1995 ANNUAL ENVIRONMENTAL REPORT
NON-RADIOLOGICAL
DUQUESNE LIGHT COMPANY
BEAVER VALLEY POWER STATION
UNITS NO. 1 AND 2
LICENSES DPR-66 AND NPF-73

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DUQUESNE LIGHT COMPANY
1995 ANNUAL ENVIRONMENTAL REPORT

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EXECUTIVE SUMMARY

The 1995 Beaver Valley Power Station (BVPS) Units 1 and 2 Non-Radiological Environmental Monitoring Program consisted of an Aquatic Program covering surveillance and field sampling of Ohio River aquatic life. The Aquatic Program is an annual program conducted by Duquesne Light Company to assess both the impact of the operating BVPS on the aquatic ecosystem of the Ohio River, and the potential impacts of biofouling organisms (Corbicula and zebra mussels) on BVPS operations. This is the twentieth year of operational environmental monitoring for Unit 1 and the ninth for Unit 2. As in previous years, no evidence of adverse environmental impact to the aquatic life in the Ohio River was observed.

The 1995 benthic macroinvertebrate surveys indicated normal community structure upstream and downstream from BVPS. These benthic surveys are a continuation of a Fate and Effects Study (1990 through 1992) conducted for the Pennsylvania Department of Environmental Protection to assess ecosystem impacts of the molluscicide CT-1. The molluscicide CT-1 is used to control biofouling organisms at BVPS. To date, these studies have shown that the continued use of CT-1 at the BVPS has not been detrimental to the aquatic community below the BVPS discharge. In 1995, five new species were added to the cumulative taxa list of macroinvertebrates collected near BVPS.

The fish community of the Ohio River in the vicinity of BVPS was sampled in 1995 by gill nets, night electrofishing and seining. Results for the 1995 fish surveys indicate normal community structure based on species composition and relative abundance. Since monitoring began in the early seventies, the number of fish taxa has increased from 43 to 77 for the New Cumberland Pool.

The results of the 1995 ichthyoplankton surveys showed normal spawning cycles for the fish species inhabiting the Ohio River in the vicinity of BVPS. Freshwater drum (eggs) dominated the 1995 ichthyoplankton surveys total catch.

The ichthyoplankton surveys also serve as a monitoring technique for detecting the presence of juvenile Corbicula and zebra mussels in the Ohio River water column, which can be drawn into the BVPS intake structure. In 1995, juvenile Corbicula were first detected in the ichthyoplankton samples collected on April 26, and peak densities were observed in the July 31 samples. No zebra mussels were collected in the 1995 ichthyoplankton samples.

In 1995, Corbicula were first detected in the larval cages removed from the BVPS intake structure in June (colonization period April 21 to June 23). The presence of larger juvenile Corbicula in the June cages indicates that the larval forms of those individuals probably entered the cages in late April or May. Corbicula densities in the larval cages peaked in August, then gradually declined in September and October. As river water temperatures declined in late October through December, the number of Corbicula colonizing the larval cages decreased and their growth rate also decreased. No zebra mussels were found in the intake structure larval cages in 1995.

The Corbicula impingement total for 1995 was the second highest since 1985 (combined total of 7,352 live and dead clams). The greatest number of Corbicula were collected from the BVPS traveling screens in August. In general, the population of Corbicula in the Ohio River has remained high and continues to provide large numbers of larvae, juvenile and adult Corbicula into BVPS. No zebra mussels were collected from the 1995 impingement surveys.

Since 1991, zebra mussels have been moving progressively upstream in the Ohio River. In 1993, zebra mussels were identified at the Pike Island Locks and Dam (mile point 84.2), fifty miles downstream of BVPS. In 1994, zebra mussels were identified in the Ohio River upstream from the BVPS at the Emsworth Locks and Dam (mile point 6.2) and at Lock & Dam 4 and 7 on the Allegheny River. The U.S. Army Corps of Engineers reported zebra mussels at the New Cumberland Locks and Dam (Ohio River) on May 11, 1995 and on July

28, 1995, sixteen zebra mussels were reported at the Maxwell Locks and Dam (Monongahela River).

The 1995 Zebra Mussel Monitoring Program indicated the presence of live zebra mussels at BVPS. In 1995, live zebra mussels were found by divers in the BVPS main intake structure and auxiliary intake structure during scheduled cleaning operations conducted on October 25 (main intake) and November 2 (auxiliary intake). Twenty-four zebra mussels were collected, fourteen from the inner Bay C of the main intake structure and ten from the auxiliary intake structure. The largest zebra mussel found measured 16 mm in length.

DUQUESNE LIGHT COMPANY
1995 ANNUAL ENVIRONMENTAL REPORT

I. INTRODUCTION

This report presents a summary of the Non-Radiological Environmental Program conducted by Duquesne Light Company (DLC) during calendar year 1995, for the Beaver Valley Power Station (BVPS) Units 1 & 2, Operating License Numbers DPR-66 and NPF-73. This is a voluntary program, since the Nuclear Regulatory Commission (NRC) on February 26, 1980, granted DLC's request to delete all of the Aquatic Monitoring Program, with the exception of the fish impingement (Amendment No. 25), from the Environmental Technical Specifications (ETS), and in 1983, dropped the fish impingement studies from the ETS program of required sampling along with non-radiological water quality requirements. However, in the interest of providing a non-disruptive database DLC is continuing the Aquatic Monitoring Program.

A. <u>SCOPE AND OBJECTIVES OF THE PROGRAM</u>

The objectives of the 1995 environmental program were:

(1) to assess the possible environmental impact of BVPS operation on the benthos and fish communities in the Ohio River,

(2) to provide a sampling program for continuing a non-disruptive database for the Ohio River near BVPS, preoperational to present,

(3) to protect BVPS from the biofouling organisms,
- to evaluate the presence, growth and reproduction of <u>Corbicula</u> at BVPS,
- monitor for the infestation of the zebra mussel at BVPS.

B. SITE DESCRIPTION

BVPS is located on the south bank of the Ohio River in the Borough of Shippingport, Beaver County, Pennsylvania, on a 501 acre tract of land. The Shippingport Atomic Power Station once shared the site with BVPS before being decommissioned. Figure I-1 shows an aerial view of BVPS. The site is approximately 1 mile (1.6 km) from Midland, Pennsylvania; 5 miles (8 km) from East Liverpool, Ohio; and 25 miles (40 km) from Pittsburgh, Pennsylvania. Figure I-2 shows the site location in relation to the principal population centers. The population within a 5 mile (8 km) radius of the plant is approximately 18,000. The Borough of Midland, Pennsylvania, has a population of approximately 3,500.

The site lies along the Ohio River in a valley which has a gradual slope extending from the river (elevation 665 ft. (203 m) above sea level) to an elevation of 1,160 ft. (354 m) along a ridge south of BVPS. Plant entrance elevation at the station is approximately 735 ft. (224 m) above sea level.

The station is situated on the Ohio River at river mile 34.8, at a location on the New Cumberland Pool that is 3.3 river miles (5.3 km) downstream from Montgomery Lock and Dam and 19.4 miles (31.2 km) upstream from New Cumberland Lock and Dam. The Pennsylvania-Ohio-West Virginia border is 5.2 river miles (8.4 km) downstream from the site. The river flow is regulated by a series of dams and reservoirs on the Beaver, Allegheny, Monongahela, and Ohio Rivers and their tributaries. The average flow in 1995 was 28,000 cubic feet per second (cfs). The range of flows in 1995 is shown on Figure I-3, as well as Table I-1. The maximum flow occurred in January (101,000 cfs) and the minimum in August and September (4,000 cfs).

Ohio River water temperatures generally vary from 32° to 84°F (0° to 29°C). Minimum and maximum temperatures generally occur in January and July/August, respectively. During 1995, minimum temperatures

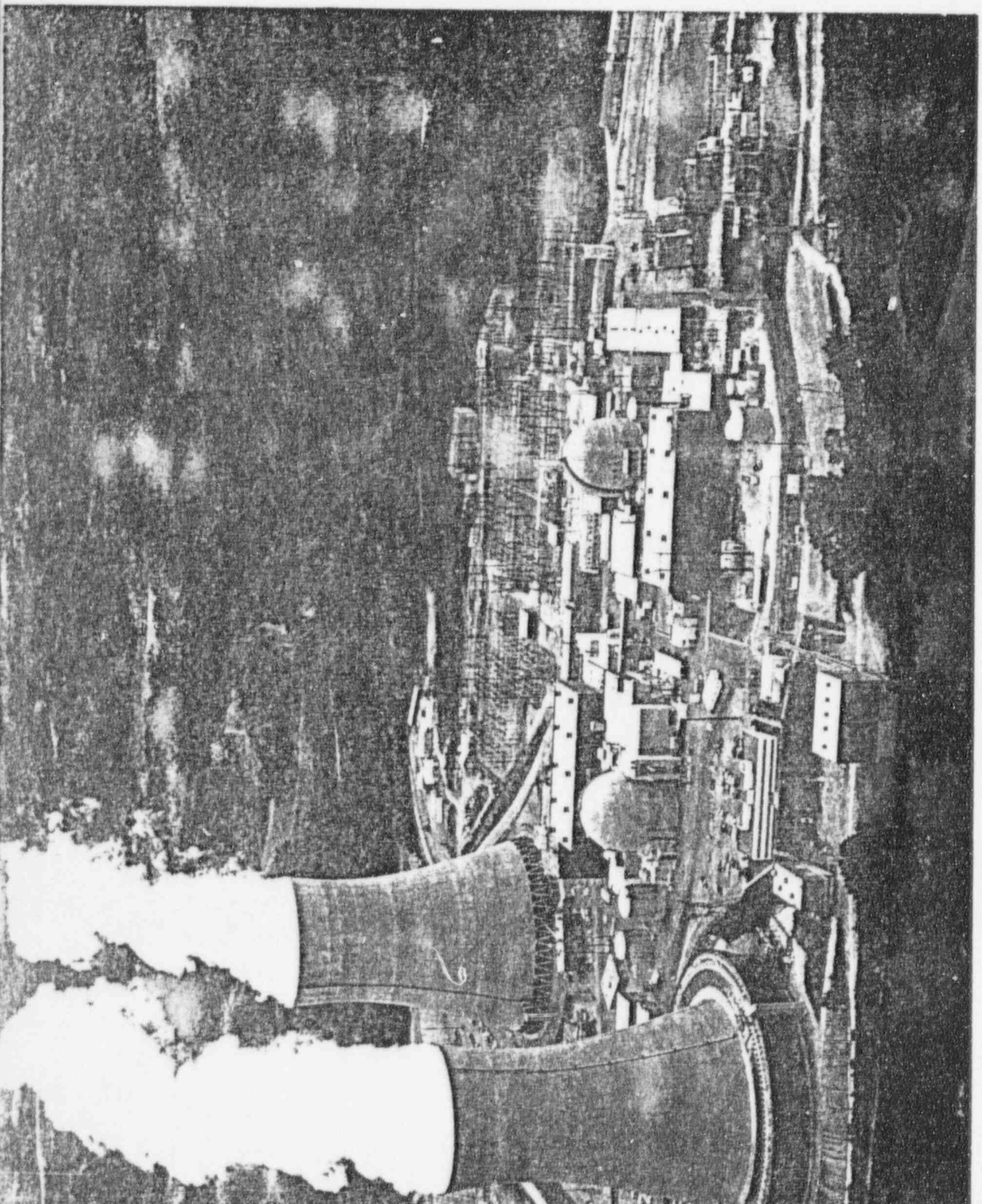


FIGURE I-1
VIEW OF THE BEAVER VALLEY POWER STATION
BVPS

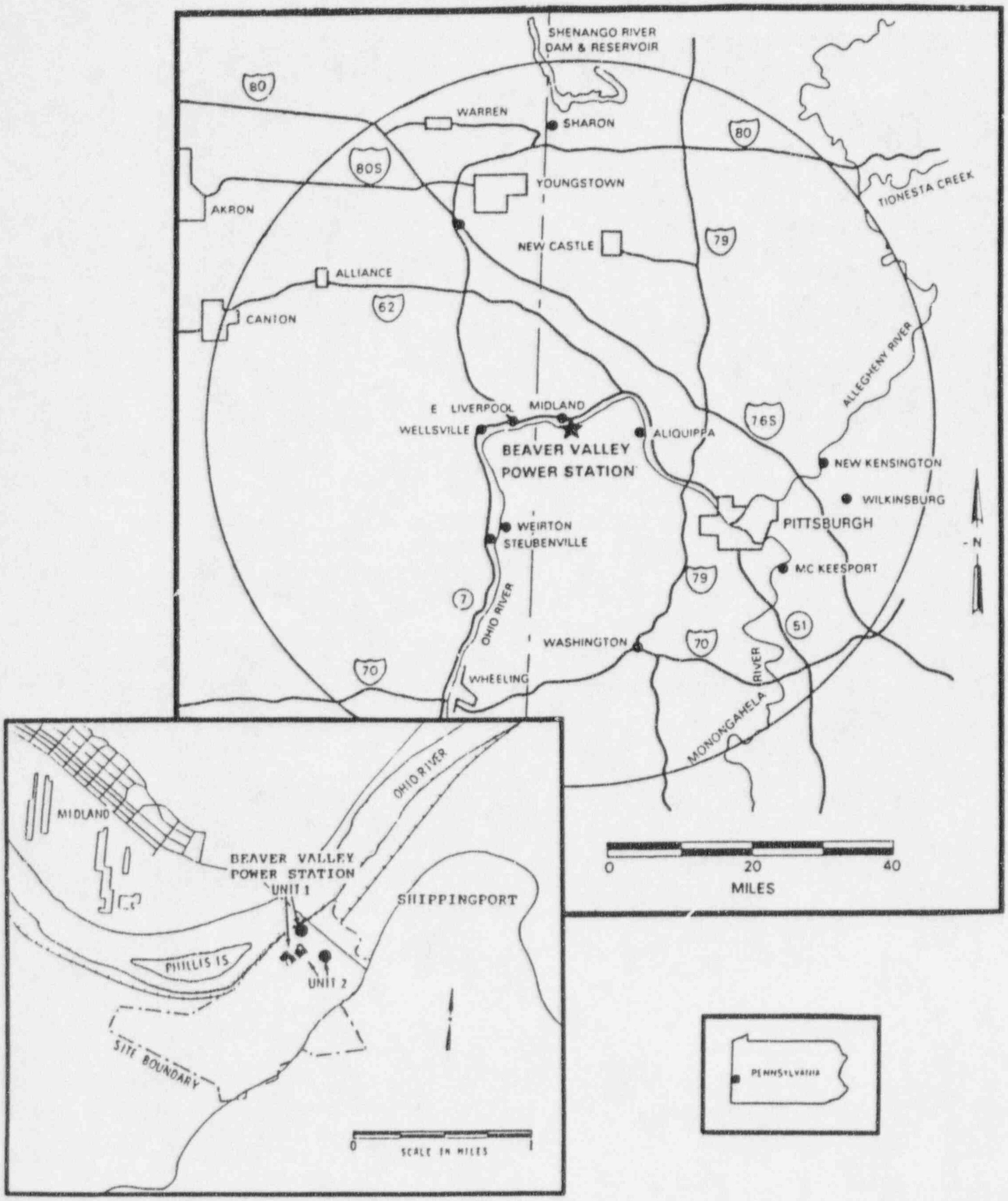


FIGURE I-2

LOCATION OF STUDY AREA, BEAVER VALLEY POWER STATION
SHIPPINGPORT, PENNSYLVANIA
BVPS

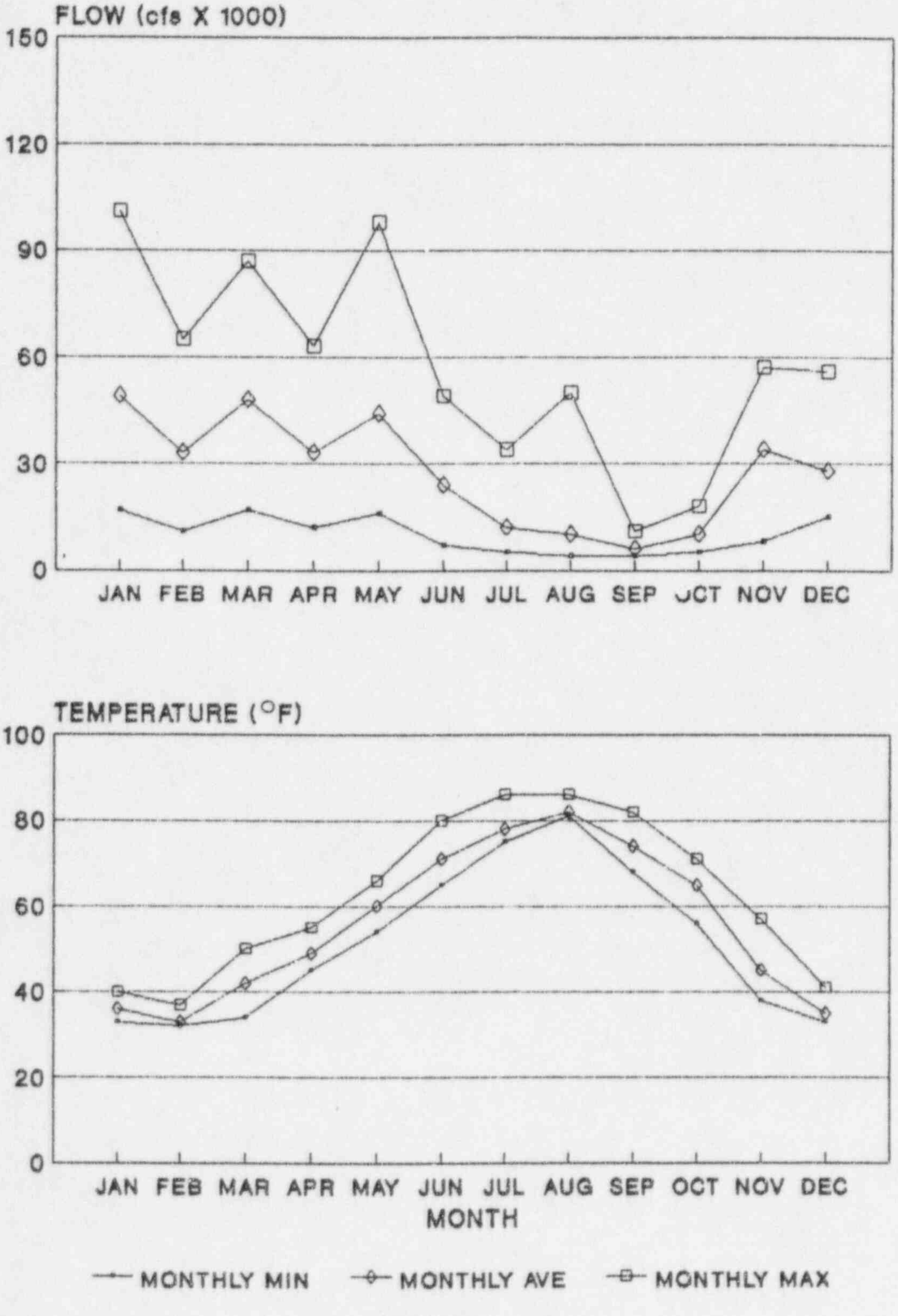


FIGURE I-3

OHIO RIVER FLOW (cfs) AND TEMPERATURE (°F)
RECORDED BY THE U.S. ARMY CORPS OF ENGINEERS
FOR THE NEW CUMBERLAND POOL, 1995
BVPS

TABLE I-1

OHIO RIVER FLOW (cfs) AND TEMPERATURE (°F) RECORDED BY THE
U.S. ARMY CORPS OF ENGINEERS FOR THE
NEW CUMBERLAND POOL, 1995
BVPS

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flow (cfs x 10^3)												
Monthly Maximum	101	65	87	63	98	49	34	50	11	18	57	56
Monthly Average	49	33	48	33	44	24	12	10	6	10	34	28
Monthly Minimum	17	11	17	12	16	7	5	4	4	5	8	15
Temperature (°F)												
Monthly Maximum	40	37	50	55	66	80	86	86	82	71	57	41
Monthly Average	36	33	42	49	60	71	78	82	74	65	45	35
Monthly Minimum	33	32	34	45	54	65	75	81	68	56	38	33

were observed in February and maximum temperatures in July and August (Figure I-3 and Table I-1).

BVPS Units 1 & 2 have a thermal rating of 2,660 megawatts (Mw). Units 1 & 2 have a design electrical rating of 835 Mw and 836 Mw, respectively. The circulating water systems are a closed cycle system using a cooling tower to minimize heat released to the Ohio River. Commercial operation of BVPS Unit 1 began in 1976 and Unit 2 began operation in 1987.

II. SUMMARY AND CONCLUSIONS

The following paragraphs summarize the findings for each section of the BVPS Aquatic Program:

Benthos

Substrate was probably the most important factor controlling the distribution and abundance of the benthic macroinvertebrates in the Ohio River near BVPS. Soft muck-type substrates along the shoreline were conducive to worm and midge proliferation, while limiting macroinvertebrates which require a more stable bottom. At the shoreline stations, Oligochaeta accounted for 77% of the macrobenthos collected, whereas Chironomidae and Mollusca each accounted for about 18% and 4%, respectively.

In 1995, five new species were added to the cumulative taxa list of macroinvertebrates collected near BVPS. This included four species collected in the benthos samples, plus the zebra mussel Dreissena polymorpha, which was collected by divers in the BVPS main and auxiliary intake structures during scheduled cleaning operations.

Community structure has changed little since preoperational years and there was no evidence that BVPS operations were affecting the benthic community of the Ohio River.

Phytoplankton/Zooplankton

The plankton communities (phyto- and zooplankton) have been sampled and analyzed at the BVPS on a monthly basis from 1973 through 1992. The results of this twenty year study showed that the long term trends for the plankton communities were consistent from year to year. Annual variations were attributable to either extremes in precipitation and/or temperature. Overall, the plankton communities, both phytoplankton and zooplankton were considered typical of those in temperate climates (Hutchinson 1967).

Therefore, having compiled an extensive plankton database for the Ohio River, BVPS modified the plankton program, effective January 1993. Currently, samples are still collected from the same intake structure at monthly intervals and properly preserved as in previous years. However, these preserved samples have been archived pending a need for future laboratory analysis.

Fish

The fish community of the Ohio River in the vicinity of BVPS was sampled in 1995 by gill nets, electrofishing and seining. The results of the 1995 fish surveys show normal community structure based on species composition and relative abundance. Forage species were collected in the highest numbers, particularly gizzard shad and emerald shiners. This indicates a normal fish community, since game species (predators) rely on this forage base for their survival. Variations in total annual catch are a natural occurrence and are attributable primarily to fluctuations in the population size of the forage species. Forage species, such as gizzard shad and emerald shiner with high reproductive potentials frequently respond to changes in natural environmental factors (competition, food availability, cover, and water quality) with large fluctuations in population size.

Although variations in total catch occurred from station to station in 1995, species composition remained fairly stable. Common taxa collected in the 1995 surveys by all methods included gizzard shad, emerald shiner, redhorse species, spottail shiner, channel catfish, common carp, sauger, freshwater drum, quillback and flathead catfish. Differences observed in catch between the Control (1) and Non-Control Stations (2A, 2B and 3) were probably caused by habitat preferences of individual species. Habitat preference is probably the most influential factor that affects where the different species of fish are collected and in what relative abundance.

Ichthyoplankton

Freshwater drum dominated the 1995 ichthyoplankton catch from the back channel of Phillis Island. Common carp and gizzard shad ranked next in terms of abundance. Ichthyoplankton densities were low during April and early May, then moderately increased in late May prior to the peak in early June. Densities gradually decreased through late July, and remained low through the final survey. This represents normal spawning cycles for the fish species inhabiting the Ohio River in the vicinity of the BVPS.

Fish Impingement

The results of the 1995 impingement surveys indicate that during the month of August large numbers of Corbicula were collected off of the traveling screens. Although this trend has occurred in previous years, the August 1995 total was the second highest in the period since 1985. The number of fish collected from the 1995 impingement surveys at BVPS was within the range observed for previous operational years and indicates that withdrawal of river water at BVPS intake for cooling purposes has very little effect on the fish populations. No zebra mussels were collected from the 1995 impingement surveys.

Plankton Entrainment

1. Ichthyoplankton

Freshwater drum (eggs) dominated the 1995 ichthyoplankton catch from the main channel of the Ohio River in front of the BVPS. The most common fish larvae collected were freshwater drum, common carp and gizzard shad. Ichthyoplankton densities began to increase in May, peaked in early June and decreased in late July. This represents normal spawning cycles for the fish species inhabiting the Ohio River in the vicinity of the BVPS.

2./3. Phytoplankton / Zooplankton

The plankton communities (phyto- and zooplankton) have been sampled and analyzed at the BVPS on a monthly basis from 1973 through 1992. The results of this twenty year study showed that the long term trends for the plankton communities were consistent from year to year. Annual variations were attributable to either extremes in precipitation and/or temperature. Overall, the plankton communities, both phytoplankton and zooplankton were considered typical of those in temperate climates (Hutchinson 1967).

Therefore, having compiled an extensive plankton database for the Ohio River, BVPS modified the plankton program, effective January 1993. Currently, samples are still collected from the same intake structure at monthly intervals and properly preserved as in previous years. However, these preserved samples have been archived pending a need for future laboratory analysis.

Corbicula Monitoring

The weekly screen washing data for 1995 showed that juveniles and adult Corbicula float into BVPS. A trend that has been observed every year since 1985 is that the August and September screen washing collections produce the highest number of Corbicula. The Corbicula screen washing total for 1995 was the second highest since 1985.

The monthly reservoir scraper samples collected in Units 1 and 2 cooling towers during 1995 indicated when Corbicula were entering and colonizing the reservoirs. Corbicula entered the Units 1 and 2 cooling towers through the circulating water systems primarily in July and August of 1995.

Sediment samples were collected in the Unit 1 cooling tower (January 12, 1995) and Unit 2 cooling tower (March 27, 1995) lower reservoirs during the scheduled outages in order to estimate the

Corbicula populations within those structures. The estimated number of Corbicula inhabiting the Units 1 and 2 cooling towers at the time of the surveys were 382 million and 7 million clams, respectively. Population surveys of both BVPS cooling tower reservoirs conducted during scheduled outages (1986 through 1995) have resulted in lower densities of Corbicula in the Unit 2 tower compared to the Unit 1 cooling tower. This can be attributed to differences in cooling tower design and the faster water currents in the Unit 2 cooling tower reservoir, which decrease sediment deposition.

The collection of juvenile Corbicula from the ichthyoplankton samples demonstrates that Corbicula are typically present in the water column of the Ohio River during the late spring/summer period. These small clams are carried downstream by river currents and enter BVPS through the intake structure. The highest densities of Corbicula in 1995 occurred in the July 31 ichthyoplankton samples collected from both the main and back channel stations.

Juvenile Corbicula were first detected in the larval cages removed from the BVPS intake structure in June. This late spring/early summer spawning period typically occurs in the Ohio River near BVPS each year. The Corbicula larvae entering the larval cages during the summer months exhibited rapid growth, attaining a maximum length of 15.17 mm (colonization period July 21 to September 15). The presence of juvenile Corbicula in the December larval cages suggests that Corbicula were still spawning up to the end of October. As the river temperatures dropped below 50 °F in mid November, the growth rate of Corbicula in the intake structure larval cages decreased. No zebra mussels were found in the intake structure larval cages in 1995.

Zebra Mussel Monitoring

The zebra mussel (Dreissena polymorpha) is an exotic freshwater mollusk that is believed to have been introduced into Lake St. Clair in 1987 via ballast water of ocean-going cargo vessels.

Since then, they have spread rapidly to the other Great Lakes and are infesting riverine systems in the United States.

Due to the proximity of the Ohio River to Lake Erie, BVPS initiated a Zebra Mussel Monitoring Program in January 1990. From 1991 through 1993, zebra mussels moved progressively upstream from the lower to upper Ohio River. In 1994, there were confirmed zebra mussel sightings at locations both upstream and downstream from BVPS, including the Allegheny River. The July 1995 sighting of zebra mussels at Maxwell Locks and Dam on the Monongahela River establishes the presence of these organisms within the Allegheny, Monongahela and Ohio Rivers in Western Pennsylvania.

The 1995 Zebra Mussel Monitoring Program indicated the presence of live zebra mussels at BVPS. In 1995, live zebra mussels were found by divers in the BVPS main intake structure and auxiliary intake structure during scheduled cleaning operations conducted on October 25 (main intake) and November 2 (auxiliary intake). Twenty-four zebra mussels were collected, fourteen from the inner Bay C of the main intake structure and ten from the auxiliary intake structure. The largest zebra mussel found measured 16 mm in length.

III. ANALYSIS OF SIGNIFICANT ENVIRONMENTAL CHANGE

The BVPS Unit 1 ETS, Appendix B to Operating License No. DPR-66, initially required that significant environmental change analyses be performed on benthos, phytoplankton, and zooplankton data. However, on February 26, 1980, the NRC granted DLC a request to delete all of the Aquatic Monitoring Program, with the exception of the fish impingement, from the ETS (Amendment No. 25, License No. DPR-66). Consequently, the requirements for Analysis of Significant Environmental Change was deleted by the NRC, and is not applicable to the present Aquatic Monitoring Program. In 1983, the NRC also deleted the requirement for fish impingement studies. However, in the interest of providing a non-disruptive database, DLC is continuing the Aquatic Monitoring Program.

IV. MONITORING NON-RADIOLOGICAL EFFLUENTS

A. MONITORING CHEMICAL EFFLUENTS

The Environmental Technical Specifications (ETS) that were developed and included as part of the licensing agreement for the BVPS, required that certain non-radiological chemicals and the temperature of the discharges be monitored and if limits were exceeded they had to be reported to the NRC. During 1983, the NRC (Amendment No. 64, License No. DPR-66) deleted these water quality requirements. The basis for this deletion is that the reporting requirements would be administered under the NPDES permit. However, the NRC requested that if any NPDES permit requirements were exceeded, that a copy of the violation be forwarded to the Director, Office of Nuclear Reactor Regulation.

B. HERBICIDES

Monitoring and reporting of herbicides used for weed control during 1995, is no longer required as stated in Amendment No. 64; thus, this information is not included in this report.

V. AQUATIC MONITORING PROGRAM

A. INTRODUCTION

The environmental study area, established to assess potential impacts, consisted of four sampling stations each having a north and south shore (Figure V-A-1). Station 1 is located at river mile (RM) 34.5, approximately 0.3 mi (0.5 km) upstream of BVPS and is the Control Station. Station 2A is located approximately 0.5 mi (0.8 km) downstream of the BVPS discharge structure in the main channel. Station 2B is located in the back channel of Phillis Island, also 0.5 mi downstream of the BVPS discharge structure. Station 2B is the principal Non-Control Station because the majority of aqueous discharges from BVPS Units 1 and 2 are released to the back channel. Station 3 is located approximately 2 mi (3.2 km) downstream of BVPS.

Sampling dates for each of the program elements are presented in Table V-A-1.

The following sections of this report present a summary of findings for each of the program elements.

B. BENTHOS

Objectives

The objectives of the benthic surveys were to characterize the macroinvertebrates of the Ohio River near BVPS and to determine the impacts, if any, of BVPS operations.

Methods

Benthic surveys were performed in May and September, 1995. Benthos samples were collected at Stations 1, 2A, 2B, and 3 (Figure V-B-1), using a Ponar grab sampler. Duplicate samples were taken off the south shore at Stations 1, 2A, and 3. Sampling at Station 2B, in

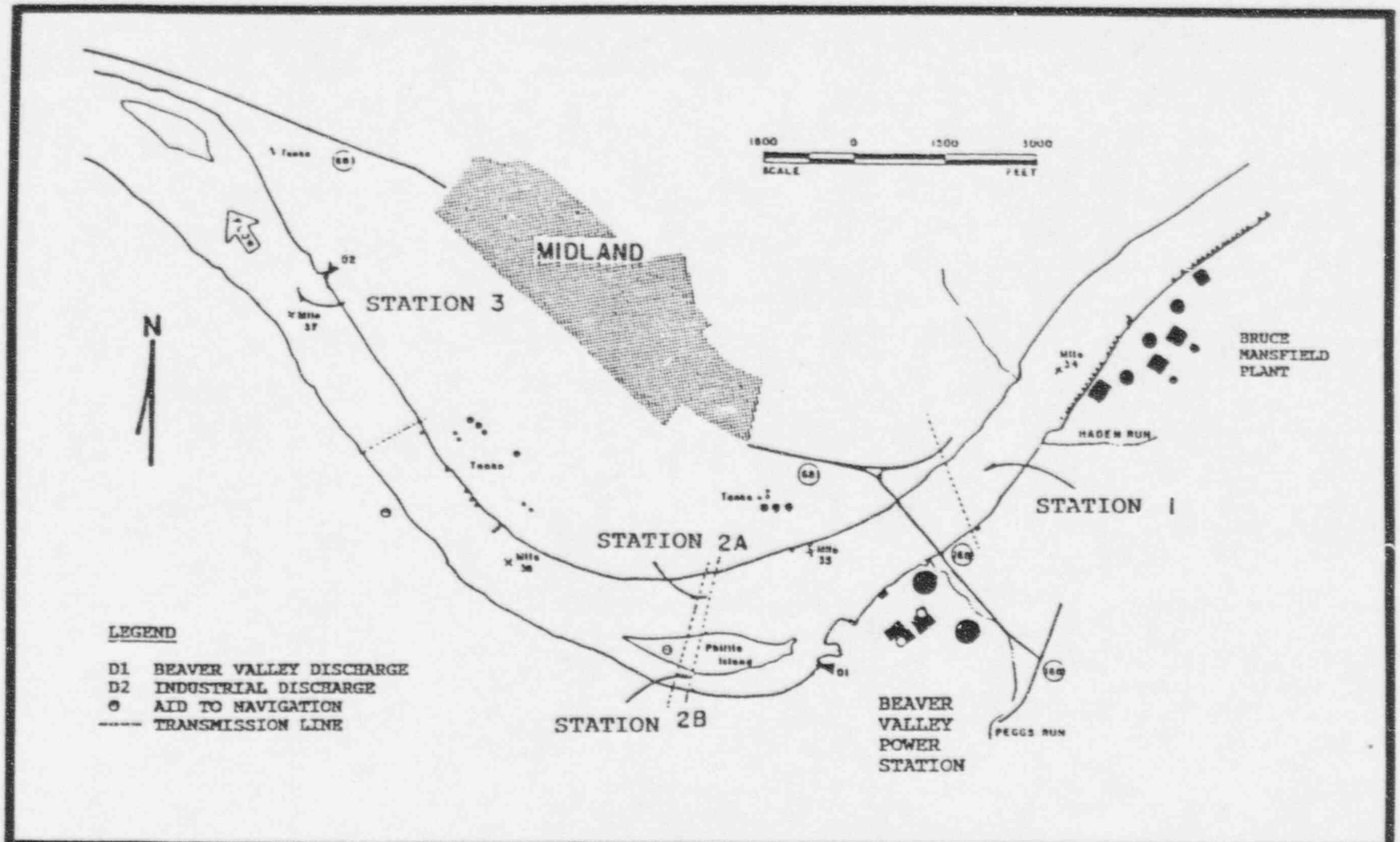


FIGURE V-A-1

SAMPLING STATIONS IN THE VICINITY OF THE
BEAVER VALLEY POWER STATION
BVPS

TABLE V-A-1

AQUATIC MONITORING PROGRAM SAMPLING DATES
1995 BVPS

Month	Benthos	Zebra Mussel and *Corbicula* Monitoring[a]	Fish	Impingement	Ichthyoplankton Night	Phyto- and Zooplankton
January		6,29		6		13
February		3,17		17,24		17
March		3,17,26,27,31		3,10,17,24,31		17
April		21		7,14,21,28	13,26	7
May	8	5,19	8,9	5,19,26	9.26	19
June		23,30		2,9,16,23,30	6,22	23
July		7,21,23	10,11	7,14,21,28	7,18,31	14
August		4,18		4,11,18,25	14,30	11
September	12	1,15,18	11,12	8,15,22,29		8
October		6,20,27		6,13,20,27		20
November		3,24	20,21	3,10,17,24		24
December		8,15,22		1		15

[a] Zebra Mussel and *Corbicula* Monitoring also includes all Impingement dates.

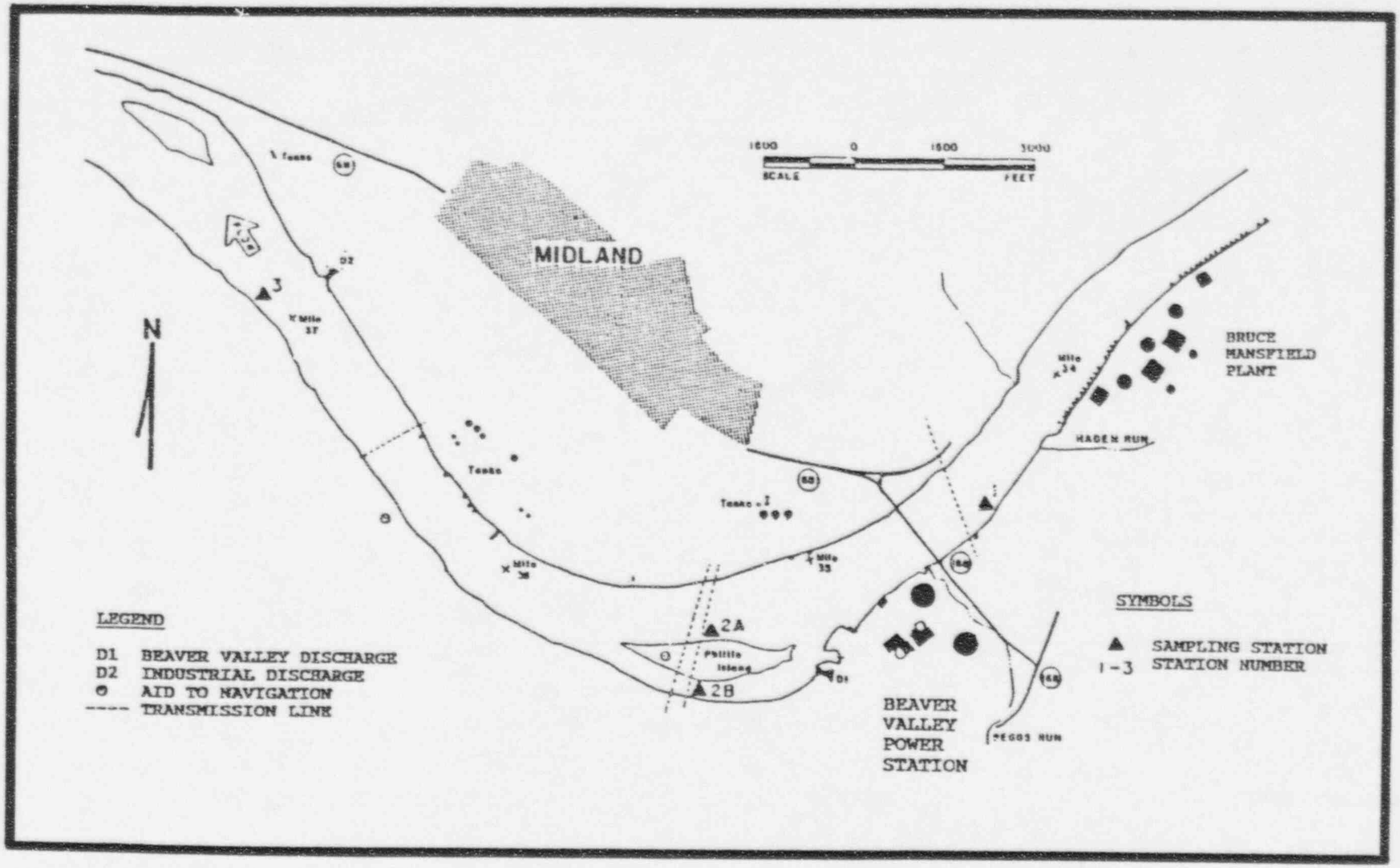


FIGURE V-B-1

BENTHOS SAMPLING STATIONS
BVPS

the back channel of Phillis Island, consisted of a single Ponar grab at the south, middle and north side of the channel.

Each grab was washed within a U.S. Standard No. 30 sieve and the remains placed in a bottle and preserved. In the laboratory, macroinvertebrates were sorted from each sample, identified to the lowest possible taxon and counted. Mean densities (numbers/m^2) for each taxon were calculated for each of the two replicates and three back channel samples. Three species diversity indices were calculated: Shannon-Weiner, evenness indices (Pielou 1969), and the number of species (taxa).

Habitats

Substrate type was an important factor in determining the composition of the benthic community. Two distinct benthic habitats exist in the Ohio River near BVPS. These habitats are the result of damming, channelization, and river traffic. Shoreline habitats were generally soft muck substrates composed of sand, silt, and detritus. An exception occurs along the north shoreline of Phillis Island at Station 2A where clay and sand predominate. The other distinct habitat, hard substrate, is located at midriver. The hard substrate is probably the result of channelization and scouring by river currents and turbulence from commercial boat traffic.

Results

Sixty-one macroinvertebrate taxa were identified during the 1995 monitoring program (Table V-B-1). Species composition during 1995 was similar to that observed during previous preoperational (1973 through 1975) and operational (1976 through 1994) years. The macroinvertebrate assemblage during 1995 was composed primarily of burrowing organisms typical of soft unconsolidated substrates. Oligochaetes (worms) and chironomid (midge) larvae were abundant (Tables V-B-2, V-B-3, and V-B-4). Common genera of oligochaetes were Limnodrilus, Nais, and Paranais. Common genera of chironomids

TABLE V-B-1

SYSTEMATIC LIST OF MACROINVERTEBRATES COLLECTED FROM 1973 THROUGH 1995 IN THE OHIO RIVER NEAR BVPS

Taxa	Collected in Previous Years	Collected in 1995
Porifera		
Spongilla fragilis	X	
Cnidaria		
Hydrozoa		
Clavidae		
Cordylophora lacustris	X	
Hydridae		
Craspedacusta sowerbii	X	
Hydra sp.	X	X
Platyhelminthes		
Tricladida	X	X
Rhabdocoela	X	
Nemertea	X	X
Nematoda	X	X
Entoprocta		
Urnatella gracilis	X	
Ectoprocta		
Fredericella sp.	X	X
Paludicella articulata	X	
Pectinatella sp.	X	
Plumatella sp.	X	
Annelida		
Oligochaeta		
Aeolosomatidae	X	
Enchytraeidae	X	X
Naididae		
Allonais pectinata	X	X
Amphichaeta leydigi	X	X
Amphichaeta sp.	X	
Arcteonais lomondi	X	X
Aulophorus sp.	X	
Chaetogaster diaphanus	X	X
C. diastrophus	X	
Dero digitata	X	
Dero flabelliger	X	
D. nivea	X	
Dero sp.	X	X
Nais barbata	X	
N. behningi	X	
N. bretscheri	X	X
N. communis	X	X
N. elinguis	X	X
N. pardalis	X	X
N. pseudobtusa		X
N. simplex	X	
N. variabilis	X	X
Nais sp.	X	
Ophidonais serpentina	X	X
Paranais frici	X	X
Paranais sp.	X	
Piguetiella michiganensis	X	X
Pristina idrensis	X	X
Pristina longisoma		X
Pristina longiseta	X	
P. osborni	X	X
P. sima	X	X
Pristina sp.	X	
Ripistes parasita	X	X
Slavina appendiculata	X	
Stephensoniana trivandrana	X	
Stylaria fossularis	X	X
S. lacustris	X	
Uncinais uncinata	X	
Vejdovskyella comata		X
Vejdovskyella intermedia	X	X
Vejdovskyella sp.	X	

TABLE V-B-1
(Continued)

Taxa	Collected in Previous Years	Collected in 1995
Tubificidae		
Aulodrilus limnobius	X	X
A. pigueti	X	X
A. pluriseta	X	X
Bothrioneurum vejdovskyanum	X	
Branchiura sowerbyi	X	X
Ilyodrilus templetoni	X	
Limnodrilus cervix	X	X
L. cervix (variant)	X	
L. claparedianus	X	
L. hoffmeisteri	X	X
L. spiralis	X	
L. udekemianus	X	X
Limnodrilus sp.	X	
Peloscolex multisetosus longidentus	X	
P. m. multisetosus	X	
Potamothrix moldaviensis	X	
P. vejdovskyi	X	
Psammoryctides curvisetosus	X	
Tubifex tubifex	X	
Unidentified immature forms:		
with hair chaetae	X	X
without hair chaetae	X	X
Lumbriculidae	X	
Hirudinea		
Glossiphoniidae	X	
Helobdella elongata	X	
H. stagnalis	X	
Helobdella sp.	X	
Erpobdellidae		
Erpobdella sp.	X	
Mooreobdella microstoma	X	
Arthropoda		
Acarina	X	X
Ostracoda	X	
Isopoda		
Asellus sp.	X	
Amphipoda		
Talitridae		
Hyalella azteca	X	
Gammaridae		
Crangonyx pseudogracilis	X	
Crangonyx sp.	X	
Gammarus fasciatus	X	
Gammarus sp.	X	X
Decapoda	X	
Collembola	X	
Ephemeroptera		
Heptageniidae	X	
Stenacron sp.	X	
Stenonema sp.	X	
Ephemeridae		
Ephemera sp.	X	
Hexagenia sp.	X	X
Baetidae	X	
Caenidae		
Caenis sp.	X	
Tricorythidae		
Tricorythodes sp.	X	
Megaloptera		
Sialis sp.	X	
Odonata		
Gomphidae		
Dromogomphus spoliatus	X	
Dromogomphus sp.	X	
Gomphus sp.	X	
Libellulidae		
Libellula sp.	X	

TABLE V-B-1
(Continued)

Taxa	Collected in Previous Years	Collected in 1995
Trichoptera		
Hydropsychidae	X	
Cheumatopsyche sp.	X	
Hydropsyche sp.	X	
Hydroptilidae		
Hydroptila sp.	X	
Oxyethira sp.	X	
Leptoceridae		
Ceraclea sp.	X	
Oecetis sp.	X	X
Polycentropodidae		
Cyrnellus sp.		X
Polycentropus sp.	X	
Coleoptera		
Hydrophilidae	X	
Elmidae		
Ancyronyx variegatus	X	
Dubiraphia sp.	X	X
Helichus sp.	X	
Stenelmis sp.	X	X
Psephenidae	X	
Diptera		
Unidentified Diptera	X	
Psychodidae	X	
Pericoma sp.	X	
Psychoda sp.	X	
Telmatoscopus sp.	X	
Unidentified Psychodidae pupae	X	
Chaoboridae		
Chaoborus sp.	X	
Simuliidae		
Similium sp.	X	
Chironomidae		
Chironominae	X	
Tanytarsini pupa	X	
Chironominae pupa	X	X
Axarus sp.	X	
Chironomus sp.	X	X
Cladopelma sp.	X	X
Cryptochironomus sp.	X	X
Dicrotenoipes nervosus	X	
Dicrotendipes sp.	X	X
Glyptotendipes sp.	X	
Harnischia sp.	X	X
Microchironomus sp.	X	X
Micropsectra sp.	X	
Microtendipes sp.	X	
Parachironomus sp.	X	
Paratendipes albimanus	X	
Phaenopsectra sp.	X	
Polypedilum (s.s.) convictum type	X	
P. (s.s.) simulans type	X	
Polypedilum sp.	X	X
Rheotanytarsus sp.	X	
Stenochironomus sp.	X	
Stictochironomus sp.	X	
Tanytarsus sp.	X	X
Xenochironomus sp.	X	
Tanypodinae		
Tanypodinae pupae	X	
Ablabesmyia sp.	X	
Coelotanypus scapularis	X	X
Djalmabatista pulcher	X	
Djalmabatista sp.	X	
Procladius (Procladius)	X	
Procladius sp.	X	X
Tanypus sp.	X	
Thienemannimyia group	X	
Zavrelimyia sp.	X	

TABLE V-B-1
(Continued)

Taxa	Collected in Previous Years	Collected in 1995
Orthocladiinae	X	
Orthocladiinae pupae	X	
Cricotopus bicinctus	X	
C. (s.s.) trifascia	X	
Cricotopus (Isocladius)- -sylvestris Group	X	
C. (Isocladius) sp.	X	
Cricotopus (s.s.) sp.	X	X
Eukiefferiella sp.	X	
Hydrobaenus sp.	X	
Limnophyes sp.	X	
Nanocladius (s.s.) distinctus	X	
Nanocladius sp.	X	X
Orthocladius sp.	X	X
Parametriocnemus sp.	X	
Paraphaenocladius sp.	X	
Psectrocladius sp.	X	
Pseudorthocladius sp.	X	
Pseudosmittia sp.	X	
Smittia sp.	X	
Diamesinae		
Diamesa sp.	X	
Potthastia sp.	X	
Ceratopogonidae	X	
Dolichopodidae	X	
Empididae	X	
Wiedemannia sp.	X	
Ephydridae	X	
Muscidae	X	
Rhagionidae	X	
Tipulidae	X	
Stratiomyidae	X	
Syrphidae	X	
Lepidoptera	X	
Mollusca		
Gastropoda		
Ancylidae		
Ferrissia sp.	X	
Planorbidae	X	
Valvatidae		
Valvata perdepressa	X	
Pelecypoda	X	
Corbiculidae		
Corbicula fluminea	X	X
Sphaeriidae	X	
Pisidium sp.	X	
Sphaerium sp.	X	X
Unidentified immature Sphaeriidae	X	
Dreissenidae		
Dreissena polymorpha		X
Unionidae		
Anodonta grandis	X	
Anodonta immature	X	
Elliptio sp.	X	
Unidentified immature Unionidae	X	

TABLE V-B-2

MEAN NUMBER OF MACROINVERTEBRATES (Number/m^2) AND PERCENT COMPOSITION
OF OLIGOCHAETA, CHIRONOMIDAE, MOLLUSCA AND OTHER ORGANISMS, 1995
BVPS

	STATION							
	1		2A		2B		3	
	#/m^2	%	#/m^2	%	#/m^2	%	#/m^2	%
May 8								
Oligochaeta	6938	86	4653	86	7225	78	7276	77
Chironomidae	1105	14	643	12	1774	19	1746	18
Mollusca	0	0	30	1	99	1	266	3
Others	40	<1	50	1	185	2	189	2
Total	8083	100	5376	100	9283	100	9477	100
September 12								
Oligochaeta	1185	71	809	51	2112	55	2442	82
Chironomidae	217	13	159	10	1570	41	227	8
Mollusca	257	15	611	39	164	4	286	10
Others	10	1	0	0	27	<1	10	<1
Total	1669	100	1579	100	3873	100	2965	100

TABLE V-B-3

BENTHIC MACROINVERTEBRATE DENSITIES (Number/m²), MEAN OF TRIPLICATE FOR BACK CHANNEL AND DUPLICATE SAMPLES COLLECTED IN THE MAIN CHANNEL OHIO RIVER, MAY 8, 1995 BVPS

Taxa	STATION 1	2A	2B	3
Cnidaria				
Hydrozoa				
Hydridae				
Hydra sp.		10	26	
Nemertea	40		7	20
Nematoda		10		30
Annelida				
Oligochaeta				
Enchytraeidae		20		
Naididae				
Oligochaeta eggs		+		+
Allonais pectinata			7	
Amphichaeta leydigi	79			
Arcteonais lomondi			7	
Chaetogaster diaphanus			85	40
Dero sp.			72	10
Nais bretscheri		10		
Nais communis	40	20	112	20
Nais elinguis		30		50
Nais pardalis		1044	900	365
Nais pseudobtusa	1025	69	558	40
Nais variabilis	79	10	72	
Ophidonais serpentina			33	
Paranais frici	1892	1960	2522	2305
Piguetiella michiganensis		158		50
Pristina idrensis		20	20	
Ripistes parasita			33	30
Stylaria fossularis		30	250	138
Vejdovskyella comata			7	10
Vejdovskyella intermedia		99	269	1369
Tubificidae				
Aulodrilus limnobius		306	13	50
Aulodrilus pigueti		10	72	10
Aulodrilus pluriseta			59	
Branchiura sowerbyi	79			69
Limnodrilus cervix	79			30
Limnodrilus hoffmeisteri	867	118	184	611
Limnodrilus udekemianus	40			
Unidentified immature forms:				
with hair chaeta	197	670	125	99
without hair chaeta	2561	79	1825	1980

TABLE V-B-3
(Continued)

Taxa	STATION 1	2A	2B	3
Arthropoda				
Amphipoda				
Gammaridae				
Gammarus sp.		10	125	99
Ephemeroptera				
Ephemeridae				
Hexagenia sp.		20		30
Trichoptera				
Leptoceridae				
Oecetis sp.			20	
Coleoptera				
Elmidae				
Dubiraphia sp.			7	
Stenelmis sp.				10
Diptera				
Chironomidae				
Chironominae pupae		30	40	59
Chironomus sp.	158	20	131	178
Cryptochironomus sp.	79	109	53	119
Dicrotendipes sp.		10		10
Harnischia sp.				10
Microchironomus sp.				10
Polypedilum sp.	828	335	1471	1300
Tanypodinae				
Procladius sp.	40		26	
Orthocladiinae				
Cricotopus sp.		129	53	40
Nanocladius sp.		10		10
Orthocladius sp.				10
Mollusca				
Pelecypoda				
Corbiculidae				
Corbicula fluminea		20	99	266
Sphaeriidae				
Sphaerium sp.		10		
Total	8083	5376	9283	9477

\+ Indicates organisms present.

TABLE V-B-4

BENTHIC MACROINVERTEBRATE DENSITIES (Number/m²), MEAN OF TRIPLICATE FOR BACK CHANNEL AND DUPLICATE SAMPLES COLLECTED IN THE MAIN CHANNEL OHIO RIVER, SEPTEMBER 12, 1995
BVPS

Taxa	STATION 1	2A	2B	3
Platyhelminthes				
Tricladida			7	
Ectoprocta				
Fredericella sp.			+	
Annelida				
Oligochaeta				
Naididae				
Oligochaeta eggs			+	
Dero sp.				30
Nais communis	60			39
Nais pardalis	20	217		10
Nais variabilis		59		
Piguetiella michiganensis		10		
Pristina idrensis				89
Pristina longisoma			7	
Pristina osborni		20		10
Pristina sima				10
Tubificidae				
Aulodrilus limnobius	20	10	217	10
Aulodrilus pigueti			131	20
Aulodrilus pluriseta			13	
Branchiura sowerbyi			79	40
Limnodrilus cervix				20
Limnodrilus hoffmeisteri	99	49	309	522
Limnodrilus udekemianus	20		13	10
Unidentified immature forms				
with hair chaeta	40		99	49
without hair chaeta	926	444	1244	1583
Arthropoda				
Acarina				
Hydracaria sp.	10			10
Trichoptera				
Polycentropodidae				
Cyrnellus sp.			20	
Diptera				
Chironomidae				
Chironominae pupae	10	20		
Chironomus sp.	10			
Cladopelma sp.			7	

TABLE V-B-4
(Continued)

Taxa	STATION 1	2A	2B	3
Cryptochironomus sp.	69	40	46	50
Dicrotendipes sp.		20		
Harnischia sp.			26	
Microchironomus sp.			164	
Polypedilum sp.	118	69	1103	177
Tanytarsus sp.			98	
Tanypodinae				
Coelotanypus scapularis			66	
Procladius sp.			53	
Orthocladiinae				
Cricotopus sp.	10	10		
Nanocladius sp.			7	
Mollusca				
Pelecypoda				
Corbiculidae				
Corbicula fluminea	257	611	164	286
Total	1669	1579	3873	2965

+ Indicates organisms present.

were Polypedilum, Cryptochironomus, and Chironomus. The Asiatic clam (Corbicula fluminea), has been observed in the Ohio River near BVPS from 1974 to present. In 1995, no zebra mussels were collected in the BVPS benthos samples, however, they were detected by divers in the BVPS main and auxiliary intake structures during scheduled cleaning operations.

In 1995, five new species were added to the cumulative taxa list of macroinvertebrates collected near BVPS (Table V-B-1). In May, the oligochaete Nais pseudobtusa was collected at all four sampling stations, whereas Vejdovskyella comata was collected only at Stations 2B and 3 (Table V-B-3). In September, the oligochaete Pristina longisoma and a Trichoptera, Cyrnellus sp. were collected at Station 2B (Table V-B-4). In late October/early November, the zebra mussel Dreissena polymorpha was detected by divers in the BVPS main intake structure and auxiliary intake structure. No threatened or endangered macroinvertebrate species were collected during 1995.

Community Structure and Spatial Distribution

Oligochaetes accounted for the highest mean percentage of the macroinvertebrates at all sampling stations in May and September (Figure V-B-2). Among the individual stations for both sampling dates, oligochaetes were always the dominant organisms.

Density and species composition variations observed within the BVPS study area were due primarily to habitat differences and the tendency of certain types of macroinvertebrates (e.g., oligochaetes) to cluster. Overall, abundance and species composition throughout the study area were similar.

In general, the mean density of macroinvertebrates during 1995 was lowest at Station 2A in May and September. Higher mean densities occurred at Stations 2B and 3 in May and September. Higher mean densities usually occur at Stations 1, 2B, and 3 where substrates near the shore were composed of soft mud or various combinations of

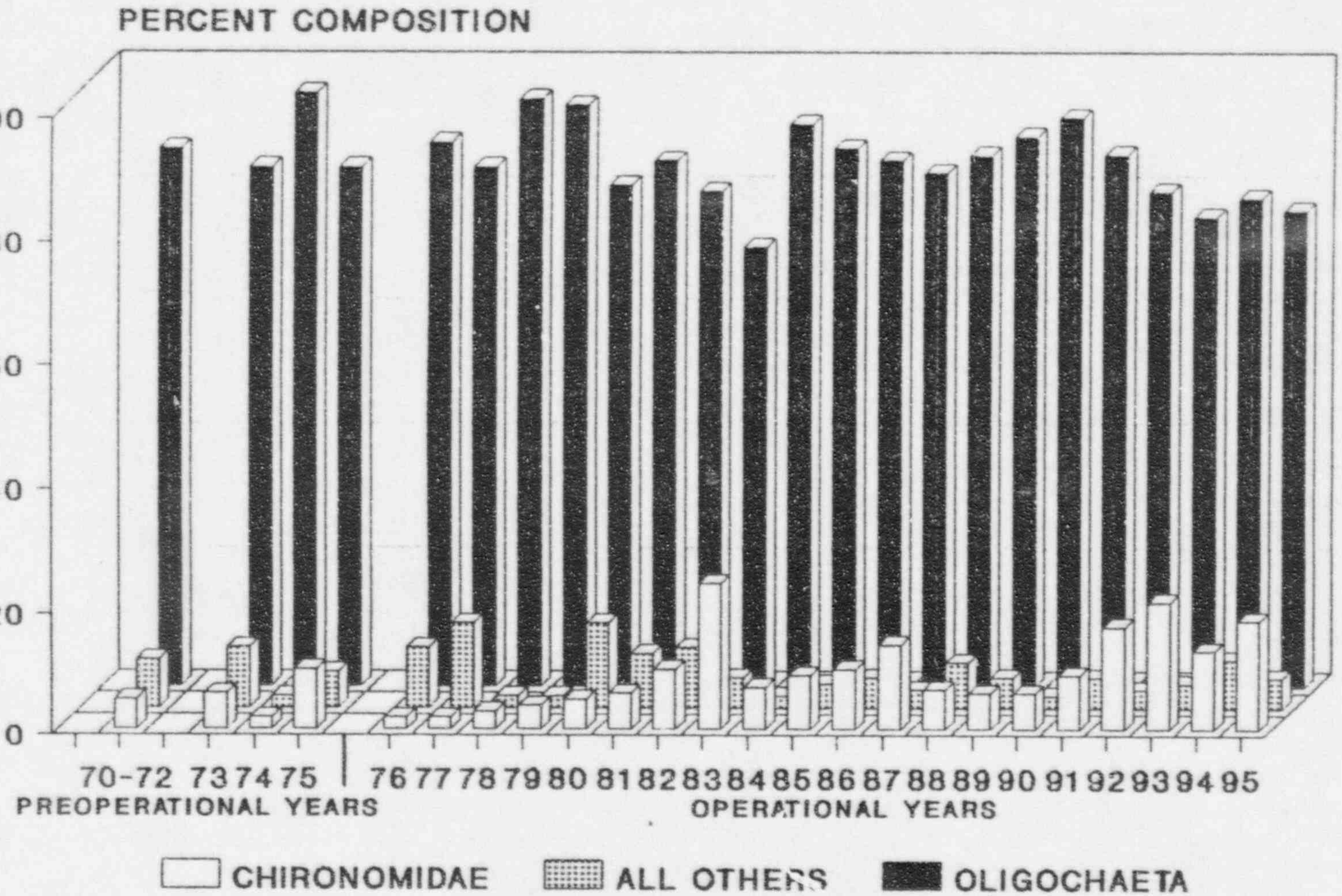


FIGURE V-B-2

MEAN PERCENT COMPOSITION OF THE BENTHOS COMMUNITY
IN THE OHIO RIVER NEAR BVPS DURING
PREOPERATIONAL AND OPERATIONAL YEARS
BVPS

sand and silt. The lower abundances at Station 2A were probably related to substrate conditions (clay and sand) along the north shoreline of Phillis Island.

Comparison of Control and Non-Control Station

No adverse impact to the benthic community was observed during 1995. This conclusion is based on a comparison of data collected at Station 1 (Control) and 2B (Non-Control) and on analyses of species composition and densities.

Data indicate that oligochaetes were usually predominant throughout the study area (Figure V-B-2), (Tables V-B-3 and V-B-4). In May, common taxa at both stations were the oligochaetes Nais pseudobtusa and Paranais frici, and the midges Polypedilum and Chironomus. In September, the oligochaete Limnodrilus hoffmeisteri, and the midges Polypedilum and Cryptochironomus were the common organisms collected at both stations. Several taxa were collected in May and September at Station 2B, that were not found at Station 1 (Tables V-B-3, V-B-4).

In May and September 1995, more taxa were collected at Non-Control Station 2B than at Control Station 1 (Table V-B-5). This has occurred several times during the past surveys. The mean number of taxa for the back channel (2B) usually exceeded the values observed for other stations in the study area. In May and September, only Station 3 had higher mean number of taxa that those at Station 2B. Shannon-Weiner indices were the highest at Station 2B compared to Station 1 and other stations in 1995. Differences observed between Station 1 (Control) and 2B (Non-Control) and between other stations could be related to the differences in habitat. None of the differences were attributed to BVPS operation.

Comparison of Preoperational and Operational Data

Composition, percent occurrence and overall abundance of macroinvertebrates has changed little from preoperational years

TABLE V-B-5

MEAN DIVERSITY VALUES FOR BENTHIC MACROINVERTEBRATES
COLLECTED IN THE OHIO RIVER, 1995
BVPS

	STATION			
	1	2A	2B	3
DATE: May 8				
No. of Taxa	8	15	21	23
Shannon-Weiner Index	2.38	2.97	3.17	2.85
Evenness	0.67	0.67	0.73	0.67
DATE: September 12				
No. of Taxa	11	10	11	14
Shannon-Weiner Index	1.33	2.26	2.46	2.26
Evenness	1.46	0.70	0.75	0.60

through the current study year. Oligochaetes have been the predominant macroinvertebrate in the community each year and they comprised approximately 77% of the individuals collected in 1995 (Figure V-B-2). A similar oligochaete assemblage has been reported each year. Chironomids and mollusks have composed most of the remaining fractions of the community each year. The Asiatic clam, Corbicula, had increased in abundance from 1974 through 1976, but declined in number during 1977. Since 1981, Corbicula have been collected in all benthic surveys, including 1995 when their densities were greater in September than in May.

Total macroinvertebrate densities for Station 1 (Control) and 2B (Non-Control) for each year since 1973 are presented in Table V-B-6. Mean densities of macroinvertebrates gradually increased from 1973 through 1976 (BVPS Unit 1 start-up) to 1983. In 1995, densities were greater at Station 2B than those at Station 1. These higher mean densities at Station 2B in 1995 were in the upper range of previous data from preoperational and operational years. There does not appear to be a consistent trend of higher or lower mean densities between the back channel of Phillis Island (Non-Control 2B) when compared to densities at Station 1 (Control). In years such as 1994, 1993, 1991, 1990, 1985, 1984, 1983, and 1979, mean densities were lower at Station 2B than at Station 1, whereas in other years mean densities were slightly higher at Station 2B. These differences could be related to substrate variability and randomness of sample grabs.

Summary and Conclusions

Substrate was probably the most important factor controlling the distribution and abundance of the benthic macroinvertebrates in the Ohio River near BVPS. Soft muck-type substrates along the shoreline were conducive to worm and midge proliferation, while limiting macroinvertebrates which require a more stable bottom. At the shoreline stations, Oligochaeta accounted for 77% of the macrobenthos collected, whereas Chironomidae and Mollusca each accounted for about 18% and 4%, respectively.

TABLE V-B-6

BENTHIC MACROINVERTEBRATE DENSITIES (Number/m^2) FOR STATION 1 (CONTROL) AND STATION 2B (NON-CONTROL) DURING PREOPERATIONAL AND OPERATIONAL YEARS BVPS

	Preoperational Years						Operational Years									
	1973		1974		1975		1976		1977		1978		1979		1980	
Month	1	2B	1	2B	1	2B	1	2B	1	2B	1	2B	1	2B	1	2B
January																
February	205	0	703	311			358	200	312	1,100	1,499	2,545			1,029	1,296
March													425	457		
April																
May	248	508	1,116	2,197			927	3,660	674	848	351	126	1,004	840	1,041	747
June	5	40	507	686												
July	653	119	421	410												
August	99	244	143	541	1,017	1,124	851	785	591	3,474	601	1,896	1,185	588		
September			175	92											1,523	448
October	256	239														
November	149	292	318	263	75	617	388	1,295	108	931	386	1,543	812	806		
December																
Mean	231	206	483	643	546	871	631	1,485	421	1,588	709	1,528	857	673	1,198	830

TABLE V-B-6
(Continued)

	Operational Years													
	1981		1982		1983		1984		1985		1986		1987	
Month	1	2B	1	2B	1	2B	1	2B	1	2B	1	2B	1	2B
May	209	456	3,490	3,026	3,590	1,314	2,741	621	2,256	867	601	969	1,971	2,649
September	2,185	912	2,956	3,364	4,172	4,213	1,341	828	1,024	913	849	943	2,910	2,780
Mean	1,197	684	3,223	3,195	3,881	2,764	2,041	725	1,640	890	725	956	2,440	2,714

	Operational Years													
	1988		1989		1990		1991		1992		1993		1994	
Month	1	2B	1	2B	1	2B	1	2B	1	2B	1	2B	1	2B
May	1,804	1,775	3,459	2,335	15,135	5,796	7,760	6,355	7,314	10,560	8,435	2,152	6,980	2,349
September	1,420	1,514	1,560	4,212	5,550	1,118	3,855	2,605	2,723	4,707	4,693	2,143	1,371	2,930
Mean	1,612	1,645	2,510	3,274	10,343	3,457	5,808	4,480	5,019	7,634	6,564	2,148	4,176	2,640

	Operational Years	
	1995	
Month	1	2B
May	8,083	9,283
September	1,669	3,873
Mean	4,876	6,578

In 1995, five new species were added to the cumulative taxa list of macroinvertebrates collected near BVPS. This included four species collected in the benthos samples, plus the zebra mussel Dreissena polymorpha, which was collected by divers in the BVPS main and auxiliary intake structures during scheduled cleaning operations.

Community structure has changed little since preoperational years and there was no evidence that BVPS operations were affecting the benthic community of the Ohio River.

C./D. PHYTOPLANKTON / ZOOPLANKTON

The plankton communities (phyto- and zooplankton) have been sampled and analyzed at the BVPS on a monthly basis from 1973 through 1992. The results of this twenty year study showed that the long term trends for the plankton communities were consistent from year to year. Annual variations were attributable to either extremes in precipitation and/or temperature. Overall, the plankton communities, both phytoplankton and zooplankton were considered typical of those in temperate climates (Hutchinson 1967).

Therefore, having compiled an extensive plankton database for the Ohio River, BVPS modified the plankton program, effective January 1993. Currently, samples are still collected from the same intake structure at monthly intervals and properly preserved as in previous years. However, these preserved samples have been archived pending a need for future laboratory analysis.

E. FISH

Objective

Fish sampling was conducted in order to detect any changes which might occur in the fish populations in the Ohio River near BVPS.

Methods

Adult fish surveys were performed in May, July, September, and November 1995. During each survey fish were sampled at four stations (Figure V-E-1) utilizing gill nets and electrofishing. Seining was performed at Station 1 (north shore) and Station 2B (south shore).

The gill nets consisted of five 25 ft. panels of 1.0, 2.0, 2.5, 3.0, and 3.5 inch square mesh. Two nets were positioned at each station, one angled along each shoreline, with the small mesh positioned inshore. The Ohio River is divided by Phillis Island into two separate channels, the main channel (2A) and the back channel (2B). Two gill nets were set in each of these channels, resulting in a total of eight gill nets set per sampling date. The gill nets were set in late afternoon/early evening (preferred sampling period), left in place overnight, then pulled the following morning.

Night electrofishing was conducted using a boat-mounted boom electroshocker and underwater lights mounted to the bow of the boat. Direct current of 220 volts at two amperes was generally used. The north and south shoreline areas at each station were shocked for ten minutes (five minutes each shore) during each survey.

Juvenile fish seining was performed at Station 1 (control) and Station 2B (non-control) during each 1995 BVPS fishery survey. A twenty foot long seine (1/4" nylon mesh) was used to collect fish located close to shore in a water depth of one to four feet. Three seine hauls were performed at both Station 1 (north shore) and Station 2B (south shore) during each survey.

Fishes collected using gill nets, electrofishing equipment and the seine were processed according to the following procedures: All game fishes were identified, counted, measured for total length (mm), and weighed (g) individually. Non-game fishes were counted

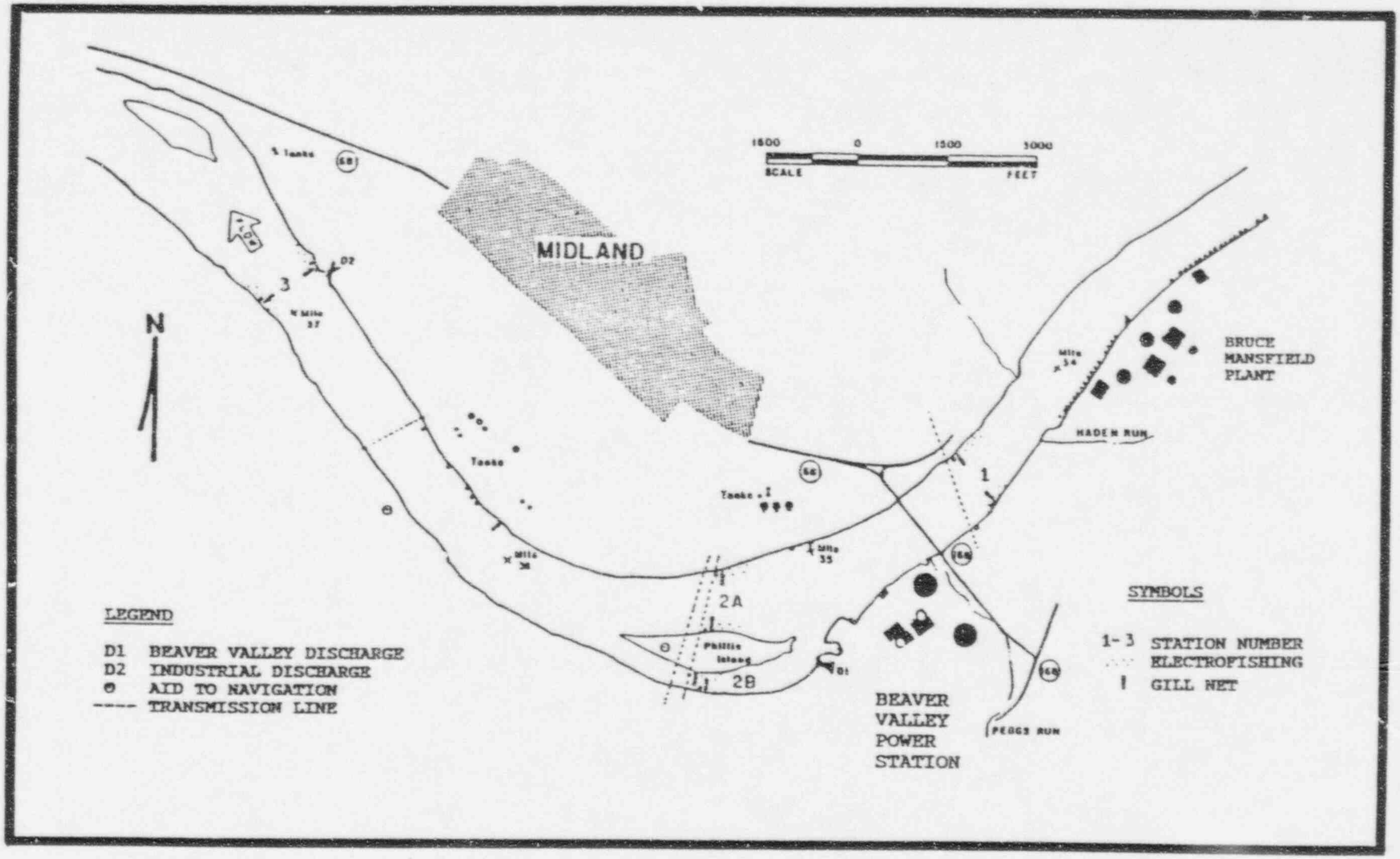


FIGURE V-E-1

FISH SAMPLING STATIONS
BVPS

and lengths estimated and recorded as <6 inches, 6-12 inches, >12-18 inches, >18-24 inches, and >24 inches. Live fish were returned to the river immediately after processing was completed. All fishes which were unidentifiable or of questionable identification were placed in plastic sample bottles, preserved, labeled and returned to the laboratory. Any fish which has not previously been collected at BVPS was retained for the voucher collection. A threatened or endangered species (if collected), would be photographed and released.

Results

Fish population surveys have been conducted in the Ohio River near BVPS from 1970 through 1995. These surveys have collected 69 fish species and four hybrids (Table V-E-1). Various agencies (PAF&BC, ORSANCO) have also conducted fishery surveys in the New Cumberland Pool in recent years resulting in the identification of taxa not collected in previous BVPS surveys. These additional fish taxa (goldeye, redear sunfish, pumpkinseed-redear sunfish hybrid, and alewife) are included on Table V-E-1, bringing the total number of fish taxa to 77 for the New Cumberland Pool of the Ohio River.

In 1995, 3,073 fishes representing 32 taxa were collected during BVPS surveys by gill nets, electrofishing, and seining. The largest fish collected was a muskellunge measuring 770 mm total length (30 inches).

A total of 139 fishes, representing 20 taxa were collected by gill nets in 1995 (Table V-E-2). The gill net results varied by month with the highest catch (50 fishes) in September (Table V-E-3). The most common fish species collected by gill nets in 1995 were channel catfish (18%), common carp (11%), sauger (11%) and quillback (11%). All other taxa accounted for 6% or less of the 1995 gill net catch.

A total of 2,518 fishes, representing 21 taxa were collected during 1995 BVPS surveys by electrofishing (Table V-E-2). Gizzard shad

TABLE V-E-1

(SCIENTIFIC AND COMMON NAME)[1]
FAMILIES AND SPECIES OF FISH COLLECTED IN THE NEW CUMBERLAND POOL OF THE OHIO RIVER, 1970 THROUGH 1995
BVPS

Family and Scientific Name	Common Name
Lepisosteidae (gars)	
Lepisosteus osseus	Longnose gar
Hiodontidae (mooneyes)	
Hiodon alosoides	Goldeye
H. tergisus	Mooneye
Clupeidae (herrings)	
Alosa chrysochloris	Skipjack herring
A. pseudoharengus	Alewife
Dorosoma cepedianum	Gizzard shad
Cyprinidae (carps and minnows)	
Campostoma anomalum	Central stoneroller
Carassius auratus	Goldfish
Ctenopharyngodon idella	Grass carp
Cyprinella spiloptera	Spotfin shiner
Cyprinus carpio	Common carp
C. carpio x C. auratus	Carp-goldfish hybrid
Luxilus chrysocephalus	Striped Shiner
Macrhybopsis storeriana	Silver chub
Nocomis micropogon	River chub
Notemigonus crysoleucas	Golden shiner
Notropis atherinoides	Emerald shiner
N. buccatus	Silverjaw minnow
N. hudsonius	Spottail shiner
N. rubellus	Rosyface shiner
N. stramineus	Sand shiner
N. volucellus	Mimic shiner
Pimephales notatus	Bluntnose minnow
P. promelas	Fathead minnow
Rhinichthys atratulus	Blacknose dace
Semotilus atromaculatus	Creek chub
Catostomidae (suckers)	
Carpiodes carpio	River carpsucker
C. cyprinus	Quillback
C. velifer	Highfin carpsucker
Catostomus commersoni	White sucker
Hypentelium nigricans	Northern hog sucker
Ictiobus bubalus	Smallmouth buffalo
I. niger	Black buffalo
Minytrema melanops	Spotted sucker

TABLE V-E-1
(Continued)

Family and Scientific Name	Common Name
Moxostoma anisurum	Silver redhorse
M. carinatum	River redhorse
M. duquesnei	Black redhorse
M. erythrurum	Golden redhorse
M. macrolepidotum	Shorthead redhorse
Ictaluridae (bullhead catfishes)	
Ameiurus catus	White catfish
A. melas	Black bullhead
A. natalis	Yellow bullhead
A. nebulosus	Brown bullhead
Ictalurus punctatus	Channel catfish
Noturus flavus	Stonecat
Pylodictis olivaris	Flathead catfish
Esocidae (pikes)	
Esox lucius	Northern pike
E. masquinongy	Muskellunge
E. lucius x _E. masquinongy_	Tiger muskellunge
Salmonidae (trouts)	
Oncorhynchus mykiss	Rainbow trout
Percopsidae (trout-perches)	
Percopsis omiscomaycus	Trout-perch
Cyprinodontidae (killifishes)	
Fundulus diaphanus	Banded killifish
Atherinidae (silversides)	
Labidesthes sicculus	Brook silverside
Percichthyidae (temperate basses)	
Morone chrysops	White bass
M. saxatilis	Striped bass
M. saxatilis x _M. chrysops_	Striped bass hybrid
Centrarchidae (sunfishes)	
Ambloplites rupestris	Rock bass
Lepomis cyanellus	Green sunfish
L. gibbosus	Pumpkinseed
L. macrochirus	Bluegill
L. microlophus	Redear sunfish
L. gibbosus x _L. microlophus_	Pumpkinseed-redear sunfish hybrid
Micropterus dolomieu	Smallmouth bass
M. punctulatus	Spotted bass
M. salmoides	Largemouth bass
Pomoxis annularis	White crappie
P. nigromaculatus	Black crappie

TABLE V-E-1
(Continued)

Family and Scientific Name	Common Name
Percidae (perches)	
Etheostoma blennioides	Greenside darter
E. nigrum	Johnny darter
E. zonale	Banded darter
Perca flavescens	Yellow perch
Percina caprodes	Logperch
P. copelandi	Channel darter
Stizostedion canadense	Sauger
S. vitreum	Walleye
S. canadense x *S. vitreum*	Saugeye
Sciaenidae (drums)	
Aplodinotus grunniens	Freshwater drum

[1]Nomenclature follows Robins, *et al*. (1991)

TABLE V-E-2

NUMBER OF FISH COLLECTED AT VARIOUS STATIONS BY GILL NET (G), ELECTROFISHING (E), AND SEINING (S) IN THE NEW CUMBERLAND POOL OF THE OHIO RIVER, 1995
BVPS

Taxa	1			2A		2B			3		Grand Total			Annual Total	Percent Annual Total
	G	E	S	G	E	G	E	S	G	E	G	E	S		
Longnose gar					1	3			5		8	1		9	0.3
Mooneye		2		1							1	2		3	0.1
Gizzard shad	1	1348	2		304	1	472		4	101	6	2225	2	2233	72.7
Spotfin shiner			4										4	4	0.1
Common carp	3	11		3	5	5			4	1	15	17		32	1.0
Striped shiner					1							1		1	<0.1
Silver chub					2		2			1		5		5	0.2
Emerald shiner		3	130		10		2	191		1		16	321	337	11.0
Spottail shiner		1	66				2	4				3	70	73	2.4
Sand shiner			15		2			1				2	16	18	0.6
Shiner spp.							30					30		30	1.0
Bluntnose minnow								2					2	2	0.1
Fathead minnow			1										1	1	<0.1
River carpsucker	1			1					1		3			3	0.1
Quillback	6			5		1			3		15			15	0.5
Highfin carpsucker									1		1			1	<0.1
Smallmouth buffalo	2	1		1	2	3	2		3	1	9	6		15	0.5
Silver redhorse		3			1		2			2		8		8	0.3
Golden redhorse	1	12		2	15		4		2	13	5	44		49	1.6
Shorthead redhorse	1	1			1		2		1	3	2	7		9	0.3
Redhorse spp.		10			10		4			19		43		43	1.4
Channel catfish	3	3		7	4	1	2		14	6	25	15		40	1.3
Flathead catfish	1	1		1			1		5	1	7	3		10	0.3
Muskellunge									1		1			1	<0.1
White bass					1		1			1		3		3	0.1
Striped bass						1					1			1	<0.1
Striped bass hybrid	2			3					4		9			9	0.3
Smallmouth bass		4					4					8		8	0.3
Spotted bass				1		1	1		1		3	1		4	0.1
Black crappie									1		1			1	<0.1
Sauger	6	4		3	3	1	2		5	1	15	10		25	0.8
Walleye						3			2		5			5	0.2
Saugeye		2			3		1					6		6	0.2
Freshwater drum		2		3	5		2		3	2	6	11		17	0.6
Unidentified		13		1	10		21			7	1	51		52	1.7
Total	27	1421	218	32	380	20	557	198	60	160	139	2518	416	3073	

TABLE V-E-3

NUMBER OF FISH COLLECTED BY MONTH BY GILL NET (G), ELECTROFISHING (E), AND SEINING (S)
IN THE NEW CUMBERLAND POOL OF THE OHIO RIVER, 1995
BVPS

Taxa	May			Jul			Sep			Nov			Grand Total			Annual	Percent Annual
	G	E	S	G	E	S	G	E	S	G	E	S	G	E	S	Total	Total
Longnose gar	1	1		4			3						8	1		9	0.3
Mooneye					1		1	1					1	2		3	0.1
Gizzard shad	2	8		1	304		2	332		1	1581	2	6	2225	2	2233	72.7
Spotfin shiner						4									4	4	0.1
Common carp	1	1		9	3		4	1		1	12		15	17		32	1.0
Striped shiner		1												1		1	<1.0
Silver chub								4			1			5		5	0.2
Emerald shiner		8			1	6		7	275			40		16	321	337	11.0
Spottail shiner						53		3	15			2		3	70	73	2.4
Sand shiner			5		2	10			1					2	16	18	0.6
Shiner spp.		30												30		30	1.0
Bluntnose minnow									2						2	2	0.1
Fathead minnow			1												1	1	<0.1
River carpsucker				1			2						3			3	0.1
Quillback				5			7			3			15			15	0.5
Highfin carpsucker	1												1			1	<0.1
Smallmouth buffalo		1		9	3			2					9	6		15	0.5
Silver redhorse		4			3						1			8		8	0.3
Golden redhorse		10		3	14		1	12		1	8		5	44		49	1.6
Shorthead redhorse		2		1			1	2			3		2	7		9	0.3
Redhorse spp.		9			27			2			5			43		43	1.4
Channel catfish	5	6		8	4		11	5		1			25	15		40	1.3
Flathead catfish	2	1		3			2	2					7	3		10	0.3
Muskellunge										1			1			1	<0.1
White bass								1			2			3		3	0.1
Striped bass	1												1			1	<0.1
Striped bass hybrid	3			3			2			1			9			9	0.3
Smallmouth bass		5			2			1						8		8	0.3
Spotted bass							3				1		3	1		4	0.1
Black crappie							1						1			1	<0.1
Sauger	2	3			3		5	1		8	3		15	10		25	0.8
Walleye										5			5			5	0.2
Saugeye		3			2			1						6		6	0.2
Freshwater drum		4		1	1		4	6		1			6	11		17	0.6
Unidentified		27			14		1	9			1		1	51		52	1.7
Total	18	124	6	48	384	73	50	392	293	23	1618	44	139	2518	416	3073	

accounted for the largest percentage (88%) of the electrofishing catch in 1995. Redhorse species accounted for 4% of the electrofishing catch. All other fish species each comprised less than 3% of the total catch.

It should be noted that "observed" fishes are typically included in the electrofishing total catch. This category is sometimes necessary because of the turbidity and swiftness of the water, although these conditions were minimal in 1995. When these conditions do exist, it is often not physically possible for the collectors to net these stunned fishes. Therefore, they are identified to genus level (if possible), and lengths are estimated and recorded. Additionally, during summer months, gizzard shad are often encountered in very high densities during electrofishing, at which time the numbers and size ranges for these "observed" fish are estimated and recorded.

A total of 416 fishes representing seven taxa were collected by seining in 1995 (Table V-E-2). Fish taxa collected included emerald shiner (77%), spottail shiner (17%), sand shiner (4%), and spotfin shiner, gizzard shad, bluntnose minnow and fathead minnow (totaling 2%). The September seining survey produced the most fishes (293 fishes). Fewer fish were collected in July, November and May with totals of 73, 44 and 6 fishes, respectively (Table V-E-3). Spotfin shiner, bluntnose minnow and fathead minnow were the only fish species collected exclusively by seining.

The most common species collected in 1995 BVPS surveys through the use of gill nets, electrofishing and seining included gizzard shad (73%), emerald shiner (11%), redhorse species (4%), and spottail shiner (2%). The remaining species each accounted for 1% or less of the total catch. Game fishes collected during the 1995 fish surveys included: muskellunge, white bass, smallmouth bass, spotted bass, sauger, walleye and saugeye.

Comparison of Control and Non-Control Stations

The gill net results for 1995 indicate that all four stations had similarities in fish taxa. The number of fish taxa collected at Stations 1, 2A, 2B and 3 by gill nets were 11, 12, 10 and 18, respectively. Channel catfish (18%) and common carp, sauger and quillback (each 11%) were the fishes most frequently collected by gill nets. Game fishes such as muskellunge, walleye and black crappie were collected less frequently at the four stations. The most fishes (60) were collected from gill nets located at Station 3 (Table V-E-2).

The electrofishing data (Table V-E-2) reflects relatively minor differences in species composition between the Control Station (1) and Non-Control Stations 2A, 2B, and 3. However, total electrofishing catch varied widely among the stations due to the highly fluctuating gizzard shad populations during the July, September and November surveys (Table V-E-3). Electrofishing collects mostly small forage species (minnows and gizzard shad). Gizzard shad was the most abundant fish species collected by electrofishing at all four stations, however, the highest numbers were collected at Stations 1 and 2B.

The seining data for 1995 indicated minor variations in species composition and relative abundance between Stations 1 and 2B. Emerald shiner was the most abundant species collected at Stations 1 and 2B, with 130 and 191 individuals, respectively (Table V-E-2). Spottail shiner and sand shiner were more abundant at Station 1 than at Station 2B.

Summary and Conclusions

The fish community of the Ohio River in the vicinity of BVPS was sampled in 1995 by gill nets, electrofishing and seining. The results of the 1995 fish surveys show normal community structure based on species composition and relative abundance. Forage species were collected in the highest numbers, particularly gizzard shad and emerald shiners. This indicates a normal fish community, since game species (predators) rely on this forage base for their survival. Variations in total annual catch are a natural occurrence and are attributable primarily to fluctuations in the population size of the forage species. Forage species, such as gizzard shad and emerald shiner with high reproductive potentials frequently respond to changes in natural environmental factors (competition, food availability, cover, and water quality) with large fluctuations in population size.

Although variations in total catch occurred from station to station in 1995, species composition remained fairly stable. Common taxa collected in the 1995 surveys by all methods included gizzard shad, emerald shiner, redhorse species, spottail shiner, channel catfish, common carp, sauger, freshwater drum, quillback and flathead catfish. Differences observed in catch between the Control (1) and Non-Control Stations (2A, 2B and 3) were probably caused by habitat preferences of individual species. Habitat preference is probably the most influential factor that affects where the different species of fish are collected and in what relative abundance.

F. ICHTHYOPLANKTON

Objective

Ichthyoplankton sampling was performed in order to monitor the extent to which fishes utilize the back channel of Phillis Island as spawning and nursery grounds.

Methods

The ichthyoplankton night surveys were conducted twice a month from April through August, which is the primary spawning season for most resident fish species. Each survey was started two hours after dusk and was completed within four hours after dusk.

One surface tow and one bottom tow were performed simultaneously at Station 2B (back channel of Phillis Island) during each survey (Figure V-F-1). The two tows were conducted for nine minutes, proceeding in an upstream direction. The near bottom sample was collected with a conical 505 micron mesh plankton net with a 0.5 m diameter mouth, mounted on a bottom sled. The surface sample was collected with an identical size net which was connected to a 0.5 m metal ring with an attached buoy.

A General Oceanics Model 2030 digital flowmeter was mounted centrically in mouth of each net to determine the volume of water filtered in each sample. A preservative containing rose bengal dye was added to the samples while in the field.

In the laboratory, ichthyoplankton was sorted from each sample and counted. Each specimen was identified as to its stage of development (egg, yolk-sac larvae, early larvae, juvenile, or adult) and to the lowest possible taxon. Densities of ichthyoplankton (numbers/100 m^3) were calculated for each sample using flowmeter data.

Results

Combined densities for fish eggs, larvae, juveniles and adults collected in the 1995 ichthyoplankton samples from the back channel of Phillis Island are presented in Table V-F-1. No ichthyoplankton were collected in the April 13 survey samples. Ichthyoplankton densities remained low in the April 26 and May 9 samples, then moderately increased in the May 26 samples. The peak density (325/100 m^3) was obtained in the back channel surface sample for June 6. Ichthyoplankton densities gradually decreased through the July 31 survey and remained low through the final survey in August.

Species composition and yearly total densities for ichthyoplankton samples collected in the back channel of Phillis Island are presented in Table V-F-2. Twelve fish species were identified from the back channel samples. Freshwater drum eggs and larvae

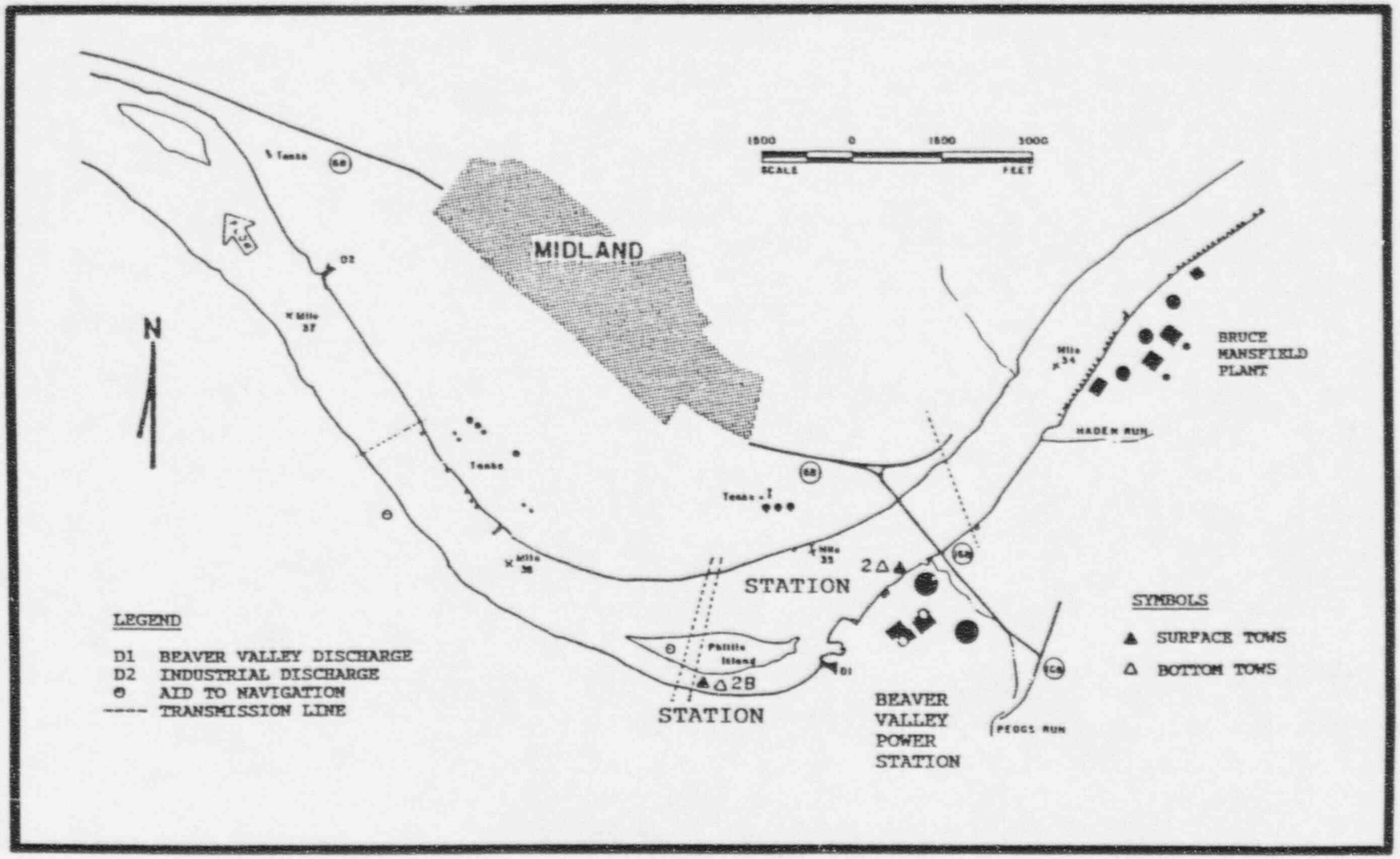


FIGURE V-F-1

ICHTHYOPLANKTON SAMPLING STATIONS
BVPS

TABLE V-F-1

COMBINED DENSITIES FOR FISH EGGS, LARVAE, JUVENILES, AND ADULTS (Number/100 m³) COLLECTED WITH A 0.5 m PLANKTON NET IN THE OHIO RIVER MAIN CHANNEL (STATION 2) AND BACK CHANNEL OF PHILLIS ISLAND (STATION 2B) DURING NIGHT SURVEYS, 1995
BVPS

	Location and Depth of Collection				
	Main Channel		Back Channel		
Date	Surface	Bottom	Surface	Bottom	Mean Density
April 13	0	0	0	0	0
April 26	1	0	2	0	<1
May 9	1	0	2	0	<1
May 26	77	87	87	27	70
June 6	275	261	325	321	296
June 22	243	182	101	178	176
July 7	91	103	25	79	75
July 18	52	51	8	15	32
July 31	10	6	2	24	11
August 14	1	7	1	6	4
August 30	6	9	0	6	5

TAXA OF FISH AND YEARLY TOTAL DENSITIES FOR FISH EGGS, LARVAE, JUVENILES, AND ADULTS (Number 100/m^3) COLLECTED DURING THE NIGHT ICHTHYOPLANKTON SURVEYS, 1995
BVPS

Taxa	Location and Depth of Collection				
	Main Channel		Back Channel		
	Surface	Bottom	Surface	Bottom	Mean Density
Eggs					
Freshwater drum (EE)	32	31	26	28	29
Unidentified (EE)	1	1	1	<1	<1
Larvae					
Gizzard shad (YL)	3	1	3	1	2
Gizzard shad (EL)	6	4	1	4	4
Minnows & Carps (YL)	<1	<1	<1	<1	<1
Common carp (YL)	<1	1	0	<1	<1
Common carp (EL)	15	7	8	2	8
Shiner spp. (EL)	4	2	4	2	3
Minnow spp. (EL)	0	<1	0	0	<1
White bass (YL)	0	<1	<1	<1	<1
Perches (YL)	<1	0	<1	<1	<1
Perches (EL)	<1	<1	<1	<1	<1
Darter spp. (EL)	0	0	<1	0	<1
Yellow perch (EL)	0	<1	<1	0	<1
Sauger/Walleye spp. (YL)	<1	<1	<1	0	<1
Freshwater drum (YL)	1	1	1	1	1
Freshwater drum (EL)	5	14	7	16	11
Juveniles					
Gizzard shad (JJ)	1	<1	<1	4	1
Emerald shiner (JJ)	<1	<1	<1	3	<1
Sand shiner (JJ)	0	0	0	<1	<1
Shiner sp. (JJ)	<1	<1	<1	2	<1
Channel catfish (JJ)	0	<1	0	<1	<1
Darter sp. (JJ)	0	0	0	<1	<1
Freshwater drum (JJ)	<1	<1	0	<1	<1
Adults					
Sand shiner (OO)	0	<1	0	0	<1
Total Density	68	62	51	62	

Developmental Stages

YL - Hatched specimens with yolk and/or oil gobules present.

EL - Specimens with no yolk and/or oil gobules and with no development of fin rays and/or spiny elements.

LL - Specimens with developed fin rays and/or spiny elements and evidence of a fin fold.

JJ - Specimens with complete fin and pigment development, i.e., immature adult.

dominated the ichthyoplankton catch (70%), with common carp larvae and gizzard shad larvae accounting for 9% and 8%, respectively. Juvenile fish collected in ichthyoplankton samples from the back channel included gizzard shad, emerald shiner, channel catfish, and freshwater drum. There were no adult fish collected during the 1995 ichthyoplankton surveys in the back channel of Phillis Island.

Summary and Conclusions

Freshwater drum dominated the 1995 ichthyoplankton catch from the back channel of Phillis Island. Common carp and gizzard shad ranked next in terms of abundance. Ichthyoplankton densities were low during April and early May, then moderately increased in late May prior to the peak in early June. Densities gradually decreased through late July, and remained low through the final survey. This represents normal spawning cycles for the fish species inhabiting the Ohio River in the vicinity of the BVPS.

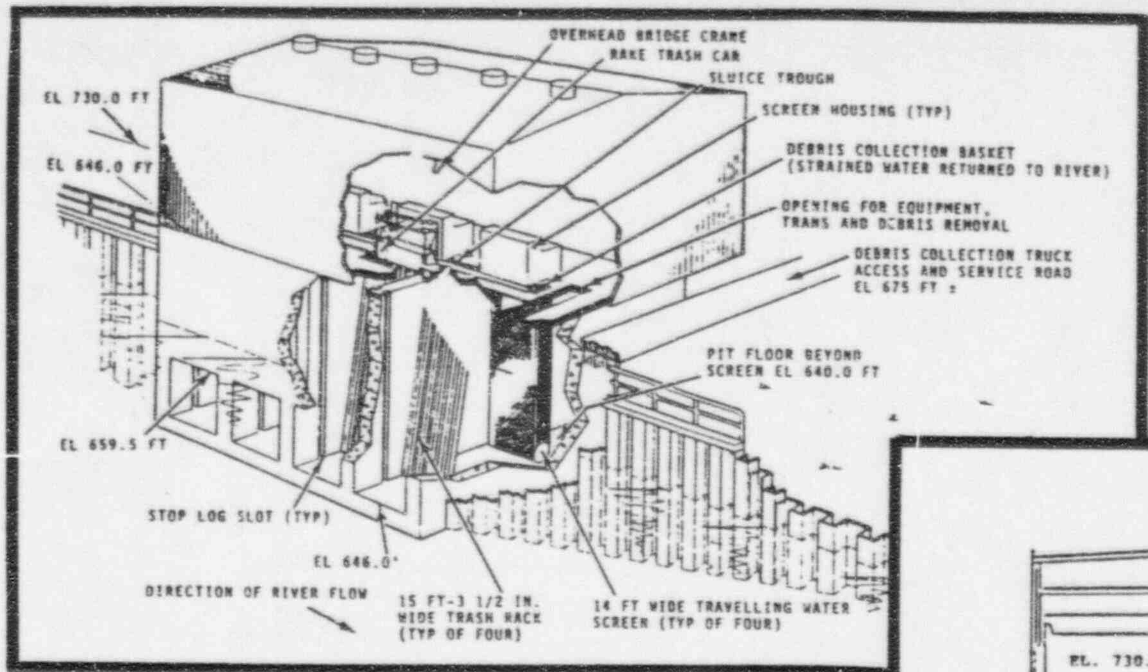
G. IMPINGEMENT

Objective

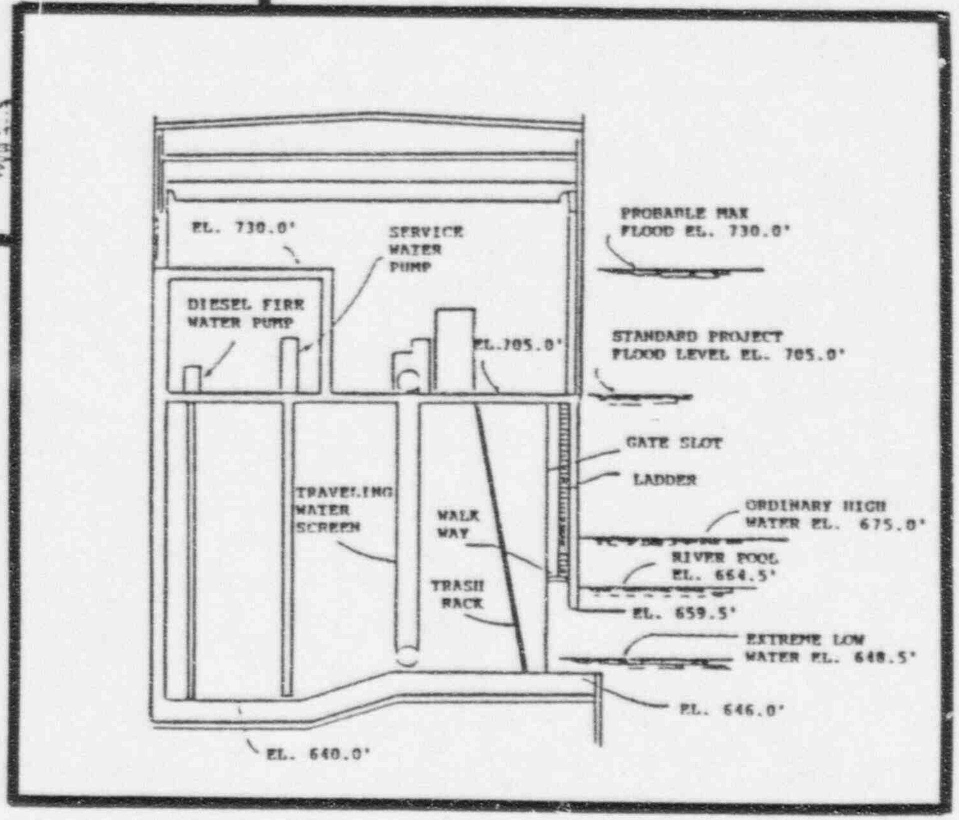
Impingement surveys were conducted to monitor the quantity of fish and Corbicula impinged on the traveling screens. These surveys were also conducted to monitor for the infestation of the zebra mussel to BVPS.

Methods

The surveys were scheduled weekly throughout 1995 for a total of 41 weeks (Table V-A-1). Weekly impingement sampling was conducted on Friday mornings. A collection basket of 0.25 inch mesh netting was placed at the end of the screen washwater sluiceway (Figure V-G-1). One screen was washed for 15 minutes (one complete revolution of the screen) and the aquatic organisms and associated debris were collected. All other screens were then washed as a pre-wash for the following week's impingement. Each week's screen wash



(THREE DIMENSIONAL: CUTAWAY VIEW)



(TWO DIMENSIONAL: SIDE VIEW)

FIGURE V-G-1

INTAKE STRUCTURE
BVPS

collection represents, under normal operations, one week (7 days) of impinged sample. The impingement sample was sorted for Corbicula and fish, and examined for zebra mussels.

Results

A total of 1,838 Corbicula (87% alive) were collected in 1995 from the 41 weekly impingement surveys, when one screen per week was washed. If all four screens had been washed each week during the year (as in 1981 through 1992), approximately 7,352 clams would have been collected in 1995, as illustrated in Figure V-I-1. The shell lengths for the largest and smallest Corbicula collected during impingement surveys in 1995 were 21.85 mm and 3.90 mm, respectively. The greatest number of live Corbicula (3,752 clams) were collected during the weekly impingement surveys conducted in August (Figure V-I-1). No zebra mussels were collected in the 1995 impingement surveys.

A total of 51 fishes were collected in 1995 during the impingement survey. Fish species collected included gizzard shad, channel catfish, green sunfish, flathead catfish, bluegill, smallmouth bass and freshwater drum. The most frequently collected species was bluegill. The largest fish collected was a smallmouth bass (210 mm total length) and the smallest fish was a gizzard shad (23 mm total length). Total weight of fish collected from impingement surveys in 1995 was 1.1 pounds (510 grams). No endangered or threatened species were collected (Commonwealth of Pennsylvania, 1994).

Summary and Conclusions

The results of the 1995 impingement surveys indicate that during the month of August large numbers of Corbicula were collected off of the traveling screens. Although this trend has occurred in previous years, the August 1995 total was the second highest in the period since 1985. The number of fish collected from the 1995 impingement surveys at BVPS was within the range observed for previous operational years and indicates that withdrawal of river water at BVPS intake for cooling purposes has very little effect on the fish populations. No zebra mussels were collected from the 1995 impingement surveys.

H. PLANKTON ENTRAINMENT

1. Ichthyoplankton

Objectives

The ichthyoplankton surveys conducted in the Ohio River main channel are designed to determine the species composition, relative abundance, and distribution of ichthyoplankton near the BVPS intake structure.

Methods

Previous studies have demonstrated that species composition and relative abundance of ichthyoplankton samples collected in front of the intake structure were very similar to those ichthyoplankton entrainment samples taken at BVPS (DLC 1976, 1977, 1978, and 1979). Therefore, for survey years 1980 through 1995, ichthyoplankton entrainment samples have been collected from the Ohio River near the BVPS intake structure.

The BVPS ichthyoplankton sampling program consisted of sampling in the main channel adjacent to the BVPS intake structure at Station 2 (Figure V-F-1, Section F). One surface tow and one bottom tow were performed simultaneously at Station 2 during each survey for nine minutes proceeding in an upstream direction. Sampling at Station 2 in the main channel was performed immediately after the ichthyoplankton sampling in the back channel of Phillis Island was completed for each survey. Sampling methodologies used for ichthyoplankton collection in the main channel were identical to the methodologies outlined in the Methods section of Section F - Ichthyoplankton.

In the laboratory, eggs, larvae, juveniles, and adults were sorted from the samples, identified to the lowest possible taxon and stage of development, and counted. Densities of ichthyoplankton (number/100 m^3) were calculated using appropriate flowmeter data.

Results

Combined densities for fish eggs, larvae, juveniles and adults collected in the 1995 ichthyoplankton samples from the main channel (Station 2) of the Ohio River are presented in Table V-F-1 (Section F, Ichthyoplankton). No ichthyoplankton were present in the samples collected on April 13, 1995, and very low numbers were present in the April 26 and May 9 samples. The sharp increase in number of ichthyoplankton in the May 26 samples (average 82/100 m^3) indicated that the spawning season was in progress in the Ohio River. Ichthyoplankton densities peaked in the samples collected on June 6 (average 268/100 m^3). Ichthyoplankton densities gradually decreased through the July 31 survey and remained low through the end of August.

The number of fish eggs, larvae, juveniles and adults collected from the 1995 ichthyoplankton samples from the main channel (Station 2) are identified according to taxa in Table V-F-2 (Section F). These taxa represented eleven fish species. Freshwater drum eggs accounted for the 48% of the total catch. Common carp larvae and gizzard shad larvae accounted for 18% and 16% of the total catch, respectively. Juvenile specimens, collected in the main channel, accounted for four species. Sand shiner was the only adult fish species collected in the main channel during the 1995 ichthyoplankton surveys.

Summary and Conclusions

Freshwater drum (eggs) dominated the 1995 ichthyoplankton catch from the main channel of the Ohio River in front of the BVPS. The most common fish larvae collected were freshwater drum, common carp and gizzard shad. Ichthyoplankton densities began to increase in

May, peaked in early June and decreased in late July. This represents normal spawning cycles for the fish species inhabiting the Ohio River in the vicinity of the BVPS.

2./3. Phytoplankton / Zooplankton

The plankton communities (phyto- and zooplankton) have been sampled and analyzed at the BVPS on a monthly basis from 1973 through 1992. The results of this twenty year study showed that the long term trends for the plankton communities were consistent from year to year. Annual variations were attributable to either extremes in precipitation and/or temperature. Overall, the plankton communities, both phytoplankton and zooplankton were considered typical of those in temperate climates (Hutchinson 1967).

Therefore, having compiled an extensive plankton database for the Ohio River, BVPS modified the plankton program, effective January 1993. Currently, samples are still collected from the same intake structure at monthly intervals and properly preserved as in previous years. However, these preserved samples have been archived pending a need for future laboratory analysis.

I. CORBICULA MONITORING PROGRAM

Introduction

The introduced Asiatic clam, *Corbicula fluminea* was first detected in the United States in 1938 in the Columbia River near Knappton, Washington (Burch 1944). It has since spread throughout the country, inhabiting any suitable freshwater habitat. Information from prior aquatic surveys has demonstrated the presence of *Corbicula* in the Ohio River in the vicinity of the BVPS, and the plant is listed in NUREG/CR-4233 (Counts 1985).

One adult clam is capable of producing many thousands of larvae called veligers. These veligers are very small (approximately 0.2 mm) and will pass easily through the water passages of a power plant. Once the veliger settles to the substrate, growth of the clam occurs rapidly. If clams develop within a power plant's water passages, they impair the flow of water through the plant. Reduction of flow may be so severe that a plant shutdown is necessary. The clams are of particular concern when they develop undetected in emergency systems where the flow of water is not constant (NRC, IE Bulletin 81-03).

The Corbicula Monitoring Program includes the Ohio River and the circulating river water system of the BVPS (intake structure and cooling towers). This report describes this Monitoring Program and the results obtained during field and plant surveys conducted through 1995.

1. Monitoring

Objectives

The objective of the Monitoring Program was to evaluate the presence of Corbicula at BVPS and the Ohio River in the vicinity of the intake structure, in order to evaluate the potential for infestation of the BVPS.

Methods

(Intake Structure - Screen Washing)

The weekly screen washing surveys (impingement surveys) at the intake structure monitored the number of Corbicula which enter the BVPS from the Ohio River. Corbicula obtained during the washing of the traveling screen (see Section G, Impingement Methods), were returned to the laboratory for size analysis. These clams were rinsed through a series of stacked U.S. Standard sieves ranging in mesh size from 16.0 mm to 0.6 mm. The number of live and dead clams retained on each sieve was recorded.

(Cooling Towers - Reservoir Scraper Sampling)

Corbicula enter the BVPS from the Ohio River by passing through the water intakes, and eventually settle out in the lower reservoirs of Units 1 and 2 cooling towers. The density and growth development of these Corbicula are monitored by collecting monthly samples from the lower reservoir sediments by using a scraper sampler. The sampler consists of a D-frame net attached behind a foot long metal scraping edge. This device is connected to a pole long enough to allow the sampler to extend down into the reservoir sediment area from the outside wall of the cooling tower.

During each monthly sampling event, five scraper pulls (each 4 ft. length) were taken along the bottom of the reservoir, scraping up sediment covering approximately 20 square feet of area for each cooling tower. The sample collected from each tower was returned to the laboratory and processed. Samples were individually washed and Corbicula removed and rinsed through a series of stacked U.S. Standard sieves ranging in mesh size from 16.0 mm to 0.6 mm. Live and dead clams on each sieve were counted and the numbers were recorded. The size distribution data obtained using the sieves reflects clam width, rather than length.

(Cooling Towers - Corbicula Density Determination)

Population surveys of both BVPS cooling tower reservoirs have been conducted during scheduled outages (1986 through 1995) in order to estimate the number of Corbicula present in these structures. In 1995, both BVPS cooling towers were sampled during their respective scheduled outages to estimate the Corbicula population. The sediment and Corbicula were removed from the drained cooling tower basin after the population survey sampling was completed for each respective outage.

(Unit 1 Cooling Tower)

The Corbicula population in the lower reservoir of the Unit 1 cooling tower was estimated based on sampling performed during a scheduled outage. Seventeen samples were collected at designated sampling locations within the drained reservoir basin on January 12, 1995, using a (6" x 6") petite ponar dredge. These sampling locations were consistent with previous Unit 1 cooling tower population surveys (DLC, 1993).

The substrate of each sample was characterized at the time of collection. The samples were returned to the laboratory and sorted for Corbicula within 72 hours of collection. This procedure increased overall sorting efficiency because a preservative was not needed, and live Corbicula could be seen moving in the sorting trays. Counts were made of live and dead Corbicula in each dredge sample. These sample counts were converted to densities (clams/m^2) based on the surface area sampled by the dredge. An average density was then calculated for each cooling tower sample. An estimate of the area of the cooling tower basin covered by sediment was calculated, since the Corbicula were concentrated almost entirely in the sediment. The estimated population was calculated by multiplying the average density times the area of sediment coverage.

(Unit 2 Cooling Tower)

The Corbicula population in the lower reservoir of the Unit 2 cooling tower was estimated based on sampling performed during a scheduled outage. Ten samples were collected at designated sampling locations within the drained reservoir basin on March 27, 1995, using a petite ponar dredge. These sampling locations were consistent with previous Unit 2 cooling tower population surveys (DLC, 1993). The methods used for sample processing and the calculation of the estimated Corbicula population are identical to those described in the Unit 1 cooling tower population survey section.

(Ohio River - Ichthyoplankton Surveys)

The ichthyoplankton surveys (April through August) performed in front of the intake structure also served to monitor for the number of Corbicula which could potentially enter BVPS from the Ohio River. Corbicula can become suspended in the water column and are carried by river currents downstream to new habitats. While performing the ichthyoplankton surveys, these clams are often collected in the samples along with the ichthyoplankton. The 1995 ichthyoplankton samples were sorted at the laboratory for Corbicula and numbers recorded. Corbicula densities (clams/100 m^3 water filtered) were calculated based on the volume of water filtered.

Results

(Intake Structure - Screen Washing Surveys)

A total of 1,838 Corbicula were collected during the 1995 impingement surveys, when one traveling screen was washed each week. Monthly totals for Corbicula collected during impingement surveys for the years 1985 through 1995 are presented in Figure V-I-1. The monthly totals for 1995 have been multiplied by four to account for the fact that in 1995 only one screen was washed during each weekly survey, in contrast to previous years' surveys (1985 through 1992) when all four screens were typically washed.

The majority of Corbicula were collected in the impingement surveys conducted in August, with the monthly total (live and dead) exceeding 3,900 clams. The 1995 results represent the second highest collection of Corbicula from the traveling screens since 1985, with the highest number occurring in 1989 (Figure V-I-1). Eighty-seven percent of the Corbicula collected from the screens in 1995 were alive. The largest and smallest live Corbicula collected during 1995 impingement surveys were 21.85 mm (length) and 3.90 mm (length), respectively.

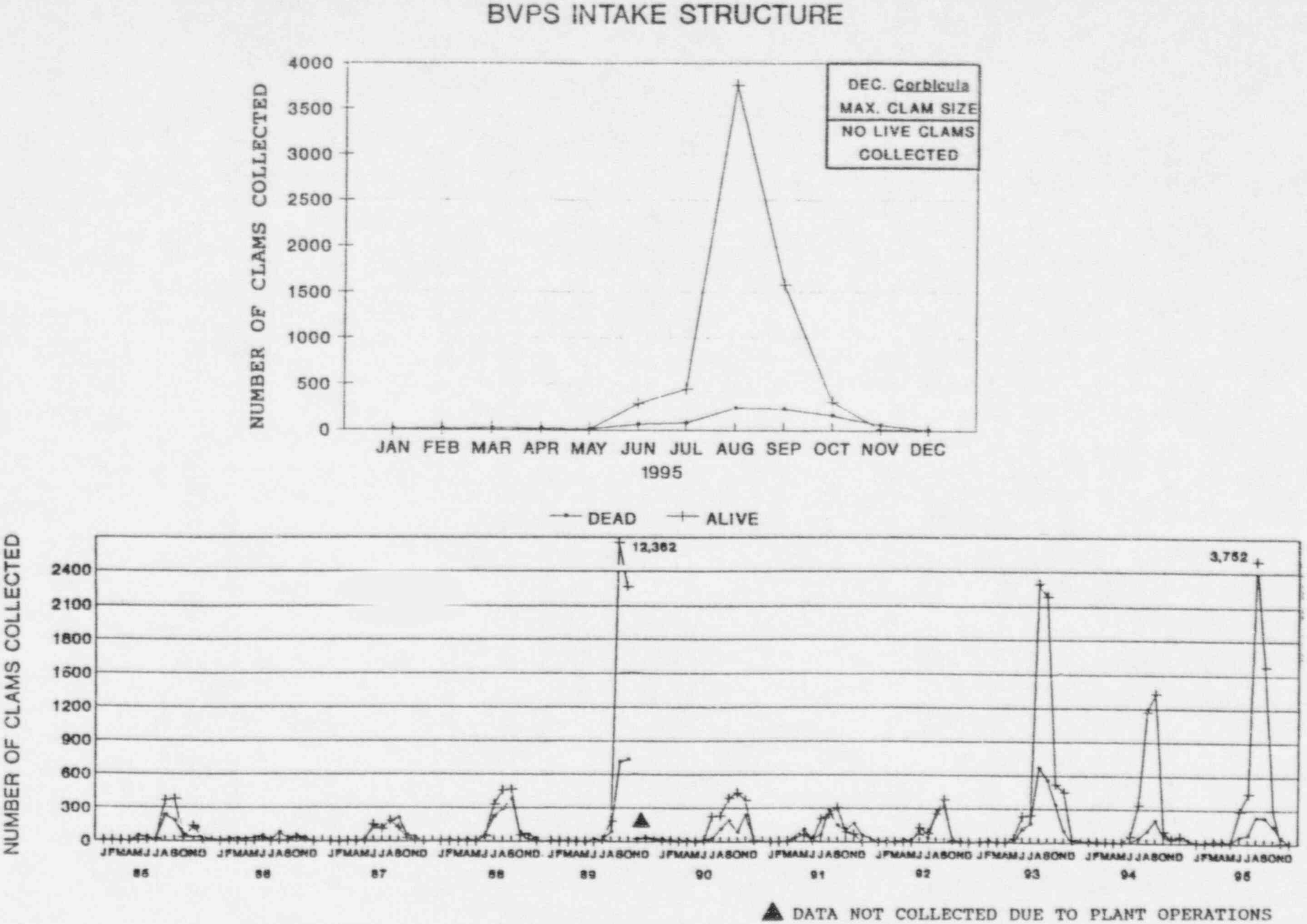


FIGURE V-I-1

SUMMARY OF Corbicula COLLECTED FROM THE INTAKE STRUCTURE TRAVELING SCREENS DURING IMPINGEMENT SURVEYS, 1985 THROUGH 1995
BVPS

(Unit 1 Cooling Tower - Reservoir Scraper Sampling)

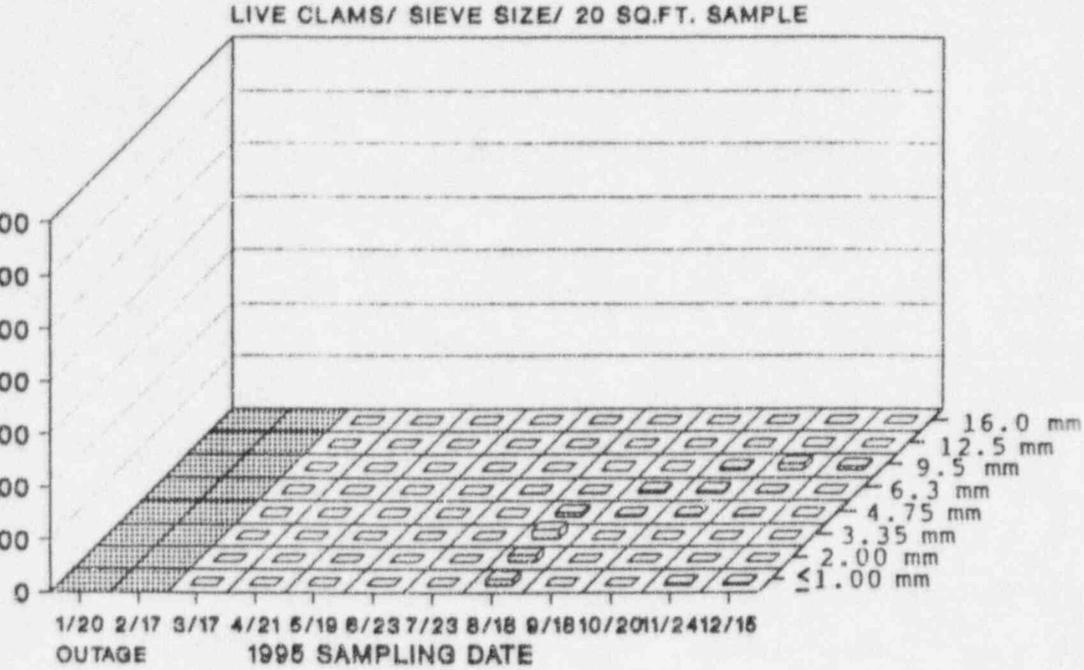
In 1995, a total of 149 Corbicula (70% alive) were collected from the Unit 1 cooling tower basin using the scraper sampler. The largest live Corbicula collected measured 17.44 mm in length.

In 1995, DLC continued its Corbicula Control Program (sixth year) which included the use of a molluscicide (CT-1) to prevent the proliferation of Corbicula within BVPS. BVPS was granted permission by the Pennsylvania Department of Environmental Protection to use CT-1 in the BVPS Units 1 and 2 river water systems.

In 1990 through 1993, the molluscicide applications (CT-1) focused on reducing the Corbicula population throughout the entire river water system of each BVPS plant (Units 1 and 2). In 1994 and 1995, the CT-1 applications targeted the internal water systems, therefore the CT-1 concentrations in the cooling towers were reduced during CT-1 applications. Consequently, adult and juvenile Corbicula in the cooling towers often survived the CT-1 applications. Reservoir scraper samples taken after CT-1 applications represent mortality of Corbicula in the cooling tower only and do not reflect mortality in BVPS internal water systems.

Subsequent to the Unit 1 scheduled outage in January/February 1995, Corbicula had not recolonized the cooling tower reservoir as of the June 23, 1995 sampling date (Figure V-I-2, top graph). However, on June 27, 1995, the Unit 1 river water system was dosed with CT-1 based on the data from the Corbicula larval cages and impingement surveys which indicated that Corbicula were currently spawning in the Ohio River, and could potentially enter BVPS internal water systems. The Corbicula scraper sample collected from the Unit 1 cooling tower reservoir three days after the CT-1 dosing contained no Corbicula. Unit 1 was dosed again with CT-1 on October 17, 1995. The October 20 scraper sample indicated 7% mortality in the cooling tower reservoir, with survival of both adult and larger juvenile Corbicula (Figure V-I-2, top graph).

UNIT 1 COOLING TOWER RESERVOIR SCRAPER SAMPLE DATA



UNIT 2 COOLING TOWER RESERVOIR SCRAPER SAMPLE DATA

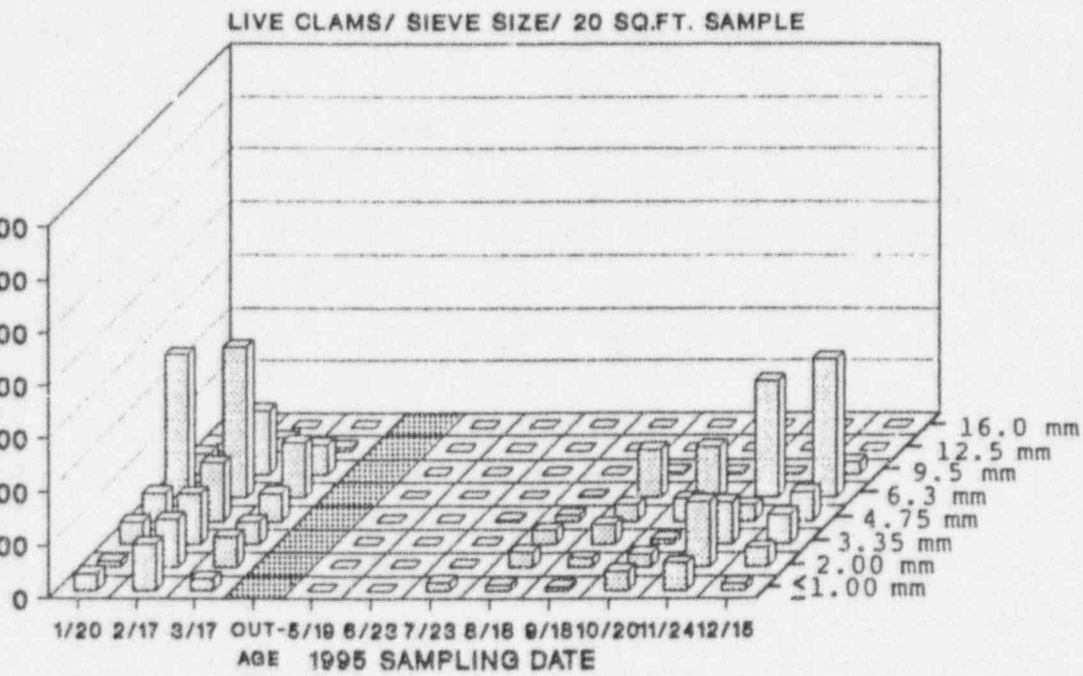


FIGURE V-I-2

Corbicula DENSITIES AND SIZE DISTRIBUTION IN SCRAPER SAMPLES COLLECTED FROM UNITS 1 AND 2 COOLING TOWERS, 1995
BVPS

(Unit 2 Cooling Tower - Reservoir Scraper Sampling))

In 1995, a total of 3,412 Corbicula (90% alive) were collected from the Unit 2 cooling tower reservoir using the scraper sampler. The largest Corbicula collected measured 22.08 mm in length. After the scheduled outage in April 1995, Corbicula larvae had begun to recolonize the cooling tower at the end of July and the beginning of August (Figure V-I-2, bottom graph).

The Unit 2 river water system was dosed with CT-1 on June 20, 1995. There were no Corbicula collected in the June 23 scraper sample from the Unit 2 cooling tower. Unit 2 was dosed with CT-1 again on October 3, 1995. The scraper sample collected three days after CT-1 dosing indicated 19% mortality, with survival of both adult and juvenile Corbicula.

(Cooling Towers - Corbicula Density Determination)

(Unit 1 Cooling Tower)

The results of the January 12, 1995 Corbicula density determination in the Unit 1 cooling tower (lower reservoir) are presented in Table V-I-1. Based on the seventeen ponar dredge samples collected from the lower reservoir, the estimated number of Corbicula inhabiting this area was 382 million clams, of which 74.3% were alive (Figure V-I-3). The largest Corbicula collected measured 14.24 mm in length. No zebra mussels were found in the seventeen samples collected from the Unit 1 cooling tower reservoir.

(Unit 2 Cooling Tower)

The results of the March 27, 1995 Corbicula density determination in the Unit 2 cooling tower reservoir are presented in Table V-I-2. Based on the ten ponar dredge samples collected from the reservoir, the estimated number of Corbicula inhabiting this area was 7 million clams, of which 93% were alive (Figure V-I-3). The largest Corbicula collected measured 20.01 mm in length. No zebra mussels

TABLE V-I-1

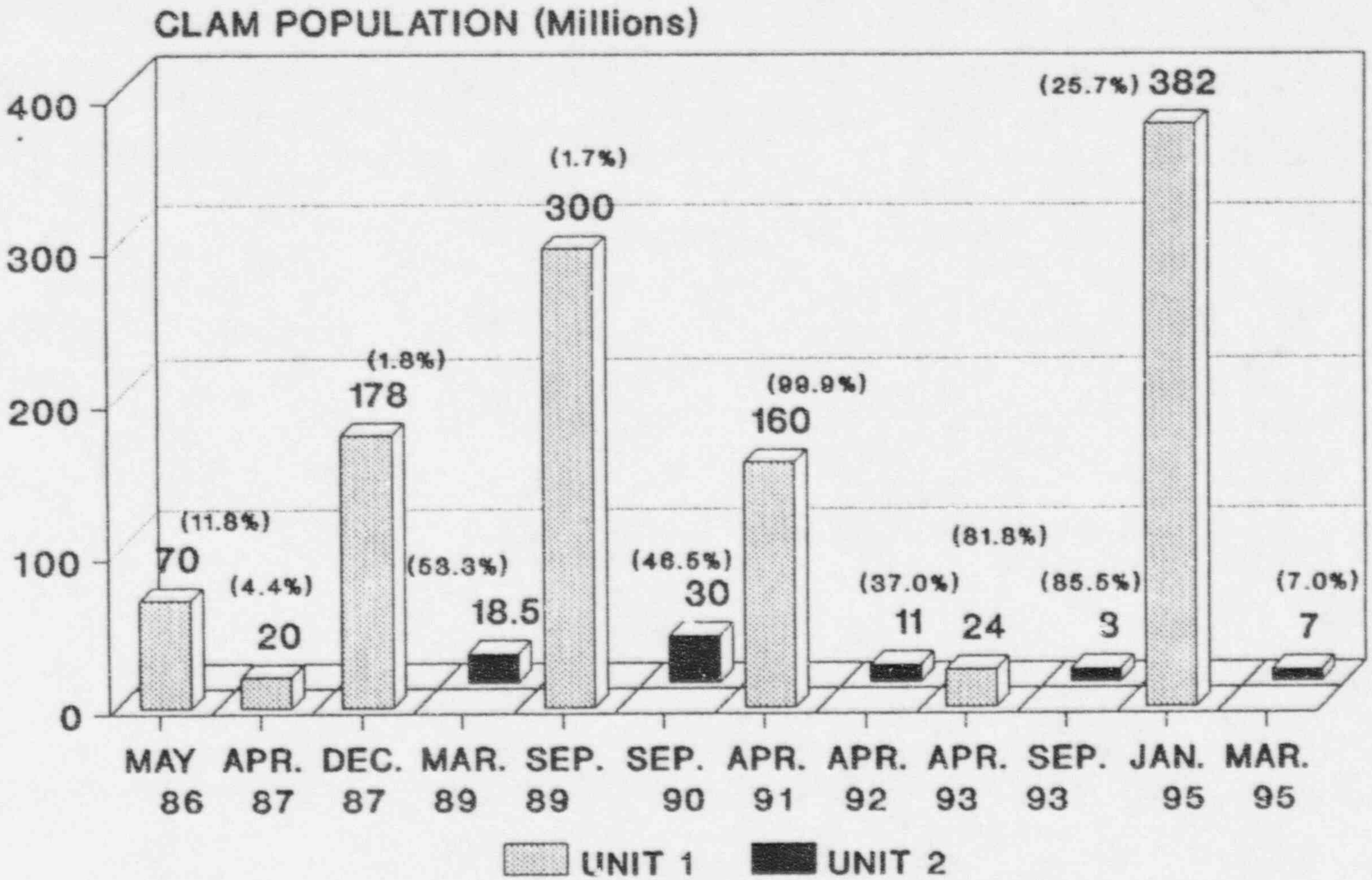
Corbicula COLLECTED IN UNIT 1 COOLING TOWER
LOWER RESERVOIR, JANUARY 12, 1995
BVPS

Station	Substrate	Clams Collected Alive	Clams Collected Dead	Station Density Live Clams/m²
Lower Reservoir				
1	silt	1098	1197	47,324
2	silt	117	205	5,043
3	silt	2114	385	91,113
4	silt	686	48	29,567
5	silt	655	96	28,231
6	silt	471	125	20,300
7	silt	264	27	11,378
8	silt	805	76	34,696
9	silt	16	2	690
10	silt	220	153	9,482
11	silt	362	92	15,602
12	silt	513	102	22,110
13	silt	226	177	9,741
14	silt	283	116	12,197
15	silt	480	77	20,688
16	silt	9	0	388
17	silt	170	57	7,327

Estimated number of Corbicula present in the lower reservoir of the Unit 1 cooling tower at the time of sampling was 382 million clams, of which 74.3% were alive.

Size range (Length)

Sampling Location	Small	Large
Lower Reservoir	1.52 mm	14.24 mm



( ) - Indicates percentage of dead <u>Corbicula</u> in estimated total.

FIGURE V-I-3

APPROXIMATE POPULATION OF <u>Corbicula</u> LOCATED IN UNITS 1 AND 2 COOLING TOWERS
DERIVED FROM SURVEYS CONDUCTED IN 1986 THROUGH 1995
BVPS

TABLE V-I-2

Corbicula COLLECTED IN UNIT 2 COOLING TOWER
RESERVOIR, MARCH 27, 1995
BVPS

Station	Substrate	Clams Collected Alive	Clams Collected Dead	Station Density Live Clams/m^2
Reservoir				
1	silt	80	13	3,448
2	silt	100	8	4,310
3	silt	82	10	3,534
4	silt	85	8	3,664
5	silt	93	3	4,008
6	silt	46	2	1,983
7	silt	120	11	5,172
8	silt	88	5	3,793
9	silt	79	3	3,405
10	silt	100	6	4,310

Estimated number of *Corbicula* present in the reservoir of the Unit 2 cooling tower at the time of sampling was estimated at 7 million clams, of which 93% were alive.

Size range (Length)

Sampling Location	Small	Large
Reservoir	1.91 mm	20.01 mm

were found in the ten samples collected from the Unit 2 cooling tower basin.

(Ohio River)

Table V-I-3 summarizes Corbicula densities (clams/100 m³ volume water filtered) in ichthyoplankton samples collected at night once a month in May and July for 1988 through 1992, and twice each month for April through August in 1993 through 1995. However, in survey year 1994, only one ichthyoplankton survey was conducted in both April and August, due to high river conditions, and one survey added in early September. In 1995, Corbicula were first detected in the Ohio River water column in the April 26 samples (Table V-I-3). Corbicula densities peaked in the samples collected on July 31, 1995. The Corbicula collected in the ichthyoplankton samples were very small, typically two to four millimeters in length.

Summary

The weekly screen washing data for 1995 showed that juveniles and adult Corbicula float into BVPS. A trend that has been observed every year since 1985 is that the August and September screen washing collections produce the highest number of Corbicula. The Corbicula screen washing total for 1995 was the second highest since 1985.

The monthly reservoir scraper samples collected in Units 1 and 2 cooling towers during 1995 indicated when Corbicula were entering and colonizing the reservoirs. Corbicula entered the Units 1 and 2 cooling towers through the circulating water systems primarily in July and August of 1995.

Sediment samples were collected in the Unit 1 cooling tower (January 12, 1995) and Unit 2 cooling tower (March 27, 1995) lower reservoirs during the scheduled outages in order to estimate the Corbicula populations within those structures. The estimated number of Corbicula inhabiting the Units 1 and 2 cooling towers at

TABLE V-I-3

Corbicula DENSITIES (Clams/100 m³) PRESENT IN ICHTHYOPLANKTON SAMPLES COLLECTED AT NIGHT WITH A 0.5 m PLANKTON NET IN THE OHIO RIVER, 1988 THROUGH 1995
BVPS

Date		Sample Location			
		Main Channel		Back Channel	
		Surface	Bottom	Surface	Bottom
1988					
May	11	0	1	22	19
July	14	0	15	1	9
1989					
May	24	1	0	1	6
July	13	2	3	5	10
1990					
May	25	0	0	1	3
July	26	35	30	38	27
1991					
May	14	1	1	14	22
July	25	139	36	9	6
1992					
May	19	36	100	71	62
July	9	49	130	38	205
1993					
April	14	0	0	0	0
	29	0	0	0	0
May	13	3	4	44	57
	27	0	1	0	6
June	10	0	0	0	0
	23	0	0	0	0
July	7	7	19	0	1
	21	54	89	31	68
August	4	8	8	4	5
	18	0	0	0	5

TABLE V-I-3
(Continued)

Date		Sample Location			
		Main Channel		Back Channel	
		Surface	Bottom	Surface	Bottom
1994					
April	25	0	0	0	0
May	11	0	0	0	0
	24	2	1	4	9
June	9	7	2	11	24
	22	1	1	2	4
July	3	0	1	1	3
	20	1	4	11	35
	30	29	47	106	125
August	16	0	9	2	5
September	8	6	6	5	10
1995					
April	13	0	0	0	0
	26	4	9	45	19
May	9	5	21	46	69
	26	2	3	2	7
June	6	3	12	19	35
	22	0	2	5	15
July	7	2	3	0	5
	18	6	18	15	42
	31	26	103	0	99
August	14	6	52	0	6
	30	2	9	0	3

the time of the surveys were 382 million and 7 million clams, respectively. Population surveys of both BVPS cooling tower reservoirs conducted during scheduled outages (1986 through 1995) have resulted in lower densities of Corbicula in the Unit 2 tower compared to the Unit 1 cooling tower (Figure V-I-3). This can be attributed to differences in cooling tower design and the faster water currents in the Unit 2 cooling tower reservoir, which decrease sediment deposition.

The collection of juvenile Corbicula from the ichthyoplankton samples demonstrates that Corbicula are typically present in the water column of the Ohio River during the late spring/summer period. These small clams are carried downstream by river currents and enter BVPS through the intake structure. The highest densities of Corbicula in 1995 were present in the July 31 ichthyoplankton samples collected from both the main and back channel stations.

2. Corbicula Larvae Study

Objective

The Corbicula larvae study was designed to collect data on spawning activities in the Ohio River.

Methods

Specially constructed clam cages were utilized for this study. Each cage was constructed of a one square foot durable plastic frame with fiberglass screening (1 mm mesh) secured to cover all open areas. Each cage contained approximately ten pounds of industrial glass beads (3/8" diameter) to provide ballast and a uniform substrate for the clams. The clam cage mesh size permits only very small clams or pediveliger larvae to enter and colonize the cage.

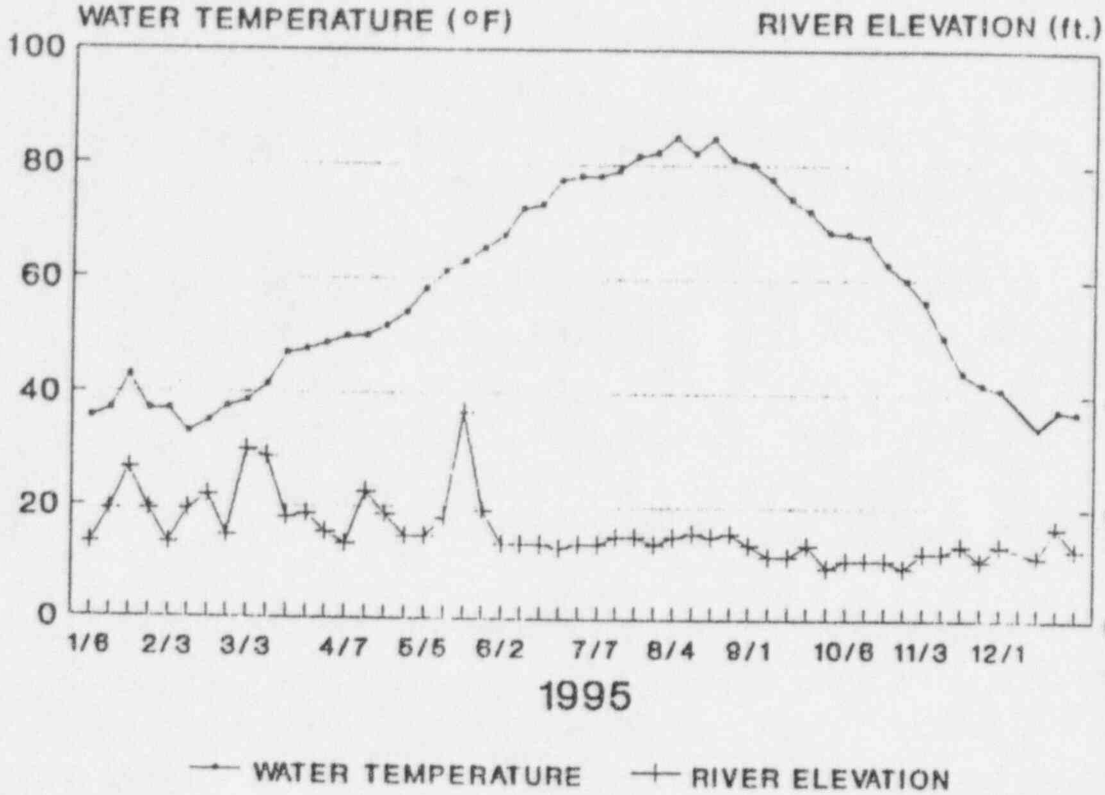
Larval cages were maintained in the BVPS intake structure in 1995 according to the following procedure. Each month, two empty clam cages were placed in the intake structure bays. Each cage was left in place for two months, after which time it was removed and examined for clams. Four clam cages were maintained in the intake structure bays each month throughout 1995.

The rotation schedule used in 1995 for the clam cages differed from that used in 1988 through 1994, when the cages were left in place for five months following initial placement. This change in procedure was made to better define the time period when Corbicula were spawning in the Ohio River, thereby releasing larvae that could enter BVPS through the intake structure.

Each clam cage removed after the two month colonization period was returned to the laboratory where it was processed to obtain the clams which had colonized inside the cage. Corbicula obtained from each cage were rinsed through a series of stacked U.S. Standard sieves ranging in mesh size from 9.5 mm to 0.6 mm. Live and dead clams on each sieve were counted and the numbers were recorded. The largest and smallest clams were measured using Vernier calipers to establish a length range for the sample. The size distribution data obtained using the sieves reflects clam width, rather than length.

Results

Figure V-I-4 illustrates size distribution data which represents the average for the two larval cages which were removed each month from the intake structure. Larval cages removed from January to May 1995 contained no Corbicula. The two intake structure larval cages removed in June 1995 contained juvenile Corbicula (average 15 live clams, Figure V-I-4). The presence of larger juveniles in the June larval cages indicates that the larval forms of those individuals probably entered the cages in late April or May. Corbicula densities increased in cages removed during July, then peaked in August (average 281 live clams). Corbicula densities gradually declined in September and October. As river water



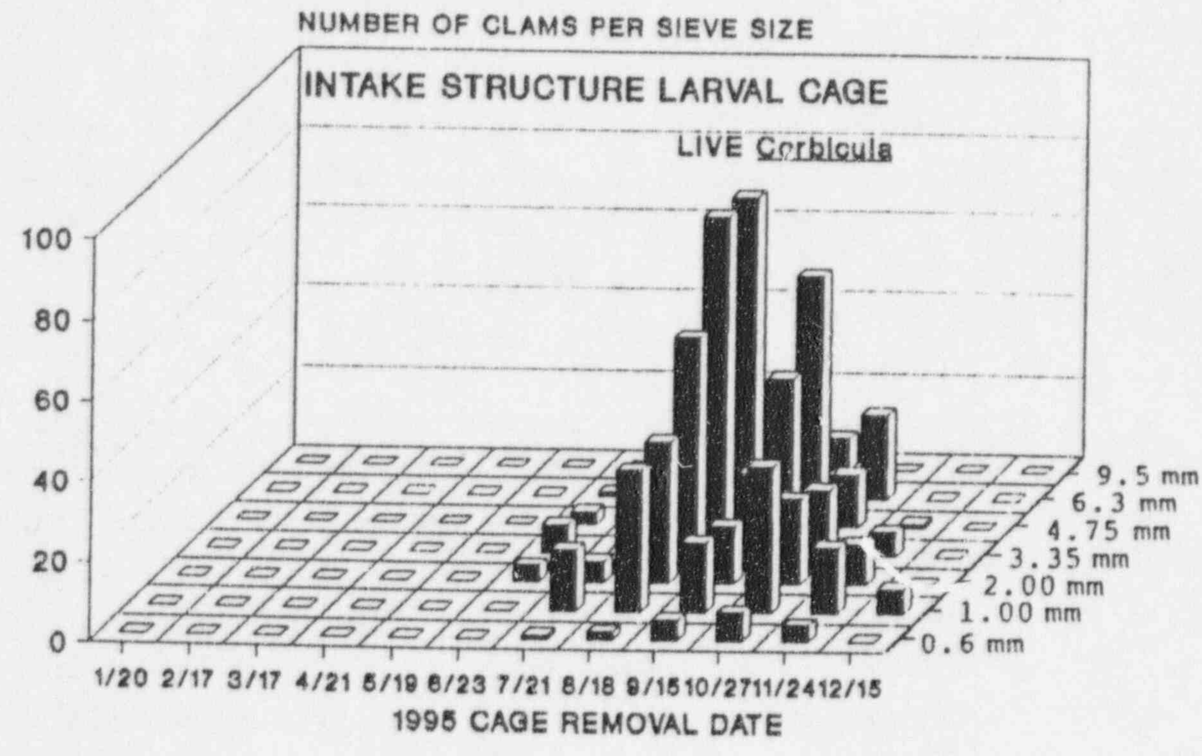


FIGURE V-I-4

RESULTS OF THE <u>Corbicula</u> LARVAE STUDY SIZE DISTRIBUTION
IN THE INTAKE STRUCTURE, 1995
BVPS

temperatures declined in late October through December, the number of Corbicula colonizing the cages decreased and their growth rate also decreased. The largest Corbicula collected in 1995 measured 15.17 mm in length and was removed from one of the September larval cages.

Summary

Juvenile Corbicula were first detected in the larval cages removed from the BVPS intake structure in June. This late spring/early summer spawning period typically occurs in the Ohio River near BVPS each year. The Corbicula larvae entering the larval cages during the summer months exhibited rapid growth, attaining a maximum length of 15.17 mm (colonization period July 21 to September 15). The presence of juvenile Corbicula in the December larval cages suggests that Corbicula were still spawning up to the end of October. As the river temperatures dropped below 50 °F in mid November, the growth rate of Corbicula in the intake structure larval cages decreased. No zebra mussels were found in the intake structure larval cages in 1995.

J. ZEBRA MUSSEL MONITORING PROGRAM

Introduction

Zebra mussels (Dreissena polymorpha) are exotic freshwater mollusks that look similar to marine barnacles, and have brown shells marked with alternating zig-zag yellowish bands. They are believed to have been introduced into North America through the ballast water of ocean-going cargo vessels probably from Eastern Europe. They first appeared in Lake St. Clair in 1987, spread rapidly to other Great Lakes, and have become increasingly abundant in the lower, middle and upper Ohio River in recent years.

Adult zebra mussels can live up to five years and grow to two inches in length. Recent research suggests that each female may be capable of producing one million microscopic (veliger larvae) offspring per year, that can easily pass through water intake screens. They use adhesive hairlike (byssus) threads to attach themselves to any hard surfaces (e.g., boat hulls, intake pipes and other mussels). Transportation of these organisms between water bodies is accomplished in part by boats that have adult mussels attached to their hulls or larvae in their live wells and/or bilges. In anticipation of zebra mussel infestation and responding to NRC Notice No. 89-76 (Biofouling Agent-Zebra Mussel, 21 November 1989), BVPS instituted a Zebra Mussel Monitoring Program in January 1990.

The Zebra Mussel Monitoring Program includes the Ohio River and the circulating river water system of the BVPS (intake structure and cooling towers). This section describes this Monitoring Program and the results obtained during Ohio River and BVPS surveys conducted through 1995.

1. Monitoring

Objectives

The objectives of the Monitoring Program were:

(1) to identify if zebra mussels are in the Ohio River adjacent to BVPS and provide early warning to operations personnel as to their possible infestation.

(2) to provide data as to when the larvae are mobile in the Ohio River and insights as to their vulnerability to potential treatments.

(3) to provide data as to their growth rates under different water temperatures and provide estimates as to the time it requires for these mussels to reach clogging size.

Methods

(Intake Structure)

Three surveillance techniques used in the intake structure were:

(1) the weekly screen washing (impingement) monitoring program.
(2) observations of the divers during regularly scheduled cleaning operations.
(3) Corbicula larval clam cages inspected for zebra mussel colonization.

(Cooling Towers)

The cooling towers were monitored for zebra mussels using three techniques:

(1) the monthly reservoir scraper sample collected in each cooling tower.
(2) the bi-monthly wall scraper sample collected in each cooling tower.
(3) the Corbicula population survey conducted during regularly scheduled outages.

(Ohio River Shoreline)

Each week, in conjunction with the regular impingement survey, the BVPS discharge area was observed for fish, waterfowl and beaver activities. In 1995, the discharge area, along with the barge slip next to the Unit 1 cooling tower, and the intake structure were designated as observation zones for zebra mussels. The barge slip wall and intake shore wall support were sampled bi-monthly using a scraper (with net attached). Approximately 12 square feet of the barge slip wall and intake wall were scraped twice each month. The pilings and rocks were also checked for colonization since these organisms will attach to hard surfaces.

(Communications Network)

The informal communication network established in 1992 for monitoring zebra mussel movements within the Ohio River was continued in 1995. This included an exchange of information between the DEP, U.S. Army Corps of Engineers, ORSANCO, universities, industrial water users, and other electric utilities. BVPS cooperated in this communications program from 1992 through 1995.

Results

The 1995 Zebra Mussel Monitoring Program revealed that live zebra mussels were found by divers at BVPS in the main intake structure (14 individuals) and auxiliary intake structure (10 individuals) during scheduled cleaning operations conducted on October 25, 1995 (main intake) and November 2, 1995 (auxiliary intake). The zebra mussels collected ranged up to 16 mm in length.

The U.S. Army Corps of Engineers reported that twenty-five zebra mussels were identified at New Cumberland Locks and Dam (Ohio River M.P. 54.4) on May 11, 1995, and sixteen zebra mussels were identified at the Maxwell Locks and Dam (Monongahela River M.P. 61.2). These reports confirm the continued dispersal of this organism throughout the upper Ohio River Basin.

Summary

The zebra mussel (Dreissena polymorpha) is an exotic freshwater mollusk that is believed to have been introduced into Lake St. Clair in 1987 via ballast water of ocean-going cargo vessels. Since then, they have spread rapidly to the other Great Lakes and are infesting riverine systems in the United States.

Due to the proximity of the Ohio River to Lake Erie, BVPS initiated a Zebra Mussel Monitoring Program in January 1990. From 1991 through 1993, zebra mussels moved progressively upstream from the lower to upper Ohio River. In 1994, there were confirmed zebra mussel sightings at locations both upstream and downstream from BVPS, including the Allegheny River. The July 1995 sighting of zebra mussels at Maxwell Locks and Dam on the Monongahela River establishes the presence of these organisms within the Allegheny, Monongahela and Ohio Rivers in Western Pennsylvania.

The 1995 Zebra Mussel Monitoring Program indicated the presence of live zebra mussels at BVPS. In 1995, live zebra mussels were found by divers in the BVPS main intake structure and auxiliary intake structure during scheduled cleaning operations conducted on October 25 (main intake) and November 2 (auxiliary intake). Twenty-four zebra mussels were collected, fourteen from the inner Bay C of the main intake structure and ten from the auxiliary intake structure. The largest zebra mussel found measured 16 mm in length.

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