1	2	1
Bluntnose minnow	*Pimephales notatus*	1	0	0	1	1	0	0	0	0	0	1	1
Greenside darter	*Etheostoma blennioides*	0	0	0	0	0	1	0	0	1	1	1	1
Mimic shiner	*Notropus volucellus*	1	0	0	1	1	0	0	0	0	0	1	1
Pumpkinseed	*Lepomis gibbosus*	0	0	0	0	0	1	0	0	1	1	1	1
Yellow bullhead	*Ictalurus natalis*	0	0	0	0	0	0	0	1	1	1	1	1
Total catch		973	89	993	2,055		9,220	528	958	10,706		12,761	
Total number of species		12	7	16	19		16	12	14	21		24	

* Numbers were extrapolated from three tows.

Table 11

Comparison of Fish Caught in Day Versus Night Samples Collected Near the Breakwaters at West Harbor, Ohio (April 1982-September 1983)

Date	Number of Fish		Biomass of Fish, kg	
	Day	Night	Day	Night
1982				
20 Apr	325	649	3.98	7.18
6 Jul*	24	29	1.04	3.29
13 Sep	178	815	4.62	12.52
Subtotal	527	1,493	9.64	22.99
1983				
19 Apr	3,541	5,680	37.02	46.71
11 Jul	79	449	1.88	18.14
19 Sep	303	668	3.51	8.41
Subtotal	3,923	6,797	42.41	73.26
Total	4,450	8,290	52.05	96.25
Total as a percent of grand total	(35)	(65)	(35)	(65)
Grand total of day plus night catches	12,740		148.30	

* Sum of three tows only; all other values are the sum of five tows.

Table 12

Age Comparison (Percent) of Fish Caught Near the Breakwaters at West Harbor, Ohio (April 1982-September 1983)

	1982			1983		
Age Class	April	July*	September	April	July	September
Young-of-the-year	0	12	85	0	37	84
Yearling	80	59	13	59	53	14
Age II and older	20	29	2	41	10	2

* These values were extrapolated from three tows.

Table 13

Mean Chlorophyll (Chl) Content (mg/m^2) and Dry Weight Biomass (g/m^2) of Periphyton Collected on Breakwaters at West Harbor, Ohio (April 1982-September 1983) (N = sample size)

	East Breakwater			West Breakwater			Average		
Date	N	Chl	Biomass	N	Chl	Biomass	N	Chl	Biomass
1982									
23 Apr	5	1	1		*		5	1	1
7 Jul	5	2,384	302		*		5	2,384	302
14 Sep	5	206	23	4	119	9	9	167	17
1983									
19 Apr	5	38	11	4	17	4	9	29	8
12 Jul	5	688	110	4	1,562	161	9	1,076	132
15 Sep	5	115	25	4	111	21	9	113	23

* Under construction.

APPENDIX A: WATER QUALITY DATA (TRANSECTS)

DATE	TRANSECT	STATION	WIND DIR.	WIND SPEED	BOTTOM TYPE	DISSOLVED OXYGEN (PPM) SURFACE	DISSOLVED OXYGEN (PPM) BOTTOM	TEMPERATURE (C) SURFACE	TEMPERATURE (C) BOTTOM	SUSPENDED PARTICULATE MATTER (MG/L) SURFACE	TURBIDITY (NTU'S) SURFACE
8/ 6/81	I	1	N	8	SAND	10.8	11.0	24.5	24.0	19.6	10.8
		2	N	8	SAND	10.8	11.2	24.5	24.0	12.0	7.5
		3	N	8	SAND & GRAVEL	10.6	11.2	24.0	24.0	12.8	10.2
		4	N	10	RUBBLE	9.2	9.6	24.0	24.0	9.5	6.0
	II	1	N	10	SAND	10.8	11.2	24.5	24.5	30.8	17.4
		2	N	10	SAND	11.0	11.0	24.0	24.0	24.8	13.2
		3	N	10	SAND	10.4	10.8	24.0	24.0	10.2	5.4
		4	N	10	SAND	10.2	10.2	24.0	24.5	8.6	4.2
	III	1	N	8	SAND	10.3	10.5	24.5	24.5	28.8	18.9
		2	N	8	SAND	11.2	11.6	24.5	24.5	23.4	10.5
		3	N	10	SAND & GRAVEL	10.6	11.4	24.5	24.0	10.8	6.0
		4	N	10	SAND	10.4	10.6	24.0	24.0	8.8	5.4
	IV	1	N	8	SAND	10.1	10.2	24.8	25.0	34.0	21.9
		2	N	6	SAND & GRAVEL	10.2	10.8	24.5	24.5	18.6	11.2
		3	NE	6	ORGANIC DEBRIS	9.9	10.1	24.0	24.1	12.8	6.3
		4	NE	6	SAND & CLAY	9.8	9.9	24.0	24.0	10.3	5.0
	V	1	NE	10	SAND & GRAVEL	9.3	9.4	24.0	24.0	40.8	24.6
		2	NE	10	SAND	9.2	9.3	24.1	24.1	16.3	8.7
		3	NE	10	SAND & MUD	9.3	9.4	24.2	24.1	12.6	7.8
		4	NE	10	SAND & MUD	9.2	9.3	24.0	24.0	11.1	6.0
8/26/82	I	1	SW	10	COARSE GRAVEL	8.6	8.6	23.7	23.5	33.5	24.8
		2	SW	10	SAND	8.6	8.2	22.2	22.1	26.0	19.4
		3	SW	10	SAND & CLAY	8.4	7.9	22.5	22.2	23.5	18.3
		4	SW	10	SILT	8.5	8.0	22.5	22.2	26.5	17.1
	II	1	SW	10	SAND	9.2	9.3	23.7	23.8	37.0	30.0
		2	SW	10	SAND	8.6	8.0	22.4	22.1	23.5	20.0
		3	SW	10	SAND	8.4	8.2	22.4	22.2	26.5	19.5
		4	SW	10	SILT & CLAY	8.3	7.9	22.2	22.2	28.5	18.9
	III	1	SW	10	SAND & CLAY	8.5	8.5	22.5	22.5	22.5	17.4
		2	SW	10	CLAY	8.8	7.7	22.9	22.0	21.0	18.0
		3	SW	10	CLAY	8.8	8.5	22.9	22.7	22.5	16.5
		4	SW	10	CLAY	8.7	8.2	22.9	22.1	23.5	16.2
	IV	1	SW	10	SAND	8.9	8.9	23.1	22.8	61.5	39.0
		2	SW	10	SAND & CLAY	9.3	8.4	22.9	22.0	24.5	18.9
		3	SW	10	SAND & CLAY	8.7	8.3	22.8	22.1	22.0	18.2
		4	SW	10	SAND & CLAY	8.7	8.0	22.7	22.1	25.0	16.1
	V	1	SW	10	SAND	9.1	9.0	22.8	22.6	20.0	18.3
		2	SW	10	SAND	8.6	8.0	22.8	22.4	16.0	13.1
		3	SW	10	SAND	8.5	8.1	22.7	22.1	16.5	12.6
		4	SW	10	SAND	8.3	8.1	22.5	22.1	13.5	13.5

DATE	TRANSECT	STATION	WIND DIR.	WIND SPEED	BOTTOM TYPE	DISSOLVED OXYGEN (PPM) SURFACE	DISSOLVED OXYGEN (PPM) BOTTOM	TEMPERATURE (C) SURFACE	TEMPERATURE (C) BOTTOM	SUSPENDED PARTICULATE MATTER (MG/L) SURFACE	TURBIDITY (NTU'S) SURFACE
8/30/83	I	1	SW	10	SAND	8.5	8.4	27.5	27.0	15.8	15.0
		2	SW	5	SAND	7.7	6.0	26.5	26.0	15.8	12.0
		3	W	10	SAND & CLAY	7.8	5.9	26.5	26.5	13.6	10.5
		4	W	10	SILT	7.6	5.2	26.8	26.3	17.2	10.2
	II	1	SE	5	SAND	8.0	7.6	28.0	28.5	15.6	15.6
		2	SE	5	SAND	7.8	6.2	27.5	25.5	16.0	13.4
		3	S	10	SILT	7.8	5.0	27.5	27.0	15.8	13.1
		4	S	7	SAND & SILT	7.5	4.5	27.0	27.0	21.4	10.7
	III	1	SE	7	SILT	7.3	4.6	26.5	26.5	21.4	24.8
		2	SE	5	SILT	7.2	5.0	26.5	26.0	34.4	16.5
		3	SE	5	SILT	7.4	2.5	26.5	26.5	28.3	19.1
		4	SE	7	SAND	7.3	4.3	27.0	26.0	28.4	18.5
	IV	1	SE	5	SAND	7.1	6.0	26.0	26.0	17.0	12.8
		2	SE	5	CLAY	6.9	3.3	26.0	26.0	16.6	13.8
		3	SE	5	SAND & SILT	7.4	2.5	26.0	26.0	16.0	18.5
		4	SE	5	SILT	7.6	2.2	26.0	26.0	16.6	17.3
	V	1	SE	5	SAND	8.4	7.6	26.0	26.0	16.6	11.6
		2	SE	5	SAND	5.0	3.2	26.0	26.0	15.4	9.9
		3	SE	5	SAND	8.2	2.2	25.5	26.0	15.0	11.9
		4	SE	5	SAND & SILT	7.8	3.0	26.0	26.0	14.4	10.5

APPENDIX B: WATER QUALITY DATA (BREAKWATERS)

DATE	STATION	WIND DIR.	WIND SPEED	BOTTOM TYPE	DISSOLVED OXYGEN (PPM) SURFACE	INTER.	BOTTOM	TEMPERATURE (C) SURFACE	INTER.	BOTTOM	SUSPENDED PARTICULATE MATTER (MG/L) SURFACE	TURBIDITY (NTU'S) SURFACE
4/23/82	1	W	10	RUBBLE	10.6	10.6	10.7	11.0	10.9	9.0	76.0	54.0
	2	W	15	RUBBLE	10.7	10.7	10.5	10.0	10.0	9.7	86.0	68.0
	3	W	20	RUBBLE	11.3	10.6	10.8	10.0	10.0	9.9	78.0	66.5
	4	W	15	RUBBLE	11.6	10.5	10.8	10.2	10.0	10.0	82.0	71.0
	5	W	15	RUBBLE	11.9	11.8	11.3	10.8	10.7	10.6	76.0	62.0
7/ 7/82	1	SW	10	RUBBLE	7.4	7.4	7.5	22.1	22.1	22.1	38.0	31.0
	2	SW	10	RUBBLE	7.4	6.7	5.5	22.2	22.2	22.2	35.5	28.0
	3	SW	10	RUBBLE	6.8	6.5	6.9	23.0	23.0	23.0	42.0	35.0
	4	SW	10	RUBBLE	6.4	6.4	6.0	22.3	22.2	22.3	32.5	25.5
	5	SW	10	RUBBLE	6.3	6.3	6.3	22.2	22.5	22.3	42.0	32.0
9/14/82	1	NE	5	RUBBLE	6.3	6.0	6.3	21.5	21.5	21.5	11.8	5.6
	2	NE	5	RUBBLE	5.9	5.7	5.9	21.5	21.5	21.5	6.8	4.6
	3	NE	5	RUBBLE	6.8	5.8	6.6	21.5	21.7	21.7	10.5	6.6
	4	NE	5	RUBBLE	5.3	4.9	5.3	22.0	21.9	21.9	7.3	4.5
	5	NE	5	RUBBLE	5.8	5.4	5.3	22.5	22.2	22.2	7.8	5.3
	6	NE	5	RUBBLE	6.2	5.9	5.7	22.5	22.0	21.5	8.0	5.2
	7	NE	5	RUBBLE	6.0	5.8	5.8	22.0	22.0	22.0	9.3	7.0
	8	NE	5	RUBBLE	6.9	6.7	6.4	22.8	22.5	22.0	14.5	8.0
	9	NE	5	RUBBLE	5.9	6.0	5.5	22.9	23.0	22.1	17.3	11.7
4/19/83	1	NE	15	RUBBLE	11.8	11.6	11.2	5.8	5.8	5.8	82.0	57.5
	2	NE	15	RUBBLE	10.9	11.0	11.0	5.3	5.5	5.2	79.0	57.0
	3	NE	15	RUBBLE	11.2	11.2	11.0	5.7	5.7	5.5	94.0	69.5
	4	NE	15	RUBBLE	11.2	11.4	11.0	5.3	5.6	5.7	88.0	63.0
	5	NE	15	RUBBLE	11.2	10.9	11.2	6.5	6.2	6.5	61.0	43.0
	6	NE	10	RUBBLE	11.6	11.4	10.6	6.1	6.1	6.1	87.0	69.0
	7	NE	10	RUBBLE	11.0	11.0	10.8	6.1	6.0	6.1	77.0	67.5
	8	NE	10	RUBBLE	11.0	11.2	11.2	6.1	6.0	6.1	86.0	70.0
	9	NE	5	RUBBLE	6.0	6.0	6.0	10.8	11.0	10.6	90.0	68.5
7/12/83	1	SW	10	RUBBLE	11.0	11.0	11.2	22.6	22.1	22.1	16.9	8.4
	2	SW	10	RUBBLE	11.1	10.8	10.6	22.0	22.0	21.9	11.8	6.9
	3	SW	10	RUBBLE	10.8	10.8	10.6	22.0	22.0	22.0	9.2	7.4
	4	SW	10	RUBBLE	10.6	10.1	9.9	23.9	23.7	23.2	21.0	13.2
	5	SW	10	RUBBLE	10.4	9.0	8.4	23.7	24.2	22.4	23.2	15.0
	6	SW	10	RUBBLE	10.4	10.5	10.4	23.3	23.1	23.0	9.0	6.9
	7	SW	10	RUBBLE	11.1	10.6	10.1	23.2	22.7	22.3	14.1	7.5
	8	SW	10	RUBBLE	11.2	10.2	9.8	23.1	22.9	22.5	10.4	9.3
	9	SW	10	RUBBLE	10.4	10.3	10.2	23.9	23.8	23.7	26.6	14.7
9/15/83	1	SE	5	RUBBLE	8.0	7.9	7.9	21.0	21.0	21.0	20.8	8.6
	2	SE	5	RUBBLE	a/	a/	a/	21.0	21.2	21.0	13.4	8.1
	3	SE	10	RUBBLE	a/	a/	a/	21.0	21.3	21.5	18.4	9.5
	4	SE	5	RUBBLE	10.8	10.6	10.8	19.0	21.8	21.0	14.8	7.7
	5	SE	5	RUBBLE	7.3	7.1	7.2	20.0	20.0	20.0	22.2	10.7
	6	E	10	RUBBLE	10.0	9.1	9.3	21.0	21.0	21.0	16.8	10.4
	7	E	10	RUBBLE	9.9	9.6	9.5	21.0	21.0	21.0	19.8	9.8
	8	E	10	RUBBLE	9.3	9.7	9.8	21.0	21.1	21.0	20.0	9.6
	9	E	10	RUBBLE	10.6	10.5	10.5	21.0	21.0	21.1	18.2	9.2

a/ No data were collected due to meter malfunction.

APPENDIX C: MACROZOOBENTHOS DENSITY DATA (TRANSECTS)

DATE	TRANSECT	STATION	DEPTH (M)	TAXON	GRAB COUNTS			MEAN NO. /SQ.M
8/ 6/81	I	1	0.5	OLIGOCHAETA	3	10	23	533
				CHIRONOMIDAE	1	2	2	74
		2	2.0	OLIGOCHAETA	66	44	38	2192
				CHIRONOMIDAE	23	2	2	400
				AMNICOLA	2	0	0	30
				OSTRACODA	1	0	0	15
				ACARINA	1	0	0	15
				GAMMARUS	1	0	0	15
		3	3.0	OLIGOCHAETA	32	90	45	2474
				MANAYUNKIA SPECIOSA	0	6	46	770
				CHIRONOMIDAE	7	3	3	193
				TRICLADIDA	0	0	4	59
				OSTRACODA	0	1	0	15
				GAMMARUS	0	1	0	15
				HYDRA	0	0	1	15
				PISIDIUM	1	0	0	15
10/ 9/81		4	4.0	OLIGOCHAETA	22	30	10	918
				CHIRONOMIDAE	0	4	1	74
8/ 6/81	II	1	0.5	OLIGOCHAETA	38	26	31	1407
				CHIRONOMIDAE	7	1	2	148
				GAMMARUS	1	0	0	15
				NEMATODA	0	1	0	15
		2	2.0	OLIGOCHAETA	56	34	69	2355
				CHIRONOMIDAE	0	0	3	44
		3	3.0	OLIGOCHAETA	74	51	66	2829
				CHIRONOMIDAE	0	3	3	89
				MANAYUNKIA SPECIOSA	0	1	0	15
				ACARINA	0	1	0	15
				GYRAULUS	1	0	0	15
		4	4.0	OLIGOCHAETA	107	158	140	5999
				CHIRONOMIDAE	7	31	20	859
				GAMMARUS	0	0	8	119
				NEMATODA	0	0	5	74
				RHABDOCOELA	0	2	3	74
				OSTRACODA	0	1	2	44
				MANAYUNKIA SPECIOSA	1	1	0	30
				AMNICOLA	2	0	0	30
				PISIDIUM	0	1	1	30
				TRICLADIDA	0	0	1	15
				BRYOZOA	+	+	+	+

DATE	TRANSECT	STATION	DEPTH (M)	TAXON	GRAB COUNTS			MEAN NO. /SQ.M
8/ 9/81	III	1	0.5	OLIGOCHAETA	4	10	19	489
		2	2.0	OLIGOCHAETA	19	47	51	1733
				GAMMARUS	0	1	0	15
				BRYOZOA		+		+
		3	4.0	OLIGOCHAETA	96	77	115	4266
				CHIRONOMIDAE	6	3	5	207
				RHABDOCOELA	0	0	1	15
				BRYOZOA	+	+		+
		4	4.0	OLIGOCHAETA	59	159	173	5792
				CHIRONOMIDAE	10	15	12	548
				NEMATODA	0	0	6	89
				OSTRACODA	0	0	3	44
				RHABDOCOELA	1	1	1	44
				HYDROPTILA	0	0	1	15
				VALVATA SINCERA	0	0	1	15
				UNIONIDAE	0	1	0	15
				BRYOZOA	+	+	+	+
	IV	1	0.5	OLIGOCHAETA	4	1	0	74
		2	2.0	OLIGOCHAETA	9	7	22	563
				CHIRONOMIDAE	0	1	0	15
		3	3.0	MANAYUNKIA SPECIOSA	19	682	22	10710
				OLIGOCHAETA	9	41	173	3303
				CHIRONOMIDAE	11	22	21	800
				CNIDARIA	10	26	17	785
				NEMERTINEA	0	22	1	341
				NEMATODA	2	3	7	178
				TRICLADIDA	2	9	0	163
				RHABDOCOELA	3	5	1	133
				HYDRA	2	4	2	119
				VALVATA SINCERA	1	5	0	89
				ACARINA	2	1	0	44
				POLYCENTROPUS	0	3	0	44
				PLEUROCERA ACUTA	0	1	1	30
				AMNICOLA	0	1	0	15
				OSTRACODA	0	0	1	15
				MESOGASTROPODA	0	1	0	15
				BRYOZOA	+	+		+
		4	4.0	MANAYUNKIA SPECIOSA	16	27	1085	16709
				OLIGOCHAETA	15	52	49	1718
				CHIRONOMIDAE	5	11	11	400
				NEMATODA	1	0	15	237
				OSTRACODA	2	7	2	163
				VALVATA SINCERA	0	2	5	104
				AMNICOLA	0	2	2	59
				RHABDOCOELA	1	3	0	59
				CNIDARIA	1	1	1	44
				PLEUROCERA ACUTA	2	0	0	30
				ACARINA	0	0	1	15
				GAMMARUS	0	1	0	15

DATE	TRANSECT	STATION	DEPTH (M)	TAXON	GRAB COUNTS			MEAN NO. /SQ.M
8/ 9/81	V	1	0.5	OLIGOCHAETA	5	1	2	119
				CHIRONOMIDAE	1	1	0	30
				GAMMARUS	1	0	0	15
		2	2.0	OLIGOCHAETA	35	22	17	1096
				NEMATODA	1	2	0	44
				CHIRONOMIDAE	2	0	1	44
				AMNICOLA	0	0	1	15
				BRYOZOA	+		+	+
		3	3.0	OLIGOCHAETA	23	85	27	2000
				CHIRONOMIDAE	3	8	0	163
				CNIDARIA	0	2	0	30
				BRYOZOA	+	+		+
		4	4.0	OLIGOCHAETA	325	56	148	7836
				CHIRONOMIDAE	26	13	21	889
				OSTRACODA	6	0	0	89
				PISIDIUM	4	0	2	89
				NEMATODA	2	1	0	44
				RHABDOCOELA	1	1	0	30
				MANAYUNKIA SPECIOSA	1	0	0	15
				BRYOZOA	+	+	+	+
8/26/82	I	1	0.5	OLIGOCHAETA	1	25	12	563
				CHIRONOMIDAE	3	11	2	237
				ACARINA	1	9	0	148
				AMNICOLA	0	1	0	15
				PLEUROCERA ACUTA	0	1	0	15
		2	2.0	OLIGOCHAETA	36	44	17	1437
				CHIRONOMIDAE	5	5	5	222
				MANAYUNKIA SPECIOSA	0	2	0	30
		3	3.0	MANAYUNKIA SPECIOSA	111	96	49	3792
				OLIGOCHAETA	1	154	34	2800
				CHIRONOMIDAE	16	113	24	2266
				ACARINA	4	3	1	119
				RHABDOCOELA	0	4	1	74
				AMNICOLA	0	1	2	44
				VALVATA	0	3	0	44
				AMNICOLA BINNEYANA	0	0	2	30
				NEMATODA	0	1	1	30
				UNIONIDAE	0	1	1	30
				ISOPODA	0	1	0	15
				TRICLADIDA	1	0	0	15
				OECETIS	0	1	0	15
				GAMMARUS	0	1	0	15
				PISIDIUM	0	1	0	15
				BRYOZOA		+		+

DATE	TRANSECT	STATION	DEPTH (M)	TAXON	GRAB COUNTS			MEAN NO. /SQ.M
8/26/82		4	4.0	OLIGOCHAETA	283	158	224	9851
				CHIRONOMIDAE	80	82	51	3155
				RHABDOCOELA	16	2	6	356
				OSTRACODA	3	1	5	133
				PISIDIUM	1	3	1	74
				ACARINA	1	2	1	59
				MANAYUNKIA SPECIOSA	1	0	2	44
				NEMATODA	0	0	3	44
				GAMMARUS	1	2	0	44
				UNIONIDAE	0	1	1	30
				BRANCHIURA SOWERBYI	1	0	0	15
				VALVATA SINCERA	0	0	1	15
				BRYOZOA	+	+	+	+
	II	1	0.5		0	0	0	0
		2	2.0	OLIGOCHAETA	39	54	5	1452
				CHIRONOMIDAE	23	10	7	593
				HYDRA	0	1	1	30
				GAMMARUS	0	0	1	15
				RHABDOCOELA	0	0	1	15
				ACARINA	0	0	1	15
				BRYOZOA	+	+	+	+
		3	3.0	OLIGOCHAETA	36	82	75	2859
				CHIRONOMIDAE	11	54	30	1407
				ACARINA	0	2	1	44
				OECETIS	0	1	0	15
				NEMATODA	0	1	0	15
				BRYOZOA	+	+	+	+
		4	4.0	OLIGOCHAETA	253	191	202	9569
				CHIRONOMIDAE	45	58	64	2474
				OSTRACODA	28	3	0	459
				GAMMARUS	4	7	2	193
				RHABDOCOELA	1	0	1	30
				NEMATODA	0	0	2	30
				ACARINA	1	1	0	30
				AMNICOLA	0	2	0	30
				MANAYUNKIA SPECIOSA	0	0	1	15
				PISIDIUM	1	0	0	15
				BRYOZOA	+	+	+	+

DATE	TRANSECT	STATION	DEPTH (M)	TAXON	GRAB COUNTS			MEAN NO. /SQ.M
8/26/82	III	1	0.5	CHIRONOMIDAE	0	8	5	193
				GAMMARUS	0	0	2	30
				ISOPODA	0	0	1	15
				OLIGOCHAETA	0	0	1	15
				BRYOZOA			+	+
		2	2.0	OLIGOCHAETA	89	48	42	2652
				CHIRONOMIDAE	31	13	12	830
				RHABDOCOELA	0	0	1	15
				BRYOZOA	+			+
		3	4.0	CHIRONOMIDAE	37	23	27	1289
				OLIGOCHAETA	6	10	2	267
				GAMMARUS	6	1	3	148
				PISIDIUM	0	5	1	89
				OSTRACODA	2	0	2	59
				NEMATODA	2	0	0	30
				RHABDOCOELA	2	0	0	30
				ACARINA	1	0	0	15
				TRICLADIDA	1	0	0	15
				BRYOZOA	+	+	+	+
		4	4.0	CHIRONOMIDAE	55	108	167	4888
				OLIGOCHAETA	28	28	38	1392
				GAMMARUS	5	1	11	252
				ACARINA	3	1	4	119
				NEMATODA	0	0	2	30
				OSTRACODA	0	0	1	15
				TRICLADIDA	0	0	1	15
				BRYOZOA	+		+	+
	IV	1	0.5	OLIGOCHAETA	12	14	21	696
				CHIRONOMIDAE	1	6	5	178
				GAMMARUS	0	1	0	15
				BRYOZOA	+		+	+
		2	2.0	CHIRONOMIDAE	50	32	29	1644
				OLIGOCHAETA	16	3	16	518
				OSTRACODA	1	0	1	30
				NEMATODA	0	2	0	30
				ACARINA	2	0	0	30
				UNIONIDAE	1	0	0	15
				BRYOZOA	+		+	+
		3	3.0	CHIRONOMIDAE	94	75	57	3348
				OLIGOCHAETA	44	32	58	1985
				ACARINA	2	4	3	133
				NEMATODA	1	0	3	59
				OSTRACODA	2	0	2	59
				RHABDOCOELA	0	0	1	15
				HEXAGENIA	1	0	0	15
				GAMMARUS	0	1	0	15
				AMNICOLA	0	1	0	15
				BRYOZOA	+	+	+	+

DATE	TRANSECT	STATION	DEPTH (M)	TAXON	GRAB COUNTS			MEAN NO. /SQ.M
8/26/82		4	4.0	OLIGOCHAETA	208	416	133	11214
				CHIRONOMIDAE	61	80	68	3096
				OSTRACODA	3	4	4	163
				SPHAERIUM	5	1	0	89
				AMNICOLA	1	2	1	59
				ACARINA	1	1	0	30
				GAMMARUS	0	1	1	30
				RHABDOCOELA	1	1	0	30
				HYDROPTILA	0	1	0	15
				NEMATODA	0	0	1	15
				CERATOPOGONIDAE	0	1	0	15
				UNIONIDAE	0	1	0	15
				PISIDIUM	1	0	0	15
				EMPIDIDAE	0	1	0	15
				BRYOZOA	+	+	+	+
	V	1	0.5	OLIGOCHAETA	5	1	2	119
				CHIRONOMIDAE	0	0	1	15
		2	2.0	OLIGOCHAETA	38	23	52	1674
				CHIRONOMIDAE	19	14	25	859
				RHABDOCOELA	2	0	1	44
				GAMMARUS	0	2	0	30
				BRYOZOA	+			+
		3	3.0	OLIGOCHAETA	134	166	57	5288
				CHIRONOMIDAE	80	146	71	4400
				MANAYUNKIA SPECIOSA	1	2	0	44
				NEMATODA	2	1	0	44
				RHABDOCOELA	1	0	0	15
				MYSTACIDES	0	0	1	15
				ACARINA	0	0	1	15
				UNIONIDAE	0	1	0	15
				PISIDIUM	0	1	0	15
				BRYOZOA	+	+	+	+
		4	4.0	OLIGOCHAETA	112	132	153	5881
				CHIRONOMIDAE	32	50	47	1911
				BRANCHIURA SOWERBYI	4	3	5	178
				OSTRACODA	2	0	4	89
				RHABDOCOELA	1	4	0	74
				NEMATODA	1	0	1	30
				ACARINA	0	0	1	15
				BRYOZOA	+	+	+	+

DATE	TRANSECT	STATION	DEPTH (M)	TAXON	GRAB COUNTS			MEAN NO. /SQ.M
8/30/83	I	1	0.5	OLIGOCHAETA	3	3	3	133
				CHIRONOMIDAE	0	6	0	89
				ACARINA	0	1	0	15
				BRYOZOA	+	+	+	+
		2	2.0	CHIRONOMIDAE	2	6	3	163
				OLIGOCHAETA	3	4	2	133
				ACARINA	0	0	1	15
				BRYOZOA	+			+
		3	3.0	OLIGOCHAETA	3	22	82	1585
				CHIRONOMIDAE	28	9	37	1096
				MANAYUNKIA SPECIOSA	40	0	4	652
				TRICLADIDA	9	0	0	133
				NEMERTINEA	4	0	0	59
				RHABDOCOELA	0	0	2	30
				AMNICOLA	2	0	0	30
				NEMATODA	0	0	1	15
				NEURECLIPSIS	1	0	0	15
				CHEUMATOPSYCHE	1	0	0	15
				ACARINA	1	0	0	15
				GAMMARUS	0	0	1	15
				BRYOZOA	+	+	+	+
		4	4.0	OLIGOCHAETA	278	237	200	10592
				CHIRONOMIDAE	42	46	24	1659
				MANAYUNKIA SPECIOSA	5	4	2	163
				NEMATODA	1	4	1	89
				PISIDIUM	2	2	0	59
				RHABDOCOELA	0	2	0	30
				UNIONIDAE	0	1	0	15
				BRYOZOA	+	+	+	+
	II	1	0.5	OLIGOCHAETA	23	9	11	637
				CHIRONOMIDAE	1	2	2	74
		2	2.0	OLIGOCHAETA	20	35	32	1289
				CHIRONOMIDAE	9	11	17	548
				NEMATODA	1	1	0	30
				GAMMARUS	0	0	1	15
				BRYOZOA	+			+
		3	3.0	OLIGOCHAETA	313	322	356	14680
				CHIRONOMIDAE	36	40	51	1881
				MANAYUNKIA SPECIOSA	2	3	1	89
				NEMATODA	0	1	2	44
				OSTRACODA	1	0	0	15
				BRYOZOA	+	+	+	+
		4	4.0	OLIGOCHAETA	350	383	370	16339
				CHIRONOMIDAE	87	87	86	3851
				NEMATODA	6	1	1	119
				GAMMARUS	0	1	0	15
				MANAYUNKIA SPECIOSA	0	1	0	15
				CAENIS	0	1	0	15
				ACARINA	1	0	0	15
				BRYOZOA	+	+	+	+

DATE	TRANSECT	STATION	DEPTH (M)	TAXON	GRAB COUNTS			MEAN NO. /SQ.M
8/30/83	III	1	4.0	OLIGOCHAETA	234	187	120	8014
				CHIRONOMIDAE	136	156	132	6281
				GAMMARUS	18	0	0	267
				ACARINA	11	4	2	252
				NEMATODA	3	3	4	148
				OSTRACODA	1	0	0	15
				HYDROPTILA	1	0	0	15
				HYDRA	1	0	0	15
				BRYOZOA	+	+	+	+
		2	3.0	OLIGOCHAETA	94	122	132	5155
				CHIRONOMIDAE	76	36	74	2755
				NEMATODA	4	8	0	178
				CERATOPOGONIDAE	7	0	5	178
				GAMMARUS	3	2	1	89
				OSTRACODA	1	0	1	30
				SPONGILLA	0	0	1	15
				TRICLADIDA	1	0	0	15
				ACARINA	1	0	0	15
				BRYOZOA	+	+	+	+
		3	3.0	OLIGOCHAETA	312	71	203	8681
				CHIRONOMIDAE	72	184	69	4814
				MANAYUNKIA SPECICSA	0	151	23	2578
				GAMMARUS	5	19	13	548
				NEMATODA	6	2	5	193
				OSTRACODA	4	1	5	148
				TRICLADIDA	0	4	1	74
				ACARINA	3	1	1	74
				HYCROPTILA	1	0	0	15
				RHABDOCOELA	0	0	1	15
				BRYOZOA	+	+	+	+
		4	4.0	OLIGOCHAETA	362	246	203	12014
				CHIRONOMIDAE	102	42	40	2726
				MANAYUNKIA SPECIOSA	26	1	0	400
				GAMMARUS	4	0	1	74
				NEMATODA	2	0	1	44
				TRICLADIDA	1	0	0	15
				RHABDOCOELA	1	0	0	15
				PISIDIUM	0	1	0	15
				AMBLEMA PLICATA	0	0	1	15
				BRYOZOA	+	+	+	+
	IV	1	0.5	CHIRONOMIDAE	11	4	5	296
				OLIGOCHAETA	5	8	2	222
				GAMMARUS	1	0	0	15
				BRYOZOA	+		+	+
		2	2.0	OLIGOCHAETA	15	12	15	622
				MANAYUNKIA SPECICSA	9	14	16	578
				CHIRONOMIDAE	8	12	17	548
				NEMATODA	1	0	0	15
				OECETIS	0	1	0	15
				ACARINA	0	1	0	15
				AMNICOLA	0	1	0	15
				BRYOZOA	+	+	+	+

DATE	TRANSECT	STATION	DEPTH (M)	TAXON	GRAB COUNTS			MEAN NO. /SQ.M
8/30/83		3	3.0	OLIGOCHAETA	200	198	158	8236
				CHIRONOMIDAE	147	27	24	2933
				NEMATODA	3	1	3	104
				MANAYUNKIA SPECIOSA	0	1	0	15
				TRICLADIDA	0	0	1	15
				BRYOZOA	+	+	+	+
		4	4.0	OLIGOCHAETA	257	255	274	11643
				CHIRONOMIDAE	37	47	44	1896
				SPHAERIUM	0	0	4	59
				NEMATODA	1	2	0	44
				PISIDIUM	0	0	2	30
				ACARINA	0	2	0	30
				CERATOPOGONIDAE	C	0	1	15
				MANAYUNKIA SPECIOSA	1	0	0	15
				UNIONIDAE	C	0	1	15
				GAMMARUS	C	1	0	15
				RHABDOCOELA	1	0	0	15
				BRYOZOA	+	+	+	+
	V	1	0.5		0	0	0	0
		2	2.0	OLIGOCHAETA	17	27	6	741
				CHIRONOMIDAE	4	10	8	326
				ASELLUS	5	0	0	74
				BRYOZOA		+	+	+
		3	3.0	OLIGOCHAETA	37	37	24	1452
				CHIRONOMIDAE	19	13	11	637
				RHABDOCOELA	0	2	0	30
				NEMATODA	0	1	1	30
				BRYOZOA	+	+	+	+
		4	4.0	OLIGOCHAETA	286	138	246	9925
				CHIRONOMIDAE	53	48	77	2637
				NEMATODA	3	2	5	148
				MANAYUNKIA SPECIOSA	1	0	1	30
				PISIDIUM	1	0	1	30
				ACARINA	0	1	0	15
				BRYOZOA	+	+	+	+

APPENDIX D: MACROZOOBENTHOS BIOMASS DATA (TRANSECTS)

DATE	TRANSECT	STATION	DEPTH (M)	BIOMASS (MG/SQ.M)
08/06/81	I	1	0.5	103.7
		2	2.0	457.3
		3	3.0	226.6
		4	4.0	57.8
	II	1	1.0	303.7
		2	2.0	484.4
		3	3.0	478.5
		4	4.0	597.0
	III	1	1.0	94.8
		2	2.0	373.3
		3	3.0	334.8
		4	4.0	385.2
	IV	1	1.0	16.3
		2	2.0	81.5
		3	3.0	789.6
		4	4.0	1038.4
	V	1	1.0	23.7
		2	2.0	198.5
		3	3.0	351.1
		4	4.0	1510.0
08/26/82	I	1	0.5	352.5
		2	2.0	72.5
		3	3.0	494.7
		4	4.0	1635.3
	II	1	0.5	0.0
		2	2.0	165.9
		3	3.0	395.5
		4	4.0	1253.2
	III	1	0.5	26.6
		2	2.0	263.6
		3	4.0	631.0
		4	4.0	854.7
	IV	1	0.5	239.9
		2	2.0	185.1
		3	3.0	625.1
		4	4.0	1419.1
	V	1	0.5	5.9
		2	2.0	170.3
		3	3.0	1137.6
		4	4.0	1460.5
08/30/83	I	1	0.5	69.6
		2	2.0	54.8
		3	3.0	290.3
		4	4.0	1876.9
	II	1	0.5	97.8
		2	2.0	194.1
		3	3.0	1084.3
		4	4.0	1958.5
	III	1	4.0	2841.2
		2	3.0	2214.6
		3	3.0	4127.0
		4	4.0	6756.4
	IV	1	0.5	99.3
		2	2.0	121.5
		3	3.0	850.3
		4	4.0	3430.8
	V	1	0.5	0.0
		2	2.0	96.3
		3	3.0	165.9
		4	4.0	1920.0

APPENDIX E: MACROZOOBENTHOS DENSITY DATA (BREAKWATERS)

DATE	STATION	TAXON	PUMP COUNTS			MEAN NO./ 3 MIN. PUMP
4/23/82	1	ACARINA	66	38	55	53
		OLIGOCHAETA	122	1	0	41
		GAMMARUS	71	21	24	39
		OSTRACODA	8	0	0	3
		CHIRONOMIDAE	3	1	2	2
		OECETIS	2	0	1	1
		CAENIS	3	0	0	1
		TERRESTRIAL INSECT	1	0	1	1
		STENONEMA	1	1	0	1
		NEMATODA	2	0	0	1
		EMPIDIDAE	1	0	1	1
		HYALELLA AZTECA	1	0	0	0*
		ISOPODA	1	0	0	0*
		HYDROPTILA	1	0	0	0*
		CHEUMATOPSYCHE	1	0	0	0*
		PARALEPTOPHLEBIA	0	0	1	0*
		PISIDIUM	0	0	1	0*
		BRYOZOA	+	+	+	+
	2	ACARINA	19	86	31	45
		OLIGOCHAETA	7	23	0	10
		OSTRACODA	0	9	0	3
		CHIRONOMIDAE	0	4	1	2
		GAMMARUS	1	4	0	2
		OECETIS	0	2	1	1
		HYDRA	0	1	0	0*
		CAENIS	0	1	0	0*
		OSTRACODA	1	0	0	0*
		MANAYUNKIA SPECIOSA	0	1	0	0*
		BRYOZOA	+	+	+	+
	3	ACARINA	6	5	4	5
		CHIRONOMIDAE	0	1	0	0*
		BRYOZOA		+		+
	4	ACARINA	3	4	1	3
		OLIGOCHAETA	2	3	1	2
		GAMMARUS	1	1	0	1
		BRYOZOA	+	+		+
	5	OSTRACODA	0	77	2	26
		OLIGOCHAETA	0	48	8	19
		ACARINA	18	23	6	16
		GAMMARUS	11	21	10	14
		CAENIS	2	2	0	1
		NEMATODA	0	3	0	1
		CHIRONOMIDAE	1	2	0	1
		HYDRA	0	2	0	1
		PISIDIUM	0	2	0	1
		EMPIDIDAE	1	0	0	0*
		OECETIS	0	1	0	0*
		BRYOZOA	+	+	+	+

* Value less than 1.

DATE	STATION	TAXON	PUMP COUNTS			MEAN NO./ 3 MIN. PUMP
7/ 6/82	1	GAMMARUS	505	222	395	374
		CHIRONOMIDAE	10	9	10	10
		OSTRACODA	3	2	5	3
		OLIGOCHAETA	2	0	2	1
		ACARINA	3	0	0	1
		HYDRA	1	0	0	0*
		TIPULIDAE	1	0	0	0*
		ASELLUS	1	0	0	0*
		GYRAULUS	1	0	0	0*
		PELECYPODA	0	0	1	0*
		BRYOZOA	+		+	+
	2	GAMMARUS	87	455	255	266
		OLIGOCHAETA	44	214	67	108
		CHIRONOMIDAE	4	101	116	74
		HYDRA	5	29	26	20
		ACARINA	16	9	10	12
		OSTRACODA	10	8	11	10
		HYDROPTILA	2	1	0	1
		AMNICOLA	2	0	0	1
		TIPULIDAE	0	1	0	0*
		PHYSA	0	0	1	0*
		ARGULUS	1	0	0	0*
		BRYOZOA	+	+	+	+
	3	OLIGOCHAETA	160	362	252	258
		GAMMARUS	198	155	98	150
		HYDRA	40	56	62	53
		CHIRONOMIDAE	43	20	42	35
		ACARINA	20	13	10	14
		NEMERTINEA	4	0	4	3
		OSTRACODA	3	1	0	1
		HYDROPTILA	2	1	0	1
		CAENIS	0	0	2	1
		BRYOZOA	+	+	+	+

DATE	STATION	TAXON	PUMP COUNTS			MEAN NO./ 3 MIN. PUMP
7/ 6/82	4	OLIGOCHAETA	353	290	163	269
		GAMMARUS	126	341	98	188
		HYDRA	83	27	22	44
		ACARINA	13	8	19	13
		OSTRACODA	10	9	18	12
		CHIRONOMIDAE	8	15	8	10
		PLEUROCERA ACUTA	9	1	0	3
		NEMERTINEA	1	3	1	2
		HYDROPTILIDAE	3	2	0	2
		PHYSA	1	0	1	1
		CAENIS	0	1	0	0*
		LYMNAEA	0	1	0	0*
		BRYOZOA	+	+	+	+
	5	GAMMARUS	584	479	684	582
		CHIRONOMIDAE	216	61	176	151
		OSTRACODA	39	112	49	67
		OLIGOCHAETA	8	65	2	25
		ACARINA	5	43	4	17
		PHYSA	0	12	0	4
		HYDRA	2	7	0	3
		NEMERTINEA	2	5	1	3
		HYDROPTILA	1	4	0	2
		PHYLOCENTROPUS	0	3	0	1
		EMPIDIDAE	1	2	0	1
		RHABDOCOELA	0	2	0	1
		CHEUMATOPSYCHE	0	2	0	1
		EPHEMEROPTERA	0	0	1	0*
		NEMATODA	0	1	0	0*
		BRYOZOA	+	+	+	+

DATE	STATION	TAXON	PUMP COUNTS			MEAN NO./ 3 MIN. PUMP
9/13/82	1	OLIGOCHAETA	105	1512	56	558
		OSTRACODA	33	554	0	196
		CHIRONOMIDAE	52	269	20	114
		GAMMARUS	38	89	7	45
		HYDRA	7	31	18	19
		ACARINA	21	20	5	15
		CHEUMATOPSYCHE	5	9	12	9
		NEMATODA	1	7	4	4
		HYDROPTILA	5	1	0	2
		RHABDOCOELA	2	4	0	2
		OECETIS	0	6	0	2
		CAENIS	4	0	0	1
		EMPIDIDAE	1	2	0	1
		VALVATA	0	2	1	1
		PISIDIUM	0	3	0	1
		LIMNICHIDAE	1	1	0	1
		PHYSA	1	1	0	1
		TIPULIDAE	0	0	1	0*
		CERACLEA	0	1	0	0*
		TRICLADIDA	0	1	0	0*
		MANAYUNKIA SPECIOSA	0	1	0	0*
		BRYOZOA	+	+	+	+
	2	OLIGOCHAETA	64	69	218	117
		CHIRONOMIDAE	45	60	111	72
		GAMMARUS	24	6	25	18
		CHEUMATOPSYCHE	21	6	21	16
		HYDRA	11	6	25	14
		PHYSA	2	2	3	2
		ACARINA	1	3	1	2
		LIMNICHIDAE	1	0	1	1
		HIRUDINEA	0	0	1	0*
		NEMATODA	1	0	0	0*
		BRYOZOA	+	+	+	+
	3	OLIGOCHAETA	27	71	188	95
		CHIRONOMIDAE	12	73	44	43
		HYDRA	4	29	20	18
		GAMMARUS	12	12	4	9
		CHEUMATOPSYCHE	0	11	9	7
		ACARINA	1	0	2	1
		PHYLOCENTROPUS	0	1	0	0*
		HYDROPTILA	0	0	1	0*
		PHYSA	0	0	1	0*
		BRYOZOA	+	+	+	+

DATE	STATION	TAXON	PUMP COUNTS			MEAN NO./ 3 MIN. PUMP
9/13/82	4	GAMMARUS	96	7	58	54
		CHIRONOMIDAE	72	28	51	50
		OLIGOCHAETA	22	6	24	17
		ACARINA	8	2	2	4
		HYDRA	4	1	6	4
		OSTRACODA	2	2	1	2
		PHYSA	3	0	1	1
		VALVATA SINCERA	2	1	0	1
		CHEUMATOPSYCHE	1	1	0	1
		EMPIDIDAE	0	0	1	0*
		BRYOZOA	+	+	+	+
	5	OLIGOCHAETA	218	102	1271	530
		GAMMARUS	302	49	444	265
		CHIRONOMIDAE	36	23	165	75
		HYDRA	62	9	87	53
		OSTRACODA	31	37	37	35
		RHABDOCOELA	3	1	21	8
		ACARINA	5	1	6	4
		NEMATODA	4	1	3	3
		CHEUMATOPSYCHE	3	0	4	2
		PHYSA	3	0	3	2
		EMPIDIDAE	1	0	4	2
		PISIDIUM	3	0	1	1
		TRICLADIDA	1	0	2	1
		AMNICOLA	2	0	0	1
		CAENIS	0	0	2	1
		POLYCENTROPUS	0	0	1	0*
		MANAYUNKIA SPECIOSA	0	0	1	0*
		VALVATA SINCERA	1	0	0	0*
		LIMNICHIDAE	0	0	1	0*
		BRYOZOA	+	+	+	+
	6	OLIGOCHAETA	30	35	30	32
		CHIRONOMIDAE	18	19	10	16
		GAMMARUS	3	10	3	5
		ACARINA	3	11	2	5
		OSTRACODA	1	0	1	1
		HYDRA	1	0	0	0*
		BRYOZOA	+		+	+

DATE	STATION	TAXON	PUMP COUNTS			MEAN NO./ 3 MIN. PUMP
9/13/82	7	OLIGOCHAETA	43	8	4	18
		CHIRONOMIDAE	3	1	3	2
		GAMMARUS	5	0	0	2
		ACARINA	0	2	1	1
		OSTRACODA	0	0	1	0*
		ELMIDAE	1	0	0	0*
		HYDRA	0	1	0	0*
		BRYOZOA	+			+
	8	OLIGOCHAETA	30	35	85	50
		CHIRONOMIDAE	9	21	10	13
		GAMMARUS	2	1	8	4
		ACARINA	1	2	1	1
		HYDRA	2	0	1	1
		CHEUMATOPSYCHE	2	0	0	1
		BRYOZOA		+	+	+
	9	CHIRONOMIDAE	55	18	33	35
		OLIGOCHAETA	36	22	23	27
		GAMMARUS	21	13	9	14
		HYDRA	11	5	4	7
		CHEUMATOPSYCHE	12	2	2	5
		PHYSA	2	7	3	4
		ACARINA	0	1	2	1
		POLYCENTROPUS	0	2	0	1
		HYDROPTILA	0	1	0	0*
		EMPIDIDAE	0	1	0	0*
		BRYOZOA		+		+

DATE	STATION	TAXON	PUMP COUNTS			MEAN NO./ 3 MIN. PUMP
4/19/83	1	HYDRA	146	2	4	51
		OLIGOCHAETA	138	4	3	48
		ACARINA	34	8	11	18
		CHIRONOMIDAE	26	3	2	10
		GAMMARUS	15	1	0	5
		EMPIDIDAE	12	1	0	4
		OSTRACODA	10	0	0	3
		CAENIS	9	0	0	3
		MANAYUNKIA SPECIOSA	9	0	0	3
		CHEUMATOPSYCHE	6	0	0	2
		OECETIS	3	0	0	1
		NEMATODA	3	0	0	1
		NEMERTINEA	3	0	0	1
		RHABDOCOELA	1	0	1	1
		NEURECLIPSIS	0	0	1	0*
		HYDROPTILA	1	0	0	0*
		BRYOZOA	+	+	+	+
	2	CHIRONOMIDAE	4	19	11	11
		HYDRA	19	3	11	11
		GAMMARUS	4	4	1	3
		OLIGOCHAETA	4	4	1	3
		ACARINA	3	3	1	2
		PHYSA	2	0	0	1
		OSTRACODA	1	0	0	0*
		CHEUMATOPSYCHE	0	0	1	0*
		BRYOZOA	+	+	+	+
	3	CHIRONOMIDAE	29	8	15	17
		GAMMARUS	10	13	11	11
		HYDRA	3	7	2	4
		OLIGOCHAETA	2	7	0	3
		CHEUMATOPSYCHE	1	0	1	1
		ACARINA	0	0	2	1
		NEMATODA	0	0	1	0*
		HYDROPTILA	0	0	1	0*
		FERISSIA	0	0	1	0*
		BRYOZOA	+	+	+	+

DATE	STATION	TAXON	PUMP COUNTS			MEAN NO./ 3 MIN. PUMP
4/19/83	4	OLIGOCHAETA	15	24	4	14
		HYDRA	2	11	1	5
		CHIRONOMIDAE	3	0	6	3
		GAMMARUS	3	3	1	2
		ACARINA	1	3	3	2
		MANAYUNKIA SPECIOSA	0	2	0	1
		TRICLADIDA	0	2	0	1
		OSTRACODA	0	1	0	0*
		HYDROPTILA	0	1	0	0*
		NEMERTINEA	0	1	0	0*
		BRYOZOA	+	+	+	+
	5	OLIGOCHAETA	3	2	0	2
		CHIRONOMIDAE	0	0	3	1
		GAMMARUS	0	0	2	1
		CAENIS	0	0	1	0*
		BRYOZOA	+	+	+	+
	6	GAMMARUS	100	47	36	61
		OLIGOCHAETA	97	36	42	58
		HYDRA	25	18	12	18
		CHIRONOMIDAE	12	15	5	11
		ACARINA	4	15	4	8
		OSTRACODA	16	5	0	7
		CAENIS	1	2	1	1
		HYDROPTILA	2	1	0	1
		NEMATODA	1	1	0	1
		RHABDOCOELA	1	1	0	1
		EMPIDIDAE	0	1	0	0*
		BRYOZOA	+	+	+	+

DATE	STATION	TAXON	PUMP COUNTS			MEAN NO./ 3 MIN. PUMP
4/19/83	7	HYDRA	59	40	50	50
		OLIGOCHAETA	45	27	47	40
		GAMMARUS	27	19	23	23
		CHIRONOMIDAE	8	13	8	10
		OSTRACODA	1	2	0	1
		HYDROPTILA	1	2	0	1
		NEMATODA	0	1	1	1
		MANAYUNKIA SPECIOSA	1	0	1	1
		EMPIDIDAE	0	0	1	0*
		CHEUMATOPSYCHE	0	1	0	0*
		ACARINA	0	1	0	0*
		BRYOZOA	+	+		+
	8	OLIGOCHAETA	7	2	3	4
		HYDRA	0	4	1	2
		GAMMARUS	4	0	1	2
		CHIRONOMIDAE	0	0	2	1
		BRYOZOA	+	+	+	+
	9	OLIGOCHAETA	54	110	59	74
		GAMMARUS	32	17	52	34
		HYDRA	24	28	34	29
		CHIRONOMIDAE	1	13	6	7
		OSTRACODA	2	7	5	5
		ACARINA	3	1	3	2
		CHEUMATOPSYCHE	0	1	3	1
		HYDROPTILA	0	2	1	1
		STENONEMA	0	2	0	1
		CAENIS	0	1	1	1
		RHABDOCOELA	1	0	0	0*
		NEURECLIPSIS	0	1	0	0*
		MANAYUNKIA SPECIOSA	0	1	0	0*
		EMPIDIDAE	1	0	0	0*
		NEMERTINEA	0	0	1	0*
		BRYOZOA	+	+	+	+

DATE	STATION	TAXON	PUMP COUNTS			MEAN NO./ 3 MIN. PUMP
7/11/83	1	GAMMARUS	85	50	34	56
		CHIRONOMIDAE	19	16	19	18
		OLIGOCHAETA	7	9	29	15
		ACARINA	19	17	6	14
		HYDROPTILA	18	8	10	12
		PHYSA	11	8	5	8
		OSTRACODA	4	2	0	2
		FERISSIA	4	0	2	2
		HYDRA	3	1	2	2
		CHEUMATOPSYCHE	0	1	1	1
		NEMATODA	2	0	0	1
		CAENIS	1	1	0	1
		TRICLADIDA	1	0	1	1
		ASELLUS	1	0	0	0*
		NEMERTINEA	0	0	1	0*
		EMPIDIDAE	1	0	0	0*
		AMNICOLA	0	1	0	0*
		PLEUROCERA ACUTA	1	0	0	0*
		BRYOZOA	+	+	+	+
	2	GAMMARUS	30	35	40	35
		OLIGOCHAETA	3	9	39	17
		CHIRONOMIDAE	9	14	17	13
		HYDROPTILA	4	2	10	5
		HYDRA	2	2	7	4
		PHYSA	1	3	2	2
		CHEUMATOPSYCHE	0	1	3	1
		TRICLADIDA	0	0	3	1
		ACARINA	0	0	1	0*
		FERISSIA	0	0	1	0*
		NEMATODA	0	0	1	0*
		BRYOZOA	+	+	+	+
	3	GAMMARUS	83	45	31	53
		OLIGOCHAETA	15	37	13	22
		CHIRONOMIDAE	14	18	14	15
		HYDRA	7	13	9	10
		HYDROPTILA	4	10	7	7
		CHEUMATOPSYCHE	0	1	4	2
		ASELLUS	2	1	1	1
		OSTRACODA	0	1	0	0*
		BRYOZOA	+	+	+	+

DATE	STATION	TAXON	PUMP COUNTS			MEAN NO./ 3 MIN. PUMP
7/11/83	4	OLIGOCHAETA	135	58	36	76
		GAMMARUS	156	51	20	76
		CHIRONOMIDAE	112	53	41	69
		HYDROPTILA	35	24	21	27
		HYDRA	36	19	18	24
		CHEUMATOPSYCHE	9	7	2	6
		ACARINA	7	1	5	4
		PHYSA	8	3	0	4
		TRICLADIDA	8	0	2	3
		OSTRACODA	3	3	2	3
		AMNICOLA	2	1	1	1
		ASELLUS	1	0	2	1
		NEMATODA	2	0	0	1
		HIRUDINEA	1	1	0	1
		NEMERTINEA	2	0	0	1
		LYMNAEA	1	0	0	0*
		CAENIS	1	0	0	0*
		RHABDOCOELA	0	1	0	0*
		PLEUROCERA ACUTA	1	0	0	0*
		BRYOZOA	+	+	+	+
	5	GAMMARUS	35	78	154	89
		OLIGOCHAETA	99	25	77	67
		CHIRONOMIDAE	32	19	38	30
		HYDROPTILA	18	17	20	18
		HYDRA	2	7	36	15
		CHEUMATOPSYCHE	5	11	23	13
		ACARINA	11	4	11	9
		PHYSA	2	5	14	7
		EMPIDIDAE	2	1	3	2
		OSTRACODA	2	2	1	2
		TRICHOPTERA	1	2	1	1
		NEMATODA	0	1	1	1
		TRICLADIDA	0	0	2	1
		MANAYUNKIA SPECIOSA	2	0	0	1
		NEMERTINEA	1	0	1	1
		AMNICOLA	0	0	2	1
		CORIXIDAE	1	0	0	0*
		ASELLUS	0	1	0	0*
		FERISSIA	0	1	0	0*
		TIPULIDAE	0	0	1	0*
		PARAMELETUS	1	0	0	0*
		BRYOZOA	+	+	+	+
	6	OLIGOCHAETA	185	416	96	232
		GAMMARUS	64	82	52	66
		CHIRONOMIDAE	28	40	13	27
		HYDRA	18	43	16	26
		HYDROPTILA	29	28	18	25
		ACARINA	2	4	4	3
		PHYSA	6	4	0	3
		OSTRACODA	0	3	0	1
		NEMATODA	2	0	1	1
		CAENIS	0	0	1	0*
		BRYOZOA	+	+	+	+

DATE	STATION	TAXON	PUMP COUNTS			MEAN NO./ 3 MIN. PUMP
7/11/83	7	GAMMARUS	82	174	32	96
		OLIGOCHAETA	160	34	3	66
		HYDRA	43	32	11	29
		CHIRONOMIDAE	24	16	5	15
		HYDROPTILA	9	14	1	8
		PHYSA	2	1	1	1
		ACARINA	0	3	0	1
		CURCULIONIDAE	0	0	1	0*
		EMPIDIDAE	0	1	0	0*
		SPHAERIUM	1	0	0	0*
		BRYOZOA	+	+		+
	8	GAMMARUS	62	53	46	54
		HYDROPTILA	26	22	28	25
		HYDRA	22	11	22	18
		OLIGOCHAETA	7	8	10	8
		CHIRONOMIDAE	8	6	9	8
		PHYSA	3	4	0	2
		ACARINA	1	2	0	1
		CHEUMATOPSYCHE	1	0	0	0*
		CERATOPOGONIDAE	1	0	0	0*
		TRICLADIDA	1	0	0	0*
		BRYOZOA	+	+	+	+
	9	OLIGOCHAETA	18	63	34	38
		HYDROPTILA	25	32	30	29
		CHIRONOMIDAE	6	28	24	19
		GAMMARUS	25	19	14	19
		HYDRA	7	10	4	7
		PHYSA	3	3	0	2
		ACARINA	1	2	2	2
		CHEUMATOPSYCHE	0	1	2	1
		OSTRACODA	1	0	0	0*
		CORIXIDAE	0	1	0	0*
		EMPIDIDAE	0	0	1	0*
		RHABDOCOELA	1	0	0	0*
		BRYOZOA	+	+	+	+

DATE	STATION	TAXON	PUMP COUNTS			MEAN NO./ 3 MIN. PUMP
9/12/83	1	CHIRONOMIDAE	83	46	60	63
		GAMMARUS	18	25	6	16
		OLIGOCHAETA	11	14	12	12
		HYDRA	9	10	11	10
		HYDROPTILA	9	6	4	6
		TRICLADIDA	6	1	4	4
		ACARINA	8	0	3	4
		CHEUMATOPSYCHE	5	2	3	3
		LIMNICHIDAE	1	3	0	1
		EMPIDIDAE	2	0	1	1
		RHABDOCOELA	1	0	1	1
		NEMATODA	0	1	1	1
		NEMERTINEA	1	0	0	0*
		TIPULIDAE	0	1	0	0*
		FERISSIA	0	0	1	0*
		AMNICOLA	0	1	0	0*
		UNIONIDAE	0	0	1	0*
		PISIDIUM	0	1	0	0*
		BRYOZOA	+	+	+	+
	2	OLIGOCHAETA	107	62	113	94
		CHIRONOMIDAE	25	28	34	29
		HYDRA	7	10	21	13
		GAMMARUS	14	3	18	12
		HYDROPTILA	0	0	3	1
		CHEUMATOPSYCHE	2	0	1	1
		NEMATODA	1	0	1	1
		RHABDOCOELA	1	0	0	0*
		FERISSIA	0	0	1	0*
		BRYOZOA	+	+	+	+
	3	OLIGOCHAETA	89	171	166	142
		CHIRONOMIDAE	42	30	46	39
		GAMMARUS	8	10	14	11
		HYDROPTILA	2	6	2	3
		HYDRA	1	0	6	2
		CHEUMATOPSYCHE	3	1	2	2
		NEMATODA	3	1	0	1
		LIMNICHIDAE	1	0	2	1
		FERISSIA	2	0	1	1
		POLYCENTROPUS	0	0	1	0*
		BRYOZOA	+	+	+	+

DATE	STATION	TAXON	PUMP COUNTS			MEAN NO./ 3 MIN. PUMP
9/12/83	4	CHIRONOMIDAE	46	34	75	52
		OLIGOCHAETA	91	31	24	49
		HYDRA	7	10	6	8
		GAMMARUS	10	0	6	5
		HYDROPTILA	1	3	9	4
		POLYCENTROPUS	0	1	4	2
		TRICLADIDA	2	2	1	2
		OSTRACODA	0	1	1	1
		LIMNICHIDAE	1	1	0	1
		CHEUMATOPSYCHE	0	0	1	0*
		PHYSA	1	0	0	0*
		BRYOZOA	+	+	+	+
	5	CHIRONOMIDAE	137	117	138	131
		OLIGOCHAETA	30	35	21	29
		GAMMARUS	36	17	18	24
		HYDRA	19	11	6	12
		OSTRACODA	11	2	6	6
		HYDROPTILA	4	5	2	4
		POLYCENTROPUS	5	1	4	3
		TRICLADIDA	5	1	3	3
		ACARINA	1	1	5	2
		NEMATODA	2	1	1	1
		LIMNICHIDAE	0	0	2	1
		PHYSA	0	2	0	1
		OECETIS	1	0	0	0*
		CAENIS	0	0	1	0*
		CHEUMATOPSYCHE	1	0	0	0*
		MANAYUNKIA SPECIOSA	0	1	0	0*
		EMPIDIDAE	0	0	1	0*
		BRYOZOA	+	+	+	+
	6	OLIGOCHAETA	294	121	102	172
		CHIRONOMIDAE	105	76	61	81
		HYDRA	25	22	9	19
		GAMMARUS	17	4	18	13
		HYDROPTILA	5	5	7	6
		TRICLADIDA	10	1	2	4
		PHYSA	3	0	1	1
		NEMATODA	1	0	1	1
		POLYCENTROPUS	0	0	1	0*
		OSTRACODA	0	1	0	0*
		TIPULIDAE	0	1	0	0*
		BRYOZOA	+	+	+	+

DATE	STATION	TAXON	PUMP COUNTS			MEAN NO./ 3 MIN. PUMP
9/12/83	7	OLIGOCHAETA	209	246	124	193
		CHIRONOMIDAE	63	53	45	54
		GAMMARUS	27	5	6	13
		HYDROPTILA	14	7	5	9
		HYDRA	4	3	10	6
		POLYCENTROPUS	2	1	4	2
		NEMATODA	1	5	1	2
		CHEUMATOPSYCHE	1	2	0	1
		LIMNICHIDAE	0	1	0	0*
		OSTRACODA	1	0	0	0*
		BRYOZOA	+	+	+	+
	8	OLIGOCHAETA	895	222	240	452
		CHIRONOMIDAE	112	52	48	71
		GAMMARUS	33	2	14	16
		HYDRA	8	8	13	10
		HYDROPTILA	15	4	3	7
		TRICLADIDA	4	1	4	3
		PHYSA	6	1	1	3
		NEMATODA	1	1	1	1
		CAENIS	0	1	1	1
		POLYCENTROPUS	0	0	2	1
		CHEUMATOPSYCHE	1	0	0	0*
		FERISSIA	0	1	0	0*
		EMPIDIDAE	1	0	0	0*
		BRYOZOA	+	+	+	+
	9	CHIRONOMIDAE	96	64	41	67
		OLIGOCHAETA	41	55	57	51
		GAMMARUS	70	10	10	30
		TRICLADIDA	31	11	2	15
		HYDRA	0	5	9	5
		HYDROPTILA	3	2	0	2
		NEMATODA	1	2	1	1
		OSTRACODA	3	0	0	1
		ACARINA	2	0	0	1
		POLYCENTROPUS	0	1	0	0*
		NEMERTINEA	0	0	1	0*
		CAENIS	1	0	0	0*
		PHYSA	0	0	1	0*
		BRYOZOA	+	+	+	+

APPENDIX F: MACROZOOBENTHOS BIOMASS DATA (BREAKWATERS)

DATE	STATION	DEPTH (M)	BIOMASS (MG PER 3 MIN.PUMP)
4/23/82	1	1.5	79.3
	2	1.5	13.7
	3	2.0	0.6
	4	1.0	0.1
	5	1.0	29.0
7/ 7/82	1	1.0	59.6
	2	1.0	48.9
	3	1.0	28.0
	4	1.0	59.0
	5	1.0	94.9
9/14/82	1	1.0	26.3
	2	1.0	6.3
	3	1.0	6.9
	4	0.5	4.2
	5	0.5	23.5
	6	1.5	2.5
	7	1.0	1.6
	8	1.0	2.5
	9	1.0	4.2

DATE	STATION	DEPTH (M)	BIOMASS (MG PER 3 MIN.PUMP)
4/19/83	1	0.8	78.6
	2	2.1	28.5
	3	1.7	30.4
	4	0.8	8.8
	5	1.0	1.7
	6	1.5	113.1
	7	1.0	51.0
	8	0.5	2.2
	9	0.8	65.9
7/12/83	1	1.0	24.2
	2	1.5	40.9
	3	2.0	19.7
	4	1.5	57.3
	5	1.0	46.8
	6	1.0	16.5
	7	2.0	16.3
	8	1.0	12.1
	9	0.8	7.6
9/15/83	1	0.7	22.0
	2	1.3	18.9
	3	1.2	15.1
	4	0.8	9.8
	5	0.5	24.6
	6	0.7	16.1
	7	1.2	12.2
	8	0.5	15.3
	9	0.4	16.2

APPENDIX G: FISH DATA (TRANSECTS)

DATE	TRANSECT	STATION	SPECIES	AGE CLASS	TOTAL NO.	TOTAL WEIGHT (G)	LENGTH RANGE (MM)
8/ 4/81	I	1	GIZZARD SHAD	0	254	889	10-129
			EMERALD SHINER	0	24	56	10- 52
			EMERALD SHINER	1	1	19	90
10/ 9/81		2	GIZZARD SHAD	0	156	2550	65-169
			EMERALD SHINER	0	70	88	43- 69
			WHITE PERCH	0	30	409	63-154
			WHITE BASS	0	8	129	63-154
			TROUT PERCH	0	4	14	60- 85
			FRESHWATER DRUM	0	2	14	56-130
			JOHNNY DARTER	0	1		
			FRESHWATER DRUM	1	4	182	131-203
			SPOTTAIL SHINER	2	2	30	116-116
		3	ALEWIFE	0	166	1259	61-129
			WHITE PERCH	0	166	2266	63-154
			SPOTTAIL SHINER	0	124	287	46- 78
			FRESHWATER DRUM	0	14	96	56-130
			TROUT PERCH	0	10	36	60- 85
			WHITE BASS	0	2	20	63-154
			WHITE BASS	1	1	107	202
			SPOTTAIL SHINER	2	28		104-
8/ 4/81		4	WHITE BASS	0	1140	4104	13-121
			GIZZARD SHAD	0	160	566	11-129
			ALEWIFE	0	22	44	20- 99
			FRESHWATER DRUM	0	20	12	10- 93
			WHITE PERCH	0	13	31	13-121
			SPOTTAIL SHINER	0	4	3	23- 63
			SPOTTAIL SHINER	1	13	70	64-103
			FRESHWATER DRUM	1	7	192	116-142
			WHITE PERCH	1	1	74	122
			BROWN BULLHEAD	2	7	1263	226-257
			CARP	2	4	1525	294-297
	II	1	GIZZARD SHAD	0	30	105	10-129
			EMERALD SHINER	1	1	5	90
		2	WHITE PERCH	0	28	66	13-121
			WHITE BASS	0	27	98	13-121
			SPOTTAIL SHINER	0	8	2	23- 63
			GIZZARD SHAD	0	7	25	10-129
			FRESHWATER DRUM	0	4	2	10- 93
			ALEWIFE	0	2	4	20- 99
			WALLEYE	0	1	16	135
			WHITE BASS	1	7	472	122-226
			FRESHWATER DRUM	1	2	54	94-191
			WHITE PERCH	1	1	74	122
			WHITE CRAPPIE	1	1		115
			WALLEYE	1	1	294	320
			YELLOW PERCH	1	1	32	141
			FRESHWATER DRUM	2	1	577	365
			GOLDFISH	2	1	390	345
		3	WHITE BASS	0	71	256	13-121
			FRESHWATER DRUM	0	30	17	10- 93
			YELLOW PERCH	0	28	50	15- 99
			GIZZARD SHAD	0	12	42	10-129
			SPOTTAIL SHINER	0	8	6	23- 63
			RAINBOW SMELT	0	4	4	18- 76
			ALEWIFE	0	2	4	20- 99
			LOGPERCH	0	1		44
			WHITE PERCH	0	1	2	67
			YELLOW PERCH	1	8	253	100-183
			FRESHWATER DRUM	1	2	55	94-191
			SPOTTAIL SHINER	1	1	5	83
			WHITE PERCH	1	1	74	174
			LOGPERCH	1	1		86
			FRESHWATER DRUM	2	3	396	217-247
			GOLDFISH	2	1	312	318
			GOLDFISH X CARP	2	1	525	332
			UNID. REDHORSE	2	1		330
			YELLOW PERCH	2	1	110	209
			SILVER CHUB	2	1		117

NOTE: Age class designations are as follows: 0, young-of-the-year; 1, yearling; and 2, all fish older than yearlings (see text for additional explanation).

CATE	TRANSECT	STATION	SPECIES	AGE CLASS	TOTAL NO.	TOTAL WEIGHT (G)	LENGTH RANGE (MM)
8/ 4/81		4	WHITE BASS	0	2759	10042	13-121
			GIZZARD SHAD	0	1247	4365	10-129
			ALEWIFE	0	41	86	20- 99
			WHITE PERCH	0	31	73	13-121
			RAINBOW SMELT	0	18	16	18- 76
			YELLOW PERCH	0	9	16	15- 99
			WALLEYE	0	8	132	41-227
			EMERALD SHINER	0	3	1	10- 52
			FRESHWATER DRUM	0	2	1	10- 93
			TROUT PERCH	C	2	2	25- 69
			WHITE CRAPPIE	C	1	6	56
			SPOTTAIL SHINER	1	16	87	64-103
			YELLOW PERCH	1	12	451	100-183
			WHITE BASS	1	4	312	122-226
			EMERALD SHINER	1	3	7	53- 95
			TROUT PERCH	1	2	14	70-112
			FRESHWATER DRUM	1	1	27	142
			WALLEYE	1	1	294	320
			SPOTTAIL SHINER	2	8		104-
			GOLCFISH X CARP	2	2	905	268-361
			BROWN BULLHEAD	2	2	603	250-327
			EMERALD SHINER	2	1	5	96
	III	1	WHITE BASS	0	4C	144	13-121
			SPOTTAIL SHINER	C	39	12	23- 63
			GIZZARD SHAD	0	7	25	10-129
			FRESHWATER DRUM	0	7	5	10- 93
			ALEWIFE	0	1	2	60
			WHITE PERCH	0	1	2	174
			RAINBOW SMELT	0	1	1	47
			FRESHWATER DRUM	1	1	27	142
			FRESHWATER DRUM	2	3	229	269-280
			GOLDFISH X CARP	2	1	180	225
	IV	1	GIZZARD SHAD	0	28	98	10-129
			ALEWIFE	0	4	8	20- 99
			WHITE BASS	0	1	4	67
			FRESHWATER DRUM	0	1	1	43
			EMERALD SHINER	1	6	17	53- 95
			SPOTTAIL SHINER	1	1	5	83
		2	GIZZARD SHAD	0	298	1043	10-129
			SPOTTAIL SHINER	0	83	65	23- 63
			WHITE BASS	0	18	66	13-121
			WHITE PERCH	0	16	38	13-121
			FRESHWATER DRUM	0	10	6	10- 93
			RAINBOW SMELT	0	3	3	18- 76
			ALEWIFE	0	2	4	20- 99
			SPOTTAIL SHINER	1	12	65	64-103
			EMERALD SHINER	1	7	20	53- 95
			LOGPERCH	1	3		48- 57
			WHITE PERCH	1	2	148	122-226
			YELLOW PERCH	1	2	63	100-183
			FRESHWATER DRUM	1	2	58	94-191
			WHITE BASS	1	1	67	174
			WHITE CRAPPIE	1	1		145
			SPOTTAIL SHINER	2	3	36	108-108
			FRESHWATER DRUM	2	1	296	297
			YELLOW PERCH	2	1	105	206
			LOGPERCH	2	1		100
		3	GIZZARD SHAD	0	32	112	10-129
			WHITE BASS	0	21	76	13-121
			WHITE PERCH	0	17	40	13-121
			SPOTTAIL SHINER	0	9	9	23- 63
			RAINBOW SMELT	0	1	1	47
			FRESHWATER DRUM	0	1	1	10
			WHITE PERCH	1	6	444	122-226
			SPOTTAIL SHINER	1	4	22	64-103
			WALLEYE	1	3	882	228-417
			YELLOW PERCH	1	3	95	100-183
			LOGPERCH	1	1		57
			FRESHWATER DRUM	1	1	27	94
			SPOTTAIL SHINER	2	1	12	108
			FRESHWATER DRUM	2	1	188	258

DATE	TRANSECT	STATION	SPECIES	AGE CLASS	TOTAL NO.	TOTAL WEIGHT (G)	LENGTH RANGE (MM)
8/ 4/81		4	GIZZARD SHAD	0	505	1768	10-129
			WHITE BASS	0	465	1693	13-121
			SPOTTAIL SHINER	0	53	41	23- 63
			ALEWIFE	0	16	33	20- 99
			WHITE PERCH	0	3	6	13-121
			FRESHWATER DRUM	0	3	2	10- 93
			WALLEYE	0	2	33	41-227
			RAINBOW SMELT	0	2	2	18- 76
			YELLOW PERCH	0	1	2	57
			SPOTTAIL SHINER	1	40	216	64-103
			YELLOW PERCH	1	27	922	100-183
			EMERALD SHINER	1	16	46	53- 95
			WALLEYE	1	4	1176	228-417
			LOGPERCH	1	1		
			WHITE BASS	1	1	67	174
			WHITE PERCH	1	1	54	174
			SPOTTAIL SHINER	2	8	96	104-
			WHITE BASS	2	5	480	154-203
			QUILLBACK	2	4		222-403
			GOLDFISH X CARP	2	2	733	292-292
			CARP	2	1	1379	472
			YELLOW PERCH	2	1	64	197
			FRESHWATER DRUM	2	1	247	201
	V	1	GIZZARD SHAD	0	19	67	10-129
			WHITE BASS	0	1	4	67
			EMERALD SHINER	1	24	70	53- 95
			EMERALD SHINER	2	2	10	90- 90
		2	GIZZARD SHAD	0	213	746	10-129
			WHITE BASS	0	46	166	13-121
			FRESHWATER DRUM	0	42	24	10- 93
			WHITE PERCH	0	26	62	13-121
			SPOTTAIL SHINER	0	25	20	23- 63
			ALEWIFE	0	15	32	20- 99
			TROUT PERCH	0	1	1	47
			EMERALD SHINER	1	2	6	10- 52
			WHITE PERCH	1	1	74	174
			YELLOW PERCH	1	1	32	57
			SPOTTAIL SHINER	1	1	5	83
			TROUT PERCH	1	1	7	90
			FRESHWATER DRUM	2	3	641	252-263
			YELLOW PERCH	2	1	283	282
			BROWN BULLHEAD	2	1	112	209
		3	WHITE BASS	0	25	90	13-121
			GIZZARD SHAD	0	13	45	10-129
			FRESHWATER DRUM	0	5	3	10- 93
			RAINBOW SMELT	0	2	2	18- 76
			ALEWIFE	0	2	4	20- 99
			FRESHWATER DRUM	2	2	383	242-277
		4	WHITE BASS	0	1409	5072	13-121
			GIZZARD SHAD	0	1260	4410	10-129
			SPOTTAIL SHINER	0	110	86	23- 63
			ALEWIFE	0	30	63	20- 99
			WHITE PERCH	0	12	28	13-121
			RAINBOW SMELT	0	12	11	18- 76
			WALLEYE	0	7	116	41-227
			YELLOW PERCH	0	6	11	15- 99
			FRESHWATER DRUM	0	1	1	43
			EMERALD SHINER	1	26	83	53- 95
			SPOTTAIL SHINER	1	19	103	64-103
			YELLOW PERCH	1	5	228	100-183
			WHITE PERCH	1	2	147	122-226
			SPOTTAIL SHINER	2	12		104-
			BROWN BULLHEAD	2	1	258	274
			FRESHWATER DRUM	2	1	156	244
			CARP	2	1	560	340
			GOLDFISH	2	1	318	320

DATE	TRANSECT	STATION	SPECIES	AGE CLASS	TOTAL NO.	TOTAL WEIGHT (G)	LENGTH RANGE (MM)
8/26/82	I	1	GIZZARD SHAD	0	73	258	10-129
			WHITE BASS	0	1	4	13
		2	WHITE PERCH	0	13	31	13-121
			WHITE BASS	0	8	29	13-121
			QUILLBACK	0	2		
			GIZZARD SHAD	0	1	4	10
			WALLEYE	0	1	16	41
		3	WHITE BASS	0	37	88	13-121
			FRESHWATER DRUM	0	17	10	10- 93
			WHITE BASS	0	12	44	13-121
			WALLEYE	0	11	181	41-227
			GIZZARD SHAD	0	4	14	10-129
			RAINBOW SMELT	0	3	3	18- 76
			TROUT PERCH	0	1	1	25
			LOGPERCH	0	1		
			YELLOW PERCH	1	3	95	100-183
			YELLOW PERCH	2	6		184-
			CARP	2	2	579	271-417
			FRESHWATER DRUM	2	1	388	323
		4	FRESHWATER DRUM	0	1148	666	10- 93
			WHITE PERCH	0	414	981	13-121
			WHITE BASS	0	204	743	13-121
			GIZZARD SHAD	0	72	255	10-129
			SPOTTAIL SHINER	0	42	33	23- 63
			WALLEYE	0	36	593	41-227
			TROUT PERCH	0	24	28	25- 69
			YELLOW PERCH	0	12	22	15- 99
			FRESHWATER DRUM	1	52	1426	94-191
			SPOTTAIL SHINER	1	12	65	64-103
			TROUT PERCH	1	6	41	70-112
			YELLOW PERCH	1	6	190	100-183
			WHITE PERCH	1	4	295	122-226
			YELLOW PERCH	2	96		184-
			FRESHWATER DRUM	2	70		192-
			CARP	2	4		203-
			BROWN BULLHEAD	2	2		138-
			WHITE BASS	2	2		227-
	II	1	GIZZARD SHAD	0	29	103	10-129
			WHITE BASS	0	8	29	13-121
			ALEWIFE	0	2	4	20- 99
			QUILLBACK	0	1		
			GOLDFISH	1	1	40	150
			SPOTTAIL SHINER	1	1	5	83
			CARP	2	1	560	340
		2	FRESHWATER DRUM	0	36	21	10- 93
			RAINBOW SMELT	0	15	14	18- 76
			WHITE PERCH	0	11	26	13-121
			WALLEYE	0	4	66	41-227
			WHITE BASS	0	4	15	13-121
			GIZZARD SHAD	0	2	7	10-129
			QUILLBACK	0	1		
			TROUT PERCH	0	1	1	47
			SPOTTAIL SHINER	0	1	1	43
			YELLOW PERCH	1	10	317	100-183
			SPOTTAIL SHINER	1	2	11	64-103
			YELLOW PERCH	2	5	529	195-217
		3	RAINBOW SMELT	0	47	42	18- 76
			FRESHWATER DRUM	0	35	20	10- 93
			TROUT PERCH	0	10	10	25- 69
			SPOTTAIL SHINER	0	5	4	23- 63
			WALLEYE	0	5	82	41-227
			WHITE PERCH	0	3	7	13-121
			WHITE BASS	0	3	11	13-121
			GIZZARD SHAD	0	2	7	10-129
			LOGPERCH	0	2		
			FRESHWATER DRUM	1	2	55	94-191
			TROUT PERCH	1	2	14	70-112
			YELLOW PERCH	2	5		184-

DATE	TRANSECT	STATION	SPECIES	AGE CLASS	TOTAL NO.	TOTAL WEIGHT (G)	LENGTH RANGE (MM)
8/26/82		4	FRESHWATER DRUM	C	1097	636	10- 93
			TROUT PERCH	0	48	49	25- 69
			WALLEYE	0	28	461	41-227
			WHITE PERCH	0	15	36	13-121
			RAINBOW SMELT	0	15	14	18- 76
			SPOTTAIL SHINER	0	10	8	23- 63
			YELLOW PERCH	0	5	9	15- 99
			CHANNEL CATFISH	0	3	2	10- 81
			FRESHWATER DRUM	1	45	1234	94-191
			YELLOW PERCH	1	5	158	100-183
			TROUT PERCH	1	3	20	70-112
			CHANNEL CATFISH	1	3	75	82-161
			YELLOW PERCH	2	90		184-
			FRESHWATER DRUM	2	35		192-
			BROWN BULLHEAD	2	2		137-
	III	1	FRESHWATER DRUM	C	59	34	10- 93
			WALLEYE	C	3	49	41-227
			TROUT PERCH	0	1	1	47
			WHITE PERCH	0	1	2	67
			WHITE BASS	0	1	4	67
			GIZZARD SHAD	0	1	4	70
			FRESHWATER DRUM	1	8	219	94-191
			YELLOW PERCH	2	5		184-
			BROWN BULLHEAD	2	3	338	194-228
			CARP	2	2	727	279-302
	IV	1	WHITE BASS	0	4	15	13-121
			GIZZARD SHAD	0	2	7	10-129
			SPOTTAIL SHINER	0	1	1	43
			SPOTTAIL SHINER	2	1		
		2	FRESHWATER DRUM	0	12	7	10- 93
			WHITE PERCH	0	1C	24	13-121
			WHITE BASS	0	7	25	13-121
			SPOTTAIL SHINER	0	6	5	23- 63
			WALLEYE	0	4	66	41-227
			RAINBOW SMELT	0	3	3	18- 76
			GIZZARD SHAD	0	2	7	10-129
			TROUT PERCH	0	1	1	47
			YELLOW PERCH	0	1	66	178
			SPOTTAIL SHINER	1	1	5	83
			WHITE BASS	1	1	67	174
		3	WHITE PERCH	0	19	45	13-121
			FRESHWATER DRUM	0	18	10	10- 93
			RAINBOW SMELT	0	11	10	18- 76
			TROUT PERCH	0	7	7	25- 69
			WALLEYE	0	6	988	41-227
			WHITE BASS	0	4	15	13-121
			WHITE CRAPPIE	0	1		
			FRESHWATER DRUM	1	4	109	94-191
			TROUT PERCH	1	4	27	70-112
			YELLOW PERCH	1	1	31	141
			YELLOW PERCH	2	13		184-
			BROWN BULLHEAD	2	4	546	204-242
			CARP	2	2	1121	300-380

DATE	TRANSECT	STATION	SPECIES	AGE CLASS	TOTAL NO.	TOTAL WEIGHT (G)	LENGTH RANGE (MM)
8/26/82		4	FRESHWATER DRUM	0	468	271	10- 93
			YELLOW PERCH	0	136	322	15- 99
			TROUT PERCH	0	104	107	25- 69
			WHITE BASS	0	92	335	13-121
			YELLOW PERCH	0	76	138	15- 99
			WALLEYE	0	60	988	41-227
			GIZZARD SHAD	0	56	198	10-129
			SPOTTAIL SHINER	0	32	25	23- 63
			RAINBOW SMELT	0	28	26	18- 76
			FRESHWATER DRUM	1	28	768	94-191
			YELLOW PERCH	1	12	884	100-183
			SPOTTAIL SHINER	1	8	43	64-103
			CHANNEL CATFISH	1	4	99	122-122
			TROUT PERCH	1	4	27	70-112
			YELLOW PERCH	1	4	127	100-183
			YELLOW PERCH	2	59		184-
			SPOTTAIL SHINER	2	20		104-
			FRESHWATER DRUM	2	4		192-
			WHITE BASS	2	2		227-
			BROWN BULLHEAD	2	2		138-
			GOLDFISH	2	1	318	320
			CARP	2	1	560	340
	V	1	GIZZARD SHAD	0	20	71	10-129
			WHITE BASS	0	4	15	13-121
			SPOTTAIL SHINER	0	2	2	23- 63
			WHITE PERCH	0	1	2	67
		2	WHITE PERCH	0	27	64	13-121
			RAINBOW SMELT	0	8	7	18- 76
			WHITE BASS	0	3	11	13-121
			GIZZARD SHAD	0	2	7	10-129
			FRESHWATER DRUM	0	2	1	10- 93
			SPOTTAIL SHINER	0	1	1	43
			CARP	2	1	1240	454
		3	FRESHWATER DRUM	0	44	26	10- 93
			WHITE PERCH	0	42	100	13-121
			WALLEYE	0	18	296	41-227
			TROUT PERCH	0	8	8	25- 69
			YELLOW PERCH	0	4	7	15- 99
			RAINBOW SMELT	0	4	4	18- 76
			WHITE BASS	0	2	7	13-121
			GIZZARD SHAD	0	2	7	10-129
			SPOTTAIL SHINER	0	1	1	23
			CARP	1	2	132	111-202
			SPOTTAIL SHINER	1	1	5	64
			FRESHWATER DRUM	1	1	27	142
			YELLOW PERCH	1	1	32	141
			TROUT PERCH	1	1	7	90
			YELLOW PERCH	2	6		184-
		4	WHITE PERCH	0	504	1194	13-121
			FRESHWATER DRUM	0	312	181	10- 93
			GIZZARD SHAD	0	69	244	10-129
			WALLEYE	0	66	1087	41-227
			YELLOW PERCH	0	48	87	15- 99
			SPOTTAIL SHINER	0	36	202	23- 63
			WHITE BASS	0	24	87	13-121
			RAINBOW SMELT	0	15	14	18- 76
			TROUT PERCH	0	15	15	25- 69
			SPOTTAIL SHINER	1	60	325	64-103
			TROUT PERCH	1	12	82	70-112
			YELLOW PERCH	1	4	127	100-183
			WHITE BASS	1	3	202	122-226
			SPOTTAIL SHINER	2	66		104-
			YELLOW PERCH	2	48		184-
			BROWN BULLHEAD	2	7		138-
			FRESHWATER DRUM	2	4		192-
			CARP	2	1	560	340

DATE	TRANSECT	STATION	SPECIES	AGE CLASS	TOTAL NO.	TOTAL WEIGHT (G)	LENGTH RANGE (MM)
8/29/83	I	1	GIZZARD SHAD	0	7	57	70-119
			ALEWIFE	0	1	2	66
			WHITE BASS	0	1	2	70
			WHITE CRAPPIE	0	1	1	40
			SPOTTAIL SHINER	1	1	4	84
			EMERALD SHINER	1	1	3	80
			FRESHWATER DRUM	2	1	500	335
		2	WHITE PERCH	0	8	27	54- 77
			GIZZARD SHAD	0	6	4	31- 40
			SPOTTAIL SHINER	0	3	3	47- 54
			FRESHWATER DRUM	0	3	6	69- 81
			CHANNEL CATFISH	0	2	5	53- 61
			YELLOW PERCH	1	2	50	123-139
			FRESHWATER DRUM	1	1	10	120
			GIZZARD SHAD	1	1	25	136
			SPOTTAIL SHINER	1	1	2	70
		3	FRESHWATER DRUM	0	61	236	36- 92
			WHITE PERCH	0	30	91	40- 83
			ALEWIFE	0	18	14	31- 62
			SPOTTAIL SHINER	0	16	13	27- 61
			WHITE BASS	0	6	11	42- 95
			TROUT PERCH	0	2	2	50- 54
			GIZZARD SHAD	0	1	2	66
			WHITE CRAPPIE	0	1	1	57
			FRESHWATER DRUM	1	4	88	119-147
			YELLOW PERCH	1	1	20	124
			WHITE PERCH	1	1	58	158
			CARP	2	1	675	375
		4	GIZZARD SHAD	0	125	258	26- 72
			ALEWIFE	0	63	69	31- 55
			TROUT PERCH	0	46	90	52- 67
			WHITE PERCH	0	31	110	51- 85
			WHITE BASS	0	17	60	34-110
			SPOTTAIL SHINER	0	6	11	43- 63
			FRESHWATER DRUM	0	4	17	71- 87
			EMERALD SHINER	0	3	1	24- 27
			YELLOW PERCH	1	9	568	126-178
			TROUT PERCH	1	5	20	88- 95
			SPOTTAIL SHINER	1	3	22	86-103
			WHITE PERCH	1	2	227	127-187
			WHITE CRAPPIE	1	1	46	155
			WALLEYE	1	1	113	256
			WHITE BASS	1	1	113	216
			EMERALD SHINER	1	1	1	83
			CHANNEL CATFISH	1	1	30	153
			CARP	2	5	6804	391-484
			SPOTTAIL SHINER	2	2	22	115-117
			CHANNEL CATFISH	2	2	80	201-208
			GOLDFISH	2	1	454	297

DATE	TRANSECT	STATION	SPECIES	AGE CLASS	TOTAL NO.	TOTAL WEIGHT (G)	LENGTH RANGE (MM)
8/29/83	II	1	GIZZARD SHAD	0	15	66	53-123
			EMERALD SHINER	0	10	2	36- 48
			WHITE BASS	0	8	26	57- 79
			CHANNEL CATFISH	0	3	3	57- 61
			WHITE PERCH	0	1	23	118
			SPOTFIN SHINER	0	1	1	42
			EMERALD SHINER	1	23	76	53- 87
			SPOTFIN SHINER	1	3	7	61- 68
			GIZZARD SHAD	1	2	87	131-187
			WHITE PERCH	1	1	30	127
		2	WHITE PERCH	0	27	54	43- 83
			WHITE BASS	0	9	23	47- 92
			GIZZARD SHAD	0	2	1	27- 29
			SPOTTAIL SHINER	0	1	1	27
			WHITE PERCH	1	2	95	137-156
			GIZZARD SHAD	1	1	63	155
			SPOTTAIL SHINER	1	1	2	65
			CARP	2	1	500	365
		3	WHITE PERCH	0	21	65	38- 91
			FRESHWATER DRUM	0	10	28	57- 81
			TROUT PERCH	0	1	1	54
			WHITE BASS	0	1	14	102
			FRESHWATER DRUM	1	2	23	106-110
			WHITE PERCH	1	1	30	128
			TROUT PERCH	1	1	4	94
			CARP	2	1	750	395
			SPOTTAIL SHINER	2	1	18	125
		4	WHITE PERCH	0	26	67	35- 90
			ALEWIFE	0	21	17	30- 60
			SPOTTAIL SHINER	0	9	28	50- 61
			TROUT PERCH	0	9	12	37- 66
			GIZZARD SHAD	0	9	43	27-112
			FRESHWATER DRUM	0	1	1	66
			SPOTTAIL SHINER	1	14	54	64- 99
			WALLEYE	1	2	323	229-250
			WHITE BASS	1	1	113	209
			YELLOW PERCH	1	1	16	117
			WHITE PERCH	1	1	34	130
			CHANNEL CATFISH	1	1	46	78
			WHITE CRAPPIE	1	1	22	126
			QUILLBACK	2	2	568	263-288
			CARP	2	2	3405	448-528
			SPOTTAIL SHINER	2	2	20	106-110
	III	1	WHITE PERCH	0	1	1	60

DATE	TRANSECT	STATION	SPECIES	AGE CLASS	TOTAL NO.	TOTAL WEIGHT (G)	LENGTH RANGE (MM)
8/29/83	IV	1	GIZZARD SHAD	0	57	228	51-128
			WHITE BASS	0	3	20	50-107
			SPOTTAIL SHINER	0	2	3	57- 61
			EMERALD SHINER	0	2	1	46- 48
			QUILLBACK	0	1	8	78
			WHITE PERCH	0	1	3	67
			EMERALD SHINER	1	30	98	72- 88
			WHITE BASS	1	1	33	137
			SPOTTAIL SHINER	2	1	16	120
		2	FRESHWATER DRUM	0	11	44	59- 87
			SPOTTAIL SHINER	0	9	11	53- 62
			WHITE BASS	0	7	18	55- 73
			FRESHWATER DRUM	1	7	126	95-147
			YELLOW PERCH	1	1	21	126
		3	SPOTTAIL SHINER	0	5	7	32- 63
			WHITE PERCH	0	4	19	54- 84
			WHITE BASS	0	3	23	61-109
			FRESHWATER DRUM	0	2	6	69- 72
			SPOTTAIL SHINER	1	2	13	94-103
			FRESHWATER DRUM	1	2	27	97-125
		4	WHITE PERCH	0	43	136	40- 89
			GIZZARD SHAD	0	24	40	30- 86
			SPOTTAIL SHINER	0	21	35	40- 69
			ALEWIFE	0	17	25	46- 64
			WHITE BASS	0	5	17	40-102
			TROUT PERCH	0	3	4	46- 62
			YELLOW PERCH	0	1	3	74
			FRESHWATER DRUM	0	1	5	78
			WHITE PERCH	1	23	795	121-177
			SPOTTAIL SHINER	1	11	112	85-120
			YELLOW PERCH	1	10	455	129-185
			FRESHWATER DRUM	1	4	97	105-153
			SILVER CHUB	1	4	97	113-168
			WHITE BASS	1	1	21	122
			CHANNEL CATFISH	1	1	80	150
			WHITE CRAPPIE	1	1	36	138
			CHANNEL CATFISH	2	10	828	200-279
			CARP	2	4	3541	278-509
			QUILLBACK	2	3	1285	213-368
			YELLOW PERCH	2	2	100	196-278
			BROWN BULLHEAD	2	1	150	227
	V	1	GIZZARD SHAD	0	22	86	50-124
			WHITE PERCH	0	4	13	51- 82
			BROOK SILVERSIDE	0	1	1	55
			EMERALD SHINER	0	1	1	47
			WHITE PERCH	1	4	122	127-133
			EMERALD SHINER	1	4	8	73- 81
			SPOTTAIL SHINER	1	1	8	93
		2[a/]	WHITE PERCH	0	16	85	60- 85
			FRESHWATER DRUM	0	2	11	73- 90
			WHITE BASS	0	2	24	87- 90
			SPOTTAIL SHINER	0	2	1	56- 60
			WHITE PERCH	1	1	52	149
			CHANNEL CATFISH	1	1	29	154
			FRESHWATER DRUM	1	1	37	154
			YELLOW PERCH	1	1	23	122
		3	WHITE PERCH	0	16	45	48- 83
			FRESHWATER DRUM	0	4	18	64- 91
			WHITE BASS	0	1	3	69
			FRESHWATER DRUM	1	5	101	98-147
			CARP	2	2	1050	345-470
			CHANNEL CATFISH	2	2	62	163-220
			FRESHWATER DRUM	2	1	100	250
			SPOTTAIL SHINER	2	1	12	113

DATE	TRANSECT	STATION	SPECIES	AGE CLASS	TOTAL NO.	TOTAL WEIGHT (G)	LENGTH RANGE (MM)
8/29/83		4	GIZZARD SHAD	0	302	287	24- 86
			ALEWIFE	0	110	104	35- 68
			WHITE PERCH	0	36	144	42- 75
			WHITE BASS	0	26	250	35-120
			SPOTTAIL SHINER	0	16	37	48- 63
			WHITE CRAPPIE	0	2	1	39- 52
			EMERALD SHINER	0	1	1	43
			WALLEYE	1	4	450	224-255
			SPOTTAIL SHINER	1	2	14	94- 97
			WHITE PERCH	1	1	6	140
			YELLOW PERCH	1	1	120	114
			CARP	2	1	1970	617

APPENDIX H: FISH DATA (BREAKWATERS)

DATE	TOW	TIME	SPECIES	AGE CLASS	TOTAL NO.	TOTAL WEIGHT (G)	LENGTH RANGE (MM)
4/20/82	1	DAY	YELLOW PERCH	1	20	168	55-129
			RAINBOW SMELT	1	14	29	35- 95
			EMERALD SHINER	1	13	16	43- 69
			WHITE BASS	1	2	32	63-155
			TROUT PERCH	1	1	4	72
			YELLOW PERCH	2	14	1265	188-205
			SPOTTAIL SHINER	2	8		76-
			FRESHWATER DRUM	2	4	940	250-328
			TROUT PERCH	2	3		85-
		NIGHT	SPOTTAIL SHINER	1	57	132	48- 76
			TROUT PERCH	1	21	76	59- 85
			YELLOW PERCH	1	15	126	55-129
			FRESHWATER DRUM	1	10	69	54-130
			EMERALD SHINER	1	10	13	43- 69
			LOGPERCH	1	4		-
			WHITE PERCH	1	4	55	63-155
			RAINBOW SMELT	1	2	4	35- 95
			SPOTTAIL SHINER	2	36		77-
			YELLOW PERCH	2	13	788	146-220
			TROUT PERCH	2	3		86-
			FRESHWATER DRUM	2	1	179	254
			WHITE BASS	2	1	79	183
	2	DAY	SPOTTAIL SHINER	1	20	46	48- 76
			EMERALD SHINER	1	3	4	43- 69
			YELLOW PERCH	1	2	17	55-129
			TROUT PERCH	1	1	4	72
			WHITE PERCH	1	1	14	109
			SPOTTAIL SHINER	2	5		76-
		NIGHT	SPOTTAIL SHINER	1	45	104	48- 76
			EMERALD SHINER	1	22	28	43- 69
			TROUT PERCH	1	19	69	59- 85
			YELLOW PERCH	1	6	50	55-129
			FRESHWATER DRUM	1	5	34	54-130
			WHITE PERCH	1	4	55	63-155
			WHITE BASS	1	1	16	109
			WALLEYE	1	1	101	232
			RAINBOW SMELT	1	1	2	65
			SPOTTAIL SHINER	2	8		77-
			YELLOW PERCH	2	6	416	149-219
			WHITE BASS	2	5	511	158-261
			FRESHWATER DRUM	2	3	394	154-307
			TROUT PERCH	2	2		86-
	3	DAY	SPOTTAIL SHINER	1	21	2	48- 76
			YELLOW PERCH	1	11	92	55-129
			EMERALD SHINER	1	5	6	43- 69
			TROUT PERCH	1	3	11	59- 85
			WHITE PERCH	1	2	27	63-155
			RAINBOW SMELT	1	1	2	65
			WHITE BASS	1	1	16	109
			MIMIC SHINER	1	1		
			SPOTTAIL SHINER	2	4		76-
			FRESHWATER DRUM	2	2	183	256-256
			YELLOW PERCH	2	2	116	130-212
		NIGHT	EMERALD SHINER	1	33	42	43- 69
			SPOTTAIL SHINER	1	31	72	48- 76
			TROUT PERCH	1	14	51	59- 85
			FRESHWATER DRUM	1	7	48	54-130
			WHITE PERCH	1	3	41	63-155
			YELLOW PERCH	1	2	17	55-129
			RAINBOW SMELT	1	1	2	65
			SPOTTAIL SHINER	2	7		77-
			FRESHWATER DRUM	2	5	431	152-239
			YELLOW PERCH	2	4		130-
			WHITE BASS	2	1	77	182

NOTE: Age class designations are as follows: 0, young-of-the-year; 1, yearling; and 2, all fish older than yearlings (see text for additional explanation).

DATE	TOW	TIME	SPECIES	AGE CLASS	TOTAL NO.	TOTAL WEIGHT (G)	LENGTH RANGE (MM)
4/20/82	4	DAY	EMERALD SHINER	1	35	43	43- 69
			SPOTTAIL SHINER	1	16	37	48- 76
			YELLOW PERCH	1	8	67	55-129
			TROUT PERCH	1	5	18	59- 85
			WHITE PERCH	1	2	27	63-155
			WHITE BASS	1	2	16	63-155
			RAINBOW SMELT	1	1	2	65
			SPOTTAIL SHINER	2	3		76-
			WHITE BASS	2	1	52	160
			TROUT PERCH	2	1	6	85
		NIGHT	EMERALD SHINER	1	47	59	43- 69
			TROUT PERCH	1	21	76	59- 85
			YELLOW PERCH	1	11	92	55-129
			SPOTTAIL SHINER	1	8	18	48- 76
			FRESHWATER DRUM	1	5	34	54-130
			WHITE PERCH	1	5	68	63-155
			FRESHWATER DRUM	2	7	1140	155-301
			SPOTTAIL SHINER	2	5		76-
			YELLOW PERCH	2	4	291	179-188
			TROUT PERCH	2	3		86-
			WHITE BASS	2	1	52	160
	5	DAY	SPOTTAIL SHINER	1	24	56	48- 76
			TROUT PERCH	1	22	80	59- 85
			YELLOW PERCH	1	15	126	55-129
			EMERALD SHINER	1	5	6	43- 69
			WHITE PERCH	1	2	27	63-155
			RAINBOW SMELT	1	2	4	35- 95
			BLUNTNOSE MINNOW	1	1		
			SPOTTAIL SHINER	2	9		76-
			YELLOW PERCH	2	4	164	129-176
			FRESHWATER DRUM	2	1	205	265
			WHITE BASS	2	1	50	158
		NIGHT	EMERALD SHINER	1	51	64	43- 69
			TROUT PERCH	1	22	80	59- 85
			SPOTTAIL SHINER	1	14	32	48- 76
			YELLOW PERCH	1	6	50	55-129
			WHITE PERCH	1	4	55	63-155
			FRESHWATER DRUM	1	3	21	54-130
			RAINBOW SMELT	1	1	2	65
			YELLOW PERCH	2	9	496	138-203
			FRESHWATER DRUM	2	4	400	196-243
			TROUT PERCH	2	3	62	86-169
			EMERALD SHINER	2	1	2	70
			SPOTTAIL SHINER	2	1	4	77
7/ 6/82	1	DAY	YELLOW PERCH	0	1	1	38
			FRESHWATER DRUM	1	3	59	84-173
			WHITE BASS	1	1	48	156
			YELLOW PERCH	1	1	24	130
		NIGHT	WHITE PERCH	0	1	1	43
			FRESHWATER DRUM	0	1	1	37
			YELLOW PERCH	1	1	24	38
			FRESHWATER DRUM	1	1	20	128
			YELLOW PERCH	2	1	71	182

DATE	TOW	TIME	SPECIES	AGE CLASS	TOTAL NO.	TOTAL WEIGHT (G)	LENGTH RANGE (MM)
7/ 6/82	4	DAY	YELLOW PERCH	0	1	1	38
			YELLOW PERCH	1	3	73	85-175
			WHITE PERCH	2	2	55	115-150
			YELLOW PERCH	2	1	102	204
			FRESHWATER DRUM	2	1	53	174
			SPOTTAIL SHINER	2	1	24	135
		NIGHT	YELLOW PERCH	1	10	2419	85-175
			WHITE PERCH	1	2	100	101-213
			FRESHWATER DRUM	1	2	39	84-173
			YELLOW PERCH	2	1	93	198
	5	DAY	WHITE PERCH	0	1	1	43
			YELLOW PERCH	1	2	48	85-175
			WALLEYE	1	1	236	300
			CHANNEL CATFISH	1	1	13	108
			WHITE PERCH	1	1	50	156
			YELLOW PERCH	2	3	247	181-201
		NIGHT	WHITE PERCH	C	1	1	43
			YELLOW PERCH	C	1	1	38
			YELLOW PERCH	1	1	24	130
			WHITE PERCH	1	1	50	156
			YELLOW PERCH	2	4	421	183-202
			SPOTTAIL SHINER	2	1	24	135
9/13/82	1	DAY	FRESHWATER DRUM	C	3	10	34-114
			WHITE PERCH	C	2	12	36-138
			WALLEYE	C	1	52	191
			BROWN BULLHEAD	2	1	249	271
		NIGHT	FRESHWATER DRUM	0	69	238	34-114
			GIZZARD SHAD	C	14	120	40-149
			WHITE BASS	C	12	98	36-138
			SPOTTAIL SHINER	0	1	1	53
			WHITE PERCH	1	33	3280	139-240
			SPOTTAIL SHINER	1	3	20	72-106
			QUILLBACK	1	1		
			BROWN BULLHEAD	2	2	322	225-245
			SPOTTAIL SHINER	2	1		
			CARP	2	1	443	312
	2	DAY	WALLEYE	0	4	209	115-265
			WHITE PERCH	0	3	18	36-138
			FRESHWATER DRUM	0	2	7	34-114
			SPOTTAIL SHINER	C	1	7	89
			WHITE BASS	0	1	6	88
			EMERALD SHINER	C	1	1	45
			SPOTTAIL SHINER	1	10	15	35- 71
			FRESHWATER DRUM	1	1	36	155
			LOGPERCH	2	1		
			CARP	2	1	466	318
		NIGHT	WHITE PERCH	C	80	492	36-138
			FRESHWATER DRUM	0	73	252	34-114
			SPOTTAIL SHINER	0	19	28	35- 71
			WHITE BASS	C	6	49	36-138
			GIZZARD SHAD	C	5	43	40-149
			TROUT PERCH	0	4	9	45- 77
			YELLOW PERCH	C	1	4	76
			WALLEYE	C	1	52	191
			EMERALD SHINER	0	1	1	45
			CHANNEL CATFISH	0	1	2	57
			SPOTTAIL SHINER	1	12	81	89- 89
			YELLOW PERCH	1	4	161	115-190
			JOHNNY DARTER	1	2		
			GIZZARD SHAD	1	1	194	206
			WHITE PERCH	1	1	99	189
			BROWN BULLHEAD	2	1	376	310

DATE	TOW	TIME	SPECIES	AGE CLASS	TOTAL NO.	TOTAL WEIGHT (G)	LENGTH RANGE (MM)
9/13/82	3	DAY	FRESHWATER DRUM	0	16	55	34-114
			WHITE PERCH	0	12	74	36-138
			SPOTTAIL SHINER	0	3	4	35- 71
			TROUT PERCH	0	2	4	45- 77
			JOHNNY DARTER	0	1		
			CARP	2	2	1780	319-489
			FRESHWATER DRUM	2	2	509	199-368
		NIGHT	FRESHWATER DRUM	0	88	304	34-114
			TROUT PERCH	0	22	48	45- 77
			EMERALD SHINER	0	11	7	27- 62
			WHITE PERCH	0	5	31	36-138
			SPOTTAIL SHINER	0	3	4	35- 71
			GIZZARD SHAD	0	3	26	40-149
			YELLOW PERCH	0	1	4	76
			WHITE CRAPPIE	0	1		
			WALLEYE	0	1	52	191
			CHANNEL CATFISH	0	1	2	57
			YELLOW PERCH	1	8	320	115-190
			SPOTTAIL SHINER	1	5	34	72-106
			WHITE PERCH	1	2	200	139-240
			EMERALD SHINER	1	2	7	63- 96
			GIZZARD SHAD	1	1	194	206
			TROUT PERCH	1	1	8	94
			CHANNEL CATFISH	1	1	2	136
			EMERALD SHINER	2	1		
	4	DAY	WHITE PERCH	0	26	160	36-138
			FRESHWATER DRUM	0	4	14	34-114
			SPOTTAIL SHINER	0	4	6	35- 71
			WHITE CRAPPIE	0	2		
			WALLEYE	0	1	52	191
			TROUT PERCH	0	1	2	61
			FRESHWATER DRUM	1	2	72	115-192
			SPOTTAIL SHINER	1	2	14	72-106
			CARP	2	1	328	280
		NIGHT	WHITE PERCH	0	50	308	36-138
			FRESHWATER DRUM	0	25	86	34-114
			GIZZARD SHAD	0	24	205	40-149
			SPOTTAIL SHINER	0	15	22	35- 71
			WHITE BASS	0	7	57	36-138
			WALLEYE	0	4	209	115-265
			EMERALD SHINER	0	1	1	45
			CHANNEL CATFISH	0	1	2	57
			SPOTTAIL SHINER	1	12	81	72-106
			GIZZARD SHAD	1	11	2136	150-260
			YELLOW PERCH	1	2	80	115-190
			WHITE PERCH	1	2	199	139-240
			BROWN BULLHEAD	2	2	212	185-225
	5	DAY	WHITE PERCH	0	48	295	36-138
			FRESHWATER DRUM	0	6	21	34-114
			SPOTTAIL SHINER	0	5	7	35- 71
			WHITE BASS	0	4	33	36-138
			WHITE PERCH	1	1	99	189
			EMERALD SHINER	1	1	4	79
		NIGHT	WHITE PERCH	0	65	400	36-138
			FRESHWATER DRUM	0	48	166	34-114
			SPOTTAIL SHINER	0	15	22	35- 71
			WHITE BASS	0	14	114	36-138
			JOHNNY DARTER	0	1		
			WALLEYE	0	1	52	191
			FRESHWATER DRUM	1	3	108	115-194
			SPOTTAIL SHINER	1	2	13	72-106
			BROWN BULLHEAD	2	2	278	260-295
			CHANNEL CATFISH	2	1	57	180
			YELLOW PERCH	2	1	96	200

DATE	TOW	TIME	SPECIES	AGE CLASS	TOTAL NO.	TOTAL WEIGHT (G)	LENGTH RANGE (MM)
4/19/83	1	DAY	FRESHWATER DRUM	1	241	2330	86-129
			YELLOW PERCH	1	57	627	71-128
			WHITE PERCH	1	50	570	71-114
			GIZZARD SHAD	1	46	776	94-142
			WALLEYE	1	13	689	155-188
			TROUT PERCH	1	8	32	81- 85
			RAINBOW SMELT	1	7	6	53- 73
			WHITE BASS	1	3	61	98-145
			TROUT PERCH	2	121	1118	86-131
			SPOTTAIL SHINER	2	102	1816	76-133
			YELLOW PERCH	2	55	2321	130-212
			FRESHWATER DRUM	2	2	50	131-145
			LOGPERCH	2	1	4	106
			RAINBOW SMELT	2	1	10	153
		NIGHT	YELLOW PERCH	1	464	1268	63-125
			FRESHWATER DRUM	1	308	2692	71-126
			SPOTTAIL SHINER	1	210	214	51- 71
			TROUT PERCH	1	194	1066	61- 85
			GIZZARD SHAD	1	160	2600	94-137
			WHITE PERCH	1	78	452	62-122
			RAINBOW SMELT	1	24	28	54- 70
			CHANNEL CATFISH	1	2	4	60- 60
			SPOTTAIL SHINER	2	1022	5862	73-149
			TROUT PERCH	2	62	532	86-131
			YELLOW PERCH	2	30	992	129-186
			GIZZARD SHAD	2	4	112	143-151
	2	DAY	TROUT PERCH	1	49	233	58- 85
			YELLOW PERCH	1	41	231	63- 99
			FRESHWATER DRUM	1	39	312	73-122
			GIZZARD SHAD	1	10	110	73-128
			WHITE PERCH	1	6	32	64- 94
			SPOTTAIL SHINER	1	2	2	50- 53
			WALLEYE	1	1	41	179
			RAINBOW SMELT	1	1	2	72
			SPOTTAIL SHINER	2	416	4998	73-120
			TROUT PERCH	2	31	232	86-101
			YELLOW PERCH	2	5	297	144-177
		NIGHT	YELLOW PERCH	1	432	2458	65- 98
			TROUT PERCH	1	122	744	71- 85
			FRESHWATER DRUM	1	38	338	74-129
			SPOTTAIL SHINER	1	14	14	61- 71
			WHITE PERCH	1	6	28	70- 91
			RAINBOW SMELT	1	6	6	63- 67
			GIZZARD SHAD	1	2	34	132-132
			WHITE BASS	1	2	30	113-113
			SPOTTAIL SHINER	2	390	4438	78-135
			TROUT PERCH	2	48	372	86-115
			YELLOW PERCH	2	8	494	164-175
	3	DAY	FRESHWATER DRUM	1	106	1120	85-127
			YELLOW PERCH	1	53	292	71- 99
			TROUT PERCH	1	31	112	62- 84
			GIZZARD SHAD	1	21	315	100-165
			WHITE PERCH	1	9	46	58- 91
			SPOTTAIL SHINER	1	3	4	58- 65
			CHANNEL CATFISH	1	1	1	57
			WALLEYE	1	1	78	229
			SPOTTAIL SHINER	2	465	959	77-133
			TROUT PERCH	2	34	292	90-129
			YELLOW PERCH	2	13	628	140-201
			FRESHWATER DRUM	2	1	18	135
			GREENSIDE DARTER	2	1	1	51
		NIGHT	FRESHWATER DRUM	1	196	1506	76-130
			YELLOW PERCH	1	128	698	64-124
			TROUT PERCH	1	32	134	65- 85
			SPOTTAIL SHINER	1	26	162	41- 67
			NORTHERN REDHORSE	1	2	46	129-129
			GIZZARD SHAD	1	2	42	138-138
			CHANNEL CATFISH	1	2	1	78- 78
			SPOTTAIL SHINER	2	74	688	74-137
			TROUT PERCH	2	30	188	86-108
			YELLOW PERCH	2	8	350	140-194
			FRESHWATER DRUM	2	6	102	132-151
			GIZZARD SHAD	2	2	900	398-398

DATE	TOW	TIME	SPECIES	AGE CLASS	TOTAL NO.	TOTAL WEIGHT (G)	LENGTH RANGE (MM)
4/19/83	4	DAY	YELLOW PERCH	1	220	1339	71-126
			FRESHWATER DRUM	1	2C6	1818	74-129
			TROUT PERCH	1	52	78	67- 85
			WHITE PERCH	1	9	54	65- 97
			GIZZARD SHAD	1	3	43	121-124
			PUMPKINSEED	1	1	1	48
			SPOTTAIL SHINER	1	1	1	56
			SPOTTAIL SHINER	2	246	2786	73-138
			YELLOW PERCH	2	36	1324	132-339
			TROUT PERCH	2	27	352	86-112
			FRESHWATER DRUM	2	3	60	131-136
			GIZZARD SHAD	2	2	101	173-191
			QUILLBACK	2	1	59	167
			BROWN BULLHEAD	2	1	8	105
		NIGHT	YELLOW PERCH	1	3C2	1860	66-104
			FRESHWATER DRUM	1	60	426	79-128
			TROUT PERCH	1	40	164	67- 85
			SPOTTAIL SHINER	1	16	30	62- 73
			WHITE PERCH	1	10	40	70- 93
			RAINBOW SMELT	1	4	2	55- 67
			SPOTTAIL SHINER	2	262	2480	77-133
			TROUT PERCH	2	26	182	86-106
			YELLOW PERCH	2	6	362	152-209
	5	DAY	FRESHWATER DRUM	1	512	4397	92-123
			YELLOW PERCH	1	3C	163	73- 97
			GIZZARD SHAD	1	20	494	89-165
			TROUT PERCH	1	18	72	74- 85
			WHITE PERCH	1	6	46	74-119
			SPOTTAIL SHINER	1	2	1	30- 60
			YELLOW PERCH	2	30	1666	134-206
			SPOTTAIL SHINER	2	28	392	103-128
			TROUT PERCH	2	22	224	86-115
			FRESHWATER DRUM	2	12	479	130-289
			GIZZARD SHAD	2	6	297	170-187
		NIGHT	FRESHWATER DRUM	1	442	4618	87-130
			GIZZARD SHAD	1	62	1030	93-145
			TROUT PERCH	1	54	1046	71- 85
			YELLOW PERCH	1	50	356	76-125
			WHITE PERCH	1	22	144	65-128
			SPOTTAIL SHINER	1	16	11	51- 67
			RAINBOW SMELT	1	6	4	52- 72
			TROUT PERCH	2	64	520	86-124
			SPOTTAIL SHINER	2	60	746	83-134
			YELLOW PERCH	2	18	1196	132-212
			FRESHWATER DRUM	2	12	1346	146-331
			GIZZARD SHAD	2	12	536	157-190
			RAINBOW SMELT	2	2	16	115-115
7/11/83	1	DAY	WHITE PERCH	0	7	17	40- 90
			TROUT PERCH	0	2	1	31- 33
			SPOTTAIL SHINER	0	1	1	34
			FRESHWATER DRUM	1	2	15	97-125
			BROWN BULLHEAD	2	1	200	271
			CHANNEL CATFISH	2	1	500	389
			SPOTTAIL SHINER	2	1	5	113
		NIGHT	WHITE PERCH	0	44	458	31- 99
			TROUT PERCH	0	4	1	21- 30
			WHITE BASS	0	1	10	100
			SPOTTAIL SHINER	0	1	1	26
			WHITE PERCH	1	81	809	100-151
			SPOTTAIL SHINER	1	7	27	77- 94
			FRESHWATER DRUM	1	5	34	96-129
			CHANNEL CATFISH	1	2	33	140-148
			ALEWIFE	1	1	20	159
			WHITE BASS	1	1	8	122
			BROWN BULLHEAD	2	5	500	225-265
			FRESHWATER DRUM	2	2	370	197-337
			CHANNEL CATFISH	2	1	150	183
			SPOTTAIL SHINER	2	1	3	116

DATE	TOW	TIME	SPECIES	AGE CLASS	TOTAL NO.	TOTAL WEIGHT (G)	LENGTH RANGE (MM)
7/11/83	2	DAY	SPOTTAIL SHINER	0	6	1	21- 32
			TROUT PERCH	0	1	1	30
			WHITE PERCH	0	1	10	96
			SPOTTAIL SHINER	1	2	6	88- 90
			FRESHWATER DRUM	1	2	12	118-141
			BROWN BULLHEAD	2	2	100	235-267
		NIGHT	WHITE PERCH	0	6	38	32- 99
			SPOTTAIL SHINER	0	1	1	22
			WHITE PERCH	1	15	307	100-135
			FRESHWATER DRUM	1	8	112	86-142
			CHANNEL CATFISH	1	3	25	100-145
			WALLEYE	1	2	100	190-215
			SPOTTAIL SHINER	1	1	1	55
			CHANNEL CATFISH	2	5	980	158-363
			CARP	2	5	6800	379-608
			SPOTTAIL SHINER	2	1	10	126
	3	DAY	TROUT PERCH	0	8	2	26- 35
			SPOTTAIL SHINER	0	1	1	28
			FRESHWATER DRUM	1	2	30	116-158
			WHITE CRAPPIE	1	2	8	99-114
		NIGHT	FRESHWATER DRUM	0	4	31	82-100
			CHANNEL CATFISH	0	2	1	25- 25
			FRESHWATER DRUM	1	18	240	105-131
			YELLOW PERCH	1	6	93	100-165
			SPOTTAIL SHINER	1	5	28	80- 87
			WHITE BASS	1	1	12	102
			YELLOW PERCH	2	1	50	180
			SPOTTAIL SHINER	2	1	11	111
	4	DAY	WHITE PERCH	0	1	5	96
			TROUT PERCH	0	1	1	33
			SPOTTAIL SHINER	0	1	1	24
			YELLOW PERCH	1	1	10	123
			CHANNEL CATFISH	2	1	400	366
			BROWN BULLHEAD	2	1	200	229
		NIGHT	SPOTTAIL SHINER	0	25	6	19- 45
			WHITE BASS	0	16	46	23- 95
			TROUT PERCH	0	9	2	29- 35
			WHITE PERCH	0	7	74	84-100
			CHANNEL CATFISH	0	2	1	18- 22
			SPOTTAIL SHINER	1	16	97	74- 96
			WHITE PERCH	1	14	343	101-139
			FRESHWATER DRUM	1	11	177	98-165
			WALLEYE	1	1	100	240
			CHANNEL CATFISH	2	6	320	151-336
			YELLOW PERCH	2	3	234	114-175
			SPOTTAIL SHINER	2	2	19	106-110
			CARP	2	1	1250	478

DATE	TOW	TIME	SPECIES	AGE CLASS	TOTAL NO.	TOTAL WEIGHT (G)	LENGTH RANGE (MM)
7/11/83	5	DAY	WHITE PERCH	0	1	3	96
			SPOTTAIL SHINER	1	25	75	76- 91
			WHITE PERCH	1	3	18	114-115
			FRESHWATER DRUM	1	1	5	116
			BROWN BULLHEAD	2	1	250	250
		NIGHT	WHITE PERCH	C	31	186	15-100
			TROUT PERCH	0	8	1	26- 39
			SPOTTAIL SHINER	C	5	1	22- 42
			WHITE PERCH	1	20	399	101-159
			SPOTTAIL SHINER	1	9	25	68- 89
			YELLOW PERCH	1	7	156	107-162
			FRESHWATER DRUM	1	3	45	106-126
			WALLEYE	1	1	100	225
			CHANNEL CATFISH	1	1	10	135
			SPOTTAIL SHINER	2	4	39	102-114
			CHANNEL CATFISH	2	3	140	173-192
			CARP	2	2	3000	528-571
			BROWN BULLHEAD	2	1	110	202
9/19/83	1	DAY	WHITE PERCH	C	16	98	59- 94
			SPOTTAIL SHINER	C	4	11	32- 68
			FRESHWATER DRUM	C	1	8	107
			GIZZARD SHAD	O	1	12	108
			SPOTTAIL SHINER	1	2	12	75- 96
		NIGHT	WHITE PERCH	C	95	589	51-136
			FRESHWATER DRUM	0	15	65	83-114
			GIZZARD SHAD	0	3	11	62- 80
			SPOTTAIL SHINER	C	2	3	35- 58
			WHITE BASS	0	2	27	87-116
			CHANNEL CATFISH	0	1	5	83
			FRESHWATER DRUM	1	4	100	116-119
			YELLOW PERCH	1	1	32	138
			WHITE PERCH	1	1	42	139
			SPOTTAIL SHINER	1	1	2	72
			CHANNEL CATFISH	1	1	16	104
			WHITE CRAPPIE	2	1	62	172
			FRESHWATER DRUM	2	1	184	287
	2	DAY	WHITE PERCH	0	50	344	63- 93
			SPOTTAIL SHINER	0	9	28	62- 70
			GIZZARD SHAD	0	2	8	60- 83
			FRESHWATER DRUM	0	1	10	102
			SPOTTAIL SHINER	1	13	86	72- 99
		NIGHT	FRESHWATER DRUM	0	63	525	57-114
			WHITE BASS	0	38	530	63-138
			SPOTTAIL SHINER	0	5	6	35- 65
			CHANNEL CATFISH	0	3	12	73- 81
			GIZZARD SHAD	0	2	6	67- 75
			TROUT PERCH	0	1	2	67
			ALEWIFE	0	1	4	76
			FRESHWATER DRUM	1	11	367	117-189
			WHITE BASS	1	10	497	139-196
			YELLOW PERCH	1	7	281	117-174
			SPOTTAIL SHINER	1	2	8	72- 73
			BROWN BULLHEAD	2	2	656	259-270
			FRESHWATER DRUM	2	1	83	201

DATE	TOW	TIME	SPECIES	AGE CLASS	TOTAL NO.	TOTAL WEIGHT (G)	LENGTH RANGE (MM)
9/19/83	3	DAY	FRESHWATER DRUM	0	29	280	73-111
			CHANNEL CATFISH	0	23	83	58- 88
			WHITE PERCH	0	22	150	71- 98
			TROUT PERCH	0	10	29	60- 76
			WHITE CRAPPIE	0	3	18	62- 82
			SPOTTAIL SHINER	0	2	5	60- 66
			CARP	0	1	29	117
			YELLOW PERCH	0	1	16	114
			RAINBOW SMELT	0	1	1	48
			FRESHWATER DRUM	1	17	408	116-167
			SPOTTAIL SHINER	1	14	113	72-104
			YELLOW PERCH	1	5	208	125-184
			TROUT PERCH	1	4	20	78-100
			CHANNEL CATFISH	1	3	38	102-117
			WHITE CRAPPIE	1	2	52	106-150
			BROWN BULLHEAD	2	6	834	215-233
			SPOTTAIL SHINER	2	2	30	115-115
		NIGHT	FRESHWATER DRUM	0	54	444	55-114
			WHITE PERCH	0	4	25	63- 95
			GIZZARD SHAD	0	2	1	45- 72
			YELLOW PERCH	0	1	4	77
			SPOTTAIL SHINER	0	1	1	43
			YELLOW PERCH	1	9	323	118-182
			FRESHWATER DRUM	1	7	313	117-173
			WHITE PERCH	1	2	115	154-165
			CHANNEL CATFISH	1	1	9	109
			SPOTTAIL SHINER	2	1	9	110
	4	DAY	WHITE PERCH	0	6	38	75- 87
			SPOTTAIL SHINER	0	6	13	51- 71
			FRESHWATER DRUM	0	1	10	102
			SPOTTAIL SHINER	1	2	13	91- 92
		NIGHT	WHITE PERCH	0	76	503	51-126
			FRESHWATER DRUM	0	9	73	89-105
			CHANNEL CATFISH	0	2	6	73- 79
			SPOTTAIL SHINER	0	2	1	37- 66
			GIZZARD SHAD	0	1	6	84
			WHITE BASS	1	2	46	129-129
			SPOTTAIL SHINER	1	2	11	72-105
			CHANNEL CATFISH	1	2	26	115-121
			WHITE CRAPPIE	1	1	44	159
			YELLOW PERCH	1	1	32	140
			WHITE PERCH	1	1	53	153
			SPOTTAIL SHINER	2	1	9	113
			BROWN BULLHEAD	2	1	250	258
	5	DAY	WHITE PERCH	0	20	77	54- 80
			WHITE BASS	0	4	6	52- 60
			SPOTTAIL SHINER	0	3	5	27- 70
			GIZZARD SHAD	0	2	17	52-113
			SPOTTAIL SHINER	1	1	8	99
			FRESHWATER DRUM	2	1	395	372
		NIGHT	WHITE PERCH	0	153	946	42-137
			FRESHWATER DRUM	0	30	178	44-111
			WHITE BASS	0	9	154	74-135
			SPOTTAIL SHINER	0	7	36	61- 99
			GIZZARD SHAD	0	4	39	55-103
			TROUT PERCH	0	2	8	68- 74
			WHITE BASS	1	1	51	149
			WHITE PERCH	1	1	52	148
			SPOTTAIL SHINER	1	1	13	105
			FRESHWATER DRUM	1	1	18	117
			FRESHWATER DRUM	2	1	243	307
			YELLOW BULLHEAD	2	1	250	281

APPENDIX I: PERIPHYTON DENSITY DATA (BREAKWATERS)

DATE	TAXON	STA. 1	STA. 2	STA. 3	STA. 4	STA. 5	AVERAGE
		--PERCENT COMPOSITION--					
4/23/82	*BLUE-GREEN ALGAE*						
	RIVULARIA SP.	1.4	0.0	0.0	0.0	0.0	0.3
	TCTAL	1.4	0.0	0.0	0.0	0.0	0.3
	GREEN ALGAE						
	ULOTHRIX VARIABILIS	4.3	0.0	30.5	8.8	12.6	11.2
	CHLOROCCOCUM SP.	2.3	0.0	1.6	1.7	0.2	1.2
	SCENEDESMUS QUADRICAUDA	0.6	0.0	0.6	0.0	0.2	0.3
	ANKISTRCDESMUS FALCATUS	0.1	C.0	0.1	0.0	0.1	0.1
	SPHAEROCYSTIS SCHROETERI	0.0	0.0	0.9	0.0	0.8	0.3
	ACTINASTRUM HAUTSZCHII	0.0	0.0	1.7	0.0	0.3	0.4
	ULOTHRIX ZONATA	0.C	0.C	0.0	25.2	0.0	5.0
	SCENEDESMUS BIJUGA	C.0	0.0	0.0	0.0	0.2	0.0
	SCENEDESMUS DIMORPHUS	C.0	0.0	0.0	0.0	0.2	0.0
	TCTAL	7.3	0.0	35.4	35.7	14.6	18.6
	DIATOMS						
	GOMPHONEMA OLIVACEUM	65.9	0.0	37.7	42.0	42.6	37.6
	SYNEDRA ACUS	7.3	C.C	10.6	2.9	6.9	5.5
	PENNATE, UNIDENTIFIED	7.1	C.0	1.6	5.3	4.5	3.7
	SYNECRA SP.	7.0	0.0	0.9	10.9	23.3	8.4
	CENTRIC, UNIDENTIFIED	1.1	C.C	5.7	2.4	3.5	2.5
	DIATOMA TENUE VAR. ELONGATUM	C.5	C.0	0.0	0.6	1.1	0.4
	MELOSIRA GRANULATA	C.3	0.0	0.0	0.0	0.0	0.1
	MELOSIRA ISLANCICA	0.2	0.0	2.6	0.0	2.1	1.0
	SURIRELLA OVATA	C.1	0.0	0.0	0.0	0.0	0.0
	FRAGILARIA CROTONENSIS	C.0	0.C	1.7	0.0	0.0	0.3
	ASTERICNELLA FORMOSA	0.0	C.0	1.0	0.0	0.4	0.3
	CYMBELLA SP.	0.0	0.0	0.1	0.0	0.0	0.0
	TCTAL	89.5	0.0	61.9	64.1	84.4	60.0
	CRYPTOMONADS						
	CRYPTOMONAS OVATA	C.4	0.0	0.0	0.0	0.0	0.1
	UNKNOWN	C.1	C.0	1.0	0.1	0.5	0.3
	TOTAL	0.5	0.0	1.0	0.1	0.5	0.4
	OTHER						
	DINOBRYON SERTULARIA	0.8	C.0	0.7	0.0	0.3	0.4
	TRACHELOMONAS SP.	0.1	0.0	0.0	0.0	0.0	0.0
	EUGLENA SP.	C.1	C.0	0.4	0.0	0.1	0.1
	TOTAL	1.0	0.0	1.1	0.0	0.4	0.5
	TOTAL ALL ALGAE	99.7	0.0	99.4	99.9	99.9	79.8
7/ 7/82	*GREEN ALGAE*						
	CLADOPHORA GLOMERATA	99.0	99.0	99.0	99.0	99.0	99.0
	TOTAL	99.0	99.0	99.0	99.0	99.0	99.0
	DIATOMS						
	GOMPHONEMA PARVULUM	0.3	0.2	0.3	0.3	0.3	0.3
	NITZSCHIA SP.	C.3	0.2	0.0	0.0	0.0	0.1
	RHOICOSPHENIA CURVATA	0.3	C.2	0.3	0.3	0.3	0.3
	DIATOMA VULGARE	0.0	0.2	0.3	0.2	0.2	0.2
	CYMBELLA SP.	0.0	0.2	0.0	0.0	0.0	0.0
	SYNEDRA VAUCHERIAE	C.0	0.0	0.0	0.2	0.0	0.0
	COCCONEIS PECICULUS	C.0	C.0	0.0	0.0	0.2	0.0
	TOTAL	C.9	1.0	0.9	1.0	1.0	1.0
	TOTAL ALL ALGAE	99.9	1C0.0	99.9	100.0	100.0	100.0

DATE	TAXON	STA. 1	STA. 2	STA. 3	STA. 4	STA. 5	AVERAGE
		--PERCENT COMPOSITION--					
9/14/82	*BLUE-GREEN ALGAE*						
	OSCILLATORIA TENUIS	52.5	40.4	68.6	55.2	45.0	52.3
	LYNGBYA DIGUETTI	5.4	11.1	3.5	15.5	3.0	7.7
	OSCILLATORIA LIMNETICA	5.4	1.3	5.2	1.4	12.4	5.1
	ANABAENA SP.	5.0	1.1	4.4	4.9	8.5	4.8
	APHANIZOMENON FLOS-AQUAE	4.1	1.1	0.6	0.0	0.0	1.2
	LYNGBYA VERSICOLOR	2.2	1.6	3.7	9.0	6.5	4.6
	OSCILLATORIA ARTICULATA	1.6	0.0	4.1	0.5	3.0	1.8
	TOTAL	76.2	56.6	90.1	86.5	78.4	77.6
	GREEN ALGAE						
	PEDIASTRUM SIMPLEX	12.2	4.4	0.0	0.0	11.3	5.6
	OOCYSTIS BORGEI	1.0	1.2	0.0	1.4	0.0	0.7
	ACTINASTRUM HAUTSZCHII	1.0	0.0	1.5	3.1	1.0	1.3
	STIGEOCLONIUM LUBRICUM	1.0	31.7	0.0	0.0	0.0	6.5
	SCENEDESMUS QUADRICAUDA	0.5	0.0	1.1	1.0	2.7	1.1
	COSMARIUM RENIFORME	0.0	0.9	0.6	0.0	0.1	0.3
	STAURASTRUM SP.	0.0	0.1	0.0	0.0	0.0	0.0
	CLOSTERIUM ACEROSUM	0.0	0.1	0.0	0.0	0.0	0.0
	COSMARIUM BOTRYDIS	0.0	0.0	0.0	1.0	0.5	0.3
	MOUGEOTIA SP.	0.0	0.0	0.0	0.6	0.0	0.1
	CLOSTERIUM ACICULARE	0.0	0.0	0.0	0.3	0.0	0.1
	CHARACIUM SP.	0.0	0.0	0.0	0.0	0.2	0.0
	TOTAL	15.7	38.4	3.2	7.4	15.8	16.1
	DIATOMS						
	MELOSIRA SP.	1.8	0.0	0.0	0.0	0.0	0.4
	PENNATE, UNIDENTIFIED	1.6	4.0	4.6	5.1	3.7	3.8
	STEPHANODISCUS NIAGARAE	0.8	0.7	1.1	0.5	0.5	0.7
	COSCINODISCUS ROTHII	0.5	0.2	0.4	0.8	0.6	0.5
	CYMBELLA SP.	0.0	0.0	0.9	0.0	0.0	0.2
	FRAGILARIA CROTONENSIS	0.0	0.0	0.0	0.0	0.8	0.2
	TOTAL	4.7	4.9	7.0	6.4	5.6	5.7
	CRYPTOMONADS						
	UNKNOWN	2.4	0.0	0.0	0.0	0.0	0.5
	TOTAL	2.4	0.0	0.0	0.0	0.0	0.5
	TOTAL ALL ALGAE	99.0	99.9	100.3	100.3	99.8	99.9

DATE	TAXON	--PERCENT COMPOSITION-- STA. 6	STA. 7	STA. 8	STA. 9	AVERAGE
9/14/82	*BLUE-GREEN ALGAE*					
	OSCILLATORIA TENUIS	58.9	0.0	51.0	50.0	40.0
	ANABAENA SP.	16.8	0.0	9.3	17.3	10.8
	OSCILLATORIA LIMNETICA	6.2	0.0	13.7	12.0	8.0
	LYNGBYA VERSICOLOR	1.3	0.0	0.5	0.3	0.5
	LYNGBYA DIGUETTI	1.1	0.0	4.3	0.9	1.6
	OSCILLATORIA ARTICULATA	0.0	0.0	3.8	2.5	1.6
	APHANIZOMENON FLOS-AQUAE	0.0	0.0	0.0	8.7	2.2
	TOTAL	84.3	0.0	82.6	91.7	64.6
	GREEN ALGAE					
	DICTYOSPHAERIUM PULCHELLUM	4.8	0.0	0.0	2.6	1.8
	OOCYSTIS BORGEI	2.4	0.0	0.4	0.0	0.7
	COELASTRUM SPHAERICUM	1.8	0.0	0.0	0.0	0.5
	SPHAEROCYSTIS SCHROETERI	1.2	0.0	0.0	0.0	0.3
	MOUGEOTIA SP.	1.0	0.0	0.1	0.0	0.3
	SCENEDESMUS QUADRICAUDA	0.5	0.0	2.1	0.3	0.7
	SCENEDESMUS DIMORPHUS	0.5	0.0	0.0	0.0	0.1
	COSMARIUM BOTRYDIS	0.4	0.0	0.1	0.2	0.2
	CLOSTERIUM SP.	0.1	0.0	0.0	0.0	0.0
	COSMARIUM RENIFORME	0.0	0.0	0.1	0.1	0.1
	ACTINASTRUM HAUTSZCHII	0.0	0.0	2.7	0.0	0.7
	STIGEOCLONIUM LUBRICUM	0.0	0.0	6.1	0.0	1.5
	PEDIASTRUM SIMPLEX	0.0	0.0	0.0	5.3	1.3
	TOTAL	12.7	0.0	11.6	8.5	8.2
	DIATOMS					
	PENNATE, UNIDENTIFIED	2.0	0.0	5.5	0.0	1.9
	STEPHANODISCUS NIAGARAE	0.6	0.0	0.1	0.0	0.2
	COSCINODISCUS ROTHII	0.0	0.0	0.1	0.0	0.0
	TOTAL	2.6	0.0	5.7	0.0	2.1
	TOTAL ALL ALGAE	99.6	0.0	99.9	100.2	74.9

DATE	TAXON	STA. 1	STA. 2	STA. 3	STA. 4	STA. 5	AVERAGE
		--PERCENT COMPOSITION--					
4/19/83	*BLUE-GREEN ALGAE*						
	OSCILLATORIA SUBBREVIS	36.8	4.8	0.6	22.1	16.0	16.1
	OSCILLATORIA AGARDHII	35.9	16.2	2.6	25.0	24.1	20.8
	LYNGBYA SP.	15.6	0.0	0.0	3.1	7.6	5.3
	CHROOCOCCUS LIMNETICUS	1.4	0.0	0.0	0.0	0.0	0.3
	OSCILLATORIA SP.	0.9	5.3	12.1	10.7	12.1	8.2
	LYNGBYA BIRGEI	0.0	18.8	0.9	0.0	0.0	3.9
	LYNGBYA VERSICOLOR	0.0	0.0	0.0	2.5	0.0	0.5
		----	----	----	----	----	----
	TOTAL	90.6	45.1	16.2	63.4	59.8	55.0
	GREEN ALGAE						
	TETRASTRUM STAUROGENIAEFORME	0.2	0.1	0.0	0.0	0.0	0.1
	UNKNOWN	0.0	0.9	0.0	0.0	0.0	0.2
	CLOSTERIOPSIS LONGISSIMA	0.0	0.1	0.1	0.0	0.0	0.0
	ULOTHRIX SP.	0.0	1.5	0.7	0.0	0.0	0.4
	ULOTHRIX AEQUALIS	0.0	17.8	25.3	8.8	2.3	10.8
	ULOTHRIX VARIABILIS	0.0	5.7	21.8	3.1	0.0	6.1
	ULOTHRIX ZONATA	0.0	3.3	0.0	1.1	0.0	0.9
	ULOTHRIX TENERRIMA	0.0	1.6	0.0	0.0	0.0	0.3
	ULOTHRIX TENUISSIMA	0.0	8.8	1.0	0.0	0.0	2.0
	MICRACTINIUM SP.	0.0	0.2	0.0	0.0	0.0	0.0
	ACTINASTRUM HAUTSZCHII	0.0	0.3	0.4	0.0	0.0	0.1
	SCENEDESMUS QUADRICAUDA	0.0	0.0	0.2	0.0	0.4	0.1
	STIGEOCLONIUM SP.	0.0	0.0	0.9	0.0	0.0	0.2
	STIGEOCLONIUM SUBSECUNDUM	0.0	0.0	0.2	0.0	0.0	0.0
	SCENEDESMUS SP.	0.0	0.0	0.0	0.4	0.0	0.1
	CYLINDROCYSTIS SP.	0.0	0.0	0.0	2.1	1.5	0.7
	CRUCIGENIA QUADRATA	0.0	0.0	0.0	0.0	0.2	0.0
	COSMARIUM SP.	0.0	0.0	0.0	0.0	0.1	0.0
	MOUGEOTIA ELEGANTULA	0.0	0.0	0.0	0.0	0.1	0.0
	PALMELLA MUCOSA	0.0	0.0	0.0	0.0	13.2	2.6
		----	----	----	----	----	----
	TOTAL	0.2	40.3	50.6	15.5	17.8	24.9
	DIATOMS						
	MELOSIRA BINDERANA	2.7	3.6	6.6	3.5	4.1	4.1
	DIATOMA HIEMALE	2.3	4.5	6.9	4.5	4.3	4.5
	FRAGILARIA SP.	1.6	0.0	3.5	0.5	3.0	1.7
	MELOSIRA SP.	0.9	2.8	3.6	5.8	2.6	3.1
	TABELLARIA SP.	0.5	0.0	0.0	0.0	1.5	0.4
	FRAGILARIA CROTONENSIS	0.1	0.4	0.7	1.1	3.1	1.1
	GOMPHONEMA SP.	0.1	0.3	1.2	0.5	0.2	0.5
	NAVICULA SP.	0.0	0.1	0.0	0.0	0.0	0.0
	TABELLARIA FENESTRATA	0.0	0.4	1.5	1.0	0.0	0.6
	TABELLARIA FLOCCULOSA	0.0	0.1	0.0	0.0	0.0	0.0
	CYMBELLA SP.	0.0	0.1	0.1	0.0	0.0	0.0
	SYNEDRA SP.	0.0	0.1	0.3	0.9	0.0	0.3
	RHOICOSPHENIA CURVATA	0.0	0.1	0.0	0.0	0.0	0.0
	COSCINODISCUS ROTHII	0.0	0.1	0.3	0.2	0.0	0.1
	PENNATE, UNIDENTIFIED	0.0	0.0	5.3	0.5	0.0	1.2
	MELOSIRA ISLANDICA	0.0	0.0	2.3	0.0	0.0	0.5
	FRAGILARIA PINNATA	0.0	0.0	0.7	0.0	0.0	0.1
	CYMATOPLEURA SOLEA	0.0	0.0	0.1	0.0	0.0	0.0
	ASTERIONELLA FORMOSA	0.0	0.0	0.0	0.9	0.0	0.2
	STEPHANODISCUS NIAGARAE	0.0	0.0	0.0	0.0	0.2	0.0
		----	----	----	----	----	----
	TOTAL	8.2	12.6	33.1	19.4	19.0	18.5
	CRYPTOMONADS						
	UNKNOWN	0.5	1.7	0.2	1.7	2.3	1.3
	CRYPTOMONAS SP.	0.0	0.0	0.0	0.0	1.0	0.2
		----	----	----	----	----	----
	TOTAL	0.5	1.7	0.2	1.7	3.3	1.5
	OTHER						
	DINOBRYON SERTULARIA	0.0	0.0	0.0	0.4	0.0	0.1
	DINOBRYON CYLINDRICUM	0.0	0.0	0.0	0.0	0.2	0.0
		----	----	----	----	----	----
	TOTAL	0.0	0.0	0.0	0.4	0.2	0.1
	TOTAL ALL ALGAE	99.5	99.7	100.1	100.4	100.1	100.0

DATE	TAXON	STA. 6	STA. 7	STA. 8	STA. 9	AVERAGE
		--PERCENT COMPOSITION--				
4/19/83	*BLUE-GREEN ALGAE*					
	OSCILLATORIA SP.	4.0	0.0	0.0	0.0	1.0
	OSCILLATORIA AGARDHII	1.5	2.1	0.9	3.3	1.9
	OSCILLATORIA SUBBREVIS	0.0	2.9	0.0	0.0	0.7
	TOTAL	5.5	5.0	0.9	3.3	3.7
	GREEN ALGAE					
	ULOTHRIX AEQUALIS	10.8	32.5	18.7	10.3	18.1
	ULOTHRIX TENUISSIMA	5.9	19.4	43.3	18.9	21.9
	ACTINASTRUM HAUTSZCHII	2.4	0.0	0.4	0.4	0.8
	ULOTHRIX ZONATA	1.7	0.6	0.5	6.5	2.3
	ULOTHRIX VARIABILIS	1.1	8.3	8.8	6.5	6.2
	SCENEDESMUS ABUNDANS	0.2	0.0	0.0	0.0	0.0
	ANKISTRODESMUS FALCATUS	0.2	0.0	0.0	0.0	0.0
	OOCYSTIS PUSILLA	0.2	0.0	0.0	0.0	0.0
	CLOSTERIOPSIS LONGISSIMA	0.1	0.0	0.0	0.0	0.0
	CRUCIGENIA QUADRATA	0.0	0.2	0.0	0.0	0.0
	CYLINDROCYSTIS SP.	0.0	0.2	0.0	0.0	0.0
	CYLINDROCAPSA SP.	0.0	5.5	0.0	0.0	1.4
	SPHAEROCYSTIS SCHROETERI	0.0	0.0	0.9	2.5	0.8
	ULOTHRIX SUBCONSTRICTA	0.0	0.0	0.0	4.7	1.2
	TOTAL	22.6	66.7	72.6	49.8	52.9
	DIATOMS					
	DIATOMA HIEMALE	20.7	8.3	6.3	15.0	12.6
	MELOSIRA BINDERANA	10.9	10.6	5.8	5.9	8.3
	FRAGILARIA SP.	9.0	0.7	1.4	11.5	5.6
	MELOSIRA VARIANS	8.1	2.2	2.9	4.2	4.3
	MELOSIRA SP.	7.9	1.8	1.9	3.0	3.6
	TABELLARIA FENESTRATA	4.4	0.0	0.6	3.2	2.0
	FRAGILARIA CROTONENSIS	3.4	0.9	5.6	1.8	2.9
	MELOSIRA ISLANDICA	1.8	0.4	0.0	0.0	0.5
	FRAGILARIA LAPPONICA	0.9	0.0	0.0	0.0	0.2
	GOMPHONEMA SP.	0.7	0.8	0.3	0.7	0.6
	SYNEDRA SP.	0.7	0.0	0.0	0.0	0.2
	COSCINODISCUS ROTHII	0.5	0.0	0.1	0.1	0.2
	ASTERIONELLA FORMOSA	0.4	0.0	0.0	0.0	0.1
	TABELLARIA FLOCCULOSA	0.4	0.1	0.0	0.0	0.1
	CYCLOTELLA BODANICA	0.3	0.0	0.0	0.0	0.1
	STEPHANODISCUS NIAGARAE	0.2	0.2	0.1	0.1	0.1
	PENNATE, UNIDENTIFIED	0.1	0.0	0.0	0.0	0.0
	STEPHANODISCUS SP.	0.1	0.0	0.0	0.0	0.0
	TABELLARIA SP.	0.0	1.3	0.0	0.0	0.3
	COCCONEIS SP.	0.0	0.0	0.1	0.0	0.0
	CYCLOTELLA SP.	0.0	0.0	0.0	0.3	0.1
	STEPHANODISCUS ASTRAEA	0.0	0.0	0.0	0.4	0.1
	SURIRELLA SP.	0.0	0.0	0.0	0.2	0.0
	RHOICOSPHENIA SP.	0.0	0.0	0.0	0.1	0.0
	TOTAL	70.5	27.3	25.1	46.5	42.3
	CRYPTOMONADS					
	UNKNOWN	1.4	0.4	0.4	0.1	0.6
	TOTAL	1.4	0.4	0.4	0.1	0.6
	OTHER					
	DINOBRYON SP.	0.1	0.0	0.0	0.0	0.0
	DINOBRYON SERTULARIA	0.0	0.6	0.0	0.5	0.3
	TOTAL	0.1	0.6	0.0	0.5	0.3
	TOTAL ALL ALGAE	100.1	100.0	99.0	100.2	99.8

DATE	TAXON	STA. 1	STA. 2	STA. 3	STA. 4	STA. 5	AVERAGE
		--PERCENT COMPOSITION--					
7/12/83	*GREEN ALGAE*						
	CLADOPHORA GLOMERATA	99.0	99.0	99.0	99.0	99.0	99.0
	STIGEOCLONIUM SP.	0.0	0.0	0.0	0.1	0.0	0.0
	TOTAL	99.0	99.0	99.0	99.1	99.0	99.0
	DIATOMS						
	GOMPHONEMA PARVULUM	0.4	0.4	0.4	0.3	0.2	0.3
	RHOICOSPHENIA CURVATA	0.4	0.4	0.4	0.3	0.2	0.3
	FRAGILARIA INTERMEDIA	0.1	0.0	0.0	0.0	0.0	0.0
	COCCONEIS PEDICULUS	0.0	0.2	0.1	0.1	0.1	0.1
	CYMBELLA VENTRICOSA	0.0	0.0	0.1	0.0	0.1	0.0
	CYCLOTELLA SP.	0.0	0.0	0.0	0.1	0.0	0.0
	FRAGILARIA SP.	0.0	0.0	0.0	0.0	0.1	0.0
	STEPHANODISCUS HANTZSCHII	0.0	0.0	0.0	0.0	0.1	0.0
	HANTZ CHIA SP.	0.0	0.0	0.0	0.0	0.1	0.0
	TOTAL	0.9	1.0	1.0	0.8	0.9	0.9
	TOTAL ALL ALGAE	99.9	100.0	100.0	99.9	99.9	99.9

DATE	TAXON	STA. 6	STA. 7	STA. 8	STA. 9	AVERAGE
		--PERCENT COMPOSITION--				
7/12/83	*GREEN ALGAE*					
	CLADOPHORA GLOMERATA	99.0	99.0	99.0	99.0	99.0
	TOTAL	99.0	99.0	99.0	99.0	99.0
	DIATOMS					
	GOMPHONEMA PARVULUM	0.4	0.4	0.4	0.4	0.4
	RHOICOSPHENIA CURVATA	0.4	0.4	0.4	0.4	0.4
	COCCONEIS PEDICULUS	0.2	0.2	0.2	0.2	0.2
	TOTAL	1.0	1.0	1.0	1.0	1.0
	TOTAL ALL ALGAE	100.0	100.0	100.0	100.0	100.0

DATE	TAXON	STA. 1	STA. 2	STA. 3	STA. 4	STA. 5	AVERAGE
		--PERCENT COMPOSITION--					
9/15/83	*BLUE-GREEN ALGAE*						
	OSCILLATORIA AGARDHII	34.7	60.2	64.4	59.7	63.6	56.5
	MERISMCPEDIA TENUISSIMA	22.9	7.3	13.6	7.0	6.0	11.4
	ANABAENA SP.	10.3	11.1	3.1	1.5	13.0	7.8
	APHANOCAPSA ELACHISTA	8.2	1.0	0.0	0.0	0.0	1.8
	ANABAENA SPIRAICES	5.9	1.3	0.0	0.0	0.0	1.4
	LYNGBYA AERUGINEO-CAERULEA	5.6	3.2	1.4	0.0	0.0	2.0
	OSCILLATORIA TENUIS	5.0	0.0	0.0	8.1	0.0	2.6
	OSCILLATORIA ANGUSTA	3.0	4.4	8.1	6.3	12.8	6.9
	CYLINDRESPERMUM MINUTISSIMA	2.1	3.6	0.0	0.7	1.2	1.5
	MICROCYSTIS AERUGINOSA	0.8	0.0	0.9	1.6	0.6	0.8
	ANABAENA WISCCNSINENSE	0.5	0.1	1.9	3.6	1.5	1.5
	LYNGBYA LIMNETICA	0.0	5.4	0.0	0.0	0.0	1.1
	LYNGBYA MAJOR	0.0	0.0	2.7	0.0	0.0	0.5
	LYNGBYA VERSICOLOR	0.0	0.0	0.0	6.8	0.0	1.4
	LYNGBYA AESTUARII	0.0	0.0	0.0	1.3	0.0	0.3
	PHARMIDIUM SUBFUSCUM	0.0	0.0	0.0	0.6	0.0	0.1
	TOTAL	99.0	97.6	96.1	97.2	98.7	97.7
	GREEN ALGAE						
	CCSMARIUM SP.	0.1	0.1	0.0	0.1	0.0	0.1
	SCENEDESMUS QUADRICAUDA	0.1	0.1	0.0	0.0	0.1	0.1
	SCENECESMUS ABUNCANS	0.1	0.0	0.0	0.0	0.2	0.1
	CCCYSTIS SP.	0.0	0.2	0.0	0.0	0.0	0.0
	ANKISTRODESMUS SP.	0.0	0.1	0.0	0.0	0.0	0.0
	ANKISTRODESMUS CONVOLUTUS	0.0	0.1	0.1	0.0	0.0	0.0
	ACTINASTRUM HAUTSZCHII	0.0	0.4	0.0	0.0	0.0	0.1
	CCELASTRUM RETICULATUM	0.0	0.0	0.4	0.0	0.0	0.1
	ULOTHRIX SUBTILISSIMA	0.0	0.0	0.3	0.0	0.0	0.1
	PECIASTRUM DUPLEX	0.0	0.0	1.6	0.0	0.0	0.3
	SCENEDESMUS DIMORPHUS	0.0	0.0	0.0	0.2	0.0	0.0
	CLCSTERIOPSIS LONGISSIMA V. TROPICA	0.0	0.0	0.0	0.0	0.1	0.0
	TOTAL	0.3	1.0	2.4	0.3	0.4	0.9
	DIATOMS						
	PENNATE, UNIDENTIFIED	0.3	1.3	1.0	2.0	0.7	1.1
	GOMPHONEMA SP.	0.2	0.1	0.0	0.2	0.2	0.1
	CYMBELLA SP.	0.1	0.3	0.2	0.3	0.0	0.2
	COSCINODISCUS ROTHII	0.0	0.1	0.2	0.4	0.0	0.1
	MELOSIRA ISLANDICA	0.0	0.0	0.0	0.1	0.0	0.0
	MELOSIRA SP.	0.0	0.0	0.0	0.0	0.1	0.0
	STEPHANODISCUS ASTRAEA	0.0	0.0	0.0	0.0	0.1	0.0
	TOTAL	0.6	1.8	1.4	3.0	1.1	1.6
	CRYPTOMONADS						
	UNKNOWN	0.1	0.0	0.1	0.0	0.0	0.0
	TOTAL	0.1	0.0	0.1	0.0	0.0	0.0
	TOTAL ALL ALGAE	100.0	100.4	100.0	100.5	100.2	100.2

DATE	TAXON	--PERCENT COMPOSITION-- STA. 6	STA. 7	STA. 8	STA. 9	AVERAGE
9/15/83	*BLUE-GREEN ALGAE*					
	OSCILLATORIA AGARDHII	62.9	64.8	45.6	56.4	57.4
	OSCILLATCRIA ANGUSTA	9.7	3.0	9.8	13.8	9.1
	OSCILLATORIA TENUIS	6.5	0.9	8.5	0.0	4.0
	MERISMOPEDIA TENUISSIMA	5.0	11.7	10.4	6.7	8.4
	ANABAENA SP.	5.0	1C.4	17.5	7.1	10.0
	ANABAENA WISCONSINENSE	4.1	3.9	1.0	4.1	3.3
	MICROCYSTIS AERUGINOSA	2.3	0.0	0.0	0.0	0.6
	CYLINDRESPERMUM MINUTISSIMA	0.8	2.9	1.1	0.0	1.2
	LYNGBYA MARTENSIANA	0.0	0.0	2.3	0.0	0.6
	GCMPHCSPHAERIA APONINA	0.0	0.0	1.0	0.0	0.3
	LYNGBYA DIGUETTI	0.0	C.0	0.0	9.0	2.3
	TCTAL	96.3	97.6	97.2	97.1	97.0
	GREEN ALGAE					
	STAURASTRUM SP.	C.1	C.0	0.0	0.0	0.0
	PEDIASTRUM DUPLEX	C.1	C.0	0.0	0.0	0.0
	STIGECCLONIUM SP.	0.1	0.0	0.0	1.4	0.4
	OOCYSTIS PUSILLA	0.0	0.4	0.0	0.0	0.1
	SCENEDESMUS QUADRICAUDA	0.0	C.0	0.2	0.0	0.0
	ACTINASTRUM HAUTSZCHII	C.0	C.0	0.4	0.0	0.1
	COSMARIUM SP.	0.0	0.0	0.0	0.1	0.0
	LAGERHEIMIA SUBSALA	0.0	0.0	0.0	0.1	0.0
	TOTAL	0.3	0.4	0.6	1.6	0.7
	DIATOMS					
	PENNATE, UNIDENTIFIED	1.9	0.5	1.8	0.7	1.2
	FRAGILARIA CROTONENSIS	0.9	0.0	0.0	0.3	0.3
	COSCINODISCUS ROTHII	0.2	0.4	0.1	0.1	0.2
	RHOICOSPHENIA CURVATA	0.1	0.0	0.0	0.0	0.0
	GOMPHONEMA SP.	0.1	0.C	0.1	0.2	0.1
	MELOSIRA SP.	0.C	C.5	0.1	0.0	0.1
	CYCLOTELLA SP.	0.0	0.0	0.0	0.1	0.0
	CYMBELLA SP.	0.0	0.0	0.0	0.1	0.0
	TOTAL	3.2	1.4	2.1	1.5	2.0
	CRYPTOMONADS					
	UNKNOWN	0.0	0.1	0.1	0.0	0.1
	TOTAL	0.0	0.1	0.1	0.0	0.1
	TOTAL ALL ALGAE	99.8	99.5	100.0	100.2	99.9

APPENDIX J: PERIPHYTON BIOMASS DATA (BREAKWATERS)

DATE	STATION	CHL A (mg/sq m)	AFDWT (g/sq m)
04/23/82	1	1	3
	2	0	0
	3	1	1
	4	1	1
	5	1	1
07/07/82	1	1905	321
	2	1372	99
	3	1714	264
	4	2623	262
	5	4306	565
09/14/82	1	123	21
	2	328	33
	3	375	34
	4	137	12
	5	69	15
	6	100	17
	7	0	0
	8	65	7
	9	309	12
04/19/83	1	61	20
	2	23	6
	3	12	3
	4	50	15
	5	42	10
	6	11	1
	7	14	5
	8	26	7
	9	18	2
07/12/83	1	609	117
	2	129	58
	3	1257	82
	4	577	90
	5	866	203
	6	1743	114
	7	1969	261
	8	1619	106
	9	916	161
09/15/83	1	64	28
	2	124	20
	3	140	30
	4	200	34
	5	47	12
	6	70	21
	7	102	9
	8	137	22
	9	136	30