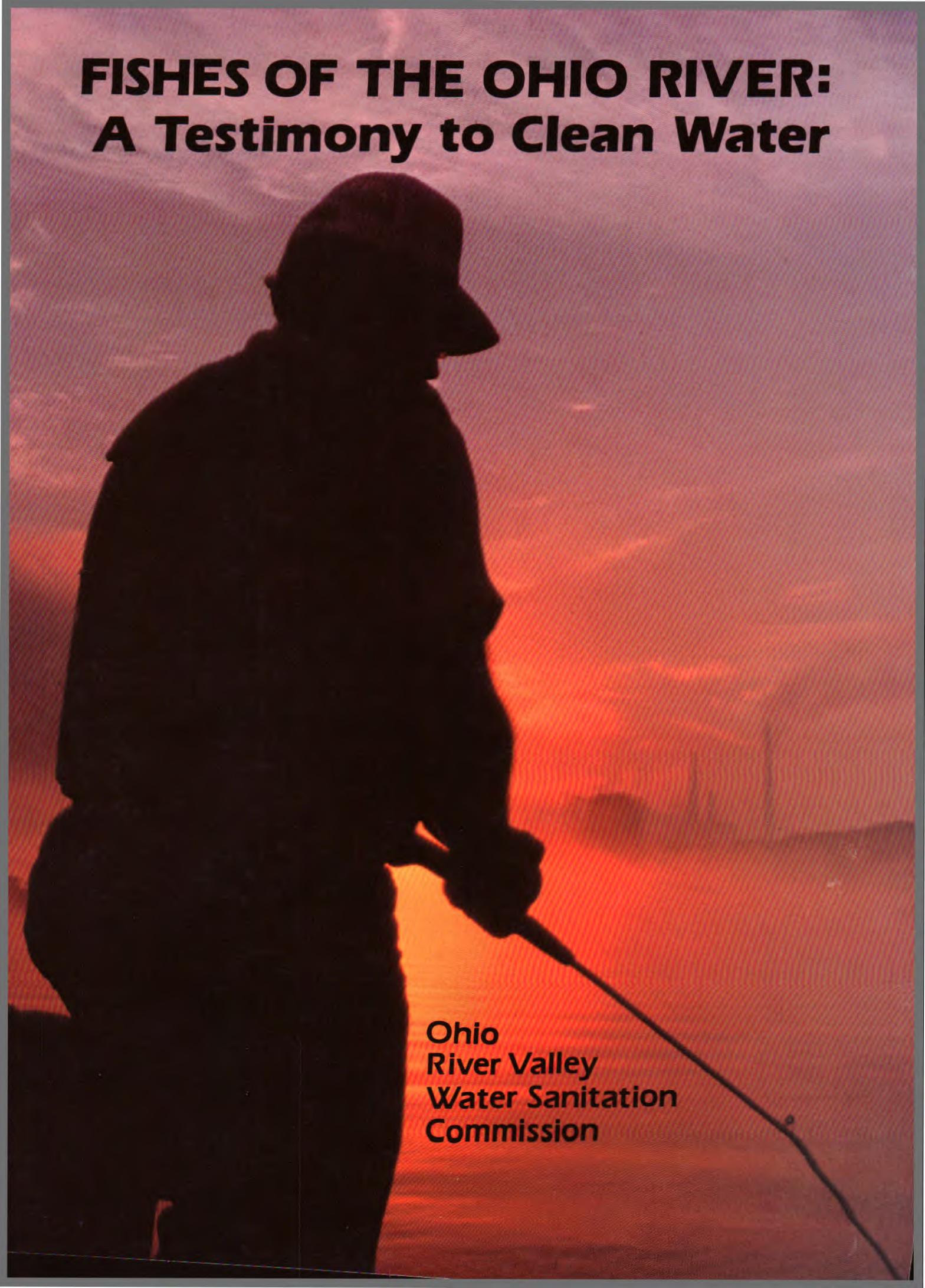


FISHES OF THE OHIO RIVER: A Testimony to Clean Water

A silhouette of a fisherman wearing a cap and holding a fishing rod, standing on a riverbank. The background is a warm, orange and red sunset over a body of water with distant hills.

**Ohio
River Valley
Water Sanitation
Commission**

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* as of March 15, 1983

FISHES OF THE OHIO RIVER: A Testimony to Clean Water



Fishing for sauger at McAlpine Dam, near Louisville, KY

Photo courtesy of the Louisville Courier-Journal

"The Sauger are booming" at Ohio River dams.
(*Outdoor Life*, 10/81)

"The river is loaded with fish"
(*Cincinnati Enquirer*, 7/19/82)

"Rockfish, a transplanted salt water Striped bass, . . . has a bright future . . . in the Ohio River"
(KY Dept. of Fish and Wildlife Resources)

"A half-hour's drive from Cincinnati, there's a fishing spot so fertile it attracts sea gulls."
(*Cincinnati Post*, 12/14/82)

"Lookit what I got" (heard at the Belleville Dam, West Virginia)

All of these comments refer to the same thing: the experience of fishing on the Ohio River. More than 80 species of fish were found in the river in recent surveys at lockchambers; approximately $\frac{1}{3}$ of these were sport and commercial fish: Sauger, Walleye, Channel Catfish, Bass; a Muskellunge was taken near Pittsburgh in 1982.

This booklet is about the fishes of the Ohio River — what they are and in general, where they have been found. This booklet also tells a story about the resurgence of the fish populations in the Ohio River and its major tributaries and how this is intrinsically tied to improved water quality. The clean-up of the Ohio River has been a major effort of Ohio Valley states, municipalities and industries. Some of the success can be found in the fisherman's creel.

The Ohio River

4



Fish kill in the early 1950's

Commission file photo

The Ohio River is formed with the meeting of the Monongahela and Allegheny Rivers at the Golden Triangle in Pittsburgh, PA. Its origins are traced to tributaries flowing from western New York and southwestern Virginia. It flows in a generally southwesterly direction for 981 miles, joining the Mississippi in Cairo, Illinois. The river forms the borders between West Virginia and Ohio, Ohio and Kentucky and Kentucky and Indiana and Illinois. It serves many vital needs for water supply, recreation, commerce and waste-water discharge.

There are 18 high-lift dams with associated locks on the Ohio River built and operated by the US Army Corps of Engineers. Before the construction of the high-lifts, 46 wood and concrete wicket dams guaranteed the nine-foot channel depth in the river that was essential to year-round navigation. Two of the wicket structures are still in use on the lower river. Before the wickets were built, a process that started in the 1880's and was completed in 1929, the Ohio was known as the river that was "frozen over one-half the year and dried up the other."* Fluctuations in river flow, including the extremes of flood and drought, were common, almost regular, events.

The extensive tributary reservoir system and the mainstem locks and dams did much to protect property and assure the transport of essential commodities — for example, coal and building materials. But they changed a free-flowing river into a

series of slow-moving lakes, some 100 miles in length and 50 feet deep behind the present high-lift dams. Riffles, rocks and marsh areas were removed starting in the middle 19th century. The early wicket dams completed the canalization of the Ohio. This had major impact on the fish populations of the Ohio River.

Concurrent with the beginning of canalization, intense tree cutting took place along the banks of the Ohio. These activities led to increased siltation loads in the river. At the same time, industrialization was intensifying in the Ohio Valley. Steel production, meat packing, distilling and hide tanning all had centers of activity here. The waste produced by these industries was disposed of in the cheapest way possible: simple discharge into the seeming limitless Ohio River and its major tributaries.

Certain fish populations declined in response to these impacts. By the first days of the 20th century, Paddlefish, Bullnosed and Shovel-nosed Sturgeons, Yellow Bullheads, Blue Catfish and Walleyes were all on the decline. Increased turbidity spelled the end of Mooneyes and Stonecats. The Mud Pickerel lost its marsh habitat to canalization.

The toll taken by pollution did not go unobserved. A 1933 letter to the editor of the **Louisville Courier-Journal** reported a pollution-caused killing of "thousands of fish . . . The white spotch . . . on the river stretched as far as the eye could see."*

But it took major outbreaks of waterborne diseases in the *human* population in the early 1930's before water pollution came under legislative control. World War II and the perceived need for unhampered industrial output intervened, but in 1948, eight states in the Ohio Valley signed a Compact pledging to control future and abate existing pollution. The *Ohio River Valley Water Sanitation Commission* (ORSANCO) was established at the same time to carry out the purposes of the Compact. This action by the states had the approval of the US Congress.

Beginning with this 1948 landmark, water quality in the Ohio Valley has benefited from a series of laws and their resultant programs on the state, interstate, and federal level.

**Aquatic Life Resources of the Ohio River, Ohio River Valley Water Sanitation Commission, Cincinnati, OH, 1962, p.8.*

**Ibid, p. 13.*

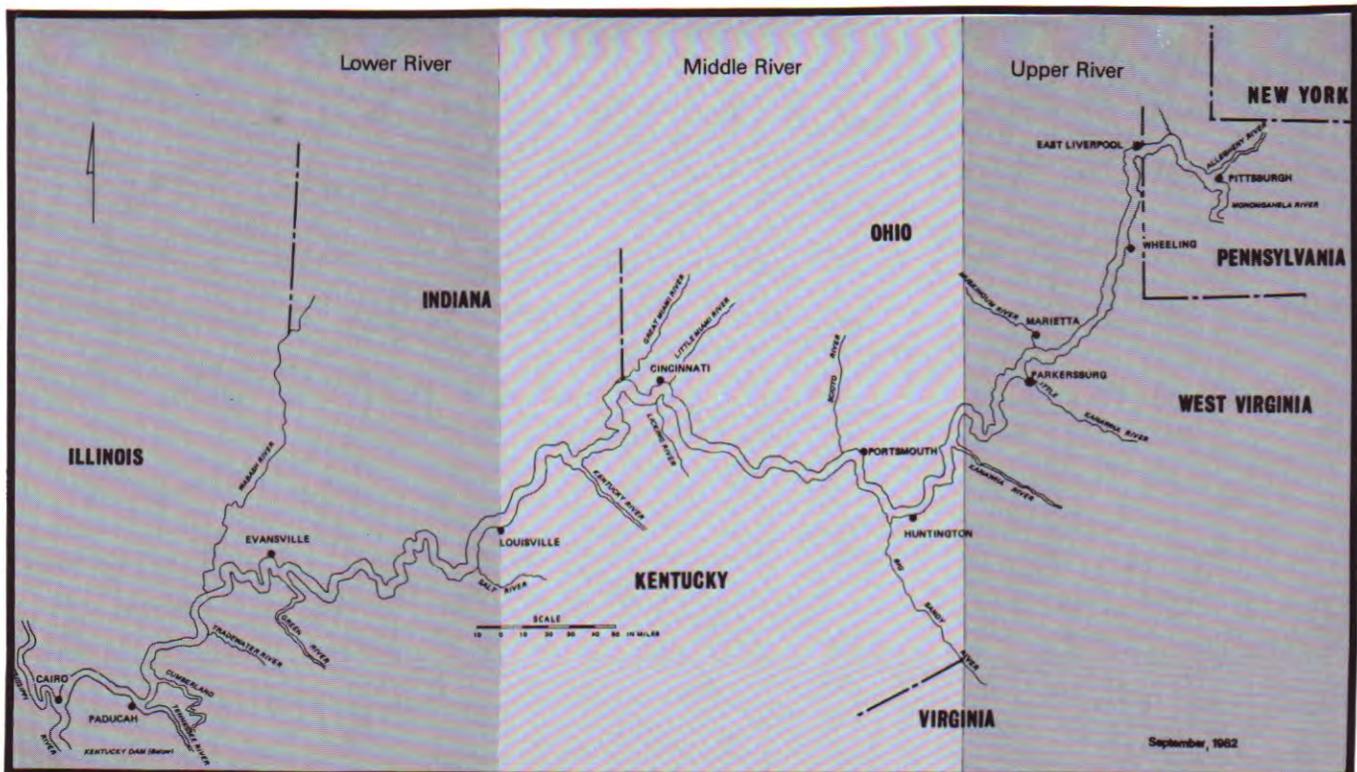
The Fish — After the Compact

Since 1957, cooperative sampling for fish populations in the Ohio Valley has occurred periodically. The first study was done over three years, 1957-60, as a cooperative project of the Commission, the University of Louisville and the Kentucky Department of Fish and Wildlife. This study not only investigated fish, but microorganisms and water chemistry as well.

Since 1968, the Commission, serving as a coordinating as well as a participating agency, has worked cooperatively with fisheries and water pollution control agencies from states along the Ohio River mainstem in fish sampling at the lock-chambers along the Ohio. Not all lock-chambers are sampled in any given year, so in reporting this information in this booklet sampling sites are grouped into upper river, middle river and lower river categories. These categories are defined on the map of the river. A more specific compilation of data on the fish surveys can be found in the Commission's publication, **Ohio River Fish Populations 1968-80** (1981).

TABLE 1

Locks and Dams Along the Ohio River Surveyed for Fish Populations			
Upper River		Lower River	
Dam	Mile-point	Dam	Mile-point
Dashields	13.3	Cannelton	720.7
Montgomery New	31.7	Newburgh	776.0
Cumberland	54.4	Uniontown	846.0
Pike Island	84.2	Lock #50	876.8
Hannibal	126.4	Smithland	918.5
Lock #15	129.1		
Willow Island	161.8	Tributaries	
Belleville	203.9	Dam/River	Mile-point
Middle River		Lock #2, Monongahela	11.2
Dam	Mile-point	Maxwell Lock Monongahela	61.2
Gallipolis	279.2	Lock #3 Allegheny	14.5
Greenup	341.0	Lock #8 Allegheny	52.6
Meldahl	436.2	Winfield Lock Kanawha	31.1
Markland	531.5	London Lock Kanawha	82.8
McAlpine	606.8		



A Guide to Some Ohio River Fish*

6

TABLE 2

Sport and Commercial Fishes of the Ohio River			
Species	Locations Found in Lockchamber Sampling		
	Upper River	Middle River	Lower River
White Bass	✓	✓	✓
Striped Bass	✓		✓
Yellow Bass			✓
Rock Bass	✓	✓	
Pumpkinseed	✓		
Bluegill	✓	✓	✓
Smallmouth Bass	✓	✓	
Spotted Bass	✓	✓	✓
Largemouth Bass	✓	✓	✓
Black Crappie	✓	✓	✓
White Crappie	✓	✓	✓
Green Sunfish	✓	✓	✓
Yellow Perch	✓		
Logperch	✓	✓	
Sauger	✓	✓	✓
Walleye	✓	✓	✓
Freshwater Drum	✓	✓	✓
Smallmouth Buffalo	✓	✓	✓
Bigmouth Buffalo	✓	✓	✓
Black Buffalo	✓	✓	✓
Blue Catfish		✓	✓
White Catfish	✓		
Channel Catfish	✓	✓	✓
Flathead Catfish	✓	✓	✓
Muskellunge	✓		

The following listing provides some information about certain species of fish commonly found in the Ohio River, primarily the sport and commercial species. Descriptions of the fish are given, but this can be used only in a general way to identify the fish you catch. Precise identification of the species of a fish can be a painstaking process, often involving scale counts and exact measurements of fins and other body parts. For smaller fish, biologists use microscopes to discern differences between species.

The guide also mentions differences in the coloration of certain fish. Some caution must be taken here, as well. Some fish change color over the course of a year; the Walleye shows its brightest colors only during the breeding season, for example. The clarity of the water in which the fish are found can also effect coloration.

The fishes called "bass" actually belong to two families, the Temperate bass family and the Sunfish family.

**Acknowledged is the assistance of Dr. William M. Clay in the development of this section. Drawings were provided by Dr. Clay and the Illinois Dept. of Conservation, reprinted with permission.*

Some drawings were reprinted with permission from Trautman, Milton B., Fishes of Ohio, Ohio State University Press, Columbus, Ohio, 1981.

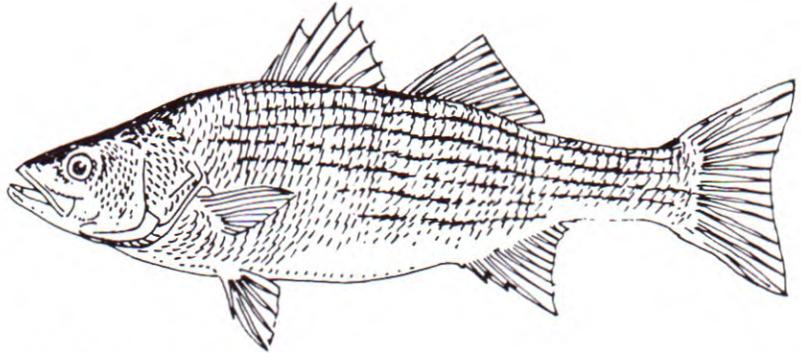
Temperate Bass Family

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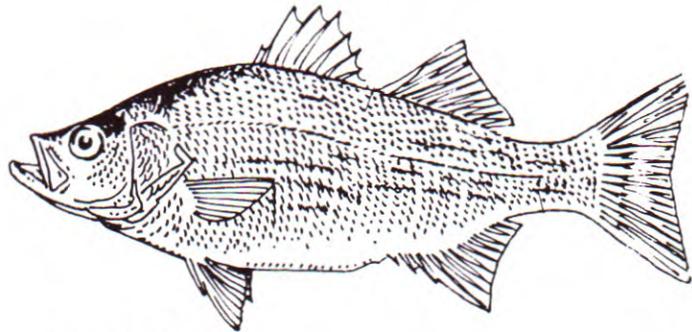
- **Striped Bass:** Also called the Rockfish. Normally a marine species that runs up rivers to breed, the Striped Bass has developed a strain that completes its life cycle in fresh waters, which has led to its introduction into inland streams and rivers through stocking programs. An excellent game-fish and able to grow to a weight of 50 pounds, it is one of the largest freshwater sport species. It has a slender body with dark coloration above, silvery on the sides and paler below, and marked with about six or eight narrow, dark lengthwise stripes. It is not very common in the Ohio River.

- **White Bass:** The sides of this fish are marked with dusky stripes along with silvery coloration; the lower sides are whitish. There are two patches of teeth on the tongue and the two dorsal fins are entirely separate. The White Bass looks like a small version of the Striped Bass. Most specimens are on the order of 10 to 12 inches in length, and the maximum size is only 18 inches. Its preferred habitat is large streams and impoundments.

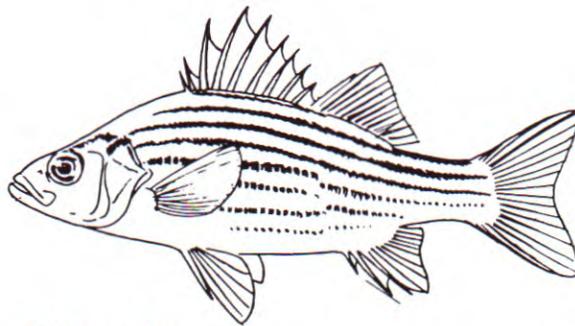
- **Yellow Bass:** Preferred as a pan fish to the White Bass, the Yellow Bass is colored green-buff above, yellowish on the sides, and white below. The six or seven dark stripes on the body are usually broken and off-set. The base of the tongue is without teeth. Its usual weight is less than one pound. This fish occurs in the lower reaches of the Ohio River.



Striped Bass



White Bass



Yellow Bass

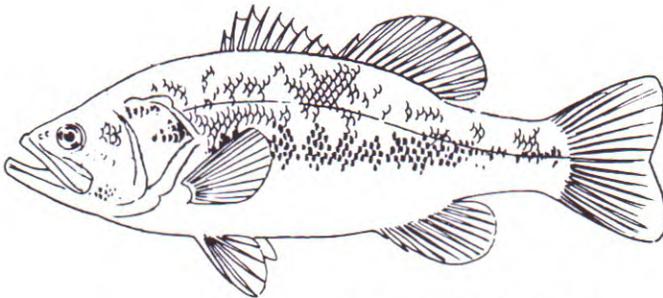
Sunfish Family

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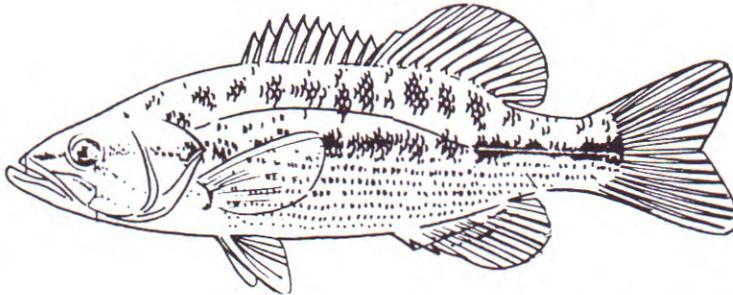
One of the most important freshwater game and pan fish families in the United States.

- **Largemouth Bass:** Also called Largemouth Black Bass, Bigmouth Bass and Green Bass. This fish has a dark olive-green back with lighter green sides over-cast with gold or bronze. Along the middle

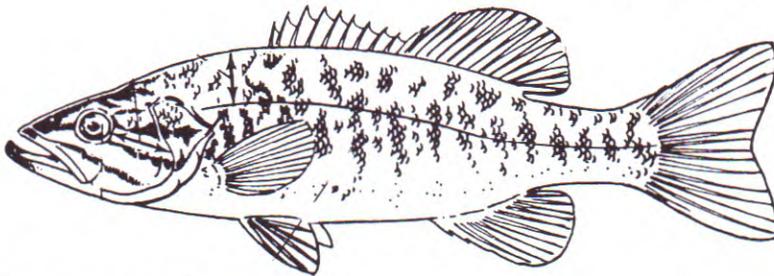
of each side is a distinct dark band, which is usually more obvious in large adults. The eye is golden. Sizes range from 10 to 18 inches and from one-half to three pounds, but the world's record is slightly more than 22 pounds. The Largemouth prefers still waters: impoundments, sluggish streams, oxbows. Adult Largemouth feed on small fish (including young shad), insects, crayfish, small frogs, and other animals.



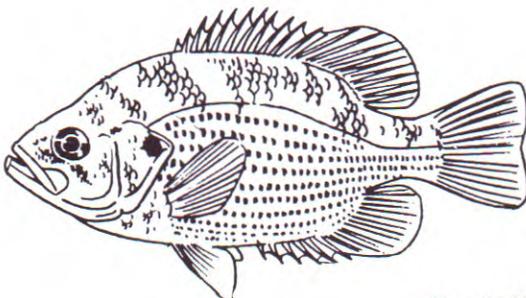
Largemouth Bass



Spotted or Kentucky Bass



Smallmouth Bass



Rock Bass

- **Spotted Bass:** Also called Kentucky Bass, Spotted Black Bass. Often taken as a Largemouth or Smallmouth Bass, this fish is somewhat intermediate between these species. Its size is similar to the Smallmouth; its coloration is much like that of the Largemouth, from which it differs mostly by having rows of small spots on the lower sides. Other differences from the Largemouth are the presence of teeth on the tongue, which are usually absent in the Largemouth, and a deeper notch in the dorsal fin. Sizes range from 8 to 15 inches, although 20-inch Kentucky bass have been taken; weights range from eight ounces to two pounds, with the maximum being five pounds. This bass prefers streams of moderate current and large pools, and is on the Pennsylvania list of protected animals.

- **Smallmouth Bass:** Also called Black Bass. This fish is greenish in front, growing darker along the back with yellowish sides. The belly is pale yellow or whitish. The sides are marked by a series of dark, vertical bars, but never a band along the length of the fish, as in the Largemouth. There is also a dark spot on the gill cover. Small fry are black overall. Ten to 18-inch Smallmouths are common and these weigh $\frac{3}{4}$ to three pounds. The record Smallmouth was close to 12 pounds. This fish prefers flowing streams with riffle areas and feeds on crayfish, insect larvae, small fish, and Hellgramites. Hellgramites are the immature form of the Dobson Fly.

- **Rock Bass;** Also called Redeye, Goggle-eye, Rock Sawfish.

This fish is usually greenish in color with a brassy luster, with dark spots on the

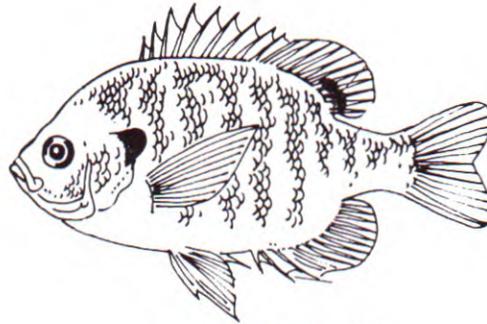
scales which seem to form interrupted lines along the length of its body. The dorsal fin has 10 to 13 spines and the anal fin is much shorter than the dorsal. It can reach weights of 1 ½ pounds and lengths of one foot, although most specimens are smaller. The Rock Bass prefers pools to riffles and feeds on Crayfish, insect larvae, and small fishes.

- **Bluegill:** Readily identified by the blue color on its gill cover, the Bluegill is one of the Valley's favorite pan fishes. Usually four to nine inches long, Bluegills are commonly green-blue on top and whitish on the belly. the belly can also be yellowish or red in color. The fish's sides are marked by six or more dusky vertical bars. It prefers sluggish waters, with little or no current.

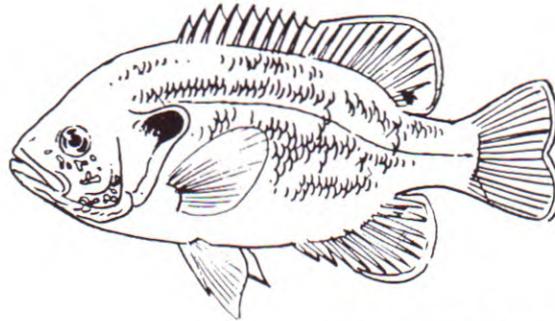
- **Green Sunfish:** Also called Blue-spotted Sunfish. This fish is olive-green above and marked with several dusky, vertical bars. Many scales are bluish and the dorsal and anal fins have dark blotches on them. this fish is commonly five or six inches long; rare specimens are longer. The Sunfish species can hybridize with one another, so intermediate characteristics between, for example, the Bluegill and Green Sunfish, may be found. The Green Sunfish has a larger mouth than the Bluegill, and a light-colored margin on the gill-cover flap. Its pectoral fins have rounded rather than pointed ends.

- **Black Crappie:** Also called Calico Bass. This fish is silvery-olive in color with curved markings in darker green. The back and belly of this fish are equally curved, making an overall oval shape. A distinguishing characteristic is the almost equal length of both the dorsal and anal fins. Its dorsal fin has seven or eight spines. This fish is strictly carnivorous, preferring invertebrates and small fishes.

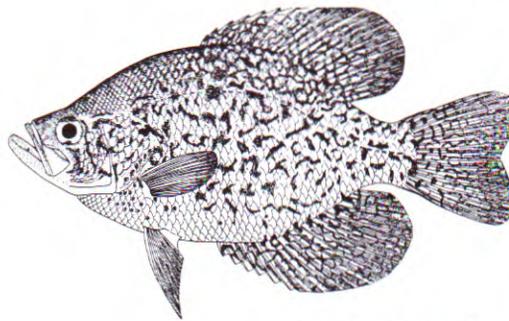
- **White Crappie:** Also called Newlight. This fish is also silvery-olive in color, but its back and sides have five to seven bands of dark green or brown. The belly is whitish. However, individuals taken from turbid waters may be almost colorless. The dorsal fin has six spines. Its preferred habitat is quiet waters — lakes, impoundments, pools or large streams. The White Crappie is usually found in deep holes, but it is not a bottom dweller.



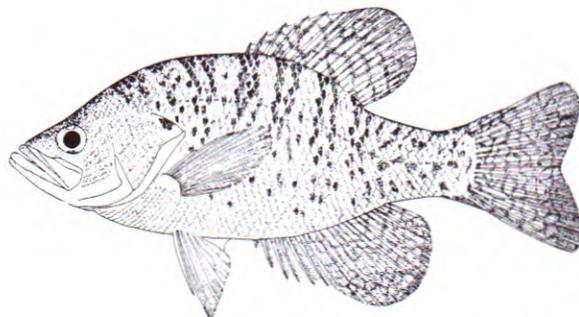
Bluegill



Green Sunfish



Black Crappie



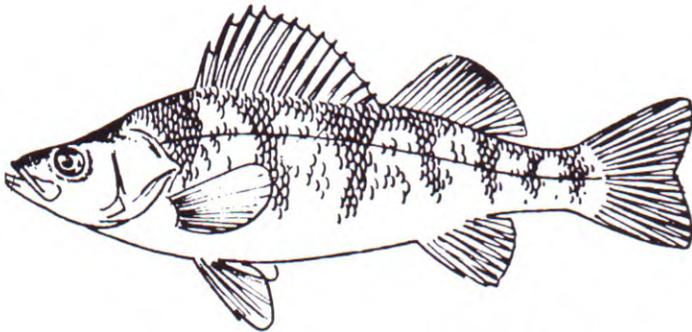
White Crappie

Perch Family

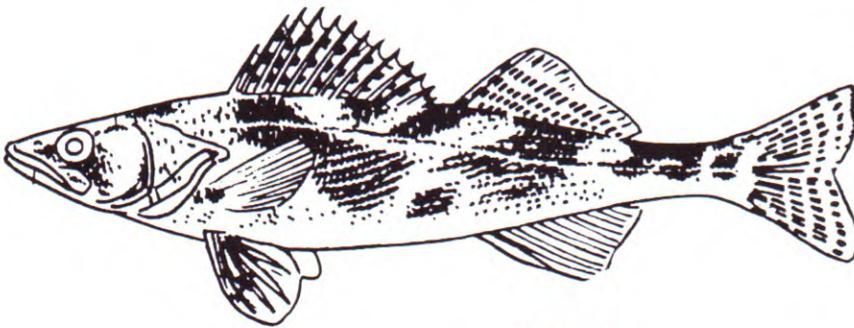
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This family has three subgroups: True perches, Pike perches and Darters. All have separated dorsal fins.

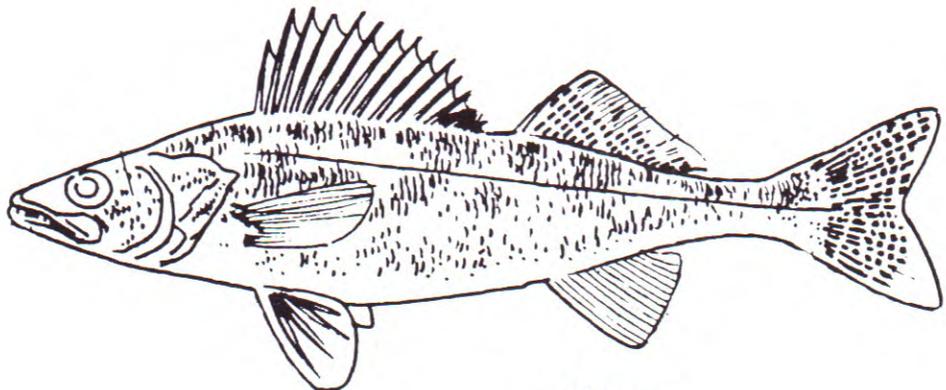
- **Yellow Perch:** More common in the upper river, this true perch is rare in the lower. This fish is olive above with yellowish sides and white belly. The upper



Yellow Perch



Sauger



Walleye

sides are crossed with six to nine dark bands. Adults are usually six to ten inches in size.

- **Sauger:** Also called Jack Salmon, Gray Pike, Sand Pike. A pike perch, this fast-swimming species has a long, almost cylindrical body. The head is tapered and the mouth large. This fish is gray to gold-olive above, brassy on the sides and silvery on the belly. It is distinguished from the Walleye most easily by the spots in irregular rows on the first dorsal fin. Adult sizes range from 9 to 15 inches. Both the Sauger and Walleye are favored sport fish in the Valley. The Sauger is on the protected species list in Pennsylvania.

- **Walleye:** Also called Walleye Pike, Pike Perch. This fish is very similar to the Sauger, but can be distinguished by the dark blotch on the last two membranes of the first dorsal fin. This fish also is olive colored above with brassy sides, although specimens from muddy waters may be paler. One to two foot lengths and weights up to five pounds are usual; but 15-pound Walleyes are not uncommon. The Kentucky state record is 34 inches and slightly more than 19 pounds.

Paddlefish Family

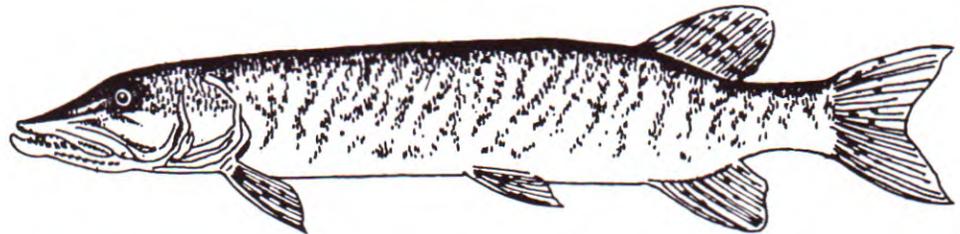
Pike Family

A family of fishes with only two species existing in modern times: one living in the large rivers of South China; the other in the central and southern rivers of the United States.

• **Paddlefish:** Also called Duckbill Catfish, Spadefish. Approximately one-third of this fish's length is its long, flattened snout, extending far in front of its large mouth. The skin is almost entirely without scales and its purplish color is suggestive of a Catfish. The gill covers have a long, pointed flap. The dorsal fin is located near the tail, which is upturned. There are no bones in this fish; the skeleton is entirely cartilage. Although the Paddlefish was once abundant and specimens of 150 pounds were found, it is now considered depleted and it is on the Ohio list of protected animals. However, it has been found in increasing numbers in recent ORSANCO lockchamber surveys in the Ohio River.

A family consisting of Northern Pike, the Pickerals and the Muskellunge.

• **Muskellunge:** This fish is yellowish to brown-olive on the back, fading to pale yellow or white on the belly. A number of small, dark spots marks the sides. It prefers medium to large streams and migrates to the headwaters of tributaries to spawn. In recent years, "Muskie" taken from the Ohio River have rarely exceeded three feet and 25 pounds. However, the Kentucky record is a 42-pounder, measuring 52 inches, taken in 1973 from the Licking River.



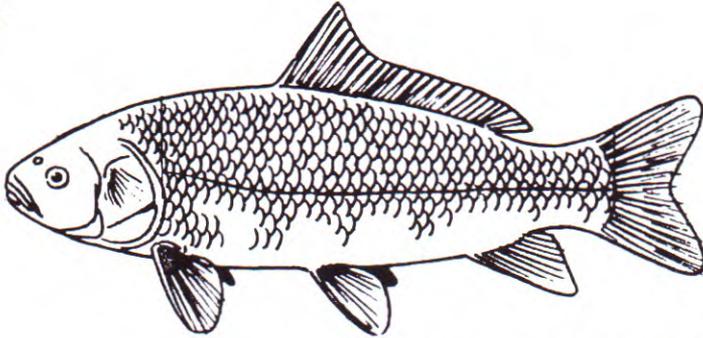
Muskellunge



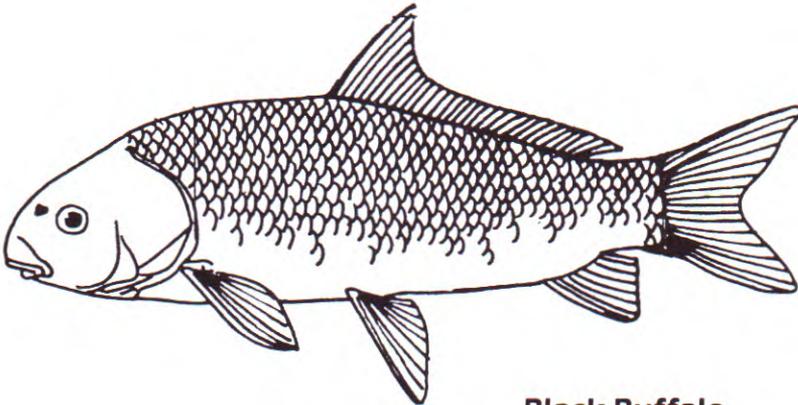
Paddlefish

Sucker Family

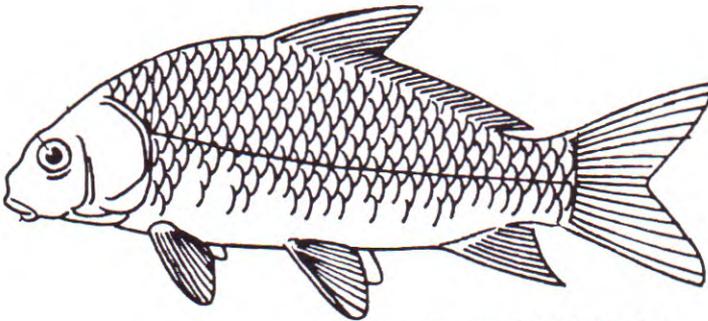
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Bigmouth Buffalo



Black Buffalo



Smallmouth Buffalo

The Sucker family includes the Buffalos, Carpsuckers, Redhorses and others. All have a sucker-like mouth and no spines in the fins. They live on the bottom of streams, lakes and ponds and eat small plants and animals which they take up from the bottom by suction. Their flesh often has a delicate flavor but is impaired by numerous, small bones. The body of Buffalos is more brownish or bronzy than that of Carpsuckers.

- **Bigmouth Buffalo:** This fish is bronze gray or brown above, yellow on the sides and pale underneath. Most adult specimens are around 15 pounds in weight, although they can reach 50 pounds.

- **Black Buffalo:** Normally the darkest of the Buffaloes, this fish is slate colored above, tapering to a white or yellowish belly. However, coloration does depend upon a number of environmental characteristics, notably water transparency. The Black Buffalo is also usually the smallest Buffalo and most individuals are one to two feet in length and weigh no more than 10 pounds. This particular species cannot tolerate heavily polluted waters.

- **Smallmouth Buffalo:** Also called White Carp. This fish is green-bronze above, yellowish on the sides, and white on the belly. However, individuals found in turbid waters may be paler. In size, this fish is between the Bigmouth and Black Buffaloes. Specimens of the Smallmouth have weighed 25 to 50 pounds. This fish prefers clear water and swift pools and its range covers much of the Mississippi and Ohio Valleys.

Catfish Family

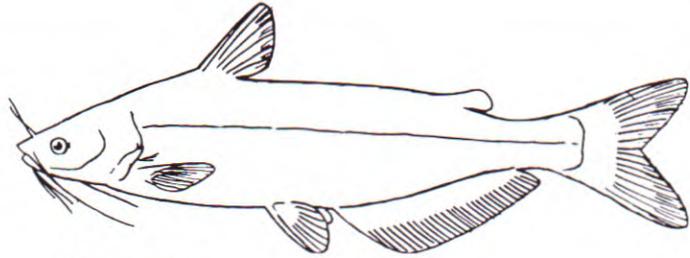
A family of fishes easily identified by the whisker-like barbels on either side of the mouth. Omnivorous bottom-dwellers, some Catfish species provide good sport fishing as well as commercial value.

- **Blue Catfish:** Also called Chuckle-head and White Catfish. This fish is blue-gray above and lighter below with a deeply forked tail. Its whisker-like barbels are long and dark. The color is even; no spots or blotches mark the Blue Catfish. It prefers large rivers and most specimens currently taken weigh between 5 and 15 pounds. Currently, it is most abundant in the lower Ohio River and very rare in the upper.

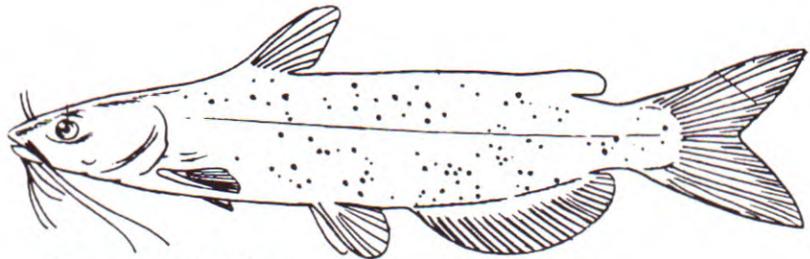
- **Channel Catfish:** Also called Fiddler and Spotted Catfish. This fish also has a deeply forked tail but dark spots on its body distinguish it from the Blue Catfish. The Channel Catfish is silver-gray above and paler below; common weights are two to seven pounds, with specimens of 15 pounds and more being found, but rarely. Omnivorous, the channel Catfish is an important Ohio River commercial species.

- **Flathead Catfish:** Also called Mud Cat and Yellow Cat. This fish has a flattened head and a wide mouth. The body is mostly a deep brown with a lighter belly. The tail is squarish, not forked as is that of the Channel Catfish. The Flathead can reach weights of 100 pounds or more in large rivers, although 25-pounders are more common. It prefers to feed on insect larvae, invertebrates and smaller fish.

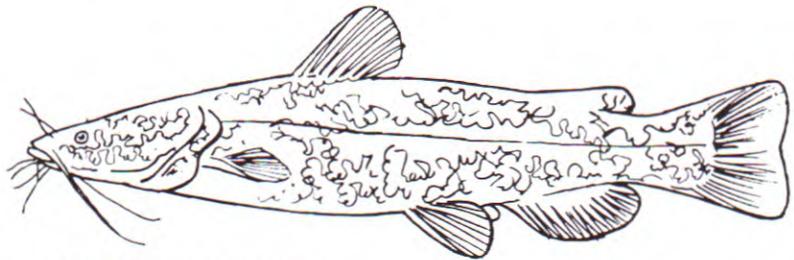
- **White Catfish:** This fish is medium-gray to blue-black above, paler on the sides and near-white on the belly. The whisker-like barbels are lightly colored. This fork in the White Cat's is less deep than that of the Blue Catfish and the tips are rounder. It is widely used to stock commercial fishing lakes in the valley; indeed, some of the specimens taken in the commission fish surveys may be escapees from these lakes.



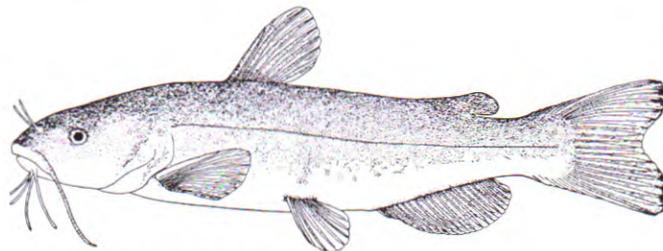
Blue Catfish



Channel Catfish



Flathead Catfish



White Catfish

Minnow Family

Drum Family

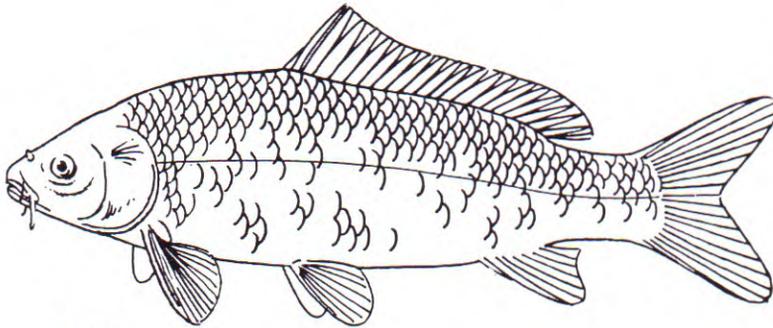
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A large family of freshwater fishes with several dozen species found in the Ohio River basin. The family includes Carp, Goldfish, Chubs, Minnows and Shiners.

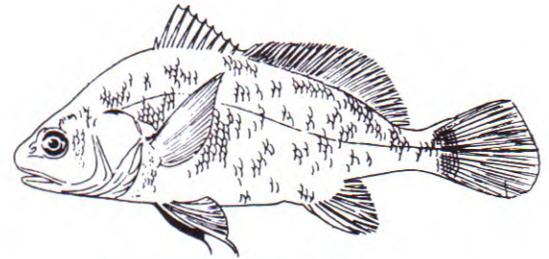
- **Common Carp:** A species introduced from Europe, the Carp can grow to weigh 30 pounds, although weights of 10 pounds are more common. It has a strongly arched back with one long dorsal fin; both the dorsal and the anal fins have a strong spine with a saw-toothed edge. The body is slate-colored above and fades to yellow or whitish on the lower sides. Its scales are large, and two tentacles fall from either side of the upper lip. Carp can live in a variety of habitats but prefer warm, sluggish and shallow waters.

While most species in this family are found in marine environments, there is one freshwater species.

- **Freshwater Drum:** Also called White Perch. This fish has a long body and high back, a small mouth low in position and a long dorsal fin. Most specimens average 12 to 15 inches in length and 1 to 1½ pounds in weight, although specimens have been taken of 10 pounds and more. It is considered to be an important commercial fish in the Valley.



Carp



Freshwater Drum



Commission file photo

Gar Family

Herring Family

These fishes have slender, cylindrical bodies covered with heavy, diamond-shaped scales and long beaks studded with sharp teeth. Strictly carnivorous, gars feed on smaller fish and crustaceans.

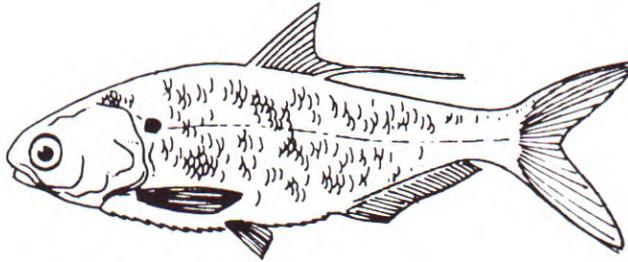
- **Shortnose Gar:** This fish has a snout which is relatively broad and wider at its tip than the diameter of the fish's eye. The top of the head is without spots and the body is olive above becoming paler along the sides and belly. Its length is commonly two feet; the record is 35 ½ inches. It is on the Ohio list of protected animals.

- **Spotted Gar:** For many years, this fish was confused with the Shortnose Gar; and indeed, identification often requires precise scale counts. The tip of the snout equals or exceeds diameter of the eye. Adults range in size from 20 to 30 inches, rarely longer. This fish is olive or brown above, paler on the sides and white to yellow below. Dark blotches or spots mark the head, back, sides and fins of this gar. Both the Spotted and Shortnose Gars prefer sluggish waters. The Spotted Gar is protected in both Ohio and Pennsylvania.

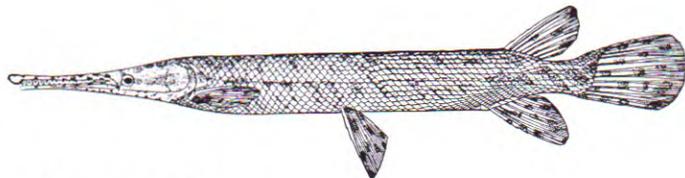
- **Longnose Gar:** This, the most common gar, occurs throughout the length of the Ohio River. Its snout is extremely long and narrow, with a width at the nostrils that is less than the diameter of the eye. The body is brownish to green above and becomes yellow or white below; there are numerous dark spots on the fins and usually a few on the body. It can grow to a length of three feet or more.

This family includes herring and shad, important forage fish on the Ohio River. These fish are a primary food source for many carnivorous fish species.

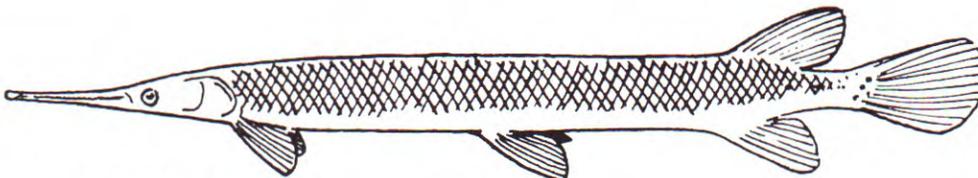
- **Gizzard Shad:** Like many open-water species, Gizzard Shad form schools. The body of this fish is oval with a short, rounded snout and small mouth. The dorsal tail fin is deeply forked. The back and sides are silvery; the belly is white. A dark spot, most pronounced in young fish, is found near the gill cleft. Adults are rarely longer than 12 to 15 inches.



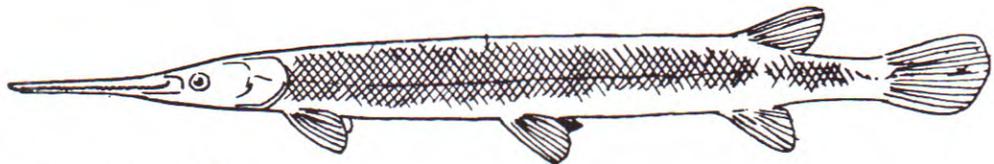
Gizzard Shad



Spotted Gar



Shortnose Gar



Longnose Gar

Fish Surveys — A portrait of the River

Why Collect Fish?

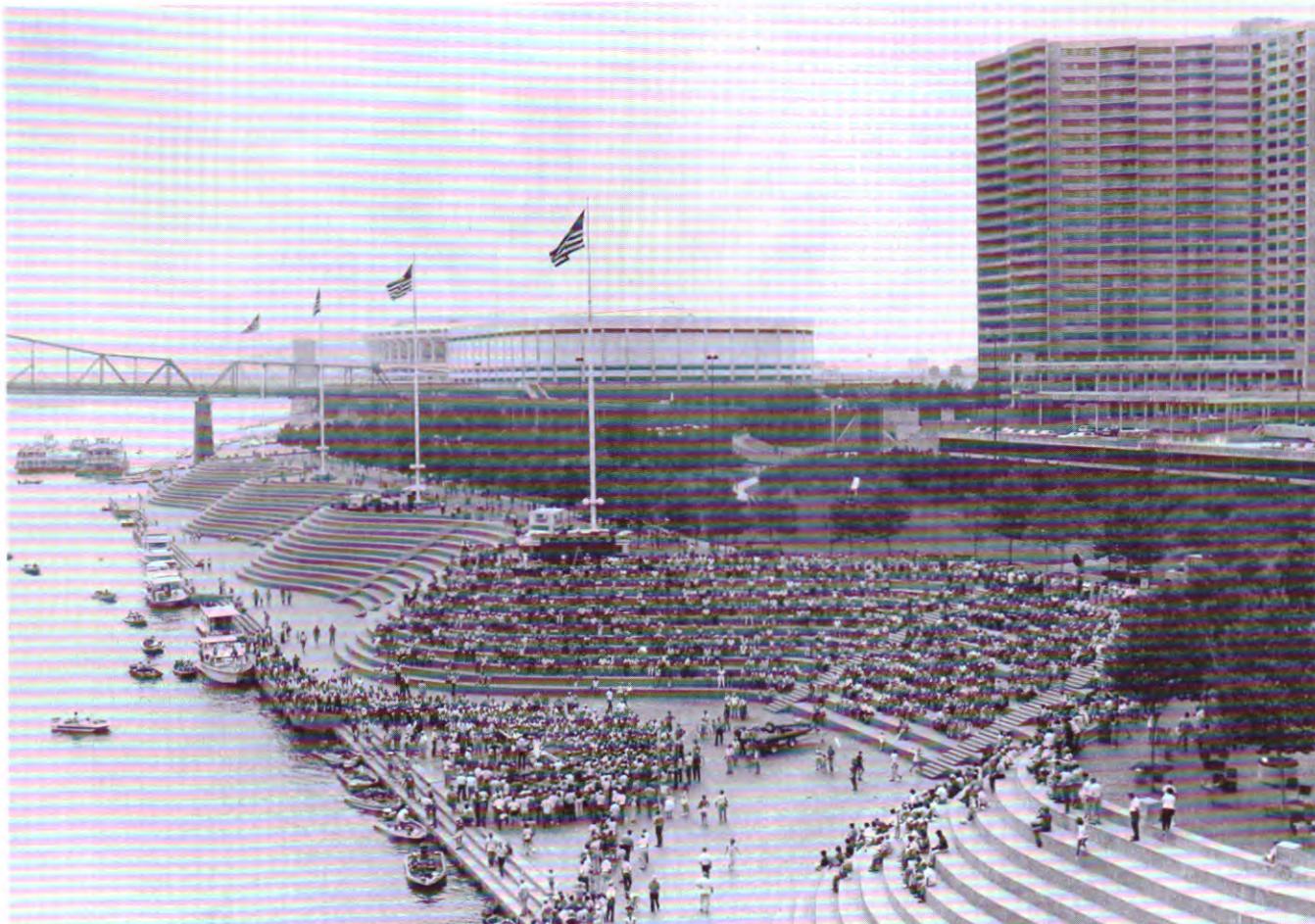


Photo courtesy of the Bass Anglers Sportsman's Society

Crowds gather for the daily weigh-in at the Bass Champs Cincinnati Invitational Contest, Cincinnati, Ohio, July, 1982.

Fish are good indicators of the relative cleanliness of a body of water. Many species of fish cannot thrive in polluted streams. When these fish are found, particularly after an absence of some years, this is evidence that attempts to prevent or clean up pollution have been successful.

Fish species are divided into five categories in ORSANCO Fish Survey reports: "sport," "commercial," "forage," "rough" and "others." These categories are used in determining the *relative abundance* of these categories in the total catch of the lockchamber surveys. These findings are described in detail starting on page 17.

Another characteristic of a healthy river is its ability to support a variety of species,

not only of adult fish, but of the plants, insects and insect larvae, crustaceans and the smaller fish they feed upon. The yardstick used to measure the degree of variety of fish supported is called a diversity index. More on this is found on page 19.

Chemical analysis of the tissues of the fish provide yet another indication of pollution of the river. The US Food and Drug Administration (FDA) analyzes samples of the fish collected for this purpose for some contaminants which bioaccumulate, such as pesticides, PCBs and heavy metals. Summaries of these findings begin on page 21.

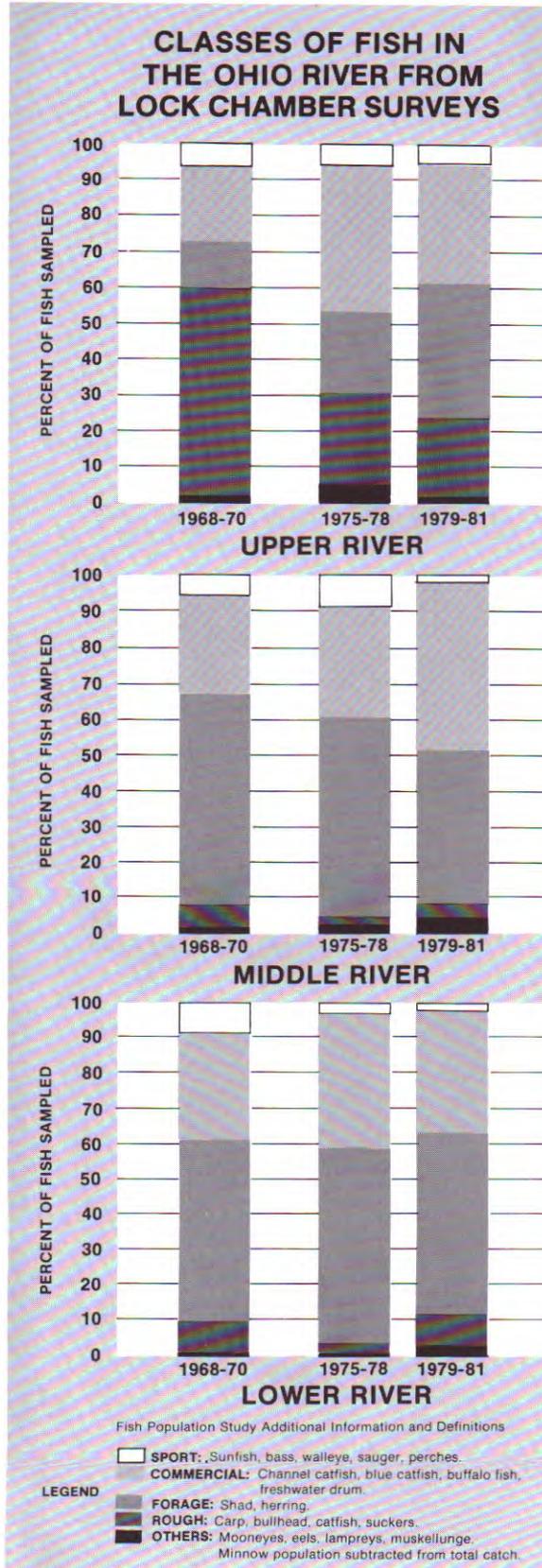
Relative Abundance

A total of 81 species of fish has been identified in the ORSANCO fish population surveys since 1968. Of these 81 species, 67 were found in the upper river; 58 in the middle river; and 56 in the lower river. The fact that 11 more species were found in the upper river than the lower is evidence of the physical, hydrologic and geographical differences along the Ohio. In all, 27 species are common to all parts of the river; the other 54 species can be found in only one or two of the segments.

The bar graphs classify the fish found according to the categories, "sport," "commercial," "forage," "rough" and "other." The bars represent the abundance of fish in each of these categories relative to the total catch. Minnows and Shiners were eliminated from the total before the calculation of these proportions. The available data have been grouped by years: 1968-70; 1975-78; and 1979-81.

The 1957-60 data collected in cooperation with the University of Louisville and Kentucky Department of Fish and Wildlife cannot be grouped with the data collected since 1968. Methods of collection in the 1957-60 survey involved not only lock-chamber collections, but shocking, seining, and fishing as well. Tributaries were also sampled and collections made at different times of the year. Furthermore, reporting methods differed substantially. The 1957-60 data do, however, point to a general improvement, particularly in the upper river.

As can be seen from the bar graphs, a significant increase in the number of *commercially valuable fish*, relative to the total catch, has been collected in the lock-chamber surveys in the upper river. In the studies conducted from 1968-70, the commercial species in the upper river represented 20.7 percent of the total; in 1975-78, this figure was 41.1 percent; and during 1979-81, it was 33.0 percent. The



decrease in the commercial catch during the last three years may be due to a decrease in the data available during this time segment and natural changes in the populations.

Concurrently, the number of *rough fish* collected in proportion to the total catch has declined significantly. Almost 60 percent of the total catch collected in the upper river during 1968-70 was rough fish as compared to 22.1 percent collected in 1979-81. The number of forage species has also increased from 12.5 percent in 1968-70 to 37.5 percent during 1979-81. The number of *sport* class fish has remained relatively stable. The *forage fish*, mostly Gizzard Shad and Herring, are a food source for the larger species.

The amount of *commercially valuable fish* found in the middle Ohio River has also increased, although not as dramatically as in the upper river. In 1968-79, 27.1 percent of the total catch was represented by commercial species. This has steadily increased to 38.1 percent during studies conducted from 1979-81. *Rough fish* have been a relatively small proportion of the catch in this river segment; this proportion has decreased even further as have the numbers of *forage fish*.

The relative abundance of the five classes of fish has remained generally stable in the lower Ohio River. There has been a slight increase in the number of *rough fish* species, but this does not represent a significant proportion of the fish population in the lower river. There has also been a slight decrease in the number of *sport* fish relative to the total catch. This decrease may be more reflective of the lack of data available from the lower river.

The relative abundance of various classes of fish since 1968 has shown steady movement toward greater proportions of the more "valuable" species. This is an indication of improved water quality, since fishes known to be relatively intolerant of pollution are increasing in number.

This is further supported by the discovery of fishes considered threatened or endangered in the Ohio River. Several states — Ohio, Pennsylvania and Kentucky — have developed lists of protected or endangered wildlife that include fish. A total of 16 fish found on the lists of one or more of these states has been found in the Ohio River in recent years (Table 3).

TABLE 3

Ohio River Fish Collected in Surveys on State Protection Lists	
Species	State List
Silver Lamprey	Ohio, Pennsylvania
Paddlefish	Ohio
Shortnose Gar	Ohio
Spotted Gar	Ohio, Pennsylvania
Mooneye	Ohio
Black Bullhead	Pennsylvania
Troutperch	Kentucky
Banded Killifish	Ohio
Pirate Perch	Ohio
Spotted Bass	Pennsylvania
Warmouth	Pennsylvania
Sauger	Pennsylvania
Channel Darter	Pennsylvania
Silver Chub	Ohio, Pennsylvania
Ghost Shiner	Ohio
Spotted Sucker	Pennsylvania

Diversity

As mentioned earlier, of the 81 species collected from the Ohio River between 1968 and 1981, 67 were found in the upper river; 58 in the middle river; and 56 in the lower river. The upper river's faster flows, steeper gradient, mountain feeder streams and colder temperatures could be expected to support a greater variety of fish, provided water quality conditions were acceptable. The upper river has the potential of sustaining a larger sport fishery than either the middle or lower river because of these characteristics.

Species collected in the upper Ohio River that are not found in the middle and lower reaches include: Pikes (Muskellunge and Tiger musky); Trout-perch; Banded Killifish; Brook Silversides; Black Redhorse; and Stonecat. Species found in the middle and lower river but *not* the upper include: Shortnose and Spotted Gar; Treadfin Shad; Goldeye; and Yellow Bass. Goldeyes were collected at only one upper river station in 1980 — the Belleville lock-chamber. This was the first time this fish was found at this station. This species is more tolerant of turbidity than its close cousin the Mooneye. Its preferred habitat is deep pools with some current. Both the Mooneye (which is on the Ohio endangered wild animal list) and the Goldeye are commonly found in the middle and lower river.

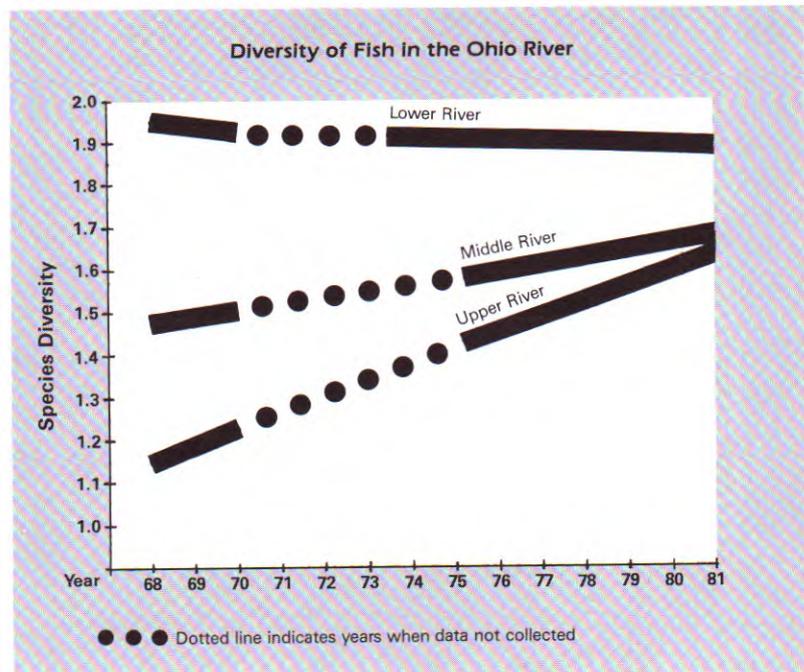
The diversity of fish in various segments of the Ohio River for a given sample can be calculated. The Shannon-Weaver Index uses the number of species present and the distribution of individual fish over those species to compare survey findings year to year and over segments of the river.* The numbers resulting from the calculation of the Shannon-Weaver Index range from zero to three. "Three" would indicate a "perfectly" diverse population: if there are 100 fish representing 10 species, there would be 10 fish from each species present. "Zero" would indicate a situation where only one species was pre-

sent. The diversity of 100 fish of the same species is almost zero.

The graph below shows the changes in fish diversity over time for the upper, middle and lower Ohio River. The dashed lines represent years during which the river fish populations were not surveyed.

Significant increases in the diversity of fish in the upper Ohio River have occurred since 1968 when the Shannon-Weaver Index was at its lowest point for the entire river. The diversity of the upper river has increased from 1.17 to 1.65 over the last 14 years. The rate of improvement has been greater in the upper river than in the other segments, as can be seen by the steepness of the upper river line. The diversity of the upper river fish community in recent years is now similar to that of the middle river.

The diversity of the middle Ohio River has also improved, but not as dramatically. The diversity measure is 1.49 for



*Kaesler, p. 92

the fish sampled during 1968 and 1.68 for the 1981 fish survey. The lower Ohio River diversity has consistently been higher than either the middle or upper river.

Although the graph indicates a slight decrease in diversity in the lower river from 1.95 in 1968 to 1.88 in 1981, this change is not significant and can probably be explained by the lack of data for this section of the river. Fewer lock-chambers are surveyed on this segment than in the upper and middle parts of the river.

The greater diversity as calculated by the Shannon-Weaver Index in the lower river as opposed to the upper river highlights the importance of the *distribution* of the fish population over the species represented. As mentioned previously, 11 more species of fish are found in the upper river than the lower; however, in the lower river, the individual fish are distributed over the species more evenly than in the upper, resulting in a greater calculated diversity in the lower river.

Several Ohio Valley states release fishery-raised fingerlings to the Ohio River. Kentucky and West Virginia have particularly large stocking programs. These releases affect the river's fish diversity and abundance, but it is difficult to determine the degree to which the Ohio River sport fishery is dependent upon these releases.

Kentucky has been introducing the Striped Bass, or Rockfish, extensively on the Ohio with releases of approximately five fingerlings per river acre — or about 800,000 fish — per year from sites near Warsaw, Maysville, Augusta and Louisville. The Kentucky Department of Fish and Wildlife Resources brochure, **Fishing in Kentucky**, states that the Ohio River stocking program "shows promise of creating another opportunity to catch the 'Rocks,' which can grow to weigh 50 pounds or more in fresh water." The brochure also points out that the Rockfish thrives on shad, a forage fish commonly found in the Ohio. Kentucky also releases Largemouth Bass on the Ohio River, if they are available after the stocking of instate streams. The state also maintains a research program on the longevity and travels of released fish through a tagging system which gives a monetary reward to the fisherman returning tags to the Fish and Wildlife Department.

West Virginia's stocking program emphasizes Northern Pike and Striped Bass hybrids. Pike fingerlings from marshes and hatcheries are released into the pools of the Hannibal, Willow Island and Gallipolis Dams. Currently, the stocking program releases fingerlings at a rate of 0.5 fish/per river acre per year. The number released between 1974 and 1982 totalled approximately 225,500. While Northern Pike have not been collected during the lockchamber surveys, individual fishermen have been catching the Pike. The largest was a 30 inch, 16 pounder.

Recently, West Virginia began stocking Striped Bass hybrids in the Ohio River in Marshall County. Results are still inconclusive but the West Virginia Division of Fish and Wildlife expects the hybrids to reach three to four pounds within three years of release.



Photo by Bernard Dowler, WV Dept. of Natural Resources

Stocking Northern Pike fingerlings on Ohio River in West Virginia

Chemical Analysis

The US Food and Drug Administration (FDA) performs analysis for heavy metals, pesticides and some organic compounds on samples of the fish taken from the river.* Fillets from Catfish and Carp are used for this purpose since these fish are common in all sections of the Ohio River. The FDA also sets criteria or *tolerance limits* for many of these substances. Fish found with quantities of certain substances above the FDA limits may not be sold for human consumption.

Only two of the 70 fish analyzed from the lockchamber survey of the fall of 1981 showed amounts of any of these substances above FDA limits. A Catfish fillet containing 0.51 parts per million (ppm) of the pesticide Chlordane was taken from McAlpine Dam near Louisville, Kentucky, and a Carp containing 5.3 parts per million of Polychlorinated biphenyls (PCBs) was found above Pittsburgh, Pennsylvania. The current FDA tolerance limit for Chlordane is 0.3 ppm; for PCBs, it is 5.0 ppm.

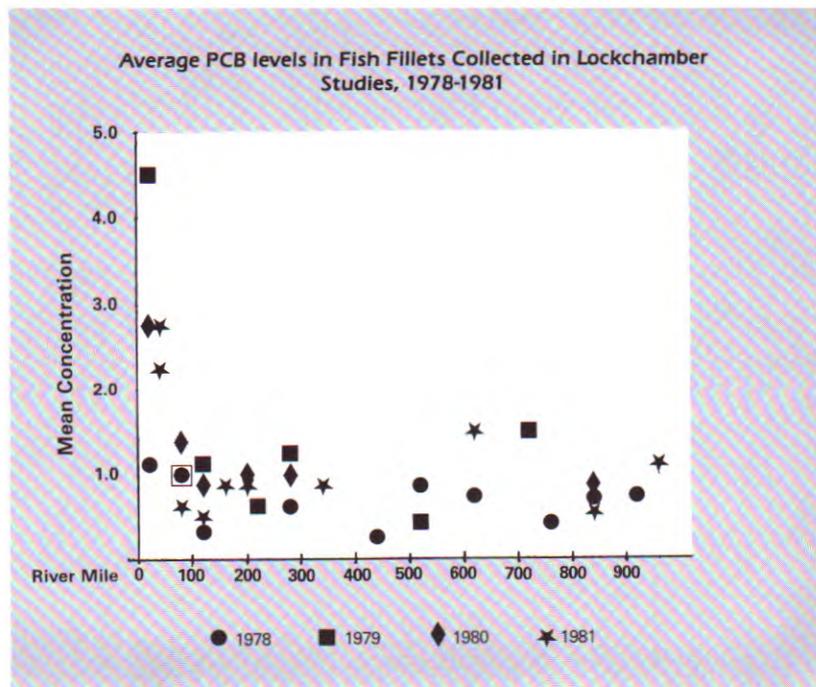
Chlordane has been excluded from use as a general house and garden insecticide, although it is still used extensively in termite control. PCBs are man-made chemicals that are largely used in electrical capacitors and transformers. Their release to the environment is usually the result of accidental breakage or leakage. Currently, the use of PCBs is permitted only in closed systems, like those described above.

The level at which PCBs constitute a health hazard is still under scientific scrutiny. For many years, the FDA used 5.0 ppm as a Temporary Tolerance Limit. A 1977 FDA proposal to reduce this criterion to 2.0 ppm engendered a great deal of debate and new studies. As of this writing, the 2.0 ppm tolerance limit

is stayed administratively and the 5.0 ppm value is in force.

The average concentration of these two substances — Chlordane and PCBs — found in fish fillets from the lockchamber surveys has decreased since 1979. In 1979, the average PCB concentration in fillets was 1.5 ppm; in 1981, the value was 1.0 ppm. In 1979, 26 percent of the fish collected contained Chlordane levels above the FDA limit; in 1981, only one percent of the fish analyzed exceeded this value.

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*Specific substances are Polychlorinated biphenyls, Hexachlorocyclohexane, Heptachlor, Hexachlorobenzene, Pentachloranisole, Chlordane, DDT, Dieldrin, Mercury, Cadmium and Lead.

A Final Word



This Commission often receives telephone calls asking, "Are the fish caught in the Ohio River safe to eat?" The answer is simply that Commission data show they are. The data also show that the fishery of the Ohio River is abundant and diverse. Many fish species thrive in these waters. Some species do not and never will, because this river is a controlled river: its depth, speed and gradient are carefully managed to support a number of uses. The protection of these uses is the guiding principle for the agencies charged with the job of water pollution control. The protection of the fishes of the Ohio River is a major goal of these agencies and one that is being met with increasing success.

— End —

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