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SUMMARY OF OHIO RIVER FISHERY SURVEYS, 1968-76

Surveillance and Analysis Division
Region III
U. S. Environmental Protection Agency
Philadelphia, Pennsylvania 19106

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by

H. Ronald Preston
U. S. Environmental Protection Agency
Wheeling Field Office, Wheeling, West Virginia

and

Glenn E. White
Ohio River Valley Water Sanitation Commission
Cincinnati, Ohio

Surveillance and Analysis Division
Region III
U. S. Environmental Protection Agency
Philadelphia, Pennsylvania 19106

DISCLAIMER

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FOREWARD

Evaluations of water pollution abatement programs must begin with an adequate inventory of the biological resources affected. Future trend analysis is dependent upon basic ambient biomonitoring information. The collection of such biomonitoring data in a large river can be complex and difficult to obtain and may be limited to certain biological communities.

The primary mission of this biomonitoring activity is to provide a baseline of data describing the kinds of fish and their relative abundance in the Ohio River.

This report provides a valuable contribution to the knowledge of the Ohio River and its aquatic life.

Jack J. Schramm
Regional Administrator
Region III

ABSTRACT

The fish life community of the Ohio River was sampled annually 1968-1970 and 1975-1976 at selected locations. The objective of these investigations was to establish a base line of data which can be used to compare past studies and to identify water quality trends. The samples were collected from lock chambers of navigation structures located throughout the length of the river. In general, the results of these studies documented the existence of a more abundant and desirable fish population than observed during investigations performed in the 1950's. Shifts in species domination and composition were observed in sections of the river and reflected water quality conditions. A total of 181,000 fish weighing 11,569 kilograms, composed of 82 species, was collected in this study.

For comparative purposes, the Ohio River fish fauna was separated into related categories which provided a means of characterizing differences between sections of the river. The upper Ohio River fish fauna was indicative of improving water quality while the lower Ohio River fauna in general, reflected stable water quality conditions. The most notable shifts in species composition occurred in river sections affected by the metropolitan complexes and these populations were composed of less desirable fishes.

Pollution abatement programs have resulted in improved water quality conditions in the Ohio River and the fish populations have responded. The construction of the higher navigation dams created additional favorable shoreline habitats for several recreationally valuable fishes. These factors contributed significantly to the increased recreational use of the river.

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INTRODUCTION

The assessment of water quality through examination of resident aquatic life communities has been employed extensively by pollution investigators during the past several decades. The science of water pollution biology is not that recent, as its conception and practical application occurred in the early 1900's. However, extensive use of biological data in water quality evaluations was not employed with much understanding until the 1950's. The degradation of water quality brought about by socioeconomic expansion in the Twentieth Century resulted in state and federal legislation to slow down and stop the environmental deterioration. Comprehensive laboratory and field water quality investigations, including biological studies, have been a result of these legislations. In performing these studies, aquatic scientists have shown the relevancy of aquatic life observations in understanding causes and impacts of environmental alterations. Biological assessments and evaluations have become basic tools in predicting environmental conditions that may result from varying degrees of pollution control. The current concerns for toxic substances in the environment has further substantiated the relevancy of aquatic life data in evaluating water quality, its significance and value to man.

Biological water quality evaluations in streams have primarily concentrated on the collection of benthic organisms. The analyses of benthic community structures and their ecological roles provide a basis for determining pollutional impacts.

Dependent upon study scope and objectives, other communities, i.e., plankton and fish have also been utilized for these evaluations. Fish occupy a unique position among aquatic communities. Their populations, diversity, age, reproduction, and community structure reflect long term water quality trends. Public interests in, and direct beneficial uses of fishery resources (recreational and commercial), place the fish community in a position of high recognition to society. It has been pointed out by aquatic scientists that because of these uses fish parameters can be used as a direct economic measure of the effects of pollution.

Beginning in the late 1960's cooperative fishery resource studies were initiated for the entire length of the Ohio River. The cooperating agencies involved were the Pennsylvania Fish Commission, Pennsylvania Department of Environmental Resources, West Virginia Department of Natural Resources, Ohio Department of Natural Resources, Kentucky Department of Fish and Wildlife, Kentucky Department of Environmental Protection, Indiana Stream Pollution Control Board, Illinois Environmental Protection Agency, Ohio River Valley Water Sanitation Commission, U. S. Army Corps of Engineers, U. S. Fish and Wildlife Service and U. S. Environmental Protection Agency. In addition, personnel from universities and scientific institutions participated in special aspects of the studies. Institutions represented were The Pennsylvania State University, University of Pittsburgh, The Ohio State University, Marshall University, University of Louisville, Auburn University and The Smithsonian Institute.

The overall purpose of these studies is to evaluate past, present and future water quality conditions of the Ohio River. Specifically, the data obtained will provide: information describing trends developing in the composition of the fishery resource and comparative data to evaluate changes from the study conducted in 1957-59 by ORSANCO-University of Louisville; information relative to determining sections of the Ohio River most severely impacted by pollution; data on the quality and quantity of Ohio River fishes, including those of recreational and commercial value; and a baseline of data to evaluate effectiveness of pollution abatement programs.

THE OHIO RIVER

The basin of the Ohio River drains an area of 528,127 square kilometers (203,910 square miles) and is formed by the confluence of the Allegheny River from the north and the Monongahela River from the south at Pittsburgh, Pennsylvania. From Pittsburgh it flows in a generally southwest direction, forming the western border of West Virginia, the northern border of Kentucky, and the southern borders of Ohio, Indiana and Illinois. It meets the Mississippi River at Cairo, Illinois 1,580 kilometers (981 miles) downstream of Pittsburgh. There are approximately 40,500 hectares (100,000 acres) of surface area in the Ohio River.

The Ohio is the eleventh largest river in the United States in length and has the greatest discharge of the six Mississippi tributaries. The average flows in cubic feet per second for the period 1946-1975 were: South Heights, Pennsylvania, mile point 15.2, low of 10,000 cfs in September and high of 70,000 cfs in March; Cincinnati, Ohio, mile point 462.4, low of 30,000 cfs in September and high of 200,000 cfs in March; and Evansville, Indiana, mile point 791.5, low of 40,000 cfs in September and a high of 300,000 cfs in March.

The Ohio has relatively steep banks and flows in a narrow valley for most of its length, therefore having few shallow wetland areas which are conducive to fish reproduction. It has a gravelly bottom for most of its upper reaches and is dotted with about 130 islands. The U. S. Corps of Engineers maintains a 3 meters (nine feet) channel for navigation; however, the depth varies up to 14 meters (45 feet) in areas upstream of the navigation dams. Geologically, the Ohio River basin is composed principally of sedimentary rock which varies from siltstone and shales to limestone and sandstone. The prototype of the Ohio was the Teays River system which existed in pre-glacial times. While there are few natural lakes in the Ohio River drainage basin, many of the tributary streams have been impounded for flood control, water supplies and recreational use. In 1824 the Corps of Engineers began modification of the river through rock removal and construction of dikes. Eventually this lead to 46 wicket dams, completed by 1929 (Butz, et al., 1974). In the mid 1950's work began on the present day 19 higher lift structures that have turned the Ohio into a series of slack water navigation lakes and have effected changes in aquatic life habitats.

HISTORICAL REVIEW

There have been numerous studies of the fishes of the Ohio River, generally localized in their scope. Many were designed to study fish populations in specific habitats or areas affected by specific sources of pollution.

Lachner (1956) summarized early Ohio River fishery studies by C. A. LeSueur and J. P. Kirkland. C. S. Rafinesque (1820) reported 113 species of fish in the Ohio River. While there are some inaccuracies in this data, it shows the well developed fish fauna before the Ohio became a great industrial waterway. Jackson (1962) reviewed early fish studies of the Ohio River and described habitat changes of the river and the general effects of these changes on the fish fauna. Trautman (1963) summarized early travels down the Ohio and reported that one observer in 1972-73 saw a great abundance of fishes. Trautman also described the changing land use and its effect on the fish life.

After about 1900, increased siltation caused changes in the fish populations with bullhead catfish, goldeye, skipjack herring, gizzard shad, and spotted bass increasing in numbers. Through the late 1800's and the early 1900's the greatest effect on fish populations took place. This was due in large part to land use and subsequent runoff from deforestation, agriculture and mining. In the 1920's mining took the largest toll and in the 1930's it was industrial expansion that contributed most to water degradation.

In 1933, an observer in Ashland, Kentucky reported a fish kill which took better than two days to pass and completely covered the river (Jackson 1962). By mid-century, 24 species of fish, found in earlier studies, were reported to be either missing in the upper river or in very low numbers (Lachner 1956).

Industrial discharges have also affected aquatic populations in recent times. In the study by Krumholz and Minckley (1964) referring to the 1957-59 data, the authors stated: "on the basis of these findings there is little doubt that the abatement of pollution in the upper Ohio River during the steel strike of 1959 provided a marked change in water quality that led to a reinvasion of the main channel of the river by fishes from nearby unpolluted waters. There was a marked resurgence in the fish populations of the river, both in species composition and in numbers of individuals."

By 1968, with the reduced effects of acid mine drainage, urban and industrial wastes and siltation,subtle changes in the fish populations were observed (Preston 1969). Carp and bullhead catfish were predominant in the upper river. Other species found included channel catfish, sunfishes, freshwater drum and shiners. The sunfishes increased in the middle third of the river and the commercial forms were more abundant in the lower half of the river.

The modernization of the navigation structures also affected aquatic populations in the river. The construction of higher dams has created additional shoreline habitats which contributed to the increased numbers of several fish species, especially those in the sunfish family.

The recent report prepared for the National Commission on Water Quality by Dames and Moore, Inc. (1975) outlines an excellent historical review of fishery investigations conducted since the early 1800's. Further, the Dames and Moore report describes past water quality problems and future trends and impacts of pollution abatement programs.

STUDY LOCATIONS AND METHODS

During the years 1968, 1969, 1970, 1975, and 1976 fishery resource studies on the Ohio River were conducted at 20 different lock chambers operated by the U. S. Army Corps of Engineers. Table 1 lists the sampling locations and year sampled. Figure 1 is a map of the Ohio River with primary stations located and their river mile point. Due to the construction of new higher-lift dams, a portion of these sampling locations have been removed and the sites inundated. The upper river was sampled in 1977, but, because data is lacking for the lower river, comparative analysis is not possible and therefore these data are not discussed in this report. During the study period, 59 separate fish samplings were conducted. However, only eight locations (considered primary stations) were sampled for each of the five year studies for a total of 40 samples. The data from these primary sites are compared in this report. The lower river stations (Locks and Dams No. 50, No. 52, Smithland Locks and Dam) are close together and are treated as one river section. The navigation higher lift structures have two lock chambers, 110 X 600 feet and 110 X 1200 feet. The smaller auxiliary chamber was selected for sampling because of its size and it presented a minimum of interference with barge traffic. Surface areas of the locks varied from 0.2025 to 1.2150 hectares and 5 of the ten sites are 0.6075 hectares.

Dashields Lock and Dam was selected because it is located below the Pittsburgh and upper river metropolitan area which is heavily indusrialized; Pike Island Lock and Dam is situated at Wheeling, a partial recovery zone from upstream industry; Belleville Lock and Dam is located just below Parkersburg, West Virginia, and was selected because it is situated below a series of upstream industries and is above the influence of the Kanawha River; Gallipolis Lock and Dam was chosen since it is immediately downstream of the Kanawha. Meldahl Lock and Dam is above Cincinnati, and Markland Lock and Dam is below Cincinnati. These locations show the effects of urban pollution. Channelton Lock and Dam was chosen because it is below the Louisville industrial complex; and the last three sites, Lock and Dam No. 50, 52, and Smithland Lock and Dam (a distance of 62 miles) were combined for reflecting fish populations in the lower end of the Ohio River.

Fish population studies are difficult to conduct in large deep rivers. Several methods are available, such as nets, trawls, electrofishing, and ichthyocides. All of these methods have their advantages and disadvantages. Rotenone, a toxicant, is relatively non-selective and is semi-effective in sampling deeper waters. However, certain requirements must be met in its use. In a river situation with lock chambers at navigable dams, rotenone has the advantage of sampling a confined area where it is concentrated and cannot be diluted.

The U. S. Army Corps of Engineers personnel were notified of the planned study well in advance and localized schedules were arranged. The day prior to the lock study, the lock personnel were again contacted and requested to leave the lower gates of the auxiliary chamber open for at least 2 hours prior to entry and preferably from midnight on if possible. At eight o'clock in the morning, the crews, usually 5 boats and 12-15 persons, entered the lock on the downriver side. The gates were closed and the water level maintained at the lower pool level throughout the sampling period. On rare occasions there were some problems with leaky upper gates and the lock chamber would gradually fill. Five percent rotenone emulsion was applied with a surface pump and a submerged, perforated 25 foot hose, to a concentration of 0.5 to 1 part per million.

Minnows and shad began to surface almost immediately since they are the more rotenone sensitive species. Last to come up are the hardier species such as carp, catfish and gar. Fish were dipped up in long handled nets until there was a definite tapering off of fish surfacing. Then the lock personnel were instructed to fill the lock chamber 2-3 feet. This tended to wash larger specimens from the bottom that either surfaced and sunk or did not surface the first time. In most instances the fish collection was finished by 12:00 noon. Following the collection, the fish were sorted, identified, measured and weighed. All fish were placed in length classes of 3 centimeter increments and weighted in grams. The smaller fish were preserved in 10 percent formalin for later laboratory processing. In the sampling sessions, professional fishery biologists from state and federal agencies assisted in the operation.

RESULTS

A total of 82 species of fish were identified from the 1968-77 collections. Table 2 lists the fishes collected and their Ohio River distribution. Table 3 lists these fishes by common name, along with relative abundance estimates. For gross comparative purposes of species distribution, the Ohio River was subdivided into three sections and the subjective relative abundance designations were based on frequency of occurrence in the collections, distribution patterns (Table 2) and known geographic range of these species. Thirty four of the

82 species are distributed throughout the length of the Ohio River. These species are identified by an asterisk in Table 2. With few exceptions, distinct distribution patterns for the remaining species cannot be determined with data that is now available. The exceptions include the blue catfish, threadfin shad, and paddlefish which are limited to the lower Ohio River and the white catfish which has only been collected in the upper river. The Dames and Moore (1975) review indicates that the lake sturgeon, Acipenser fulvescens, and the striped shiner Notropis chrysocephalus are still found in the Ohio River. These two species were not reported in the 1957-59 study nor in the 1968-76 surveys. However, this statement may have been based on commercial fisherman catches or private industry studies referred to in the report.

Eight species were collected in this study that were not reported in the 1957-59 study. These are alewife, Alosa pseudoharengus; northern pike, Esox lucius; bigeye shiner, Notropis boops; pugnose minnow, Notropis emiliae; white catfish, Ictalurus catus; striped bass, Morone saxatilis and channel darter, Percina copelandi. There were several species listed in the 1957-59 study that were not collected in this study. However, the earlier study report included many Ohio River tributary collections, whereas the 1968-76 collections were confined to the mainstem Ohio River.

The black bullhead was rarely collected in the 1968-76 collections; whereas, it was listed in the 1957-59 collections. The field biologists participating in the 1968-76 collections recognized the lack of definitive characteristics in the bullhead (yellow excepted) and submitted samples to several experts (personal communications, Reeve Bailey, Branley Branson, Ted Cavender and Milton Trautman). These taxonomists agreed that all samples were brown bullheads with intermediate characteristics between black and brown bullheads.

A review of the individual sample tabulations suggest some notable observations concerning shifts in species distributions. For the period of study, species that appear to be extending their range from downstream to upstream include the sauger and freshwater drum. Species that appear to be increasing in abundance in the upper 100 miles of the river include the channel catfish, skipjack herring and spotted bass. Also, individual sample collections indicate that the paddlefish and buffalofish may be extending their range and/or increasing from the lower Ohio into the middle section of the river. Recreationally valuable fishes, i.e. largemouth bass, spotted bass, white and black crappies, sauger, and channel catfish have occurred in the samples with regularity. However, fisherman catch reports (correspondence with state agencies) show that increasingly larger numbers of bass and sauger have been taken in recent years, indicating an increasing abundance of these fishes.

The total number of species collected at the eight primary stations in the 1968-76 period were: Dashields, 31; Pike Island, 38; Belleville, 48; Gallipolis, 37; Meldahl, 41; Markland 36; Cannelton, 45; and the farthest downstream station (No. 40, No. 52, Smithland), 46 (see Table 9).

Biomass Distribution and Trends

The 40 samples collected from the eight primary stations during 1968 through 1976 yielded a combined total of 181,000 fish weighing 11,569 kilograms (25,452) pounds. Total weight of fishes collected annually are listed below.

Year	Total Kilograms (pounds)
1968	2390 (5258)
1969	1985 (4367)
1970	1549 (3408)
1975	2211 (4864)
1976	3434 (7555)

For comparative purposes, the fish biomass collected at each location was converted to a weight per unit area sampled (kilograms/hectare) and is given in Table 4. These data show a greater fish biomass in all the downstream stations (mile points 436 to 939) in both subperiods of the study (1968-70 and 1975-76).

Table 5 is a station by station comparison of fish categories and their relative abundance (kg/ha) that were obtained from the Ohio River fish samples conducted in each of the sample years. The categories were arbitrarily created to best describe the Ohio River fish association. The criteria used to develop these categories were based on phylogentic relationships, ecologic and economic factors. Table 6 compares these fish categories (on a percent basis, kg/ha) between the primary stations for the study period 1968-1976.

These categories are:

Category	Forms included
Forage A	All minnows, shiners and chubs
Forage B	Shad and herrings
Sport A	All sunfishes and basses
Sport B	Walleye, sauger and perches
Commercial	Channel catfish, blue catfish, buffalofishes, freshwater drum
Rough	Carp, bullhead catfish and suckers
Miscellaneous	All others

Table 7 is a comparison of fishery biomass data obtained from the 1957-59 aquatic-life study (Krumholz, et al. 1962) and the 1968-76 data. The 1968-76 data have been rearranged from other presentations in this report to fit the river section designations used in the 1957-59 study. Figure 2 graphically shows these data and reflects the fish biomass trend in the Ohio River. The 1968-76 data estimates compared to the 1957-59 data show less of a biomass change in the river segments 100-300 miles and 700-800 miles than in the other river segments. The greater biomass changes between these studies occurred in river segment 0-100 miles, segment 300-700 miles and segment 800 miles to the mouth of the river (981 miles).

Table 8 is a species abundance comparison between the 1957-59 study and the 1968-76 study based on number and weight rankings. The abundance, by number, comparison reflected little change in the order of species dominance. A commercially important form, the blue catfish did not appear in the 1968-76 rankings (number of weight). The abundance, by weight, of the first four fish did not change in the two study periods. The rankings show a change in the positions 6 through 10. The disappearance of the skipjack from 1968-76 rankings is a puzzling phenomenon. The buffalofishes (bigmouth, smallmouth, and black) have displaced the skipjack, flathead catfish and blue catfish in the abundance, by weight, in 1968-76 data.

CONCLUSIONS

Because of the manner by which the data collected in the ORSANCO-University of Louisville study of 1957-59 was composited, it is difficult to outline specific comparisons. However, certain generalized conclusions can be drawn:

•The fish biomass estimates for the 1968-1976 period were greater than the estimates derived from the 1957-59 study. Throughout the length of the river there was approximately five times greater abundance of fish during the recent study than there were in the earlier study. The sections of the river with the most significant increases occurred in the sections 0-100 miles; 500-600 miles and 900-981.

•The general species composition was about the same and little difference were observed in the predominant species of both studies. Certain forms (basses, sauger, drum) appeared to be extending their upstream distribution in the more recent study.

Differences that were observed between the 1968-70 subperiod and the 1975-76 subperiod were:

•The data indicated a decrease in total biomass in the upstream portion of the river (0-280 miles) from the 1968-70 subperiod to the 1975-76 subperiod; an exception being the Belleville (mile point 204) samples. Although no major shift of species occurrence was detectable, it was apparent that these decreases were due almost entirely to a reduction in the numbers of carp and bullhead catfish in the samples. It was assumed that there has been a reduction in biodegradable organic loads to the upper Ohio River in recent years due to pollution abatement programs and this may have produced an environment less conducive to domination by these species.

•Concurrent with the decline of the "rough" species, the "commercially" valuable fishes, i.e. channel catfish and freshwater drum, increased in the

1975-76 subperiod over that observed in the 1968-70 subperiod in the upper portion of the river.

•In the upstream third of the Ohio River, minnows and shiners appeared in greater numbers than at downstream stations. Many of the same species occurred in the lower river but in fewer numbers.

•Forage B and Commercial categories increased from upstream to downstream.

•The commercially valuable fishes increased significantly in the fishery composition at the Gallipolis location and were a dominant form in the downstream half of the river.

•The Sport A and B categories were less abundant in the upper Ohio River (0-200 miles) than in the downstream sections.

•The proportion of the biomass contributed by "rough fish" decreased in the downstream samples.

•The miscellaneous forms, as a composite group, were more numerous in the middle and lower sections of the river. This correlated with increased species diversity in the downstream sections.

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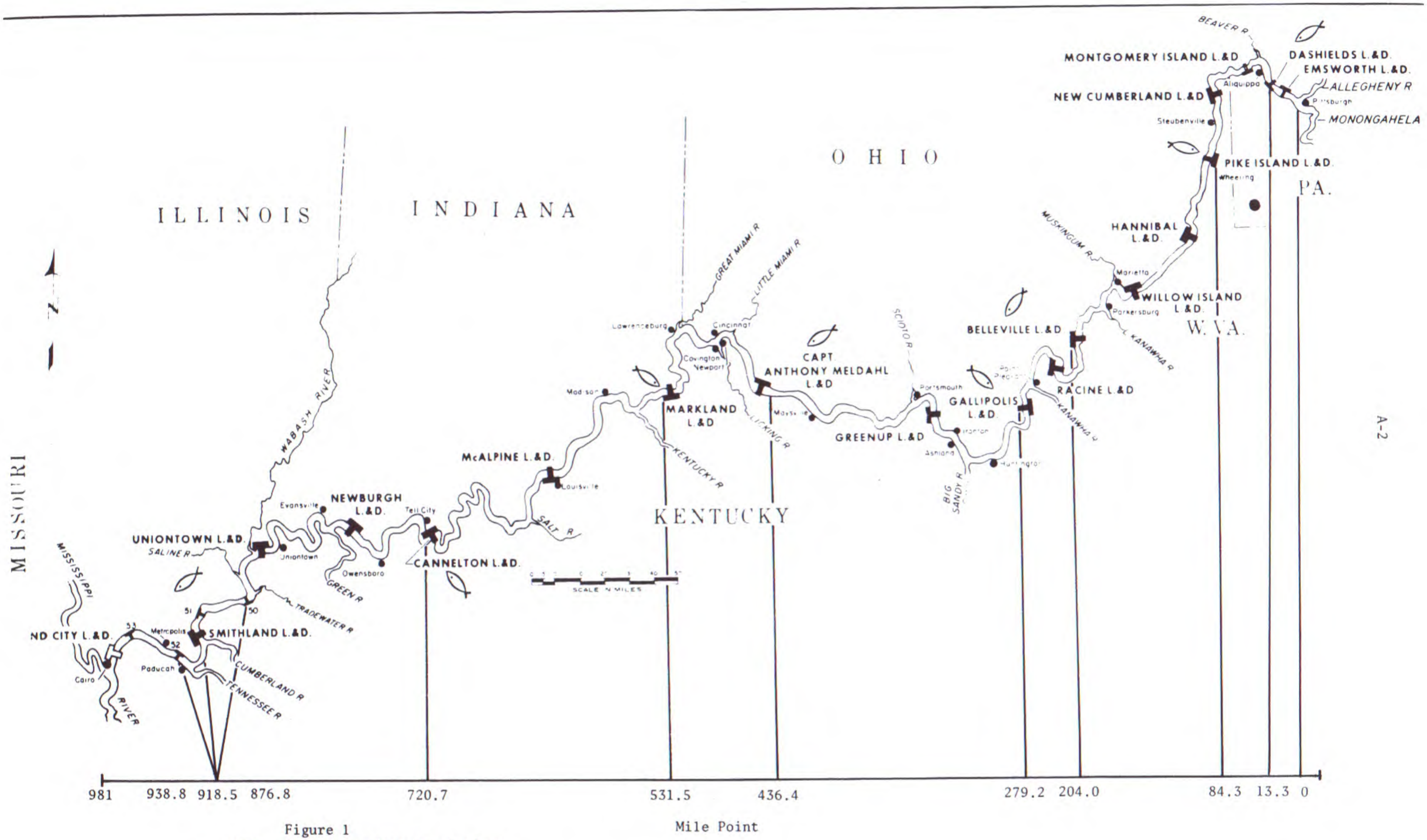

Figure 1
Primary evaluation stations
Ohio River fishery investigations, 1968 - 1977

Figure 2. Fish biomass estimates (kg/ha) for 100 mile river segments

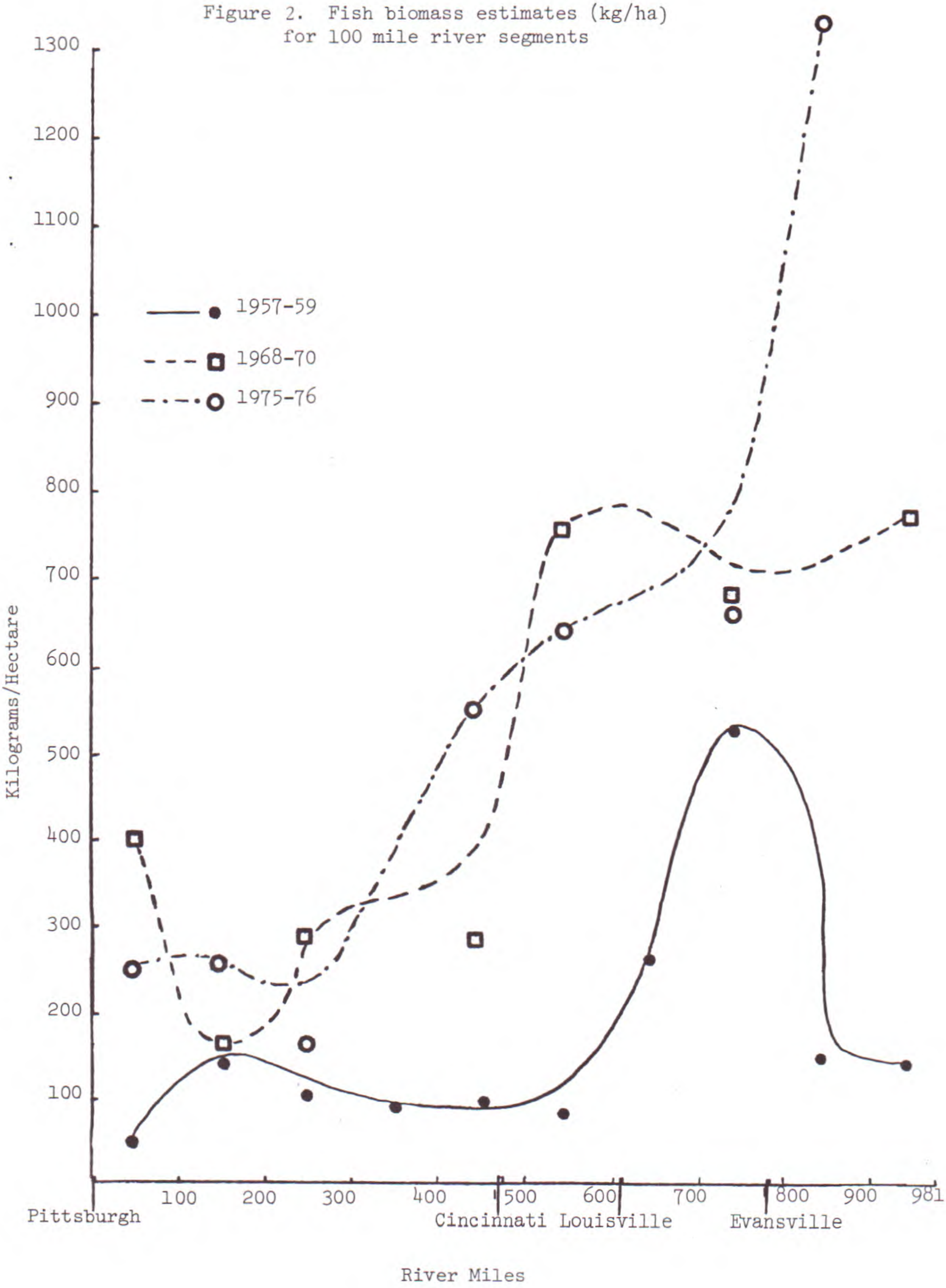

Table 1. Ohio River Fish Sampling Locations

Lock & Dam Locations,	Mile Point	1968	1969	1970	1975	1976	1977
* Dashield	13.3	X	X	X	X	X	X
Montgomery	31.7	X	X	X			
New Cumberland	54.4	X	X	X			
* Pike Island	84.3	X	X	X	X	X	X
Hannibal	126.4					X	X
No. 15	129.1	X	X	X			
* Belleville	204.0	X	X	X	X	X	X
No. 23	231.0	X					
* Gallipolis	279.2	X	X	X	X	X	X
Greenup	341.0	X	X	X			
* Meldahl	436.4	X	X	X	X	X	
* Markland	531.5	X	X	X	X	X	
McAlpine	607.0	X	X	X		X	
No. 43	633.2	X	X	X			
* Channelton	720.7	X	X	X	X	X	
Newburgh	778.7	X	X	X			
Uniontown	846.0		X				
No. 50	876.8	X	X	X			
* Smithland	918.5					X	
No. 52	938.9				X		

*Primary evaluation stations.

TABLE 2

DISTIRBUTION OF FISHES COLLECTED IN THE OHIO RIVER

Lock Chamber Sampling, 1968-1970; 1975-1976

	Dashields L & D			Pike Island L & D				Belleville L & D		Gallipolis L & D		Meldahl L & D	Markland L & D			Channelton L & D			L & D # 50	Smithland L & D	L & D # 52
Species / Mile Point:	13	32	54	84	126	129	168	204	231	279	341	436	532	607	633	721	778	846	877	918	939
Silver lamprey Ichthyomyzon unicuspis (Hubbs and Trautman)											X	X									
Paddlefish Polyodon spathula (Walbaum)												X	X	X		X	X		X	X	
Longnose gar Lepisosteus osseus (Linnaeus)					X			X		X	X	X	X	X		X	X		X	X	
Shortnose gar Lepisosteus platostomus (Rafinesque)																	X	X	X		
Bowfin Amia calva Linnaeus								X								X					
American Eel Anguilla rostrata (Lesueur)	X		X	X				X		X	X	X	X	X	X	X		X			
Skipjack herring Alosa chrysochloris (Rafinesque)				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Alewife Alosa pseudoharengus (Wilson)				X							X	X									

DISTRIBUTION OF FISHES COLLECTED IN THE OHIO RIVER (continued)

Table 2-2

	Dashields L & D			Pike Island L & D				Belleville L & D		Gallipolis L & D		Meldahl L & D	Markland L & D			Channelton L & D			L 7 D # 50	Smithland L & D	L 7 D # 52
Species Mile Point:	13	32	54	84	126	129	168	204	231	279	341	436	532	607	633	721	778	846	877	918	939
Gizzard shad Dorosoma cepedianum (Lesueur)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Threadfin shad Dorosoma petenense (Gunther)													X	X		X	X	X	X	X	X
Goldeye Hiodon alosoides (Rafinesque)											X	X	X	X		X		X			X
Mooneye Hiodon terigsus (Lesueur)										X	X		X			X		X			X
Northern pike Esox lucius (Linnaeus)											X										
Muskellunge Esox masquinongy Mitchill	X																				
Goldfish Carassius auratus (Linnaeus)	X			X							X		X	X		X					
Carp Cyprinus carpio Linnaeus	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Stoneroller Campostoma anomalum (Rafinesque)								X													
Silver chub Hybopsis storeriana (Kirtland)				X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X

DISTRIBUTION OF FISHES COLLECTED IN THE OHIO RIVER (continued)

Table 2-3

Species	Dashields L & D			Pike Island L & D				Belleville L & D		Gallipolis L & D		Meldahl L & D	Markland L & D			Channelton L & D			L & D # 50	Smithland L & D	L & D # 52
Mile Point	13	32	54	84	126	129	168	204	231	279	341	436	532	607	633	721	778	846	877	918	939
Golden shiner Notemigonus crysoleucas (Mitchill)			X	X												X					
Emerald shiner Notropis atherinoides Rafinesque	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
River shiner Notropis blennius (Girard)	X			X		X		X		X	X				X	X	X				
Bigeye shiner Notropis boops (Gilbert)	X							X													
Ghost shiner Notropis buchanani Meek			X	X	X	X		X	X	X	X	X									
Common shiner Notropis cornutus (Mitchill)											X										
Pugnose minnow Notropis emiliae (Hay)																		X	X		
Rosyface shiner Notropis rubellus (Agassiz)						X	X										X				
Spotfin shiner Notropis spilopterus (Cope)	X	X	X	X	X	X			X	X											
Sand shiner Notropis stramineus (Cope)	X	X	X	X	X	X		X	X		X						X		X		

DISTRIBUTION OF FISHES COLLECTED IN THE OHIO RIVER (continued)

Table 2 -4

Species		Dashield L & D			Pike Island L & D				Belleville L & D		Gallipolis L & D		Meldahl L & D	Markland L & D			Channelton L & D			L & D # 50	Smithland L & D	L & D # 52
	Mile Point	13	32	54	84	126	129	168	204	231	279	341	436	532	607	633	721	778	846	877	918	939
Mimic shiner Notropis volucellus (Cope)		X	X	X	X	X	X	X	X	X	X	X	X	X				X				
Steelcolor shiner Notropis whipplei (Girard)					X																	
Suckermouth minnow Phenacobius mirabilis (Girard)								X		X												
Bluntnose minnow Pimephales notatus (Rafinesque)		X	X	X	X	X	X		X	X	X	X			X				X	X		
Fathead minnow Pimephales promelas Rafinesque											X											
Creek chub Semotilus atromaculatus (Mitchill)					X																	
River carpsucker Carpiodes carpio (Rafinesque)					X	X			X		X	X	X	X	X	X	X	X	X	X		X
Quillback Carpiodes cyprinus (Lesueur)					X	X	X	X	X		X	X	X				X	X	X	X		
Highfin carpsucker Carpiodes velifer (Rafinesque)															X		X	X		X		
White sucker Catostomus commersoni (Lacepede)		X		X	X	X			X			X										

Table 2-5

DISTRIBUTION OF FISHES COLLECTED IN THE OHIO RIVER (continued)

Species	Dashields L & D			Pike Island L & D				Belleville L & D		Gallipolis L & D		Meldahl L & D	Markland L & D			Channelton L & D			L & D # 50	Smithland L & D	L & D # 52
Mile Point	13	32	54	84	126	129	168	204	231	279	341	436	532	607	633	721	778	846	877	918	939
Smallmouth buffalo Ictiobus bubalus (Rafinesque)				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Bigmouth buffalo Ictiobus cyprinellus (Valenciennes)								X								X	X	X	X	X	
Black buffalo Ictiobus niger (Rafinesque)							X	X		X		X	X		X		X	X	X		
Spotted sucker Minytrema melanops (Rafinesque)				X	X			X			X	X	X			X			X		
River redhorse Moxostoma carinatum (Cope)											X				X						
Black redhorse Moxostoma duquesnei (Lesueur)	X			X	X	X															
Golden redhorse Moxostoma erythrurum (Rafinesque)				X				X			X	X				X			X		
Shorthead redhorse Moxostoma macrolepidotum (Lesueur)								X													
White catfish Ictalurus catus (Linnaeus)	X	X	X	X	X			X		X											
Blue catfish Ictalurus furcatus (Lesueur)													X			X		X	X	X	X

Table 2-6

DISTRIBUTION OF FISHES COLLECTED IN THE OHIO RIVER (continued)

	Dashields L & D			Pike Island L & D				Belleville L & D		Gallipolis L & D		Meldahl L & D	Markland L & D			Channelton L & D			L 7 D # 50	Smithland L & D	L & D # 52
Species / Mile Point	13	32	54	84	126	129	168	204	231	279	341	436	532	607	633	721	778	846	877	918	939
Black bullhead Ictalurus melas (Rafinesque)		X	X				X	X			X		X			X			X	X	
Yellow bullhead Ictalurus natalis (Lesueur)	X	X	X	X	X		X	X		X	X		X			X		X	X		
Brown bullhead Ictalurus nebulosus (Lesueur)	X	X	X	X	X	X	X	X	X	X	X	X				X					
Channel catfish Ictalurus punctatus (Rafinesque)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Stonecat Noturus flavus Rafinesque						X															
Flathead catfish Pylodictis olivaris (Rafinesque)	X				X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Pirate perch Aphredoderus sayanus (Gilliams)																X	X		X		
Trout-Perch Percopsis omiscomaycus (Walbaum)					X																
Banded killifish Fundulus diaphanus (Lesueur)	X		X																		
Brook silverside Labidesthes sicculus (Cope)						X															

Table 2 - 7

DISTRIBUTION OF FISHES COLLECTED IN THE OHIO RIVER (continued)

Species	Mile Point	13 Dashields L & D	32	54	84 Pike Island L & D	126	129	168	204 Belleville L & D	231	279 Gallipolis L & D	341	436 Meldahl L & D	532 Markland L & D	607	633	721 Channelton L & D	778	846	877 L 7 D # 50	918 Smithland L & D	939 L & D # 52
White bass Morone chrysops (Rafinesque)		X			X	X			X	X	X	X	X	X	X		X	X	X	X	X	X
Striped bass Morone saxatilis (Walbaum)						X			X								X		X			
Yellow bass Morone mississippienis (Jordan and Eigenmann)																		X		X	X	X
Rock bass Ambloplites rupestris (Rafinesque)		X	X		X							X		X	X					X		
Green sunfish Lepomis cyanellus (Rafinesque)			X	X	X	X	X		X		X	X	X	X			X	X	X	X	X	
Pumpkinseed Lepomis gibbosus (Linnaeus)		X	X	X	X	X	X		X		X	X										
Warmouth Lepomis gulosus (Cuvier)				X		X					X	X	X	X			X	X	X	X	X	
Orangespotted sunfish Lepomis humilis (Girard)			X	X	X	X	X		X			X	X							X		
Bluegill Lepomis macrochirus Rafinesque		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Longear sunfish Lepomis megalotis (Rafinesque)				X	X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	

Table 2-8

DISTRIBUTION OF FISHES COLLECTED IN THE OHIO RIVER (continued)

	Dashields L & D			Pike Island L & D				Belleville L & D		Gallipolis L & D		Meldahl L & D	Markland L & D			Channelton L & D			L & D # 50	Smithland L & D	L & D # 52
Species / Mile Point	13	32	54	84	126	129	168	204	231	279	341	436	532	607	633	721	778	846	877	918	939
Redear sunfish *Lepomis microlophus* (Gunther)	X		X	X		X		X		X	X			X		X	X	X	X		
Smallmouth bass *Micropterus dolomieui* Lacepede					X	X	X			X		X		X		X					
Spotted bass *Micropterus punctulatus* (Rafinesque)	X			X	X	X	X	X		X	X	X	X	X		X	X	X	X	X	
Largemouth bass *Micropterus salmoides* (Lacepede)	X	X	X	X	X	X		X	X	X	X	X	X			X	X	X	X		
White crappie *Pomoxis annularis* Rafinesque	X		X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	
Black crappie *Pomoxis nigromaculatus* (Lesueur)	X	X	X	X	X	X		X	X	X	X	X	X	X		X	X	X	X		
Johnny Darter *Etheostoma nigrum* Rafinesque					X																
Yellow perch *Perca flavescens* (Mitchill)	X			X	X		X	X			X								X		
Log perch *Percina caprodes* (Rafinesque)	X	X			X			X		X		X	X						X		
Channel Darter *Percina copelandi* (Jordan)					X																

Table 2-9

DISTRIBUTION OF FISHES COLLECTED IN THE OHIO RIVER (continued)

	Dashields L & D			Pike Island L & D				Belleville L & D		Gallipolis L & D		Meldahl L & D	Markland L & D			Channelton L & D			L & D # 50	Smithland L & D	L & D # 52
Species / Mile Point	13	32	54	84	126	129	168	204	231	279	341	436	532	607	633	721	778	846	877	918	939
Blackside darter Percina maculata (Girard)								X											X		
Sauger Stizostedion canadense (Smith)	X			X	X	X		X	X	X	X	X	X	X	X	X		X	X	X	X
Walleye Stizostedion vitreum (Mitchill)	X	X	X	X	X	X		X			X	X	X	X		X		X			
Freshwater drum Aplodinotus grunniens Rafinesque	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 3. Relative Abundance of Ohio River Fishes

Species	Upper	Middle	Lower
Silver lamprey	R	R	R
Paddlefish	R	O	C
* Longnose gar	O	C	C
Shortnose gar	R	R	O
Bowfin	R	R	R
* American eel	O	O	O
* Skipjack herring	C	C	C
Alewife	R	R	R
* Gizzard shad	A	A	A
Threadfin shad	R	O	O
Goldeye	R	O	O
Mooneye	R	O	O
Northern pike	R	R	R
Goldfish	O	O	O
* Carp	A	A	A
Stoneroller	R	R	R
* Silver chub	O	O	O
Golden shiner	O	R	R
* Emerald shiner	A	A	A
* River shiner	C	C	O
Bigeye shiner	R	R	R
Ghost shiner	O	O	R

A - Abundant C - Common O - Occasional R - Rare

* Distributed throughout Ohio River

Table 3. Relative Abundance of Ohio River Fishes
(continued)

Species	Upper	Middle	Lower
Common shiner	O	O	O
Pugnose shiner	R	R	R
Rosyface shiner	R	R	R
Spotfin shiner	C	C	O
* Sand shiner	A	C	O
* Mimic shiner	A	C	O
Steelcolor shiner	O	R	R
Suckermouth minnow	R	R	R
* Bluntnose minnow	A	A	C
Fathead minnow	R	O	O
Creek chub	R	R	R
River carpsucker	C	C	C
* Quillback carpsucker	C	C	C
Highfin carpsucker	O	C	C
White sucker	O	O	O
Smallmouth buffalo	R	C	C
Bigmouth buffalo	R	C	C
Black buffalo	R	O	O
* Spotted sucker	O	O	O
River redhorse sucker	O	O	O
* Golden redhorse sucker	C	C	C
Shorthead redhorse sucker	R	R	R
Black redhorse sucker	C	O	R

*Distributed throughout Ohio River.

Table 3. Relative Abundance of Ohio River Fishes (continued)

Species	Upper	Middle	Lower
Blue catfish	R	O	C
* Channel catfish	A	A	A
White catfish	C	O	R
Black bullhead catfish	R	R	R
* Yellow bullhead catfish	C	C	C
* Brown bullhead catfish	A	A	C
* Flathead catfish	C	C	C
Stonecat	R	R	R
Trout-Perch	R	R	O
Banded killifish	O	R	R
Pirate perch	R	R	R
* White bass	O	O	O
Striped bass	R	R	R
Yellow bass	R	R	O
* Rock bass	R	R	R
Smallmouth bass	O	O	O
* Spotted bass	C	C	C
* Largemouth bass	C	C	C
* Warmouth sunfish	R	O	O
* Green sunfish	C	O	O
Pumpkinseed sunfish	O	O	O
* Orangespotted sunfish	O	R	R

*Distributed throughout Ohio River.

Table 3. Relative Abundance of Ohio River Fishes
(contined)

Species	Upper	Middle	Lower
* Bluegill sunfish	C	C	C
* Longear sunfish	O	O	O
* Redear sunfish	O	O	O
* White crappie	C	C	C
* Black crappie	C	C	C
Johnny darter	R	R	R
* Yellow perch	O	R	R
Log perch	O	O	O
Channel darter	R	R	R
Blackside darter	R	R	R
* Sauger	O	C	C
* Walleye	O	O	O
* Freshwater drum	C	A	A
Brook silverside	R	R	R

*Distributed throughout Ohio River.

TABLE 4
OHIO RIVER FISH COLLECTION 1968-1976
TOTAL WEIGHTS AND WEIGHT OF FISH PER UNIT AREA

Location	Surface Hectares	Total Weight (Kg)					Weight Per Unit Area (Kg/ha)					Average Kg/ha	
		1968	1969	1970	1975	1976	1968	1969	1970	1975	1976	1968-1970	1975-1976
Dashields	.20	115	108	66	72	55	569	534	325	356	274	476	315
Pike Island	.61	180	144	283	124	127	297	238	465	204	208	333	206
Belleville	.61	110	73	102	165	147	182	120	168	272	241	157	256
Gallipolis	.36	115	91	112	78	39	315	249	307	214	107	290	160
Meldahl	.61	256	119	155	414	247	421	195	255	681	406	290	543
Markland	.61	481	503	401	529	246	791	828	659	871	405	759	638
Cannelton	.61	109	862	250	399	394	179	1,420	412	657	649	715	653
L&D 50*	.65	1,124	85	180	-	-	1,735	131	278	-	-	715	1,339**
L&D 52*	.49	-	-	-	430	-	-	-	-	885	-	-	-
Smithland*	1.22	-	-	-	-	2,179	-	-	-	-	1,793	-	-

* L&D 50 Sampled 1968, 1969, 1970
L&D 52 Sampled 1975
Smithland Sampled 1976

** Average of 1975 - L&D 52 and 1976 - Smithland

Table 5. Ohio River Fish Category Distribution at Selected Locations.

KILOGRAMS/HECTARE

Sample Location	1968	1969	1970	1975	1976
DASHIELDS					
Forage A	4.79	17.14	9.48	146.47	-
Forage B	20.99	16.49	20.44	116.74	8.15
Sport A	6.47	1.63	0.64	0.74	1.78
Sport B	3.21	2.72	-	1.09	4.54
Commercial	3.60	2.22	10.81	39.41	31.56
Rough	529.58	493.14	277.93	44.20	224.25
Miscellaneous	0.05	4.54	3.70	7.70	1.48
PIKE ISLAND					
Forage A	2.09	9.25	30.65	3.49	4.43
For B	13.41	21.53	48.64	36.97	7.69
Sport A	9.71	5.15	6.09	17.27	1.86
Sport B	2.93	-	-	0.74	-
Commercial	14.86	10.62	11.19	21.00	28.74
Rough	251.90	190.62	364.15	122.24	112.25
Misc.	0.38	0.51	4.67	2.50	6.19
BELLEVILLE					
For A	2.93	27.65	10.39	1.91	-
For B	9.53	9.46	25.19	89.58	29.30
Sport A	0.48	7.52	15.00	17.09	8.72
Sport B	-	3.74	-	8.07	1.05
Comm.	33.61	32.31	15.49	51.13	55.41
Rough	133.54	38.88	97.07	98.52	139.33
Misc.	1.42	0.31	5.10	6.02	3.93
GALLIPOLIS					
For A	5.76	3.40	2.00	0.55	-
For B	39.42	21.04	11.77	81.95	34.90

Table 5. Ohio River Fish Category Distribution at Selected Locations (cont'd.).

KILOGRAMS/HECTARE

Sample Location	1968	1969	1970	1975	1976
GALLIPOLIS					
Sport A	3.62	1.21	8.83	5.16	0.80
Sport B	1.65	2.00	5.71	9.49	8.31
Comm.	78.82	83.87	124.36	83.02	57.45
Rough	184.38	136.87	153.06	17.59	-
Misc.	1.45	0.63	1.45	15.17	3.21
MELDAHL					
For A	0.16	0.69	0.48	-	-
For B	63.69	16.84	31.03	239.69	217.10
Sport A	6.09	6.30	7.72	23.65	5.27
Sport B	8.13	6.88	6.60	22.78	1.10
Comm.	118.47	67.27	84.92	113.56	96.43
Rough	221.03	97.40	98.04	252.34	64.44
Misc.	3.23	0.10	26.02	28.67	21.79
MARKLAND					
For A	0.10	0.05	-	-	0.23
For B	315.05	274.63	74.22	210.55	92.74
Sport A	2.02	1.79	2.62	27.46	7.16
Sport B	0.38	-	0.74	45.33	0.08
Comm.	123.36	203.28	107.37	92.35	61.73
Rough	339.77	342.55	467.41	2.77	222.50
Misc.	13.61	5.60	7.03	2.86	16.02
CANNELTON					
For A	0.49	0.12	-	-	2.83
For B	9.23	1192.20	47.29	90.42	266.37
Sport A	28.33	22.17	30.22	30.63	9.32
Sport B	1.05	1.96	0.15	26.67	4.61

Table 5. Ohio River Fish Category Distribution at Selected Locations (cont'd.).

KILOGRAMS/HECTARE

Sample Location	1968	1969	1970	1975	1976
CANNELTON					
Comm.	50.60	52.51	147.10	249.22	181.63
Rough	78.88	146.93	170.81	249.88	174.06
Misc.	10.62	3.90	13.40	10.34	9.70
L & D #50.52 SMITHLAND					
For A	0.02	0.06	-	1.50	-
For B	1403.09	47.25	55.48	438.58	1645.03
Sport A	33.35	26.71	27.22	9.88	10.67
Sport B	2.67	0.14	1.82	3.91	0.63
Comm.	190.17	27.69	132.69	297.08	50.70
Rough	105.35	18.84	55.77	113.17	32.44
Misc.	0.32	10.39	5.48	21.23	53.65

Table 6. Comparison of Fish Categories at Primary Stations, 1968-1976

Percent of total weight (based on Kg/ha)

Location Category	Forage A	Forage B	Sport A	Sport B	Commercial	Rough	Miscellaneous
DASHIELDS L & D	8.6	8.9	0.5	0.6	4.3	76.2	0.8
PIKE ISLAND L & D	3.6	9.3	2.9	0.3	6.3	75.7	1.0
BELLEVILLE L & D	4.4	16.6	5.0	1.3	19.2	51.7	1.7
GALLIPOLIS L & D	1.0	15.9	1.6	2.3	35.8	41.2	1.8
MELDAHL L & D	<0.1	29.0	2.5	2.3	24.5	37.4	4.1
MARKLAND L & D	<0.1	31.6	1.3	1.5	19.2	44.9	1.5
CANNELTON	<0.1	48.5	3.6	1.0	20.6	24.8	1.4
50, 52, SMITHLAND L & D	<0.1	74.4	2.2	0.2	14.5	6.8	1.9

Table 7. Fish Biomass Estimates (Kg/ha)
for 100 Mile River Segments

River Section	1957-59	Number of Samples	1968-70	Number of Samples	1975-76	Number of Samples
0 - 100	42.8	11	404.8	6	251.3	4
100 - 200	140.7	9	156.3	3	255.7	2
200 - 300	103.3	6	290.6	3	160.5	2
300 - 400	90.9	15	-	0	-	0
400 - 500	94.7	13	290.4	3	543.5	2
500 - 600	78.6	7	759.5	3	638.4	2
600 - 700	258.9	34	-	0	-	0
700 - 800	535.3	11	670.3	3	652.9	2
800 - 900	142.7	9	714.9	3	1339.3	2
900 - 981	136.2	9				

Table 8. Comparison of Most Abundant Ohio River Fishes 1957-59 vs. 1968-76.

Species Abundance (based on number)

Rank	1957-59	1968-76
1	emerald shiner	emerald shiner
2	gizzard shad	gizzard shad
3	freshwater drum	channel catfish
4	mimic shiner	freshwater drum
5	channel catfish	brown bullhead
6	silver chub	mimic shiner
7	black bullhead*	bluntnose minnow
8	threadfin shad	sand shiner
9	blue catfish	threadfin shad
10	sand shiner	silver chub

Species Abundance (based on weight)

Rank	1957-59	1968-76
1	gizzard shad	gizzard shad
2	carp	carp
3	channel catfish	channel catfish
4	freshwater drum	freshwater drum
5	emerald shiner	brown bullhead
6	skipjack	bigmouth buffalo
7	flathead catfish	emerald shiner
8	blue catfish	smallmouth buffalo
9	black bullhead*	river carpsucker
10	river carpsucker	black buffalo

*most likely brown bullhead

Table 9
OHIO RIVER FISH COLLECTION, 1968-1976
Number of Species and Number of Fishes

Location (Lock and Dam)	Mile Point	1968		1969		1970		1975		1976		1968-1970		1975-1976		1968-1976	
		No. Species	No. Fish	No. Species	No. Fish	No. Species	No. Fish	No. Species	No. Fish	No. Species	No. Fish	No. Species	No. Fish	No. Species	No. Fish	No. Species	No. Fish
Dashields	13.3	16	1,656	19	2,181	16	1,284	17	30,202	16	1,137	24	5,121	21	31,339	31	36,460
Pike Island	84.3	26	3,078	24	3,357	29	8,183	33	6,177	21	7,286	33	14,618	31	13,436	38	28,081
Belleville	204.0	22	4,433	27	7,033	27	6,969	31	2,150	25	1,707	35	18,435	41	3,857	48	22,292
Gallipolis	279.2	23	3,322	19	1,175	26	1,240	20	1,325	15	1,147	34	5,737	22	2,472	37	8,209
Meldahl	436.4	27	1,952	22	749	29	1,294	19	2,907	18	6.130	38	3,995	22	9,037	41	13,032
Markland	531.5	22	3,155	18	2,454	18	4,771	19	5,540	23	1,924	27	10,380	27	7,464	36	17,844
Cannelton	720.7	32	1,372	28	8,095	21	1,181	21	3,851	29	3,522	39	10,648	30	7,373	45	18,021
50, 52, and Smithland*		33	13,431	35	1,997	20	1,510	16	2,601	23	17,554	43	16,938	27	20,155	46	37,093
Total			32,399		27,041		26,432		54,753		40,407		85,872		95,160		181,032

* L&D 50 M.P. 876.8 Sampled 1968, 1969, 1970
L&D 52 M.P. 938.9 Sampled 1975
Smithland M.P. 918.5 Sampled 1976