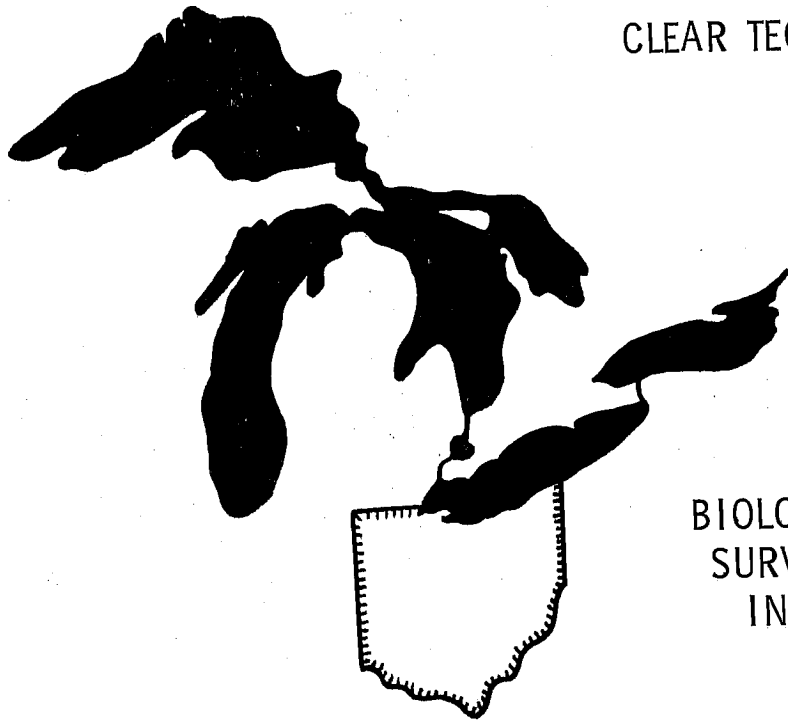


CLEAR TECHNICAL REPORT NO. 124



BIOLOGICAL AND WATER QUALITY
SURVEY OF BIG DARBY CREEK
IN NORTHEASTERN PICKAWAY
COUNTY, OHIO

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INTRODUCTION

The following report documents the biological and water quality characteristics of Big Darby Creek and immediate environs in the vicinity of State Route 762 bridge in Pickaway County, Ohio (PIC-762-0.14). This site, adjacent to Orient State Institute and approximately one mile south of Harrisburg, Ohio, has been selected for highway realignment and bridge replacement. During the period May to July 1979, a field survey was conducted to obtain the data necessary for this documentation and for an assessment of the potential impacts of bridge construction. The study site included the reach of Big Darby Creek from 2500 feet upstream of the existing State Route 762 bridge to 1000 feet downstream of this structure. The proposed location of the replacement structure is 300 feet upstream of the existing bridge.

PROCEDURES

Ecosystem Description

The general features of the ecosystem in the vicinity of the site were documented. This included basic geologic information such as bedrock, surface materials, topography, and stream characteristics. The various habitats and biological communities present at the sites during the study period were described. A search of the scientific literature was conducted to obtain additional information on these sites or nearby areas. This information was integrated with data from the field survey in order to present a comprehensive report on the biological status of the site.

Aquatic Life

Plankton. Phytoplankton and zooplankton were sampled from four stations on Big Darby Creek (Table 1). These included one station 2500 feet upstream from the existing State Route 762 bridge, one 300 feet upstream (proposed location of replacement structure), one at the existing State Route 762 bridge, and one 1000 feet downstream of the existing structure. Because of the shallowness of this stream, vertical tows with a Wisconsin plankton net were impractical. Whole water samples (four liters) were collected at each station, preserved in the field with five percent formalin, and taken to the laboratory for identification. The water from each sample was filtered through a 35 μ nitex screen and concentrated to 40 ml. One to five ml of this concentration was analyzed within a Sedgewick-Rafter cell with a compound microscope. To obtain counts of some of the smaller phytoplankton species, plankters were permitted to settle from whole water samples in a drop tube and were examined with an inverted microscope. Species lists and relative abundance percentages are presented in Table 2. Standard texts and taxonomic keys, which are listed in the References section of this report, were used to confirm plankton identification.

Rooted Aquatic Plants. A thorough visual search was conducted along the banks of the stream 1000 ft. above and below the existing Route 762 bridge. This search was conducted on two dates (early May and mid-July) to locate and identify the resident species of higher aquatic plants.

Benthic Macroinvertebrates. Four qualitative samples were taken in the stream bed in mid-July using dip nets, hand picking, and rock washing techniques. Each sample was preserved in ten percent formalin and returned to the laboratory for identification. Standard texts and manuals (see Reference section) were used to verify identifications. Species occurring at the study sites are listed and the relative abundance of the dominant forms are discussed.

Fish. Seines of varying lengths and a heavy-duty oceanographic ichthyoplankton net (0.5 m diameter, 0.571 mm mesh) were used to thoroughly sample and describe the fishery communities of the stream in the vicinity of the State Route 762 bridge. In addition to the classical

fishery techniques described previously, a literature survey was conducted in an effort to determine historical populations from the stream, and the stream was visually inspected for spawning habitats. The Fishes of Ohio by Trautman (1957) was used to confirm identifications.

In addition to identifying the fish and qualitatively defining the populations with species lists, all fish captured were weighed, measured, and enumerated. The species were ranked both by biomass and numerical abundance. The mean length and weight of each species is presented. A voucher collection of each species will be maintained until completion of construction.

Terrestrial Life

Flora. Trees, shrubs, and herbaceous vegetation were surveyed 1000 ft. upstream and downstream of the existing State Route 762 bridge as well as along a midline transect from a point on the eastern shoreline approximately 300 ft. north of the existing bridge to the State Route 762 roadbed. The purpose of the survey was to identify and delineate dominance types of vegetation. The results of the survey are presented as a list of species present with a discussion of the relative abundance of the dominant forms. Identification of the species encountered was confirmed using standard reference texts, comparison with herbarium specimens and consultation with Ohio State University Herbarium staff members.

Fauna. Using classical field techniques, visual surveys were conducted on three dates (early May, mid-June, and mid-July) within an area extending from a point 1000 ft. downstream to a point 2500 ft. upstream of the existing bridge. Actual visual sightings as well as animal signs, e.g. scats and tracks, were noted. The results are presented as lists of species of mammals, birds, reptiles and amphibians sited within the study area or believed occurring in the study area based on physical evidence encountered. Identification of species encountered were confirmed using standard texts and/or manuals.

Water Quality

Water quality determinations for 18 parameters were made at the four locations on Big Darby Creek listed in Table 1. Time dependent determinations such as temperature, dissolved oxygen, and transparency were made in the field with sensors. Water samples were collected for laboratory analysis for the remaining parameters. All water quality measurements were made using procedures prescribed in Standard Methods for Water Analysis (APHA, 1975) or techniques approved by the U.S. Environmental Protection Agency.

Impact Assessment

The information from the biological and water quality survey, along with the information from previous studies, were utilized to assess the possible impacts of the proposed project on the ecosystem. Possible adverse affects of the new construction on the area biota are discussed.

GENERAL DESCRIPTION OF ECOSYSTEM

Geological Setting

Bedrock and Surface Materials. Pickaway County, Ohio is underlain by rocks of Middle Devonian Age, largely marine sediments which have been lithified to limestones and shales. The bedrock is well masked with a thick covering of glacial drift (Stout, 1941) and, therefore, exposures are few. The bedrock underlying Big Darby Creek in the vicinity of Orient is the Columbus Limestone Formation. Orient stands at an elevation of 840 feet, Big Darby Creek at 770 feet, and the bedrock floor at 740 feet (Stout, et al., 1943).

The Big Darby Creek valley lies in an area of level or gently rolling land that ranges generally from 770 to 1000 feet above sea level. Two and probably three ice sheets advanced across the study site, the last of which, the Wisconsin, is most responsible for the present landscape. These periodic glacial advances and retreats have left a complex sequence of interbedded outwash deposits and glacial till. The till and other glacial deposits vary in thickness from a few feet to over 200 feet.

Eight soils dominate the Big Darby Creek valley. The well-drained Ross and Genesee soils occupy the floodplain. Above the alluvial plains, outwash terraces of Fox and Warsaw soils are common. The valley walls are primarily Miamian and Celina soils, while the flanking till plains above are Brookston and Crosby soils, characterized by poor drainage (Marshall, et al., 1974).

Stream Characteristics. Big Darby Creek is a free-flowing stream located within the Scioto River Basin of central Ohio. The headwaters of the stream rise near East Liberty in southeastern Logan County. Big Darby Creek flows southeasterly for most of its 78-mile length, finally emptying into the Scioto River near Circleville in Pickaway County. The creek and its tributaries drain an area of approximately 557 square miles, including portions of Logan, Union, Champaign, Clark, Madison, Franklin and Pickaway Counties (Figure 1). From an elevation of 1,170 feet at the source, the stream falls an average of 6.8 feet/mile to an elevation of 643 feet at its mouth. Big Darby Creek has been designated as a "State and National Resource Water" and as an "Exceptional Warmwater Habitat" by the Ohio Environmental Protection Agency (1978).

The U.S. Geological Survey maintains a hydrologic station (No. 03230500) on Big Darby Creek at Darbyville, approximately eight miles downstream from the State Route 762 bridge at Orient. During the 53-year period of record the mean discharge rate has been 439 cubic feet per second (CFS) at the gaging station. A maximum discharge rate of 49,000 CFS (stream elevation 731.63 feet above sea level) was recorded on January 22, 1959, while the minimum rate of 1.4 CFS was measured on September 17, 1932.

During the field survey Big Darby Creek was in flood condition on June 11, 1979, due to heavy rainfall of June 10, 1979. The stream was

very turbid, reddish-brown in color and over 100 feet wide at the State Route 762 bridge. On July 18, 1979, the stream was very clear, bottom visible throughout and generally less than five feet deep (Table 1).

Biological Habitats

Aquatic. The aquatic habitat of Big Darby Creek in Pickaway County, Ohio at the State Route 762 bridge can be described as a high gradient, rapidly flowing, shallow, riffle/pool habitat. Furthermore, the pools are generally small and occupy less than one half of the stream width. Ample cover is provided at many locations along both banks by log snags and overhanging shrubs and throughout the course of the stream behind and under the numerous boulders. As mentioned previously, Ohio EPA has declared this stream to be an "Exceptional Warmwater Habitat" due to its high water quality. The ratio of riffles to pools is high.

Wetlands. There are no wetlands in the study area except for a few, small seasonally inundated low areas lacking most wetland characteristics.

Terrestrial. The study area is essentially a hydric flood-plain forest except where it has been cleared to serve as pasture, lawn, or access roadway.

AQUATIC LIFE

Plankton

Phytoplankton. Thirty-four taxa of algae were identified from the four stations on Big Darby Creek (Table 2). Diatoms were the most abundant group in the stream (54.2%), with Navicula, Fragilaria, Nitzschia, and Melosira being the most numerous genera. Euglenoids were the next most common group, followed by green algae, cryptophytes, blue-green algae, chrysophytes, and dinoflagellates. The average population density of all taxa at all stations was 1216 cells, colonies, or filaments per liter. The downstream and upstream stations had the highest populations, 1442/l and 1439/l, respectively, while the lowest density, 860/l, was found at the existing State Route 762 bridge. Except for the four major diatom genera, the euglenoid Phacus, and the cryptophyte Cryptomonas, all other phytoplankters had population densities of less than 5/l. Differences in the taxa between stations were minor.

The environmental significance of the major algae species found in Big Darby Creek is outlined in Table 3. An inspection of this table reveals that most of the taxa found are common to streams and that 16 of them are associated with some degree of eutrophication (nutrient enrichment). Only five genera are indicators of freshwater pollution, while two are indicators of clean water. In general, the composition and density of the phytoplankton indicates a relatively clean water environment with a moderate amount of nutrient enrichment and cultural pollution.

Zooplankton. Five taxa of planktonic animals were identified from the samples collected at the four stations on Big Darby Creek (Table 2). Rotifers were the most abundant group, with Brachionus calycifloris being the most numerous species. Nematodes and oligochaetes were also obtained in the zooplankton samples but these groups are generally considered to be benthic organisms. Other common zooplankton groups such as copepods and cladocerans were not found in Big Darby Creek samples, probably because of their ability to avoid the water sampling device. The zooplankton density averaged four plankters per liter. No taxa particularly associated with degraded water quality were detected.

Rooted Aquatic Plants

Vascular aquatic plants were essentially absent with the limits of the study area. The cobble and boulder stream lacked established aquatic plants. The shoreline consisted of low but steep banks or broad cobble bars without established aquatic vascular plants.

Benthic Macroinvertebrates

River snails (Goniobasis sp.) were the predominant benthic organisms observed at the four study sites. The other dominant components of the benthic fauna, ranked in order of abundance, were caddisflies (Cheumatopsyche sp.) and mayflies (Stenonema sp.). The species encountered at each sampling site are listed in Table 4. This fauna may be considered typical of rocky, good water quality streams in central Ohio.

Fish

Big Darby Creek supports an unusually large variety of fish--about 90 verified species (Marshall, et al., 1974)--thanks to its relatively high water quality and the diversity of aquatic habitats that it provides. One species, the Sciota madtom (Noturus trautmani) is a small madtom found only in the Big Darby Creek. It is presently on the U.S. list of endangered fish and wildlife.

Trautman (1957) lists 80 species as occurring in the Pickaway County portion of Big Darby Creek (Table 5). Sampling efforts, utilizing seines, during the present study yielded six species all of which had been previously reported by Trautman (1957) (Table 6). Stonerollers were the dominant species representing 35 percent of the catch followed by spotfin shiners at 30 percent and striped shiners at 20 percent (Table 7). Schools of young-of-the-year striped shiners and stonerollers along with adult darters were common but were difficult to catch with seines due to many snags. Fish densities appeared greatest near the stream banks.

Most of the Big Darby Creek in Pickaway County can be classified as classic riffle/pool habitat. In the vicinity of the existing bridge and the proposed new bridge site the stream is almost one continual riffle with few areas over 0.5 m in depth. This is ideal spawning habitat for the six species collected and probably serves at their year-round residence.

TERRESTRIAL LIFE

Flora

Except where bordered by pastureland, lawn, or accessway, the margin of the stream is composed by hydric forest in which box elder (Acer negundo) and silver maple (Acer saccharinum) are predominant. In early May, the marsh blue violet (Viola cucullata), cut-leaf toothwort (Bentaria lacinata) and bluebell (Mertensia virginica) were dominant components of the herbaceous vegetation. Later, in June and July, Rue Anemone (Anemonella thalictroides) and Jewelweed (Impatiens sp.), respectively, were the dominant herbs. Vegetation within the limits of the study area are listed in Table 8.

Fauna

Although careful inspection of the study area produced no evidence of amphibian or reptilian inhabitants, the study area provides suitable habitat for several species of reptiles and amphibians common to central Ohio. The inspection also produced little evidence of mammalian habitation, but the area provides suitable habitat for cottontail rabbit (Sylvilagus floridanus), raccoon (Procyon lotor), and white-tail deer (Odocoileus virginianus).

Avifauna within the study area were observed during the migratory period in early May and during the breeding period in mid-June. Waterfowl and typical wetland or shore birds were not observed on either occasion. Thirteen species were observed in May. Twenty-one species were observed during the breeding bird census. The breeding bird census represents approximately 15 percent of the 135 taxa known to nest in central Ohio (Bandy, 1976). The area is utilized predominately by passerine birds. Avifauna observed within the study area are listed in Tables 9 and 10.

Ecosystem

The forest ecosystem located within the study area is hydric forest which does not occupy any appreciable part of the flood plain nor is it subject to protracted periods of overflow. This forest ecosystem exists as a fringe of varying depth, in some places it is little more than a band of stream-side trees, bordering the margins of Big Darby Creek. Gordon (1966) indicated that vegetation in the area at the time of the earliest land surveys was oak-sugar maple forest. Without the obvious impact of man's activities, the dominant canopy vegetation of this forest would be quite different.

WATER QUALITY

Table 11 contains the results of water quality determinations for samples collected at three stations on Big Darby Creek on June 11, 1979. For comparison, determinations made by the U.S. Geological Survey (1977 and 1978) at Darbyville, eight miles downstream from State Route 762 bridge, in April and June 1976 and in March and July 1977 are presented in Table 12. The results for these five dates agree reasonably well and indicate a relatively consistent quality of the water. Phosphorus concentrations appear to be higher in 1979 indicating increased nutrient enrichment in the past two years. Flood conditions in the stream in 1979 may also account for the higher value for the "total" determinations. Very little station-to-station variation was noted in the June 1979 samples.

Big Darby Creek, from its headwaters to its mouth, has been designated as an "Exceptional Warmwater Habitat" by the Ohio Environmental Protection Agency (1978). The water quality standards for such a stream are listed in Table 13. The quality of Big Darby Creek did not exceed any of the maximum permissible concentrations established by Ohio EPA, except zinc which was recorded by USGS to be 1200 ug/l on March 23, 1977. This concentration is 40 times greater than the standard. Even though the stream meets all other Ohio EPA standards, nutrient enrichment (nitrogen and phosphorus) is evident.

IMPACT ASSESSMENT

In an attempt to determine the degree of environmental disturbance associated with the proposed bridge replacement, an inspection trip was made to more recently constructed bridge over Big Darby Creek at Harrisburg in Franklin County (State Route 3). It is anticipated that a similar type of structure will be built to replace the existing State Route 762 bridge. It appears that environmental impacts of this construction will be localized and temporary. All of the vegetation and benthic organisms in the right-of-way will be eliminated. The natural vegetation is not unique to the study site; it will be replaced by slope--stabilizing ground cover. The stream bottom will probably be recognized by benthic fauna within 12 months. During the construction period, increased turbidity can be expected downstream of the crossing. This turbidity is not expected to exceed the natural condition monitored on June 11, 1979 due to heavy rainfall. Some fish spawning habitat may be lost, but this is not considered significant in terms of the entire Big Darby Creek ecosystem. In summary, environmental losses due to this project are considered minimal, primarily because of the availability of extensive undisturbed habitats of a similar nature in adjacent areas. No endangered species were observed at the study site.

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TABLES

TABLE 1
 STATION LOCATIONS AND STREAM CHARACTERISTICS
 FOR BIG DARBY CREEK

Station Code	Location	Water Depth (m)	Bottom Material
DC-1	Darby Creek at Rt. 3 Bridge (upstream)	1.5	Sand and clay
DC-2	Darby Creek at 300 ft. upstream from Rt. 762 Bridge	1.0	Gravel; cobbles and boulders
DC-3	Darby Creek at Rt. 762 Bridge	0.5	Gravel; cobbles and boulders
DC-4	Darby Creek at R.R. Bridge (downstream)	0.5	Gravel; cobbles and boulders

TABLE 2

PHYTOPLANKTON AND ZOOPLANKTON ANALYSIS FOR BIG DARBY CREEK
IN THE VICINITY OF STATE ROUTE 762, PICKAWAY COUNTY, OHIO*

Plankton Groups	PHYTOPLANKTON							
	Route 3 Bridge Station No. 1		Upstream from Route 762 Bridge Station No. 2		Route 762 Bridge Station No. 3		Downstream from Route 762 Bridge Station No. 4	
	Cells, Colonies or Filaments per liter	Relative Abundance (%)	Cells, Colonies or Filaments per liter	Relative Abundance (%)	Cells, Colonies or Filaments per liter	Relative Abundance (%)	Cells, Colonies or Filaments per liter	Relative Abundance (%)
CYANOPHYTA (Blue-Green Algae)			21	1.9				
1. <i>Chroococcus limneticus</i>	11	0.8	21	1.9	95	11.0	74	5.1
2. <i>Lynqbya</i> sp.	63	4.4						
3. <i>Oscillatoria agardhii</i>	11	0.8						
4. <i>Oscillatoria</i> sp.								
CHLOROPHYTA (Green Algae)			42	3.7	32	3.7	32	2.2
<i>Cladophora</i> sp.					21	2.4	53	3.7
<i>Closterium aciculare</i>	63	4.4	21	1.9				
<i>Closterium eboracense</i>	11	0.8						
<i>Coelastrum reticulatum</i>	11	0.8			11	1.3	11	0.8
<i>Dictyosphaerium pulchellum</i>	21	1.5	11	1.0	11	1.3	42	2.9
<i>Pediastrum boryanum</i>	42	2.9	11	1.0	11	1.3		
<i>Platydorina</i> sp.			11	1.0	11	1.3		
<i>Scenedesmus acuminatus</i>	21	1.5	21	1.9				
<i>S. bicaudatus</i>			32	2.8				
<i>S. quadricauda</i>	11	0.8			11	1.3		
<i>Selenastrum</i> sp.			21	1.9				
<i>Shroederia setigera</i>								
BACILLARIOPHYTA (Diatoms)							21	1.5
<i>Achnanthes</i> sp.	21	1.5	85	7.6				
Centric diatoms			21	1.9	11	1.3		
<i>Cymbella</i> sp.			11	1.0	201	23.4	232	16.0
<i>Fragilaria</i> sp.	359	24.7	169	14.9	11	1.3		
<i>Gyrosigma</i> sp.	11	0.8	11	1.0	32	3.7	63	4.4
<i>Melosira granulata</i>	85	5.9	32	2.8	42	4.9	53	3.7
<i>M. varians</i>	32	2.2	11	1.0	32	3.7	11	0.8
Naviculaoid diatoms	85	5.9	137	12.2	32	3.7	110	7.6
<i>Nitzschia acicularis</i>	116	8.0	85	7.6	32	3.7	211	14.6
<i>N. sigmaidea</i>	11	0.8			11	1.3	11	0.8
<i>Nitzschia</i> sp.	21	1.5	63	5.6	42	4.9	32	2.2
<i>Surirella angustata</i>	32	2.2	21	1.9	11	1.3	21	1.5
<i>Synedra</i> sp.					21	2.4		
<i>Tabellaria flocculosa</i>	11	0.8						
CRYPTOPHYTA (Cryptophytes)							95	6.6
<i>Cryptomonas ovata</i>	158	11.7	169	14.9	63	7.3		
CHRYSOPHYTA (Chrysophytes)							53	3.7
<i>Trachelomonas</i> sp.	21	0.8	11	1.0				
PYRRROPHYTA (Dinoflagellates)							21	1.5
<i>Peridinium</i> sp.			11	1.0				
EUGLENOPHYTA (Euglenoids)							296	20.4
<i>Phacus</i> spp.	211	14.5	85	7.6	148	17.2		
TOTAL ALGAE (cells, colonies or filaments)	1439	100.0	1123	100.0	860	100.0	1442	100.0
	ZOOPLANKTON							
	Route 3 Bridge Station No. 1		Upstream from Route 762 Bridge Station No. 2		Route 762 Bridge Station No. 3		Downstream from Route 762 Bridge Station No. 4	
	Animals per liter	Relative Abundance (%)	Animals per liter	Relative Abundance (%)	Animals per liter	Relative Abundance (%)	Animals per liter	Relative Abundance (%)
ROTIFERA (Rotifers)								
<i>Platylas patulus</i>	2	33.4	2	33.4				
<i>Chromogaster ovalis</i>			2	33.3	4	100.0		
<i>Brachionus calycifloris</i>								
OTHERS								
Nematode	2	33.3	2	33.3				
Oligochaete	2	33.3						
TOTAL ZOOPLANKTON	6	100.0	6	100.0	4	100.0	0	--

* Samples collected on July 18, 1979

TABLE 3

ENVIRONMENTAL SIGNIFICANCE OF ALGAE FOUND IN BIG DARBY CREEK

Phytoplankton Species	Attached Algae	Clean Water Algae	Eutrophication Indicators	Freshwater Pollution Indicators	Stream Algae	Taste and Odor Algae	Filter Clogging Algae
CYANOPHYTA (Blue-Green Algae)							
<u>Chroococcus limneticus</u>			X				
<u>Lyngbya sp.</u>	X		X	X	X		
<u>Oscillatoria agardhii</u>			X		X		
<u>Oscillatoria sp.</u>			X	X	X		X
CHLOROPHYTA (Green Algae)							
<u>Cladophora sp.</u>	X	X			X		
<u>Closterium aciculare</u>					X		
<u>Closterium eboracense</u>					X		
<u>Pediastrum boryanum</u>			X		X		
<u>Platydorina</u>					X		
<u>Scenedesmus acuminatus</u>					X		
<u>Scenedesmus bicaudatus</u>					X		
<u>Scenedesmus quadricauda</u>			X		X		
<u>Scenedesmus sp.</u>					X		
<u>Shroederia</u>					X		
BACILLARIOPHYTA (Diatoms)							
<u>Achnanthes sp.</u>					X		
<u>Cymbella sp.</u>	X	X			X		
<u>Fragilaria sp.</u>					X	X	
<u>Gyrosigma sp.</u>			X		X		
<u>Melosira granulata</u>			X		X		X
<u>Melosira varians</u>			X		X		X
<u>Nitzschia acicularis</u>			X		X		
<u>Nitzschia sigmoides</u>			X		X		
<u>Nitzschia sp.</u>			X	X	X		
<u>Surirella angustata</u>			X		X		
<u>Synedra sp.</u>			X	X	X	X	X
<u>Tabellaria flocculosa</u>			X		X		X
CRYPTOPHYTA							
<u>Cryptomonas ovata</u>					X		
CHRYSOPHYTA							
<u>Trachelomona sp.</u>					X		X
PYRRPHYTA (Dinoflagellates)							
<u>Peridinium sp.</u>					X		X
EUGLENOPHYTA							
<u>Phacus sp.</u>			X	X	X		

Data Source: Palmer (1977)

TABLE 4

LISTING OF BENTHIC MACROINVERTEBRATES
STATE ROUTE 762 AT ORIENT-PICKAWAY COUNTY
JULY 18, 1979

STATION TAXON	Upstream No. 1	300 ft. Upstream of Rt. 762 Bridge No. 2	Rt. 762 Bridge No. 3	Downstream No. 4
<u>Dugesia</u> sp. (Turbellaria: Planariidae)	x			x
<u>Fredericella</u> sp. (Bryozoa: Plumatellidae)		x	x	x
<u>Goniobasis</u> sp. (Gasteropoda: Pleuroceridae)	x		x	x
<u>Orconectes rusticus</u> (Crustacea: Cambaridae)			x	x
<u>Caenis</u> sp. (Insecta: Baetidae)	x			
<u>Stenonema</u> sp. (Insecta: Heptageniidae)	x	x	x	x
<u>Neoperla</u> sp. (Insecta: Perlidae)		x		
<u>Cheumatopsyche</u> sp. (Insecta: Hydropsychidae)		x	x	x
<u>Laccophilus</u> sp. (Insecta: Dytiscidae)	x			
<u>Hydrophilus</u> sp. (Insecta: Hydrophilidae)	x			
<u>Psephenus</u> sp. (Insecta: Psephenidae)	x	x	x	x
<u>Stenelmis</u> sp. (Insecta: Elmidae)		x	x	x

TABLE 5

HISTORICAL REVIEW* OF FISH SPECIES
INHABITING BIG DARBY CREEK IN PICKAWAY COUNTY, OHIO

COMMON NAME	SCIENTIFIC NAME**
Northern Brook Lamprey	<u>Ichthyomyzon fossor</u>
Paddlefish (1926-50)	<u>Polyodon spathula</u>
Lake Sturgeon (prior to 1916)	<u>Acipenser fulvescens</u>
Longnose Gar	<u>Lepisosteus osseus</u>
Goldeye	<u>Hiodon alosoides</u>
Redfin Pickerel	<u>Esox americanus</u>
Quillback Carpsucker	<u>Carpiodes cyprinus</u>
Silver Redhorse	<u>Moxostoma anisurum</u>
Black Redhorse	<u>M. duquesnei</u>
Golden Redhorse	<u>M. erythrurum</u>
Shorthead Redhorse	<u>M. macrolepidotum</u>
River Redhorse	<u>M. carinatum</u>
Northern Hog Sucker	<u>Hypentelium nigricans</u>
White Sucker	<u>Catostomus commersoni</u>
Spotted Sucker (prior to 1925)	<u>Minytrema melanops</u>
Creek Chubsucker (prior to 1938)	<u>Erimyzon oblongus</u>
Carp	<u>Cyprinus carpio</u>
Golden Shiner	<u>Notemigonus crysoleucas</u>
Hornyhead Chub	<u>Nocomis biguttatus</u>
River Chub (prior to 1937)	<u>N. micropogon</u>
Silver Chub	<u>Hybopsis storeriana</u>
Bigeye Chub	<u>H. amblops</u>
Streamline Chub	<u>H. dissimilis</u>
Blacknose Dace	<u>Rhinichthys atratulus</u>
Creek Chub	<u>Semotilus atromaculatus</u>
Suckermouth Minnow	<u>Phenacobius mirabilis</u>
Emerald Shiner	<u>Notropis atherinoides</u>
Silver Shiner	<u>N. photogenis</u>
Rosyface Shiner	<u>N. rubellus</u>
Rosefin Shiner	<u>N. ardens</u>
Striped Shiner	<u>N. chrysocephalus</u>
Steelcolor Shiner	<u>N. whipplei</u>
Spotfin Shiner	<u>N. spilopterus</u>
Sand Shiner	<u>N. stramineus</u>
Mimic Shiner	<u>N. volucellus</u>
Silverjaw Minnow	<u>Ericymba buccata</u>
Bullhead Minnow	<u>Pimephales vigilax</u>
Fathead Minnow	<u>P. promelas</u>
Bluntnose Minnow	<u>P. notatus</u>
Stoneroller	<u>Campostoma anomalum</u>
Channel Catfish	<u>Ictalurus punctatus</u>
Yellow Bullhead	<u>I. natalis</u>
Black Bullhead	<u>I. melas</u>
Flathead Catfish	<u>Pilodictis olivaris</u>
Stonecat Madtom	<u>Noturus flavus</u>

TABLE 5 (continued)

HISTORICAL REVIEW* OF FISH SPECIES
INHABITING BIG DARBY CREEK IN PICKAWAY COUNTY, OHIO

COMMON NAME	SCIENTIFIC NAME**
Brindled Madtom	<u>N. miurus</u>
Tadpole Madtom	<u>N. gyrinus</u>
Sciota Madtom	<u>N. trautmani</u>
American Eel	<u>Anguilla rostrata</u>
Blackstripe Topminnow	<u>Fundulus notatus</u>
Trout-perch	<u>Percopsis omiscomaycus</u>
Brook silverside	<u>Labidesthes sicculus</u>
White Crappie	<u>Pomoxis annularis</u>
Rock Bass	<u>Ambloplites rupestris</u>
Smallmouth Bass	<u>Micropterus dolomieu</u>
Spotted Bass	<u>M. punctulatus</u>
Largemouth Bass	<u>M. salmoides</u>
Green Sunfish	<u>L. cyanellus</u>
Bluegill	<u>L. macrochirus</u>
Orangespotted Sunfish	<u>L. humilis</u>
Longear Sunfish	<u>L. megalotis</u>
Pumpkinseed (prior to 1926)	<u>L. gibbosus</u>
Sauger	<u>Stizostedion canadense</u>
Walleye	<u>S. vitreum vitreum</u>
Dusky Darter	<u>P. sciera</u>
Blackside Darter	<u>Percina maculata</u>
Slenderhead Darter	<u>P. phoxocephala</u>
Logperch	<u>P. caprodes</u>
Eastern Sand Darter	<u>Ammocrypta pellucida</u>
Johnny Darter	<u>Etheostoma nigrum</u>
Greenside Darter	<u>E. blennioides</u>
Banded Darter	<u>E. zonale</u>
Variagate Darter	<u>E. variatum</u>
Bluebreast Darter	<u>E. camurum</u>
Tippecanoe Darter	<u>E. tippecanoe</u>
Rainbow Darter	<u>E. caeruleum</u>
Orangethroat Darter	<u>E. spectabile</u>
Fantail Darter	<u>E. flabellare</u>
Freshwater Drum	<u>Aplodinotus grunniens</u>
Mottled Sculpin	<u>Cottus bairdi</u>

80 species

* From Trautman (1957). Many of these species were not reported from the exact point of the bridge construction but were documented within Pickaway County within this drainage basin.

** Bailey et al. (1970)

TABLE 6

SCIENTIFIC AND COMMON NAMES¹ OF FISH SPECIES COLLECTED²
 FROM BIG DARBY CREEK NEAR THE ROUTE 762 BRIDGE
 IN PICKAWAY COUNTY, OHIO 18 JULY 1979

COMMON NAME	SCIENTIFIC NAME
Bluntnose Minnow	<u>Pimephales notatus</u>
Rainbow Darter	<u>Etheostoma caeruleum</u>
Rock Bass	<u>Ambloplites rupestris</u>
Spotfin Shiner	<u>Notropis spilopterus</u>
Stoneroller	<u>Campostoma anomalum</u>
Striped Shiner	<u>Notropis chrysocephalus</u>

¹ From Bailey *et al.* (1970)

² Collected using shore seines varying in length from 1.5-9 m and a heavy-duty oceanographic plankton net (0.5 m diameter, 0.571 mm mesh). No ichthyoplankters were observed in samples.

TABLE 7

SUMMARY OF SHORE SEINING AND FRY NETTING CATCH FROM
BIG DARBY CREEK NEAR THE ROUTE 762 BRIDGE IN
PICKAWAY COUNTY, OHIO - 18 JULY 1979

Species	Number Captured	% of Total by No.	Length (mm)		Weight (g)		% of Total by Weight
			Mean	Range	Mean	Total	
Bluntnose Minnow	1	5.0	55		1	1	0.4
Rainbow Darter	1	5.0	26		1	1	0.4
Rock Bass	1	5.0	199		205	205	91.9
Spotfin Shiner	6	30.0	64	45 - 77	1	8	3.6
Stoneroller	7	35.0	32	30 - 33	1	4	1.8
Striped Shiner	4	20.0	53	33 - 62	1	4	1.8
TOTAL	20					223	

TABLE 8
 LISTING OF VASCULAR FLORA
 State Route 762 at Orient-Pickaway County

Common Name	Scientific Name
Trees:	
Black Willow	<i>Salix nigra</i>
Cottonwood	<i>Populus deltoides</i>
American Elm	<i>Ulmus americana</i>
Hackberry	<i>Celtis occidentalis</i>
Sycamore	<i>Platanus occidentalis</i>
Black Locust	<i>Robinia pseudo-acacia</i>
Box Elder	<i>Acer negundo</i>
Red Maple	<i>Acer rubrum</i>
Silver Maple	<i>Acer saccharinum</i>
Ohio Buckeye	<i>Aesculus glabra</i>
Shrubs:	
Redbud	<i>Cercis canadensis</i>
Kinnikinnick	<i>Cornus anomum</i>
Common Elderberry	<i>Sambucus canadensis</i>
Herbaceous Vegetation:	
Wild Garlic	<i>Allium sativum</i>
Solomon's Seal	<i>Polygonatum sp.</i>
Stinging Nettle	<i>Urtica sp</i>
Wild Sweet William	<i>Phlox maculata</i>
Swamp Buttercup	<i>Ranunculus septentrionalis</i>
Meadow Rue	<i>Thalictrum sp.</i>
Rue Anemone	<i>Anemonella thalictroides</i>
Bloodroot	<i>Sanguinaria canadensis</i>
Dutchman's Britches	<i>Dicentra cucullaria</i>
Garlic Mustard	<i>Alliaria officinalis</i>
Yellow Rocket	<i>Barbarea vulgaris</i>
Cut-leaf Toothwort	<i>Dentaria lacinata</i>
Poison Ivy	<i>Rhus radicans</i>
Jewelweed	<i>Impatiens sp</i>
Virginia Creeper	<i>Parthenocissus quinquefolia</i>
Riverbank Grape	<i>Vitus riparia</i>
Marsh Blue Violet	<i>Viola cucullata</i>
Golden Alexander	<i>Zizia aurea</i>
Queen Anne's Lace	<i>Daucus carota</i>
Moneywort	<i>Lysimachia nummularia</i>
Common Milkweed	<i>Asclepias syriaca</i>
Bluebell	<i>Mertensia virginica</i>
Ground Ivy	<i>Glechoma hederacea</i>
Bedstraw	<i>Gallium sp</i>
Roundleaf Ragwort	<i>Senecio obovatus</i>
Common Burdock	<i>Arctium minus</i>
Dandelion	<i>Taraxacum officinale</i>

TABLE 9

LISTING OF AVIFAUNA OBSERVED WITHIN THE STUDY AREA-May 6, 1979
 State Route 762 at Orient-Pickaway County

Common Name	Scientific Name
Turkey Vulture	<i>Cathartes aura</i>
Rock Dove	<i>Columba livia</i>
Mourning Dove	<i>Zenaidura macroura</i>
Common Flicker	<i>Colaptes auratus</i>
Blue Jay	<i>Cyanocitta cristata</i>
House Wren	<i>Troglodytes aedon</i>
Robin	<i>Turdus migratorius</i>
Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>
Warbling Vireo	<i>Vireo gilvus gilvus</i>
Blackpoll Warbler	<i>Dendroica striata</i>
Common Grackle	<i>Quiscalus quiscula</i>
Cardinal	<i>Richmondia cardinalis</i>
Song Sparrow	<i>Melospiza melodia</i>

TABLE 10
 LISTING OF AVIFAUNA OBSERVED WITHIN THE STUDY AREA-June 11,1979
 State Route 762 at Orient-Pickaway County

Common Name	Scientific Name
Rock Dove	<i>Columba livia</i>
Common Flicker	<i>Colaptes auratus</i>
Downy Woodpecker	<i>Dendrocopos pubescens</i>
Acadian Flycatcher	<i>Empidonax virescens</i>
Eastern Wood Pewee	<i>Contopus virens</i>
Blue Jay	<i>Cyanocitta cristata</i>
House Wren	<i>Troglodytes aedon</i>
Robin	<i>Turdus migratorius</i>
Wood Thrush	<i>Hylocichla mustelina</i>
Starling	<i>Sturnus vulgaris</i>
Red-eyed Vireo	<i>Vireo olivaceus</i>
Warbling Vireo	<i>Vireo gilvus</i>
House Sparrow	<i>Passer domesticus</i>
Red-winged Blackbird	<i>Agelaius phoeniceus</i>
Northern Oriole	<i>Icterus galbula</i>
Common Grackle	<i>Quiscalus quiscula</i>
Brown-headed Cowbird	<i>Molothrus ater</i>
Indigo Bunting	<i>Passerina cyanea</i>
American Goldfinch	<i>Spinus tristis</i>
Rufous-sided Towhee	<i>Pipilo erythrophthalmus</i>
Song Sparrow	<i>Melospiza melodia</i>

TABLE 11

WATER QUALITY ANALYSIS FOR BIG DARBY CREEK IN THE
VICINITY OF STATE ROUTE 762, PICKAWAY COUNTY, OHIO

Parameter	Units	Darby Creek Station No. 1	Darby Creek Station No. 2	Darby Creek Station No. 3
Date	--	6/11/79	6/11/79	6/11/79
Time	--	3:50 p.m.	4:00 p.m.	4:10 p.m.
Temperature	°C	21.0	21.8	21.6
Conductivity	umhos/cm	450	460	460
Hydrogen ions	pH units	7.85	7.97	8.02
Transparency	meters	0.07	0.07	0.07
Water depth	meters	0.20	0.15	0.30
Sol. react. phosphorus	ppb	66.0	68.8	70.0
Soluble phosphorus	ppb	71.6	76.5	76.5
Total phosphorus	ppb	408.0	382.8	400.8
Total iron	mg/l	5.4	4.6	5.4
Ammonia nitrogen	mg/l	0.29	0.72	0.74
Nitrate + nitrite	mg/l	9.80	9.61	9.73
Total hardness	mg/l	278	260	264
Total alkalinity	mg/l	174	162	160
Total acidity	mg/l	20	18	20
Chloride	mg/l	32	27	26
Sulfate	mg/l	19	19	19
Dissolved oxygen	mg/l	9.0	8.8	8.9
Turbidity	NTU	180	200	200
Flow	visual turbid, flood conditions*			

* heavy rainfall on June 10, 1979

TABLE 12

WATER QUALITY DATA FOR BIG DARBY CREEK AT DARBYVILLE, OHIO

	1976	1976	1977	1977
1. Year				
2. Date	April 13	June 16	March 23	July 8
3. Time	1445	1400	1015	1115
4. Discharge (CFS)	144	75	1220	105
5. Conductivity (umhos/cm)	660	640	670	700
6. pH (units)	8.6	8.2	8.2	8.2
7. Temperature (°C)	13.0	23.0	5.5	27.0
8. Dissol. oxygen (mg/l)	12.8	8.7	11.4	6.8
9. DO saturation (%)	120	100	90	84
10. BOD-5 day (mg/l)	1.3	6.2	0.4	2.3
11. Hardness (mg/l)	350	320	330	330
12. Dissol. calcium (mg/l)	81	60	79	78
13. Dissol. magnesium (mg/l)	37	41	33	32
14. Dissol. sodium (mg/l)	17	18	12	14
15. Dissol. potassium (mg/l)	1.9	2.4	2.1	2.6
16. Total alkalinity (mg/l)	259	212	208	249
17. Carbon dioxide (mg/l)	1.3	2.6	2.6	3.1
18. Dissol. sulfate (mg/l)	82	76	60	58
19. Dissol. chloride (mg/l)	28	37	33	30
20. Dissol. flouride (mg/l)	0.5	0.5	0.3	0.4
21. Dissol. silica (mg/l)	0.3	6.0	5.7	9.8
22. Dissol. solids (mg/l)	403	368	350	375
23. Nitrate (N, mg/l)	0.98	1.30	5.4	5.6
24. Nitrite (N, mg/l)	0.02	0.02	0.02	0.02
25. Ammonia (N, mg/l)	0.04	0.25	0.01	0.04
26. Total phosphorus (mg/l)	0.08	0.14	0.08	0.15
27. Total arsenic (ug/l)	0.0	0.0	1.0	3.0
28. Total chromium (ug/l)	<10.0	<10.0	60	20
29. Total copper (ug/l)	10	10	0.0	36
30. Dissol. iron (ug/l)	40	50	20	10
31. Total lead (ug/l)	3	2	1200	15
32. Dissol. manganese (ug/l)	20	10	10	10
33. Total mercury (ug/l)	< 0.5	< 0.5	0.4	0.0
34. Total zinc (ug/l)	20	40	100	40
35. Total organic carbon (ug/l)	4.4	12.0	5.2	4.3

Data Source: U.S. Geological Survey (1977, 1978) Hydrologic Station No. 03230500

TABLE 13
OHIO EPA WATER QUALITY STANDARDS

Parameter	Warmwater Habitat	Exceptional Warmwater Habitat
1. Ammonia	13 mg/l	6.5 mg/l
2. Beryllium	110 ug/l	110 ug/l
3. Cadmium	12 ug/l	1.2 ug/l
4. Chlorine (total residual)	2 ug/l	2 ug/l
5. Cyanide	25 ug/l	25 ug/l
6. Dissolved Oxygen	5.0 mg/l	6.0 mg/l
7. Dissolved Solids	1500 mg/l	1500 mg/l
8. Conductivity	2400 mg/l	2400 mg/l
9. Iron	100 ug/l	100 ug/l
10. Lead	30 ug/l	30 ug/l
11. Nickel	25 ug/l	25 ug/l
12. Zinc	30 ug/l	30 ug/l
13. Mercury	0.2 ug/l	0.2 ug/l
14. Chromium	100 ug/l	50 ug/l
15. Phenolic Compound	10 ug/l	10 ug/l
16. Phthalate Esters	3 ug/l	3 ug/l
17. PCB's	0.001 ug/l	0.001 ug/l
18. MBAS	500 ug/l	500 ug/l
19. Oil and Grease	5 mg/l	5 mg/l
20. pH	6.5 - 9.0	6.5 - 9.0

Data Source: Ohio Environmental Protection Agency (1978)

FIGURES

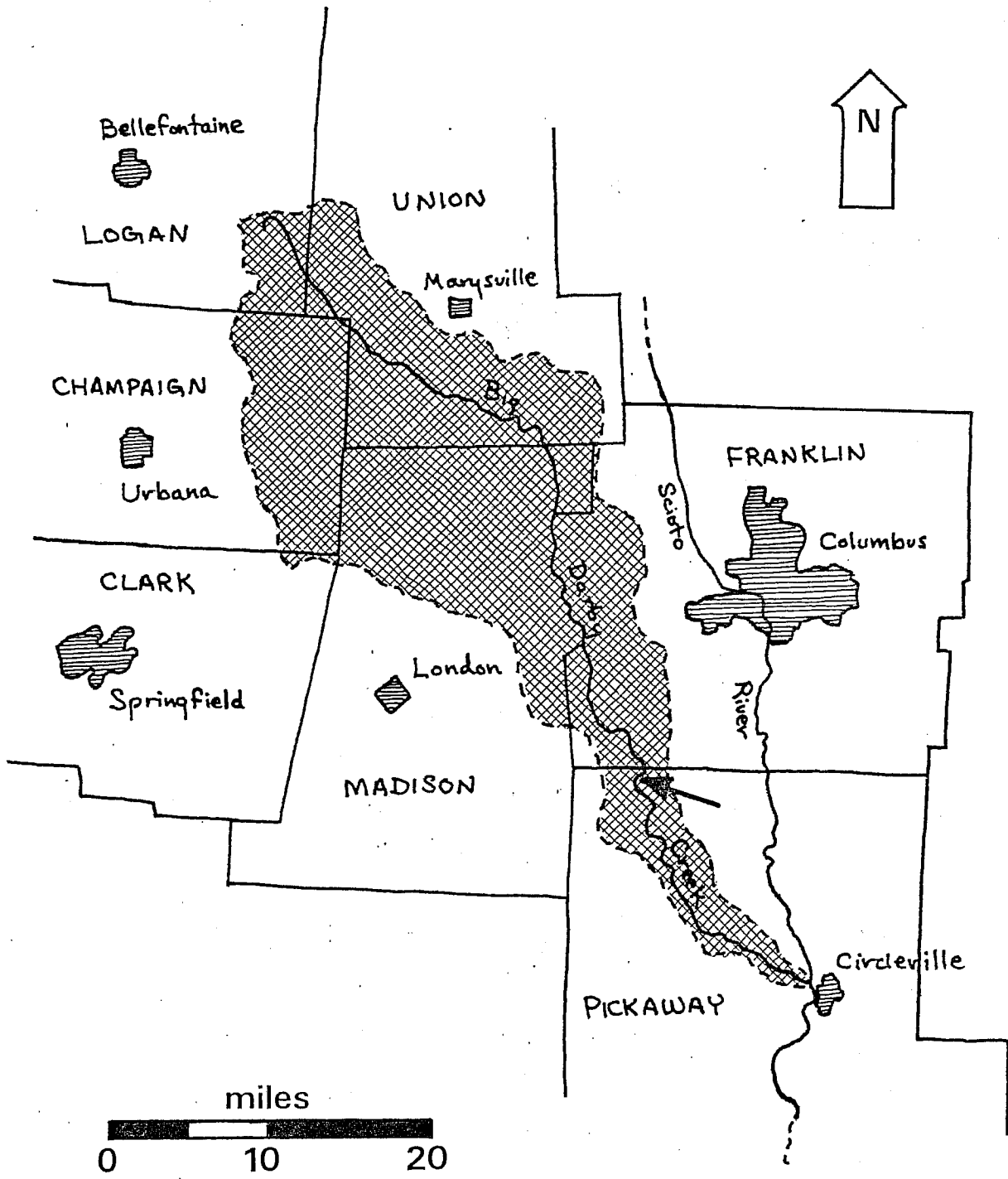


FIGURE 1. BIG DARBY DRAINAGE BASIN