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Introduction

The Ohio River, that served early Europeans, was described as a beautiful, clear, river flowing through hardwood forests and protected by marshes and other wetlands (Pearson and Pearson 1989). Since the early 1800's, however, growth in human population resulted in increases in siltation, domestic and industrial effluents, and mine wastes. Canalization of the river began in 1885 by the U.S. Corps of Engineers, that resulted in the placement of 50 lowhead locks and dams. By the late 1950's, construction of 17 high-lift dams had begun, which resulted in the lock and dam system in place on the Ohio River today. Eight navigational lock and dam facilities border Kentucky, forming mainstream reservoirs that have varying types and extent of fish habitat. Dams, commercial navigation, and flood plain modification are known to affect fish migrations, alter flows, change or modify spawning habitat, and influence fish egg survival (Southall and Hubert 1984; Grubaugh and Anderson 1988; Holland 1986a). Several fish species common prior to 1900 are less abundant, occupy more restricted ranges, or have been extirpated. Ichthyologists documented that 159 species of fish (includes 14 introduced species) have occurred in the Ohio River. Within the boundaries of Kentucky, the Ohio River contained 125 species of fish (111 native, 6 extirpated, 5 introduced, 3 exotics) (Burr and Warren 1986). Commercial and non-commercial over-harvest of fishes were partially responsible for population reductions of several sport (sauger, walleye, and several centrarchids) and commercial (lake sturgeon, shovelnose sturgeon, and paddlefish) species in the Ohio River in the late 1800's and early 1900's. The construction of large navigation pools has increased the available habitat of several sport species e.g., channel catfish, white bass, largemouth bass, bluegill, and both crappie species. Striped and hybrid striped bass, two large open water predators, have been introduced into the Ohio River since the 1970's.

The purpose of this study was to determine the status and management potential of the sport fisheries resources within the navigational pools of the 664 miles of the Ohio River that border Kentucky. Data gathered during this study will be helpful in the maintenance and improvement of the fisheries resources on the Ohio River.

Procedures

Fish population sampling on the Ohio River consisted of gill netting, electrofishing, and cove-rotenone sampling from Ohio River Mile (ORM) 317 at Catlettsburg, Kentucky to ORM 981 at the Mississippi River from 1979 to 1988. Electrofishing consisted of day and night (1988 only) samples in the summer and late fall, utilizing a 5,000 w, single phase A.C. generator. A Chenault Control Box was used to boost current levels entering the river. Standard (1.5-4.0 in square mesh) and experimental (1.0-3.0 in square mesh in 5 panels) gill nets were used to collect fish in the spring and early summer. A core of experimental gill nets was fished in 1988 to provide catch-per-unit-effort data.

Pool habitats were classified as main stem (MS), structural backwater (SBW), backwater (BW), and tailwaters (TW). Structural backwater was a term developed to describe areas of eddies and reduced currents of the main stem river that were found below islands, on the lee side of dikes, and behind land spits of the lower Ohio River. Although structural backwater areas lie adjacent to the main stem flow, they exhibit different hydrological characteristics and were sampled separately.

Lengths and weights were collected from all fish sampled along with scale samples from target species with the exception of the smallest young-of-the-year (YOY) specimens. Lengths were measured to the nearest 0.1 in and recorded as total length. Fish were weighed on a Chatillon 15-lb hanging scale or a table top Chatillon spring scale measuring to 5 lb by 0.25 oz. Length-weight regression formulas were calculated for fish species collected from the Ohio River. The equation log W = log a + log L was used to estimate weight as a power of length (Ricker 1975). Typically, 5 to 10 scales were collected near the distal end of the pectoral fin. Scales were mounted on a 1 X 3 in impression slide and read on either a MicroDesign, Model 150 microfiche reader or an Eberbach scale reader. All age and growth values were computed using the Dahl-Lea direct proportion method via a BASIC computer program.

Faunal dominance was developed by Guillory (1977) and incorporated both numeric abundance and frequency of occurrence data to generate the relative dominance of each species. All sampling methods were combined for this assessment. The percent frequency of occurrence of each species for all gear types relative to the most encountered species determines the relative abundance ranking of each species as a percentage of the most abundant species. Ranks ranged from zero to 100% and categories were defined as rare (<1%), occasional (1-19.9%), common (20-39.9%), and abundant (>40%).

Survival rates for selected species of fish were estimated using a single catch curve and the assumptions established by Robson and Chapman (1961). Unbiased estimates of annual survival rate may be derived from the catch curve for a single season if the assumptions of constant year-class strength and survival rate hold true and if all fish beyond some minimum age are equally vulnerable to the sampling gear. The following calculation was used to calculate the annual survival rate (S):

$$S = \frac{T}{n + T - 1};$$

where T (total) denotes the number of fish in each age category multiplied by the coded age of the age class; n is the sample size of fish.

Cove-rotenone studies were conducted on tributaries, embayment areas, and backwater areas of islands in the lower river from 1978 to 1987. Block nets were set at cove mouths or at either end of a section of a tributary. Potassium permanganate (1 mg/l) was used to neutralize the rotenone in areas outside the nets. Studies began soon after sunrise and lasted from 1 to 3 days in areas of 1 to 2 acres in size. Fish were sorted to species, measured by inch groups (i.e., 1.5-2.4 in = 2 in group) and weighed as a group to the nearest 0.25 oz (first day only).

Tagging activities were conducted to determine exploitation rates in the Meldahl, Markland, McAlpine, Cannelton, Newburgh, and Smithland pools from 1981 to 1986. Black bass (largemouth, smallmouth, and spotted bass), sauger, white bass, crappie (white and black), carp, freshwater drum, and channel catfish were selected for tagging studies. Fish were collected by using an A.C. electrofishing boat. A Floy FD-68B anchor tag was inserted into the dorsal musculature of each fish so that the "T" portion of the tag became locked between the fin ray bases of the soft dorsal fin. Each fish was processed in as short a time as possible and then returned to the same backwater in which it was captured. A sample size of 100 of each fish species was the goal at each survey site. Total length, weight, species, tag number, location, and date of tagging were recorded for each fish.

In an effort to encourage fishermen to report tag recaptures, tags were assigned reward values of $1, $5, $10, $25, $50, $100, or $1,000 by random drawing. A publicity program was conducted to notify anglers of the reward program. Tag return stamped, self-addressed envelopes were distributed to individual anglers, bait shops, and conservation officers.

Developmental mapping or indexing of both shores of the Ohio River within the river reach bordering Kentucky was done by monitoring existing departmental files and those references which existed among other state and federal agencies. Documentation included barge landings, electric generating stations, marinas, boat ramps, and industrial and commercial development. Most of the data was gathered by reviewing Corps of Engineers documents (U.S. Army Corps of Engineers 1988a, 1988b, 1989a, 1989b, 1990).

Results

Development

Geographical and shoreline development information for the lower Ohio River that borders Kentucky were gathered in 1989 (USCOE 1988a, 1988b, 1989a, 1990) and can be found in Table 1. Development consisted of 12 major categories encompassing commercial, industrial, and residential interests. There were 772 commercial and industrial facilities which comprised 66% of the development on the Ohio River. Nine power plants (one inactive and one being constructed) and three hydro-facilities utilize the Ohio River. One hundred twenty-eight residential centers with populations of 100 to 500,000 depend upon the river for water, energy, commerce, and recreation. Marinas were mainly concentrated in the upper third of the Kentucky portion of the river near large residential areas. Public access consists of 144 public sites (approximately 4.3 per pool on the Kentucky side of the river) and 36 fee or private access sites, most situated near populated areas. Forty-eight islands and 37 recognized gravel bars occur within Kentucky. Use of islands consists of fleeting areas, agriculture, and recreation.

Fish Population Description

One hundred two fish species were identified and classified by faunal dominance from 10 pools (Table 2). Gizzard shad and freshwater drum were abundant in each of the study pools. Carp and bluegill were abundant at 50% of the sites. Channel catfish, largemouth bass, white crappie, and sauger were common in most navigational pools. Walleye, black crappie, smallmouth bass, paddlefish, shovelnose sturgeon, blue sucker, and threadfin shad were found occasionally to rarely during this survey. Forage species (43.1%) dominated the overall catch by number of species, followed by commercial (21.6%), game (14.7%), predator and panfish (8%), and food (3%) fishes. The largest assemblages of species occurred in Greenup (n = 94), Smithland (n = 78), and Cannelton (n = 64) pools, respectively.

Age and Growth

Three black bass species were represented, with largemouth bass sample sizes being the greatest (n = 1,148) (Table 3). Twelve inches in length (the statewide length limit) was reached for this species between ages 3 and 4. The oldest largemouth bass observed was 10 years of age (19.6 in). Growth of smallmouth bass was similar to largemouth bass in the Ohio River. A length of 12 in was attained between their 3rd and 4th year. The oldest smallmouth bass aged was 7 years old (17.4 in). Spotted bass grew to 12 in between years 5 and 6, although some individuals showed growth rates of 12 in by year 4 (there is no size limit on this species in Kentucky's reach of the Ohio River). Growth rates paralleled largemouth and smallmouth bass through year 3 and then significantly declined. The oldest spotted bass observed was age 6 (13.2 in).

White and black crappie exhibited similar rates of growth but not longevity. Both attained quality size (8 in) by age 3. White crappie were found to live to age 6 and be 11.0 in, while black crappie lived to be age 4 (8.7 in).

Sauger dominated the percid population in the Ohio River and survived through age 8 (21.4 in). Quality size (15 in) was reached by age 4. Walleye were not as common as sauger in the Ohio River; however, they exceeded sauger in annual growth. Walleye attained 15 in (legal length limit) by age 3. The oldest walleye sampled was 7 years of age and had a back-calculated length of 22.4 in.

Age and growth information were acquired from two *Morone* species found in the Ohio River. Striped bass were initially stocked in the Ohio River in 1975. These fish appeared in population surveys by 1985 as 5-year-old fish. The legal size of 15 in was attained by age 2. The oldest individual to be aged from the Ohio River was age 8 (35.3 in). White bass exhibited excellent growth in comparison to other riverine populations, during their first two years of life (10.2 in by age 2). The oldest white bass collected was 17.5 in at age 5.

Gizzard shad are the major forage species in the lower Ohio River. Gizzard shad were observed to live to age 7 and attained a size of 16.8 in. They averaged 5.5 in by their first year of life and were unavailable as a food source to most predators by age 2 (9.4 in).

Catch curves were determined for six fish species caught by gill nets and electrofishing in 1988 (Table 4). Total annual mortality estimates were greater than 50% for all six species. Sauger had the highest mortality rates at 79.7%, while mortality in largemouth bass was lowest (57.9%). Gizzard shad mortality estimates averaged 36.4% between the two methods of collection.

Length-weight equations were determined for 18 principal species of fish in this study (Table 5). Sexes of all fish species were combined to reduce seasonal body condition biases. Coefficient of determination (r^2) values ranged from 0.649 (largemouth bass, n = 519) to 0.931 (striped bass, n = 332).

Rotenone surveys

Twenty-seven rotenone surveys were conducted in the backwater areas of nine pools on the Ohio River between 1978 and 1987 (Figure 1). The mean standing stock for the Ohio River was estimated to be 5,878 fish and 408.5 lb/acre. Uniontown Pool and Pool 53, with their diverse channel and flood plain topography, exhibited the greatest total biomass estimates with 1,303.7 and 1,130.1 lb/acre, respectively. Sites located in Greenup, Meldahl, Markland, and Cannelton pools, with associated backwater areas, averaged 396.5 lb/acre. However, McAlpine and Newburgh pools, with their sparse tributary and flood plain habitats, only averaged 112.9 and 55.1 lb/acre, respectively.

On a composite basis, forage fish (50%) dominated fish biomass followed by commercial fishes (27.6%) (Figure 2). Game, food, predatory, and panfish groups comprised less than 7.0% of the biomass on an individual group basis (22.7% of the biomass, collectively). Longitudinally, commercial fish biomass (30-51%) dominated in the four upper pools of the river (Figure 3). The biomass of forage fishes was greatest (45-74%) in the pools downstream of the Newburgh Pool. Game and food fish made up 10% or less of each pool's total biomass. However, panfish biomass varied from 1% at Pool 53 to 27% at Cannelton Pool.

Number and biomass estimates for selected fish species collected during rotenone studies in Ohio River backwaters are given in Table 6. Gizzard shad, the primary forage species for the lower Ohio River, were sampled in all surveys, but the largest biomass was found in the lower river (mean = 964.1 lb/acre). Largemouth bass biomass was greatest in Cannelton Pool (52.1 lb/acre), Smithland Pool (42.6 lb/acre), and Pool 53 (20.7 lb/acre). Largemouth bass biomass was not well represented at Newburgh Pool (0.2 lb/acre), which had the highest biomass of spotted bass (4.9 lb/acre). Both white and black crappie were found in all pools; however, white crappie generally dominated in total weight over the black crappie with 45.3 lb/acre at Cannelton Pool to 1.1 lb/acre at McAlpine Pool. Bluegill biomass ranged from an exceptional 327.4 lb/acre at Cannelton Pool to 4.1 lb/acre at McAlpine Pool. Channel catfish and freshwater drum averaged 27.2 and 33.3 lb/acre, respectively, at each site. Carp dominated the commercial fish biomass sampled with a mean of 104.4 lb/acre, while freshwater drum were most numerous by number per survey (mean = 438 fish/acre).

Tagging

An effort was made from 1981 through 1986 to determine exploitation of fish species by offering a reward for tagged fish to anglers in the Ohio River (Table 7). Although seven species were tagged during the project, only five species were consistently marked in various pools. Exploitation for black bass (largemouth and spotted bass) was uniform across all pools (24.7-29.0%) with the exception of Newburgh Pool (9.0%). Crappie (both black and white) varied between a low exploitation rate of 9.8% in Cannelton Pool to a high of 27.0% in Markland Pool. Estimated exploitation of channel catfish ranged from 0 to 6.0%. Carp exploitation was detected in only one of six pools at 2.1% (Meldahl Pool), while freshwater drum exploitation was low (0-8%) in five pools.

Creel surveys

Fourteen creel surveys were conducted on various pools and tailwaters of the Ohio River between 1980 and 1988 (Table 8). More fishing trips (67.8%) and man-hours (62.1%) were expended by pool anglers versus those using tailwaters; however, on a per acre basis, the pressure was skewed toward tailwater fishing (mean = 142.5 man-hours/acre). Average catch rates were comparable between sites (0.8 fish/hour in pools and 0.9 fish/hour in tailwaters); however, the number and pounds of fish harvested per acre was much higher in the tailwaters (105.0 fish/acre; 98.8 lb/acre) than the pools (2.5 fish/acre; 2.2 lb/acre).

Resident anglers (Kentucky) comprised between 42.4 and 100.0% of the fishermen interviewed. These creels indicated that 62% of pool anglers and 71.9% of tailwater anglers fished from the bank.

Nine tailwaters were creeled in the Ohio River (Table 9). Sauger (11,662), white bass (8,275), and catfish species (9,109) were the most harvested species; however, only catfish species were creeled in all nine tailwaters. Freshwater drum (32%), catfish (30.1%), and striped bass (18.3%) comprised the greatest percent of pounds harvested. The success of anglers seeking specific species was greatest for those fishing for crappie (49.6%), white bass (48.3%), catfish (47.1%), carp (38.6%), and sauger (32.8%). Catch rates were less than 0.6 fish/hour for all species except white bass (1.9 fish/hour).

Crappie (24,353), catfish species (19,768), and freshwater drum (8,309) were the most harvested fish species from each of five pools on the Ohio River (Table 9). The pounds of any fish group harvested did not exceed 1 lb/acre for any pool surveyed. Catfish (21,647 h), black bass (10,046 h), and crappie (9,094 h) were sought by anglers; however, catfish (33.0%) crappie (24.6%), and carp (19.7%) contributed the most weight in the creel. Greatest success for anglers seeking specific species was experienced with crappie (74.4%), freshwater drum (55.1%), and striped bass (53.2%). Catch rates (fish/hour) were highest for crappie (2.4), white bass (1.4), and freshwater drum (1.0). Largemouth bass were harvested at an annual rate of 0.2 lb/acre and 0.2 fish/hour.

Two creel surveys were used to compare catch and harvest statistics between pool and tailwater black bass fisheries (Tables 10 and 11). Largemouth bass comprised 95.9% of the black bass harvested in the Smithland Pool in 1985, with spotted (2.1%) and smallmouth bass (2.1%) harvested at much lower levels. Harvested black bass averaged between 12 and 12.9 inches long. Only 7.4% of legal-sized largemouth bass were released, while no spotted or smallmouth bass were released in this pool. Angler catch rates ranged from 0.18 largemouth bass to 0.01 spotted or smallmouth bass per hour of fishing. Contrarily, the harvest of black bass in the McAlpine tailwater (Table 11) was comprised of smallmouth bass (44.2%), spotted bass (35.4%), and largemouth bass (20.5%). Release rates for smallmouth and largemouth bass were considerably higher in this tailwater than in the Smithland Pool (mean = 42.4%). No spotted bass were released and 78.6% of these fish were 12 in or less (mean = 11.0 in). Harvested largemouth and smallmouth bass averaged 13.6 in at the McAlpine tailwater.

Length frequency

Fifty-nine species of fish were collected from various gill nets during the years 1979 through 1988 (Table 12). The lack of a standardized sampling scheme precluded comparisons between pools and tailwaters. Gizzard shad (3-19 in) comprised 26.7% of all fish sampled, with individuals 10 and 11 in long making up 36.9% of the gizzard shad sampled. Carpsuckers (3-25 in; 14.5%), freshwater drum (3-34 in; 11.8%), and catfish (3-32 in; 11.4%) were the next most frequently sampled species.

Sauger (6.4%) were the most dominant sport fish species collected in gill nets followed by white bass (2.1%), crappie (both species; 1.4%), striped bass (1.0%), and hybrid striped bass (0.2%). Sauger lengths ranged from 5 to 22 in, with 64.4% of these fish being ≥12 in long. Catches of white bass were extremely cyclic in the gill nets due to population numbers or gear placement during the survey. Lengths ranged from 3 to 17 in, with the average size being 10.6 in. Striped bass (n = 85) and hybrid striped bass (n = 35) were sampled in very low numbers. Lengths of striped bass ranged from 8 to 28 in (mean = 21.4 in), while hybrid striped bass ranged from 14 to 24 in (mean = 18.5 in). Blue catfish (3-30 in), channel catfish (3-27 in), and flathead catfish (5 - 30 in) were represented adequately throughout the entire gill netting survey.

Eighteen species of fish were selected for electrofishing length frequency analysis (Table 13). Gizzard shad comprised the majority of the sample, with total lengths ranging from 3 to 16 in; nearly 50% of these fish were 6 to 9 in. Freshwater drum (3-29 in) was the second most frequently captured fish with this gear. Seventy-one percent of the drum sampled were ≤10 in. Although the striped bass was the third most sampled fish species, numbers were influenced by high stocking survival and natural reproduction that occurred in the Ohio River in 1988. Lengths ranged from 3-29 in, with 97.6% of the fish being ≤5 in. Length frequency for white bass (3-16 in) collected with electrofishing gear resembled the length frequency collected with gill nets. Largemouth (n = 648; 3-21 in) and spotted bass (n = 453; 3-15 in) were sampled more often than smallmouth bass (n = 45; 3-17 in). Seventy-five percent of largemouth bass and 96% of spotted bass (not covered under 12 in length limit) were ≤12 in long. Only five smallmouth bass collected with electrofishing gear were ≥12 in. Channel catfish (n = 405; 3-25 in) were collected more frequently than either flathead catfish (n = 96; 6-31 in) or blue catfish (n = 43; 10-29 in). Eighty-eight percent of the channel catfish were ≥12 in.

Select species were examined for habitat use trends by different sizes of fish during electrofishing surveys (Table 14). Main stem habitat samples of fish were dominated numerically by gizzard shad, freshwater drum, bluegill, common carp, and largemouth bass, in that order. Tailwater fish samples were primarily composed of gizzard shad, striped bass, freshwater drum, white bass, and spotted bass. Adult channel catfish, white bass, striped bass, and freshwater drum could be found throughout the Ohio River system, but their distribution and relative abundance indicated a preference for the tailwaters. All gizzard shad sizes and larger carp utilized all available habitats. Gizzard shad were the most numerous species encountered in the structural backwater, a unique habitat. Striped bass also utilized this habitat along with freshwater drum, spotted bass, and largemouth bass. White bass and striped bass used the structural backwater area as fingerlings (3-7 in), although sauger seemed to use this habitat as fingerlings and adult-size fish. Blue catfish, between 15 and 22 in, indicated a preference for structural backwater. Compositions of fish collected in the backwater areas were quite similar to those of the main stem, although numerically greater. Gizzard shad, bluegill, largemouth bass, freshwater drum, and common carp were dominant in these areas. Smaller sizes of carp, channel catfish, largemouth bass, and both crappie species indicated a preference for backwater areas. Although the centrarchid species tend to prefer this habitat, others may have been utilizing it as a nursery area.

<u>Catch-Per-Unit-Effort</u>

Catch per unit effort (CPUE) estimates were determined for experimental gill net catches only during the spring of 1988 in the Ohio River (Table 15). Twenty-nine species were collected from a sample of 909 fish. Gizzard shad (17.08 fish/net day), river carpsucker (3.46 fish/net day), and freshwater drum (2.31 fish/net day) exhibited the highest catch rates. Channel catfish catch rates (1.69 fish/net day) exceeded both the blue catfish (0.58 fish/net day) and flathead catfish (0.08 fish/net day). Sauger were the most frequent sportfish collected (50 fish; 1.92 fish/net day), followed by white bass (9 fish; 0.35 fish/net day), largemouth bass (1 fish; 0.04 fish/net day), and walleye (1 fish; 0.04 fish/net day).

Seventeen species were selected from electrofishing samples to examine CPUE from pool and tailwater samples (Table 16). Gizzard shad occurred most frequently in the electrofishing samples with highest concentrations observed in Pool 53 (613 fish/hour) and Greenup Pool (422 fish/hour). Carp, like gizzard shad, exhibited higher catches in the upper and lower river pools. Lowest CPUE was exhibited in the McAlpine and Newburgh pools, which have very few backwater areas. Both white and striped bass CPUE (mostly young-of-year from the 1988 year class) were greatest downstream from Newburgh Pool. Both largemouth (23.7 fish/hour) and spotted bass (22.7 fish/hour) CPUE were highest in the Smithland Pool, which was impounded in 1980. Highest CPUE values for all three black bass species were found in the lower pools of the Ohio River. White crappie were sampled at rates >6 fish/hour throughout the river, with the exception of McAlpine, Newburgh, and Uniontown pools. Black crappie were less abundant, but were collected at levels of 2 fish/hour in the upper and lower ends of the Ohio River. Bluegill were the most predominant panfish species sampled and were collected at rates ≥19 fish/hour in all pools with the exception of those lacking extensive backwater areas (McAlpine, Newburgh, and Uniontown pools). Sauger CPUE was highest (≥8 fish/hour) at Greenup and Newburgh pools; however, catch rates declined from Uniontown Pool downstream. Most freshwater drum were observed in Uniontown Pool (44.6/hour), Pool 52 (53.1/hour), and Pool 53 (50.7/hour).

Catch-per-unit-effort for various species captured by electrofishing gear from different habitats is presented in Table 17. Gizzard shad and carp utilized backwater areas only slightly more than main stem habitats. Both channel and flathead catfish appeared to prefer tailwater areas (19.9 and 6.3 fish/hour), respectively, while blue catfish utilized structural backwater sites (10.0 fish/hour). White, striped, and hybrid striped bass mainly used those habitats associated with current. Highest concentrations of striped bass were found in structural backwater (64.2 fish/hour), tailwater (57.7 fish/hour), and main stem (41.1 fish/hour) habitats. White bass, however, were mostly sampled in the tailwater (13.6 fish/hour) followed by the structural backwater (8.5 fish/hour) and main stem (5.7 fish/hour) habitats. Smallmouth bass were captured mostly in the main stem (5.4 fish/hour) and tailwater (4.2 fish/hour) habitats. Spotted bass preferred structural backwater (23.6 fish/hour) and tailwater (17.8 fish/hour) sites, while largemouth bass were sampled mainly in the backwater (30.8 fish/hour) and main stem (22.4 fish/hour) areas. The remaining centrarchids were primarily sampled in the backwater sites. Most sauger were collected in the structural backwater (12.0 fish/hour) and tailwater (8.3 fish/hour) areas. Freshwater drum were represented almost equally across all habitats, with slight preferences for tailwater (28.7 fish/hour) and backwater (23.7 fish/hour) habitats.

Discussion

Water quality degradation and additional impounding of the Ohio River in the 1950's and early 1960's altered fish distribution and their relative abundance (Van Hassel et al. 1988; Pearson and Krumholz 1984; Trautman 1981). Conditions favored those species that were more tolerant of pollution and slower moving water (i.e., black bullhead and carp) and selected against large pelagic river fish species (i.e., paddlefish, flathead catfish, white bass, sauger, and freshwater drum), especially in the upper portions. However, with water quality improvements, several species such as largemouth and spotted bass entered portions of the river, where they had not been previously collected in large numbers, by successfully filling open niches (Krumholz et al. 1962). Relative abundance and distribution of fishes in large river systems can also be influenced by siltation, drainage of wetlands, and stream channel alteration (Reash and Van Hassel 1988); riprap diameter (Farabee 1986); concrete revetments (Pennington et al. 1983); loss of flood plain (Grubaugh and Anderson 1988; Fremling et al. 1989); backwater succession (Ellis et al. 1979), and serial discontinuity (interruption of movement by dams and barriers)(Gore and Bryant 1986).

Variations in species composition and relative abundance appear to occur along the longitudinal axis of a river (Pearson and Pearson 1989; Gore and Bryant 1986; Van Hassel et al. 1988). Longitudinal differences in the Ohio River have been observed with certain centrarchids, percids, cyprinids, and catastomids. These fish were collected in greater quantities in the upper reaches of the Ohio River, with only a few large river species present (Environmental Science and Engineering, Inc. 1989). Conversely, the relative abundance of the upper river fish declined in the middle portion of the river, while large river, pelagic and benthic fish species increased. Other species appeared in the lower river, but not in the upper two-thirds. Within the lower 63 miles of the Ohio River, the Mississippi, Tennessee, Cumberland, and Ohio rivers converge. Many fish associated with this area are big river species that comprise a distinct assemblage of fishes (Burr and Warren 1986). The distinctness of this assemblage (e.g. blue catfish, shovelnose sturgeon, and blue sucker), from those of the upper reaches of the Ohio River, are related to the size of the stream basin area, which influences the number of species, ecological niches, and diversity of habitat (Welcomme 1985). Longitudinal distribution may also be affected by navigational facilities which block migration routes, alter flow regimes, or change spawning habitat (Southall and Hubert 1984; Gore and Bryant 1986; Standford et al. 1988).

Prior to the high-lift dams on the Ohio River, several sport, food, and panfish were not sampled in great numbers (Krumholz et al. 1962). However, placement of these dams altered the river by creating nearly lake-like conditions along the entire Kentucky reach of the Ohio River, which flooded creek mouths and backwater areas giving rise to extensive slack-water areas. Many of these fish species have become important recreational fishes by making use of these newly created habitats (Van Hassel et al 1988; Henley 1988, Sanders 1991). During this study, four fish species were common and each is dependent upon backwater areas at some point in their life history (bluegill, channel catfish, common carp, and river carpsucker). Pearson and Krumholz (1984) determined that among the most abundant species in the Ohio River from 1957 to 1987 were the gizzard shad and freshwater drum. Gizzard shad and freshwater drum distribution is primarily main stem oriented; however, successful year-class development and abundance depends upon their use of backwaters in their early life stages (Holland and Sylvester 1983).

Biomass estimates from backwater areas of riverine systems have been an integral part of the establishment of management plans for other major river systems (Pitlo 1987; Christenson and Smith 1965; Rasmussen et al 1985). Backwater or side channel sites were chosen for observation in the Ohio River because of their ease of sampling and their overall productivity. It was initially thought that standing crop estimates would be vastly inflated when compared to those of the main river. However, Rasmussen et al. (1985) found that fish standing stocks in the main channel of the Mississippi River can mirror those of the backwater areas, given spatial and temporal considerations. Their standing stock estimates ranged from 0 to 2,691.6 lb/acre. Although these samples were taken at different times of the year (early spring and late fall) than those done in our study, they encompassed biomass estimates from Ohio River backwater areas. Species composition and length frequency closely paralleled our surveys, with the exception of the smallest young-of-year fishes and large numbers of centrarchid species, which were not present in their samples.

Pitlo (1987) determined that fish composition in the backwater and side channel areas of the Mississippi River historically averaged 6.3% predators, 5.7% game fish, 14.2% panfish, 30.8% forage fish, 4.7% catfish (and bullheads), and 38.2% commercial fish. Samples taken in the main stem indicated the biomass was comprised mainly of commercial fish (79%) and catfish (16%). Long-term trend analysis, since the late 1940's, in the upper Mississippi River indicated that a continued increase in biomass of forage and commercial fish stocks may reflect declining habitat and/or water quality parameters. Fish composition from this survey and other surveys on the Ohio River (Pearson and Krumholz 1984) reflected those in the upper Mississippi and may indicate that similar habitat and water quality changes are occurring on the Ohio River (e.g., ponding of the river; degradation of backwater areas).

Excessive development of the shoreline and floodplain habitats may adversely affect these zones for fish production and survival. The U.S. Corps of Engineers (1989b) predicted an increase in the volume of tonnage and commercial traffic into the next century for the Ohio River. Channel improvements are slated for the Ohio River through navigation structures (locks and dams), dredging, and river training devices (dikes and groins). Shoreline development along Kentucky's border ranges from light (<40 developments per pool) in the lower portion to heavy (mean = 225 developments per pool) in the upper and middle river. Increased utilization of the Ohio River will translate into greater pressures being placed on backwater areas (i.e., marinas, residential, and commercial interests). These areas are vital production and nursery sites for several riverine sport, food, and forage fishes (Sheaffer and Nickum 1986; Holland 1986b; Reash and Van Hassel 1988) and their protection from over-development will be necessary to continue the production of fish at levels currently observed.

Harvest rates of Ohio River anglers were comparable to those of the upper Mississippi River and unchannelized portions of the Missouri River (Pitlo 1990; Van Vooren 1982; Groen and Schmulback 1978). Although, main stem (including backwaters) areas on the Ohio River generally received more fishing pressure, harvest rates were generally greater in the tailwaters. Tailwaters are not typical riverine habitats; both fish and anglers are concentrated below a man-made barrier resulting in accentuated catch rates (Groen and Schmulback 1978). Anglers of the Missouri River harvested common carp, white bass, and freshwater drum from the tailwaters of Gavins Point dam, while sauger, channel catfish, and white bass were harvested from the main channel area. Anglers in the Ohio River harvested, in order of magnitude, sauger, white bass, and catfish (all species) from tailwaters and crappie, catfish (all species), and freshwater drum from the pools (including backwater areas).

The black bass population in the Ohio River is dominated by largemouth bass, with spotted bass of greater importance in limited habitat types in the main stem. Growth rates for both species compared favorably to Kentucky Lake rates (Buynak 1991a) and the upper Mississippi River for the largemouth bass (Van Vooren 1982; Pitlo 1990). Backwaters, tributaries, and side channels, compared to main channel habitats, provided more favorable lentic habitat for largemouth bass. Largemouth bass densities are higher in pools of the upper Ohio River (Sanders 1991) and Illinois River (Sparks and Starrett 1975) where backwater habitat is more prevalent. The importance of backwater habitat protection along the Ohio River cannot be overstated.

Black bass collectively, are the most popular sport fish in Kentucky (Hale et al 1992) and this popularity is shared among Ohio River anglers. Pierce et al. (1983) reported that black bass fishing comprised a major portion of the sport fisheries in the West Virginia portion of the Ohio River. This pressure was reflected in backwaters where Jernejcic (1991) reported fishing pressure as high as 32 man-hours/acre compared to two man-hours/acre in the main stem. Similar findings were observed in the upper reaches of the Mississippi River (Pitlo 1990; Van Vooran 1982). Bass tournament frequencies have not been quantified in Kentucky, but West Virginia has documented a 300% increase in black bass tournament pressure from 1980-1990 in the Ohio River.

Length frequency data for both Ohio River largemouth and spotted bass indicated significant declines of fish beyond 12 inches in length. Slower spotted bass growth rates in Kentucky was justification for removing the size limit on this species (statewide) in 1985. The McAlpine tailwater creel survey (Henley 1988) documented that 79% of the spotted bass harvested were between 10-12 in long. Length-frequency data for creels in the Ohio River pools was unavailable, but the low release rate of largemouth bass in the Smithland Pool (7.6%) is evidence that angler harvest may possibly impact the survival of larger largemouth bass. Total mortality estimates for largemouth bass ranged between 58% and 86.1% in the Ohio River (Henley 1988; Crowell 1984).

Striped bass first appeared in Ohio River creels in 1983, following annual stockings since 1975. Natural reproduction of striped bass has been documented in the Ohio River (Environmental Science and Engineering 1988) but its contribution to the sport fishery is unknown. Historically, angler catches have remained low in the pools (0.03 striped bass/acre) and moderate in the tailwaters (5.9 striped bass/acre). Angler catches of striped bass in the Ohio River are very seasonal (June through August), which corresponds with angler statistics reported in other studies (Mullis 1989; Axon 1979; McDaniel et al. 1991). Telemetry surveys documented that striped bass in the Ohio River mainly utilized the tailwater areas during the summer period, which coincided with the period of the highest fishing pressure for these fish (Henley 1988, 1991). Striped bass dispersed from the tailwater to areas throughout the main pool soon after summer temperatures declined (October).

Striped bass growth rates, relative abundance, and length frequency patterns in the Ohio River indicate that excessive natural mortality problems may exist in the population. Collections of striped bass in the Ohio River were infrequent in gill nets and by electrofishing; their sizes generally ranged from 15-29 in long. The oldest striped bass aged in this survey was 8 years old (38 in) and, considering summer temperatures in the Ohio River, thermal stress complications may be impacting older individuals (McDaniel et al. 1991; Axon 1979; Axon and Whitehurst 1985). Non-compliance of the 15-in minimum length limit by anglers was indicated in one Ohio River creel survey; however, it was not thought to be a major contributing factor to the low incidence of older individuals in the population. Water temperatures in the Ohio River typically exceed 85°F, which surpasses the striped bass's upper preferred temperature (77°F) as reported by Coutant (1985). Zale et al. (1990) indicated that striped bass usually overcome summer weight loss and regain it in the winter unless these fish occur in systems with maximum temperatures above 84.7°F or fish remain in temperatures of 81°F for at least 7 weeks. Both of these conditions can occur in the Ohio River and likely contribute to the low age frequency observed in this population. Henley (1991) observed a significant difference ($P < 0.05$) in the weights of those fish succumbing to thermal stress, which indicated that larger (heavier) striped bass were not able to tolerate extended periods of critically high temperatures in the Ohio River. The lack of suitable summer habitat may be limiting the number of older and larger striped bass in the Ohio River; however, temperature should not impact sub-adults which are annually maintained through the fingerling stocking program.

Limited returns of striped bass stocked in the Ohio River have prompted the consideration of stocking the hybrid striped bass (white bass x striped bass). This hybrid is reportedly hardier than striped bass both in the hatchery and the wild. Survival and growth rates are often high, although incidents of high mortality have been correlated to excessive stocking rates and subsequent competition (Champeau 1984). Like striped bass, hybrids prefer clupeids, but may feed on other fish species in their absence (Gleason 1982). Hybrid striped bass are not completely sterile, but reproduction in the wild has been very limited. Hybrid striped bass appear to select water temperatures intermediate to its parental stock (77.0 - 82.4°F) (Windham 986). Movement in river systems is strongly related to seasonal fluctuations in river discharge (Yeager 1982) and they are known for migrations out of reservoir systems (Young 1984), which may translate into steady downstream movement of these fish in the Ohio River. Compared to the striped bass, greater returns to sport fishermen, faster early growth, and higher survival of the hybrid striped bass have been reported (Ware 1974). Crandall (1978) reported that the monetary benefits in terms of harvest and recreation in a Texas reservoir were approximately 12 times greater than the costs of the introductions, indicating a high acceptance of this fish among sport anglers.

Sauger is the dominant percid in the Ohio River. Growth rates compared favorably with sauger populations in the upper Mississippi River (Vasey 1967; Thorn 1984). However, length frequency data indicated that sauger numbers declined significantly at 15 in or age 4+. Gill net surveys in the Ohio River indicated that 73.4% of the sauger sampled were 10-15 in long and the harvest at McAlpine tailwater in 1988 was primarily (81.2%) 12-14 in sauger. The yield of 160 lb/acre of sauger in this same tailwater at 1.3 fish/hour signifies the importance of this sport fish to Ohio River anglers in tailwaters.

Sauger are more tolerant of turbid conditions and silted bottoms than the walleye (Trautman 1981). Clady (1978) theorized that the presence of sauger usually indicated a reduction in walleye numbers. Low numbers of walleye were observed in gill net, electrofishing, and creel surveys in the Ohio River. Young-of-year sauger were commonly collected in the Ohio River, indicating successful reproduction; however, walleye young-of-year were very uncommon as were adult fish in tailwater creel surveys. Sedimentation, navigation, and placement of hydro-electric facilities were thought to be influencing sauger and walleye populations in the upper portions of the Mississippi River (Pitlo 1983). During normal flow conditions, both species utilized the main channel border. Spawning substrates such as rock, rubble, gravel, and mussel bed substrates were located along main channel borders in river bends. Both habitat types will be further impacted by development along the river and by increased navigation activity. Habitat types for various life stages of sauger need to be identified to protect this important fishery.

Both white and black crappie were collected from backwater habitats along the entire reach of the Ohio River. Of the two species, white crappie were more predominant, partially because of their ability to tolerate a wide variety of habitats which includes turbid and silty areas (Trautman 1981). Both species can be found in the low-gradient portions of larger streams. White crappie growth was comparable to populations in surrounding states, although their longevity appeared short in comparison to other populations. Black crappie growth was slower than other populations, yet their longevity was comparable. Although crappie were the third most sought species in the Ohio River pool creels, they were the most harvested (numerically), had a high success rate for those seeking crappie (74.4%), and were caught at a rate of 2.4 crappie/hour. Anglers preferences for crappie in the backwater areas of the upper Mississippi River were similar to Ohio River anglers (Pitlo 1990; Van Vooren 1982).

Although more plentiful before the damming of the Ohio River (Trautman 1981), the white bass remains an important sport fish in both pools and tailwaters. White bass were the second most harvested species in the Ohio River tailwater creels. Tailwater anglers seeking white bass had the second highest catch success (48.3%) and the highest catch rates (1.9 fish/hour) of all species creeled. In the pool creels, they were creeled at the second highest catch rate (1.4 fish/hour). Population levels can be influenced in response to changes in forage fish populations (Pflieger 1975). Growth rates of Ohio River white bass were comparable to reservoir populations in Kentucky (Laflin 1990).

Channel and flathead catfish were collected throughout the Ohio River, with the blue catfish found only in the lower portions of the river. All three species require sluggish streams with extensive habitat and trophic diversity (Pflieger 1975; Hawkinson and Grunwald 1979; Hesse et al. 1979). Although the blue catfish makes extensive migrations, the channel and flathead do not. Placement of modern dams was thought to be the major contributing factor to the blue catfish's reduced distribution in the Missouri and Mississippi rivers (Pflieger 1975). The area below Smithland Lock and Dam is influenced by the confluence of the Mississippi River, two major tributaries (the Cumberland and Tennessee rivers), and two old style "wicket dams" on the Ohio River. The ability of the blue catfish to move freely in this lower river may explain their abundance in this area. With the completion of the Olmstead Lock and Dam facility near the mouth of the Ohio River, blue catfish relative abundance and its viable sport and commercial fishery can be expected to decline in the lower Ohio River.

Catfish (channel, blue, and flathead) were most important to anglers in the lower portion of the Ohio River. Creel surveys indicated that between 55 and 72% of the Smithland Pool and tailwater anglers using this area were seeking catfish. Catch rates along the river ranged from 0.05 fish/hour at McAlpine tailwater to 2.2 fish/hour at Smithland tailwater. Blue catfish comprised 57 to 68% of the harvest in the lower reaches. Channel catfish have a fish flesh consumption advisory due to contamination by PCBs and/or chlordane which diminishes their sport and commercial fishery potential.

A draft strategic management plan has been developed for several fish species and their fisheries in the Ohio River (Appendix Table 1). This plan addresses information deficiencies, management goals, and angler needs for each species. Ideally, this plan will be implemented in conjunction with fish and wildlife agencies of adjoining states. Responsibilities of this plan would be shared between all agencies to ensure common management of all fish stocks along the length of the Ohio River and thus reducing angler confusion of fishing regulations. The plan further addresses improvement of existing access sites, construction of ramps near tailwaters, determining commercial harvest, development of a black bass tournament monitoring system, maintenance of degraded habitats due to siltation, and the feasibility of re-introducing extirpated fish species into the Ohio River.

Conclusions

The Ohio River, like most major river systems, has been subjected to major environmental alterations through time. Once a free-flowing system, the Ohio River was dammed for navigation purposes soon after the turn of this century. Now, only the remaining 62.5 miles are riverine in nature, with two original wicket dams in this section; all other sections have modern high-lift navigation locks and dams often impounding multiple acres of backwaters in tributary streams. Olmstead, the last of the high-lift dams, is in the planning phase and will impound 44.1 miles in the late 1990's, thus leaving 18.4 miles of actual riverine habitat in the Ohio River. Hydropower facilities exist on two dams and plans exist to develop hydropower on all remaining high-lift dams. Long-term impacts of entrainment and altered flows remain vague. Water quality in the Ohio River has improved since the 1970's through more stringent water quality laws. However, trace contaminants (chlordane and PCBs) still plague the river with fish consumption advisories on white bass, paddlefish, common carp, and channel catfish. Many environmental perturbations remain on the river and within its watershed. Some disturbance activities are subject to environmental review but remain site or activity specific and no mechanism or technology exists to address the cumulative impacts.

Black bass in the Ohio River are dominated by largemouth and spotted bass; overall habitat is limited for smallmouth bass. Spotted bass catch rates were only higher than largemouth bass in structural backwaters or slackwater areas associated with current. These habitat types are generally low in frequency of occurrence. However, spotted bass catch rates were also higher in pools with low backwater acreage, suggesting the importance of backwater acreage as nursery areas for largemouth bass and some level of competition between the two species in areas with limited largemouth bass habitat. Management potential for black bass in the Ohio River should be directed toward largemouth bass based on both their dominance and total recreational importance.

The lentic environment created in backwaters is the favorable habitat feature for largemouth bass. This feature also created sedimentation problem since many creek mouths have silted to the point precluding boat traffic. Several factors may influence largemouth bass year-class strength in these Ohio River nursery areas including substrate (Buynak 1988), turbidity, temperature fluctuations, wave action (Eipper 1975), water level fluctuations (Ploskey 1986), and presence of an adequate food supply (Von Geldern 1971). The role of a fish and wildlife agency in protecting this habitat type is limited to the review of site specific development activities involving 404 permits and token educational efforts. All backwaters should be protected to the maximum levels possible to preclude future development activity in this vital habitat. Mandatory or government subsidized soil and water conservation practices is the only long-term solution to the siltation problem in the Ohio River and all other major river systems in the United States.

Density of the Ohio River largemouth bass population is probably strongly related to river and backwater spawning conditions, spawning and nursery habitat, and forage fish availability. The feasibility of supplemental stocking could be considered. The growth of largemouth bass is similar to other water bodies in the state and the size distribution indicates angler pressure is impacting the numbers of fish ≥12 in long. There is a management option of regulating harvest to improve the size distribution.

White crappie dominated the catch of crappie species in the Ohio River. This species appears to be more suitable to the turbid and silty conditions often present in backwater areas. Like the largemouth bass, sedimentation and development of backwater areas may potentially impact crappie production in this habitat.

Striped bass is a pelagic predator that has been stocked in the Ohio River by the Kentucky Department of Fish and Wildlife Resources since 1975; this species is presently being stocked at a rate of 5 fish/acre. Growth of striped bass resembles other river systems but is less than reservoir growth rates. The longevity (>8 years) of the striped bass in the Ohio River is questionable since evidence indicates older fish are subject to water temperatures exceeding their thermal tolerances, adult population sizes may be contingent on the number of striped bass that can live in the tailwaters in the summer. The harvest of striped bass has been sporadic, inconsistent, and limited mainly to tailwater areas. Striped bass emigration outside the Ohio River obviously occurs at some unknown level. However, Henley (1991) documented a 24% emigration rate of adult fish outside of a study pool. Striped bass also successfully spawned in the Ohio River and possibly several other major river systems (i.e., Cumberland and Tennessee rivers) in 1988, which still contributes to an excellent tailwater fishery below Kentucky and Barkley lakes. Although hybrid striped bass may have superior qualities for producing a fishery in the Ohio River, their stocking numbers remain below the availability of striped bass. The potential of striped bass in the Ohio River may be contingent upon stocking greater quantities of striped bass, although the importance of the forage base to support these increases cannot be overlooked.

Creel statistics indicate that the white bass is a major component of the Ohio River sport fishery. However, mis-identification by anglers of smaller white bass and striped bass has resulted in the illegal harvest of striped bass. The creel survey in McAlpine tailwater in 1988 revealed that 90% of the striped bass harvested were under the legal size limit. Increased law enforcement may be needed to curve this excessive harvest of undersized striped bass or some type of aggregate limit should be considered. Education of anglers in identification of these two fish may also be needed.

Sauger will remain the feature percid since sauger reportedly survive better in murky water conditions such as the Ohio River. Their populations characteristically oscillate depending on flows and changes in water conditions during their spawning period. These variables are uncontrollable, yet major spawning areas remain unknown, i.e., gravel bars. These could be identified to provide the necessary habitat protection. Also, ideal flow regimes could be determined to possibly shunt flow from dams or hydropower facilities to maximize spawning potential at known spawning sites near dams. Growth rates of sauger are comparable to other systems; yet, angler complaints and creel surveys indicate harvest sizes are below expectations. Length limits could be applied experimentally to improve the harvest of quality-size fish.

Catfish, specifically channel catfish, are the most harvested sport fish in the Ohio River. The ubiquity, density, and size distribution of channel catfish does not pose a major concern in terms of sport fishery management. However, the fish contaminant problem will probably remain a problem for many years and will require periodic monitoring.

There are several concerns about the impact of the Olmstead Dam on lower river fish populations, especially blue catfish and possibly paddlefish and shovelnose sturgeon. The blue catfish requires open river habitat unimpeded by dams; with the completion of the Olmstead Dam, only 18.4 of the remaining 62.5 miles of free-flowing river will remain. Although the sport fishery for these species in the lower river has been creel surveyed, the level of commercial fishing for blue or channel catfish is unknown. Consideration should be given to establishing a monitoring system for commercial species in the Ohio River.

Recommendations

(1) Projects conducted in the future on the Ohio River need to structured with a standardized, reproducible sampling regime that would occur within a short time frame. Indicator pools and specific habitat types within a pool should be used as core study areas.

(2) Boating access is needed within 5 miles on the downstream side of each lock and dam facility (including Olmstead Locks and Dam); boat access facilities are also needed on the Kentucky side of the Ohio River for each 10 miles of pool length (if a bridge crossing does not exist to accommodate out of state access).

(3) Improve existing bank access facilities and provide additional bank access, since the majority of fishing pressure was from bank fishermen in the pool (62%) and tailwater (72%) areas. Fishing piers and parking facilities are inadequate in the Ohio River, especially in the tailwaters.

(4) Uniform regulations need to be formulated between states for all common fish stocks to avoid angler confusion and promote common management in the Ohio River.

(5) A strategic plan needs to be developed for the Ohio River, ideally in conjunction with bordering state fish and wildlife agencies. This plan should include shared responsibility in fish population monitoring, creel surveys, fish stocking, and/or contaminant monitoring. It should also

encompass the formalizing of fish kill evaluation procedures and mitigation, hydropower mitigation procedures, and development of a Ohio River Trust Fund from revenues of these procedures.

(6) A monitoring scheme should be developed for commercial fish harvest in the Ohio River that can be used to determine at what levels commercial fish species (with emphasis on channel catfish and paddlefish) in the Ohio River are being exploited.

(7) The feasibility of re-introduction of extirpated fish species should be explored in the Ohio River.

(8) An aquatic habitat Geographical Information System (GIS) is needed to identify major fish and mussel habitat for long range protection and management of these critical areas.

(9) Striped bass stocking success should be evaluated, including limiting factors such as forage availability, recruitment problems, and habitat availability, etc. The contribution of natural reproduction should be explored, as well as, the possibility of increasing stocking rates to 10 fish/acre.

(10) A study should be implemented to determine if suitable tailwater habitat in the summer is a limiting factor to striped bass population development and, if not, explore the full capability of establishing a put-grow-take fishery for striped bass or its hybrid in the Ohio River at a minimum of 10 fish/acre.

(11) A black bass tournament monitoring system is needed on a statewide basis which will include the Ohio River and its embayments.

(12) Backwater areas need to be prioritized that have limited boat access due to siltation, then solicit the COE to dredge these areas during their channel maintenance. If this is not feasible, the use of sport fish restoration funds ought to be considered for these projects.

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Table 1. Geographical statistics and shoreline development for the 10 navigational pools and remaining river section of the Kentucky portion of the Ohio River.

	Greenup	Meldahl	Markland	McAlpine	Cannelton	Newburgh	Union-town	Smith-land	Pool 52	Pool 53	Remaining River	Grand Total
Length (mi)	23.8	95.2	95.3	75.3	113.9	55.4	69.9	72.5	20.4	23.7	18.4	663.8
Area (acres)	4,627	21,809	21,700	18,800	22,800	16,400	19,900	27,500				168,566
Shoreline development												
Commercial[a]	1	13	32	30	1	1	5	0	0	0	0	83
Industrial[b]	33	22	50	16	27	34	40	13	10	5	7	257
Residential[c]	10	16	35	15	13	9	6	17	4	0	3	128
Intake	12	7	10	12	12	8	9	3	1	0	1	75
Marina	9	23	43	13	2	0	3	1	0	0	0	94
Bridge	3	5	12	5	3	2	2	1	1	2	2	38
Fleeting area	12	3	16	8	0	4	15	4	2	4	13	81
Aerial crossing	7	5	16	8	4	2	1	3	0	4	1	51
Submarine crossing	9	9	14	10	6	9	10	1	5	3	1	77
Power plant	0	1	2	4	0	0	0	0	0	2	0	9
Dock facility	34	32	59	5	25	35	41	18	16	3	6	274
Hydro-electric Facility	1	0	1	1	0	0	0	0	0	0	0	3
Total	131	136	290	127	93	104	132	61	39	23	34	1,170
Tributaries												
Dry	10	82	54	59	43	14	9	12	1	21	2	307
Flooded	13	37	39	14	9	2	4	34	2	3	1	158
Total	23	119	93	73	52	16	13	46	3	24	3	465
Embayments	8	17	18	0	0	1	1	2	0	0	6	53
Islands	0	3	1	8	4	7	8	10	5	0	2	48
Gravel bars	0	5	2	7	2	5	2	7	2	3	2	37
Access												
Private	1	0	15	9	2	3	5	0	0	0	1	36
Public	7	19	33	22	23	9	9	17	4	4	4	151
Total	8	19	48	31	25	12	14	17	4	4	5	187

[a]Businesses involved with serving public needs along the river, which includes restaurants, boat/motor repair, and marine services.

[b]Companies involved with the manufacture of items or the transportation of either raw materials or finished products.

[c]Residential includes those concentrations of people along the river that were recognized as villages, towns, or cities by navigation maps.

Table 2. Species list and faunal dominance rating[a] for the 10 navigational pools of the Ohio River bordering Kentucky from 1978 to 1988.

	Greenup	Meldahl	Markland	McAlpine	Cannelton	Newburgh	Uniontown	Smithland	Pool 52	Pool 53	Pool total
GAME FISHES											
Black crappie	O	O	R	R	R	R	O	O	O	O	10
Brown trout	R										1
Chain pickerel								R			1
Grass pickerel					R	R		R			3
Hybrid striped bass	O	O						R	R	R	5
Largemouth bass	C	C	C	O	A	O	O	C	O	O	10
Muskellunge	R										1
Sauger	C	O	O	C	C	C	O	O	O	O	10
Smallmouth bass	O	R	O	O	O	R			R		7
Spotted bass	O	O	O	O	O	O	O	O	C	R	10
Striped bass	O	R	R	R	O	O	O	O	O	O	10
Walleye	R	R	R	O	O	R	R	O			8
White bass	O	C	O	C	O	O	O	O	O	C	10
White crappie	C	C	C	O	A	O	O	C	O	O	10
Yellow bass							R	O	O	O	4
Yellow perch	R										1
COMMERCIAL FISHES											
Bigmouth buffalo		R	R	R	R	R	O	O	R	R	9
Black buffalo		R	R				R	R		R	5
Black bullhead	R	R	O		R		R				5
Black redhorse	R	R	R	O	O		R	R			7
Blue sucker	R		O	R	O	O	O	R	R	O	9
Brown bullhead		R	R	R	R			R			5
Common carp	A	A	A	A	C	C	C	C	C	A	10
Freshwater drum	A	A	A	A	A	A	A	A	A	A	10
Golden redhorse	R	O	O	C	O	O	R	R	R	R	10
Highfin carpsucker	R	O	R	O	R	O	O	R	R	R	10
Northern hogsucker				O							1
Paddlefish	R	R	O	R	O	R	R	O	R	O	10
Quillback carpsucker	O	O	O	O	O	C	C	O	O	R	10
River carpsucker	C	A	O	C	A	A	A	C	C	C	10
River redhorse	R	R	O	R	R	R		R			7
Shorthead redhorse	O	R	O	O	R	R	R	R			8
Shovelnose sturgeon					R	O	O	O	O	O	6

Table 2 continued.

	Greenup	Meldahl	Markland	McAlpine	Cannelton	Newburgh	Uniontown	Smithland	Pool 52	Pool 53	Pool total
Silver redhorse	O	R		R		R					4
Smallmouth buffalo	O	A	C	O	O	O	C	O	O	R	10
Spotted sucker	O	R	O	R	R		R	O	R	R	9
White sucker	R		R	R	R			R		R	6
Yellow bullhead	R	R	O	R	O	R	R	R			8
PREDATORY FISHES											
American eel					R	O	R	R		R	5
Bowfin						R	R	R	O	O	5
Goldeye	R		R	R	O	O	O	R	O	O	9
Longnose gar	O	C	O	A	O	A	O	O	O	O	10
Mooneye	O	R	R	O	R	O	O	R	O	R	10
Shortnose gar	R				R	O	C	O	C	C	7
Skipjack herring	R	O	O	O	O	O	O	O	C	O	10
Spotted gar							R	R		O	3
FOOD FISHES											
Blue catfish		R			R	R	O	C	C	O	7
Channel catfish	C	C	A	C	C	C	C	C	A	A	10
Flathead catfish	O	O	O	C	O	O	O	O	O	O	10
FORAGE FISHES											
Banded sculpin								R			1
Blackside darter						O		R			2
Blackstriped topminnow					O			R			2
Blackspotted topminnow					O			O		R	3
Bluntnose minnow	R	O	R	O	O	O		O		R	8
Brindled madtom			R								1
Brook silverside									R		1
Bullhead minnow	R						R		O	O	4
Creek chub				R		R		R			3
Emerald shiner	O	O	O	O	O	C	O	C	O	O	10
Fantail darter			R	R							2
Freckled madtom								R		R	2
Gizzard shad	A	A	A	A	A	A	A	A	A	A	10
Golden shiner	R		R		R	R	R	R			6
Goldfish	R		R		R						3
Ghost shiner	R										1

Table 2 continued.

	Greenup	Meldahl	Markland	McAlpine	Cannelton	Newburgh	Uniontown	Smithland	Pool 52	Pool 53	Pool total
Gilt darter					R						1
Johnny darter								R			1
Logperch	O	R	O	O	R	R					6
Mimic shiner					O				R	R	3
Mosquitofish					O	O		R		R	4
Mud darter								R			1
Pirate perch						O	R	O		R	4
Pugnose minnow						O					1
Redfin shiner								R			1
Ribbon shiner	O							O		O	3
River shiner						O	O	R	R	R	5
Rosefin shiner		O			R			R			3
Rosyface shiner								O			1
Sand shiner	R										1
Silverband shiner								R			1
Silvery minnow			R			R		O			3
Slough darter						R		R			2
Spotfin shiner	R			O			R	R	R		5
Silver chub	C	R	R	O	O	R	O	O	R	R	10
Silver lamprey	R							R	R		3
Spottail darter								O			1
Steelcolor shiner						R	O	R	R		4
Striped shiner				R		R					2
Tadpole madtom			R	O	R	O	R	R		R	7
Threadfin shad					R	O	O	O	O	O	6
Troutperch	R										1
PANFISHES											
Bluegill	A	A	A	C	A	C	C	A	C	C	10
Green sunfish	R	R	O	O	R	O	R	O	R	R	10
Hybrid sunfish	R		R								2
Longear sunfish	O	O	C	O	C	O	O	C	C	O	10
Orangespotted sunfish	O	R	R	R	R		R	O	R	R	9
Pumpkinseed	R		R								2
Redear sunfish	O		R		R	O	R	R	R		7
Rock bass		R		O	R						3

Table 2 continued.

	Greenup	Meldahl	Markland	McAlpine	Cannelton	Newburgh	Uniontown	Smithland	Pool 52	Pool 53	Pool total
Warmouth	O	O	C	O	O	O		O	R	R	9
Species total	59	46	53	50	60	58	53	77	48	53	100
% of total	10.6	8.3	9.5	9.0	10.8	10.4	9.5	13.8	8.6	9.5	100.0

[a] R = rare (<1%)

O = occassional (1-19.9%)

C = common (20-39.9%)

A = abundant (≥40%)

Table 3. Age and growth information for select species of fish from the Ohio River during 1978-1988 compared with several lake and river populations from the midwest United States for comparison.

Species	Location/citation	No.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Largemouth bass	Ohio River, KY	1,148	5.1	8.3	10.7	12.8	14.8	15.9	17.1	17.9	18.6	19.6		
	KY Lake, KY Buynak et al. 1991a	400	5.1	8.4	10.9	12.8	14.6	16.3	18.0	19.3	20.7			
	Mississippi River, IA, Von Vooren 1982	890	4.0	8.0	10.5	12.4	14.1	15.4	16.5	16.2				
	Mississippi River, IA, Pitlo 1990	135	4.4	9.1	12.3	14.4	15.7	16.9	18.1	18.9	19.4			
Spotted bass	Ohio River, KY	209	4.9	7.5	10.0	11.6	11.9	13.2						
	Missouri state average, Carlander 1977	743	3.4	7.2	10.0	11.5	12.7	13.9						
	Cave Run Lake, KY Buynak et al. 1991b	203	5.0	7.0	8.8	10.1	11.7	13.4	14.9					
Smallmouth bass	Ohio River, KY	30	5.3	8.2	10.7	12.2	12.8	15.6	17.4					
	Elkhorn Creek, KY Buynak, 1990	110	5.3	7.2	9.1	10.5	11.7	13.0	14.3	16.3				
	Des Moines, RI., IA Carlander 1977	270	4.7	9.0	11.7	13.4	15.3	16.2						

Table 3 continued.

Species	Location/citation	No.	AGE 1	2	3	4	5	6	7	8	9	10	11	12
	Missouri state average, Carlander 1977	3,448	3.5	6.7	9.6	11.4	13.5	14.6						
White crappie	Ohio River, KY	220	5.0	7.3	9.2	10.8	13.4							
	Mean KY, TN, KS, MO Carlander 1977		3.3	6.5	8.9	10.4	11.9	12.6	14.2	14.4				
Black crappie	Ohio River, KY	38	4.2	6.5	8.4	8.7								
	Mean KY, TN Carlander 1977		3.2	7.8	9.9	11.7	13.6							
White bass	Ohio River, KY	238	6.2	10.2	13.1	14.4	17.5							
	Barren River Lake, KY, Laflin 1990	30	7.1	11.4	13.1	14.2	14.3							
Striped bass	Ohio River, KY	102	7.6	15.0	19.0	21.8	24.8	27.7	34.8	35.3				
	L. Cumberland, KY Kinman 1988	459	7.7	16.5	22.6	26.1	29.7	32.6	35.9	37.3	41.4	45.8	47.0	
	Apalachicola Ri, FL Wooley & Crateau 1983	206	6.1	12.1	17.3	21.9	25.6	28.3	30.8	32.8	34.2	35.5	37.3	38.6

Table 3 continued.

Species	Location/citation	No.	AGE 1	2	3	4	5	6	7	8	9	10	11
Sauger	Ohio River, KY	663	7.4	10.7	13.2	15.0	16.5	17.7	19.4	21.4			
	Mississippi Ri, IA Vasey 1967	218	5.7	10.6	14.0	16.3	17.7	18.4	20.2				
	Mississippi River, MN, Thorne 1984		5.6	10.1	13.0	15.5	17.4	18.9	19.9	19.2			
Walleye	Ohio River, KY	44	8.5	12.6	15.0	16.8	19.1	21.8	22.4				
	Mississippi Ri, IA Vasey 1967	152	6.9	12.1	16.3	19.4	21.3	23.0	24.0	24.7	25.5	26.2	26.8
	Mississippi Ri, MN Thorn 1984		6.6	11.4	15.6	19.1	21.0	23.0	25.6	27.1	26.9		
Gizzard shad	Ohio River, KY	191	5.5	9.4	12.6	14.6	15.5	16.3	16.8				
	Mean KY, TN, IL, MO, Carlander 1977		8.4	10.6	12.9	14.2	16.0	16.6	16.5	16.9	17.2	17.4	

Table 4. Estimated survival and mortality rates from catch curves for selected fishes collected with electrofishing and gill net gear from the Ohio River during 1988.

Species	Gear	Number	Estimated survival(%)	Estimated mortality(%)
Sauger	GN	301	20.32	79.68
White bass	EF	70	29.62	70.38
Spotted bass	EF	166	31.75	68.25
Gizzard shad	EF	1,464	33.35	66.65
	GN	1,195	39.39	60.61
White bass	GN	83	41.84	58.16
Largemouth bass	EF	60	42.12	57.88

Gear: EF - electrofishing; GN - gill nets.

Table 5. Length-weight* data for select species sampled from the Kentucky portion of the Ohio River with electrofishing and gill net gear from 1978-1988.

Species	No.	Length range (in)	R-square	Slope (b)	Intercept (a)
Paddlefish	73	10-30	0.7687	0.624432	-14.56040
Gizzard shad	4,169	3-19	0.6979	0.103071	-0.61215
Common carp	880	6-30	0.8036	0.541552	-6.58348
Blue catfish	294	3-30	0.8059	0.011459	-4.14864
Channel catfish	882	3-27	0.7957	0.296390	-2.93248
Flathead catfish	265	5-31	0.7586	0.449026	-4.89024
White bass	433	3-17	0.8550	0.148201	-0.82536
Striped bass	332	3-29	0.9313	0.308300	-1.51767
Bluegill	564	3-8	0.8420	0.070197	-0.22590
Smallmouth bass	38	3-17	0.7711	0.134718	-0.63976
Spotted bass	391	3-15	0.8536	0.109492	-0.49256
Largemouth bass	519	3-21	0.6487	0.181599	-1.04146
White crappie	220	3-15	0.7824	0.122852	-0.67288
Black crappie	44	4-12	0.8662	0.127112	-0.70651
Sauger	815	3-22	0.8011	0.144704	-1.08369
Walleye	40	5-24	0.8568	0.245365	-1.94915
Freshwater drum	1,442	3-27	0.6650	0.281119	-2.19281
Hybrid striped bass	39		0.8197	0.436568	-4.22635

*log W = log a + b log L

Table 6. Mean number and biomass estimates for select fish species collected during twenty-seven rotenone studies in the backwaters of nine navigational pools in the Ohio River from 1978-1987.

Species	No. of surveys / Location	2 GRN	4 MEL	5 MAR	2 MCA	4 CNN	4 NEW	2 UNI	3 SMI	1 P53
Largemouth bass	Fish/acre	19.5	62.0	48.0	9.0	72.0	7.0	13.0	18.0	22.0
	Lb/acre	4.62	3.427	8.80	0.43	13.00	0.15	5.67	13.10	20.66
Spotted bass	Fish/acre	0.0	14.0	0.0	29.0	5.0	34.0	0.0	11.0	0.0
	Lb/acre	0.00	0.54	0.00	0.05	0.16	4.90	0.00	0.19	0.00
Smallmouth bass	Fish/acre	0.0	0.0	0.0	7.0	0.0	0.0	0.0	0.0	0.0
	Lb/acre	0.00	0.00	0.00	4.05	0.00	0.00	0.00	0.00	0.00
White bass	Fish/acre	7.0	19.0	0.80	48.0	0.0	18.0	10.0	133.0	26.0
	Lb/acre	0.41	1.71	0.05	0.62	0.00	1.34	8.37	5.14	0.99
Striped bass	Fish/acre	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
	Lb/acre	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
White crappie	Fish/acre	478.0	324.0	74.4	233.0	1,344.0	43.0	738.0	505.0	63.0
	Lb/acre	10.03	7.84	6.00	1.09	45.33	2.96	33.15	5.80	17.74
Black crappie	Fish/acre	135.0	20.0	2.80	3.0	20.0	11.0	88.0	57.0	22.0
	Lb/acre	9.69	2.48	0.20	0.49	1.80	4.85	23.32	5.92	7.05
Sauger	Fish/acre	11.5	2.0	2.0	64.0	7.0	13.0	9.0	13.0	0.0
	Lb/acre	4.55	0.71	0.09	13.96	1.14	1.40	4.38	2.19	0.00
Walleye	Fish/acre	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
	Lb/acre	0.00	0.00	t	0.00	0.00	0.00	0.00	0.00	0.00
Channel catfish	Fish/acre	222.5	11.0	103.0	4.0	552.0	23.0	155.0	69.0	63.0
	Lb/acre	13.77	9.70	31.40	6.42	51.40	4.76	44.81	16.71	66.25
Flathead catfish	Fish/acre	5.0	9.0	3.0	7.0	4.0	19.0	1.0	12.0	8.0
	Lb/acre	4.38	18.69	7.10	0.03	4.17	3.48	1.93	19.98	8.12
Bluegill	Fish/acre	3,092.0	482.0	618.0	827.0	11,285.0	334.0	1,088.0	1,695.0	170.0
	Lb/acre	40.90	17.79	35.20	4.13	327.38	6.05	51.48	35.54	11.05
Paddlefish	Fish/acre	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	20.0
	Lb/acre	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.49	13.76
Carp	Fish/acre	20.5	23.0	55.0	3.0	57.0	0.0	54.0	11.0	46.0
	Lb/acre	44.20	77.80	119.80	24.44	196.46	0.00	168.90	15.21	161.70
Drum	Fish/acre	629.5	195.0	285.0	891.0	679.0	103.0	549.0	402.0	207.0
	Lb/acre	10.75	9.03	23.80	25.82	75.72	11.62	45.97	19.07	54.01
Gizzard shad	Fish/acre	3,339.5	3,058.0	938.8	787.0	8,998.0	3,509.0	28,727.0	6,452.0	14,158.0
	Lb/acre	121.09	192.76	85.10	47.65	491.45	131.65	1,938.08	443.71	510.47

Table 7. Exploitation rate (total sample size) based on tag returns for selected fish species from six Ohio River navigational pools from 1981 - 1986.

Species/N	Meldahl Pool 1981	Cannelton Pool 1982	Markland Pool 1983	Smithland Pool 1984	McAlpine Pool 1985	Newburgh Pool 1986
Black bass	26.5	24.7	29	29	25.4	9
	(74)	(97)	(99)	(97)	(63)	(11)
Sauger						25
						(4)
White bass						0
						(1)
Crappie	20.2	9.8	27	12		
	(99)	(91)	(97)	(98)		
Carp	2.1	0	0	0	0	0
	(95)	(99)	(99)	(97)	(59)	(30)
Freshwater drum	4.3		8	0	3	0
	(46)		(39)	(22)	(95)	(12)
Channel catfish	5	5.3	9	0	2	6
	(20)	(19)	(95)	(49)	(98)	(50)

Table 8. Summary data from 14 creel surveys conducted on various pools and tailwaters on the Ohio River during 1980-1988.

Pools	Year	Trips	Man-hours	Man-hours per acre	Harvest Fish/acre	Harvest Lb/acre	Harvest Fish/hour	Resident anglers (%)	Fishing mode (%) Boat	Fishing mode (%) Bank
Pools										
Markland	1980	67,241	181,549	8.4	3.2	3.5	0.39	98.7	24.0	76.0
Meldahl	1981	41,315	68,828	3.2	1.3	0.9	0.45	42.4	11.7	88.3
Cannelton	1982	39,527	66,182	2.9	1.3	0.8	0.45	90.9	32.7	67.3
McAlpine	1983	15,539	38,255	2.0	1.5	0.9	0.74	91.9	46.4	53.6
Smithland	1985	16,249	83,684	3.0	5.2	5.2	2.00	66.7	75.4	24.6
Mean		35,974	87,699	3.9	2.5	2.3	0.8	78.1	38.0	62.0
Tailwaters										
Greenup	1980	3,657	6,767	45.1	21.0	14.3	0.47	100.0	1.0	99.0
Meldahl	1980	7,301	15,181	57.1	12.9	21.4	0.23	92.3	1.7	98.3
McAlpine	1981	17,105	23,740	255.3	66.1	47.1	0.72	81.3	1.1	98.9
Newburgh	1981	3,261	1,977	15.8	14.5	5.2	0.92	75.3	18.8	81.3
Markland	1983	1,102	2,619	12.1	10.0	7.8	0.82	77.7	48.4	51.6
Smithland	1985	8,053	41,472	51.0	159.4	203.8	3.1	95.8	67.0	33.0
Markland	1986	9,487	38,631	294.9	108.8	147.7	0.41	48.2	35.9	64.1
Cannelton	1986	2,454	12,639	69.8	53.6	76.2	0.81	82.9	50.3	49.7
McAlpine	1988	33,176	124,658	481.3	498.6	365.9	0.99	79.6	29.1	70.9
Mean		9,510	29,742	142.5	105.0	98.8	0.9	81.5	28.1	71.9

Table 9. Mean creel values from 14 creel surveys conducted on various pools and tailwaters for selected species from the Ohio River during 1980-1988. (Means are determined for only those pools or tailwaters where fish were creeled).

Species	Harvest (mean) No.	Harvest (mean) Lb/acre	Harvest (mean) $/lb	% trips (mean)	Fishing for that species (mean) Hours fished	No. harvested	Fish/hour	% success
				Tailwater				
Black bass	275	1.2	0.7	1.87	769.3	23	t	5.9
Crappie	1,286	1.3	9.5	0.8	352.5	777	0.9	49.6
Sauger	11,662	27.5	11.2	15.4	7,329.9	7,489	0.7	32.8
Walleye	327	1.3	0.4	0.2	234.0	t	t	t
Striped bass	1,057	17.6	18.3	16.0	3,264.5	559	0.3	27.1
White bass	9,275	18.1	10.8	3.8	880.3	6,321	1.9	48.3
Hybrid striped bass	318	2.4	0.9	0.1	27.5	t	t	t
Freshwater drum	2,704	11.4	32.0	2.0	271.3	102	0.1	18.2
Catfish species	9,109	277.2	30.1	22.1	6,303.7	8,199	0.5	47.1
Carp	199	3.6	9.3	0.7	212.0	110	0.2	38.6
				Pool				
Black bass	3,450	0.2	7.8	11.9	10,046.0	3,206	0.3	37.0
Crappie	24,353	0.7	24.6	14.3	9,094.3	22,303	2.4	74.4
Sauger	304	0.01	0.7	0.1	10.7	t	t	t
Striped bass	747	t	1.5	1.2	630.0	513	0.8	53.2
White bass	1,920	0.1	5.1	1.3	589.7	1,591	1.4	34.9
Freshwater drum	8,309	0.2	12.7	1.3	1,255.5	1,289	1.0	55.1
Catfish species	19,768	0.8	33.0	27.4	21,647.2	16,510	0.5	38.8
Carp	3,316	0.4	19.7	2.9	4,934.7	1,091	0.1	20.2

t = <0.01%.

Table 10. Black bass harvest and release data from the Smithland Pool of the Ohio River during the 1985 creel survey.

	Largemouth bass			Spotted bass			Smallmouth bass		
		Catch and release(in)			Catch and release(in)			Catch and release(in)	
	Harvest	8.0-11.9	>12.0	Harvest	8.0-11.9	>12.0	Harvest	8.0-11.9	>12.0
Total no. of black bass	10,612	5,613	844	229	91	0	229	0	0
% of black bass harvested by no.	95.9			2.1			2.1		
Total lb of black bass	12,974.2	2,409.0	727.0	170.0	31.0	0	186.4	0	0
% of black bass harvest by weight	97.3			1.3			1.4		
Mean length (in)	12.9	10.1	12.0	12.0	9.0	0	12.0	0	0
Mean weight (lb)	1.08	0.50	0.86	0.74	0.34	0	0.81	0	0
Rate (fish/hour)	0.18	0.04	t	0.01	0.01	0	0.01	0	0

Table 11. Black bass harvest and release data from the McAlpine tailwater of the Ohio River during the 1988-89 creel survey.

	Largemouth bass			Spotted bass			Smallmouth bass		
		Catch and release(in)			Catch and release(in)			Catch and release(in)	
	Harvest	8.0-11.9	>12.0	Harvest	8.0-11.9	>12.0	Harvest	8.0-11.9	>12.0
Total no. of black bass	191	613	146	330	839	0	412	3,525	292
% of black bass harvested by no.	20.5			35.4			44.2		
Total lb of black bass	248.3	279.5	183.5	187.8	293.1		487.2	959.8	299.6
% of black bass harvested by weight	26.9			20.3			52.8		
Mean length (in)	13.8	9.5	13.5	11	9.1		13.4	8.1	13.1
Mean weight (lb)	1.32	0.42	1.24	0.59	0.35		1.14	0.25	1.05
Harvest rate (fish/hour)	t	t	t	t	0.01		t	0.03	t

Table 12. Gill net length frequencies for all species collected during surveys from 1970-1988 in the Ohio River.

Species	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
GAME FISHES																								
Black crappie			1	2	2	4			2															
Brown trout								1																
Chain pickerel																	1							
Hybrid striped bass												6	4	1	4	1	5	1	4	6	2	1		
Largemouth bass		3	2		1	2	6	1	4	3	4				2									
Sauger			20	23	5	15	20	143	85	95	102	120	97	53	47	24	21	8		1				
Smallmouth bass		1	1																					
Spotted bass		1		1	1	1		3	1	2	5													
Striped bass						1	1	1			1	2	2	5	9	5	3	2	4	5	2	20	6	6
Walleye							3	1	2	3	2	4	4	1	2				1	3	2	1		
White bass	6	9	2	5	25	29	41	32	33	19	32	23	21	13	2									
White crappie	8	11	3	31	49	26	24	17	9	7	5	2												
Yellow bass	3	5	1	17	36	29	4	4																
FOOD FISHES																								
Blue catfish	1	4	7	6	12	21	24	14	11	12	15	13	31	20	39	28	23	29	12	20	20	21	14	11
Channel catfish	2	4	12	13	16	21	39	46	36	41	56	68	77	69	89	44	61	43	39	26	23	14	9	5
Flathead catfish			1		1	3	9	4	1	7	12	14	19	18	32	35	25	27	17	20	17	16	5	4
PREDATORY FISHES																								
American eel																1								1
Bowfin																			1	1	3	3	3	3
Goldeye		1				4	12	16	29	34	46	24	14	9	1									
Longnose gar									1	2	2			1		1	3	3	7	19	25	28	28	32
Mooneye					3	12	20	19	14	4	3	3	1	1										
Shortnose gar							1	2		1	1	3	2		3	5	6	20	29	48	44	52	52	28
Skipjack herring		37	44			5	30	65	36	27	42	48	58	42	28	7								
Spotted gar																		1		1		1		
COMMERCIAL FISHES																								
Bigmouth buffalo												1					2	1	1	1				1
Black buffalo																	1			2		1		
Black redhorse						3	1			2	4	1		3	1	2	2	1	1					
Blue sucker															1	2	8	16	19	25	12	16	12	7
Brown bullhead										1														
Common carp				1		1	1	2	3	3	10	19	14	18	47	81	71	91	117	98	82	41	42	19
Freshwater drum	14	31	7	38	194	98	123	269	178	137	119	111	94	40	35	47	39	18	10	3	4	1		

Species	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	No. of fish	%
GAME FISHES																										
Black crappie																									11	0.1
Brown trout																									1	0.0
Chain pickerel																									1	0.0
Hybrid striped bass																									35	0.2
Largemouth bass																									28	0.2
Sauger																									875	6.2
Smallmouth bass																									2	0.0
Spotted bass																									15	0.1
Striped bass	8	2																							85	0.6
Walleye																									29	0.2
White bass																									292	2.1
White crappie																									192	1.4
Yellow bass																									99	0.7
FOOD FISHES																										
Blue catfish	4	5	1	1	1		1																		420	3.0
Channel catfish	3																								836	6.0
Flathead catfish	1	2	1	3	2	2																			296	2.1
PREDATORY FISHES																										
American eel																									2	0.0
Bowfin		2	1		1																				18	0.1
Goldeye																									189	1.3
Longnose gar	45	38	38	29	36	23	21	20	21	18	23	15	11	15	6	15	11	4	4	9	6	1			561	4.0
Mooneye																									80	0.6
Shortnose gar	38	11	25	13		3	4				1														392	2.8
Skipjack herring																									469	3.3
Spotted gar		1																							4	0.0
COMMERCIAL FISHES																										
Bigmouth buffalo		1				1																			9	0.1
Black buffalo																									4	0.0
Black redhorse																									21	0.1
Blue sucker	4	2	1																						124	0.9
Brown bullhead																									1	0.0
Common carp	19	11	9	2			1																		800	5.7
Freshwater drum		1						1																	1,612	11.5

Table 12 continued.

	Inch group																																																No.	
Species	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	42	44	45	46	47	48	49	50	of fish	%
Golden redhorse						1	2	4	3	4	9	7	6	8	10		1		1																														56	0.4
Highfin carpsucker					1	1		4	6	10	7	18	13	5	1		1																																67	0.5
Paddlefish								1				1					1		1	5		1	2		3	1	2	1	3	4	5	3	5	6	5	6	5	9	7	3	1	3	2	3	2	1	5	1	100	0.7
Quillback carpsucker	1				1	1	4	5	6	11	16	45	78	77	36	15	6	4	1																														307	2.2
River carpsucker				1	4	1	8	26	28	32	73	188	312	362	332	147	40	22	1	1	2		1																										1,401	11.4
River redhorse											5	4		4	2	1		1	2	1	2																												22	0.2
Shovelnose sturgeon											1		1	1				1	3	6	1	3	9	14	14	14	16	11	7	6	8		2																118	0.8
Smallmouth buffalo					1	4		3	4	7	8	10	7	16	32	32	32	23	12	7	4	4	3	1																									210	1.5
White sucker												1																																					1	0.0
Silver redhorse										1		3	1	1	2	1	5	2																															16	0.1
Spotted sucker							1			3	4	9	2	2		1																																	22	0.2
Shorthead redhorse							1	1	2	2	3	4	11	8	3	2	1	1																															39	0.3
Yellow bullhead					1				1	1																																							3	0.0
PANFISHES																																																		
Bluegill	3	1	12	11	4	9																																											40	0.3
Green sunfish					1																																												1	0.0
Longear sunfish	3	3	7	2																																													15	0.1
Orangespotted sunfish	3																																																3	0.0
Redear sunfish						1																																											1	0.0
Rock bass				1			1																																										2	0.0
Warmouth	1	1	2	4		1																																											9	0.1
FORAGE FISHES																																																		
Gizzard shad	27	27	8	82	542	437	278	676	667	336	297	180	78	21	3		2																																3,643	26.0
Golden shiner							1																																										1	0.0
Goldfish											1	1		1																																			3	0.0
Logperch			12	3																																													15	0.1
Pirate perch		1																																															1	0.0
Silver chub		62	80	7																																													149	1.1
Silver lamprey					1	1																																											2	0.0
Threadfin shad	5	40	1																																														50	0.4

Table 13. Electrofishing length frequency data for selected species sampled from the Ohio River during 1978-1988.

	Inch group																													No. of
Species	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	fish
Gizzard shad	1,971	752	507	680	1,070	1,399	990	535	291	106	40	22	2	2																8,367
Common carp		3	5	6	1		2	5	4	7	5	13	11	28	14	30	39	54	44	44	27	14	17	4	4	1	2			384
Blue catfish								1		1	2		3	5	2	9	5	7	4	2		1					1			43
Channel catfish	2	3	7	3	11	4	3	7	10	9	16	26	33	39	32	42	47	37	23	34	11	4	2							405
Flathead catfish				3	10	8	11	10	12	9	6	2	6	3	6	1	3		1	1			2		1				1	96
White bass	19	70	60	40	19	23	20	17	20	14	7	13	6	1																329
Striped bass	260	751	201	22	1	1												2	1			1			1		1			1,242
Hybrid striped bass		3	1	2							2			2																10
Bluegill	161	207	288	312	126	7																								1,102
Smallmouth bass	4	14	3	1	4	3	4	5	2	3				1	1															45
Spotted bass	61	96	68	43	39	35	55	22	16	8	4	4	2																	453
Largemouth bass	16	75	94	70	35	30	40	51	75	48	41	26	23	9	4	7	1	1	2											648
White crappie	3	3	16	24	18	32	28	11	11	6	3	1	1																	157
Black crappie		1	4	10	7	7	10	6		1																				46
Sauger	1	5	27	45	7	9	14	12	5	4	2	6	4	2	1	3			1											148
Walleye			3	7	1			1							1															13
Freshwater drum	278	75	41	88	111	109	100	109	80	78	52	29	35	21	23	15	19	6	4	3	3	5			1		1			1,286
Total																														14,774

Table 14. Electrofishing habitat use trends from length frequency data collected from the Ohio River during 1978-1988.

Species	Inch group 3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	No./ habitat	%/ habitat	% total
Mainstem																																
Gizzard shad	809	124	122	183	417	496	459	155	47	11	2																			2,825	77.3	19.1
Common carp								1		1		2	4	3	3	9	7	12	18	19	11	2	4	2	1	1	1			101	2.9	0.7
Blue catfish													1						1	1										3	0.1	0.0
Channel catfish	1	1	2	1	2				3	4	1	4	6	8	7	8	11	5	5	4	1	2								76	2.1	0.5
Flathead catfish					1	2	2			2			1		2		1													11	0.3	0.1
White bass	2	11	7	12	6	8	3	1	1	1	1		2																	55	1.5	0.4
Striped bass	10	49	16																											75	2.1	0.5
Bluegill	34	21	49	33	14	2																								153	4.2	1.0
Smallmouth bass	3	4	3	1	3	1	2		1																					18	0.5	0.1
Spotted bass	11	16	8	1	4	5	4	4	4	1																				58	1.6	0.4
Largemouth bass	2	4	22	9	6	8	11	9	12	6	1	3			1															94	2.6	0.6
White crappie		1					1																							2	0.1	0.0
Black crappie		1						2																						3	0.1	0.0
Sauger			4	2	1	2	1				1	1	1			1			1											15	0.4	0.1
Walleye																														0	0.0	0.0
Freshwater drum	16	2	4	8	24	28	21	13	12	9	10	4	4	2	1	1	2	2			2									166	4.5	1.1
Hybrid striped bass											1																			1	0.0	0.0
Total																															100.0	24.6

Table 14 continued.

Species	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	No./ habitat	%/ habitat	% total
	Inch group																															
Tailwater																																
Gizzard shad	183	244	227	165	189	250	192	224	160	87	31	19	2	1																1,954	49.1	13.2
Common carp			1											1		3	1	10	13	9	6	2	4		1		1			52	1.3	0.4
Blue catfish								1		1	1		1	2		1		2				1								10	0.3	0.1
Channel catfish			3			1		2	1	1	6	8	16	17	16	18	16	16	6	17	3		1							150	3.0	1.0
Flathead catfish				1	4	2	4	6	11	4	2	1	2										2						1	40	1.0	0.3
White bass	8	27	10	19	12	12	13	13	19	12	5	11	4	1																166	4.2	1.1
Striped bass	114	442	61	12	1													2	1			1			1		1			636	16.0	4.3
Bluegill	17	35	24	50	18	1																								145	3.6	1.0
Smallmouth bass	1	9						4	1	2				1																18	0.5	0.1
Spotted bass	14	30	18	28	20	10	17	8	5	1	2	2																		155	3.9	1.0
Largemouth bass	2	4	6	12	2	2	5	11	19	11	6	3	5	1																89	2.2	0.6
White crappie						2	1																							3	0.1	0.0
Black crappie							4																							4	0.1	0.0
Sauger				1	2	5	5	4	4	4	1	1																		27	0.7	0.2
Walleye															1															1	0.0	0.0
Freshwater drum	56	38	15	15	12	30	51	73	53	49	26	16	19	15	16	12	13	3	3	2		4			1		1			522	13.1	3.5
Hybrid striped bass		1	1	2							1			2																7	0.2	0.0
Total																															100.0	26.8

Table 14 continued.

Species	Inch group																												No./	%/	%
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	habitat	habitat	total
Structural backwater																																
Gizzard shad	111	75	40	66	105	179	118	65	43	16	5	3																		826	33.7	5.6
Common carp		3	1							2		2			2	4	7	8	6	5	3	2	4		1					50	2.0	0.3
Blue catfish											1		1	3	2	7	4	5	3	1							1			28	1.1	0.2
Channel catfish		2	2		1	2	1	2	5	4	7	7	5	8	3	6	8	3	2	4	1	1	1							75	3.1	0.5
Flathead catfish					4	2	3	3	1	3	1			1	1				1						1					21	0.9	0.1
White bass	6	23	33	8		2	4	2		1		2																		81	3.3	0.5
Striped bass	120	230	113	8				1																						481	19.6	3.3
Bluegill	19	20	30	38	18	1																								136	5.5	0.9
Smallmouth bass						2	1	1							1															5	0.2	0.0
Spotted bass	17	36	35	13	14	15	18	6	5	2	2	1	2																	166	6.8	1.1
Largemouth bass	4	28	25	12	4	2	3	12	16	8	10	5	7	3	1	3		1												145	5.9	1.0
White crappie					4	3	1			1																				9	0.4	0.1
Black crappie				1		1		1																						3	0.1	0.0
Sauger	1	3	23	36	2	1	5	7	1			1	1																	81	3.3	0.5
Walleye			3	7	1			1																						12	0.5	0.1
Freshwater drum	165	25	6	22	18	11	12	8	12	9	12	4	10	2	4	2	3	1	1	1	1	1								330	13.5	2.2
Hybrid striped bass		2																												2	0.1	0.0
Total																															100.0	16.4

Table 14 continued.

Species	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	No./ habitat	%/ habitat	% total
	Inch group																															
Backwater																																
Gizzard shad	868	308	110	266	358	474	221	91	41	12	2			1																2,762	58.9	18.7
Common carp			3	6	1		2	4	4	4	5	9	7	24	9	14	24	24	7	11	7	8	5	2	1					181	3.9	1.2
Blue catfish																1	1													2	0.0	0.0
Channel catfish	1			2	8	1	2	3	1			7	6	6	6	10	12	13	10	9	6	1								104	2.2	0.7
Flathead catfish				2	1	2	2	1			3	1	3	2	3	1	2			1										24	0.5	0.2
White bass	3	9	10	1	1	1		1			1																			27	0.6	0.2
Striped bass	16	21	11	2																										50	1.1	0.3
Bluegill	91	131	177	191	75	3																								668	14.2	4.5
Smallmouth bass		1			1		1			1																				4	0.1	0.0
Spotted bass	19	14	7	1	1	5	16	4	2	4		1																		74	1.6	0.5
Largemouth bass	8	39	41	37	23	18	21	19	20	22	24	15	11	5	2	4	1		2											320	6.8	2.2
White crappie	3	2	16	24	14	27	25	11	11	5	3	1	1																	143	3.1	1.0
Black crappie			4	9	7	6	6	3		1																				36	0.0	0.2
Sauger		2		6	2	1	3	1				3	2		2	1	2													25	0.5	0.2
Walleye																														0	0.0	0.0
Freshwater drum	41	10	16	43	57	39	16	15	3	11	4	5	3	2	2			1												268	5.7	1.8
Hybrid striped bass																														0	0.0	0.0
Total																														14,774	100.0	31.7

Table 15. Catch-per-unit-effort-data for select fish species collected during 26 net nights from the Ohio River in 1988.

Species	Number	Catch per net night
Shovelnose sturgeon	15	0.58
Longnose gar	15	0.58
Shortnose gar	28	1.08
Bowfin	1	0.04
Goldeye	4	0.15
Mooneye	1	0.04
Skipjack herring	43	1.65
Gizzard shad	444	17.08
Threadfin shad	8	0.31
Common carp	14	0.54
Silver chub	27	1.04
River carpsucker	90	3.46
Quillback	6	0.23
Highfin carpsucker	3	0.12
Blue sucker	13	0.50
Smallmouth buffalo	2	0.08
Black buffalo	1	0.04
River redhorse	1	0.04
Golden redhorse	2	0.08
Blue catfish	15	0.58
Channel catfish	44	1.69
Flathead catfish	2	0.08
White bass	9	0.35
Yellow bass	8	0.31
Bluegill	1	0.04
Largemouth bass	1	0.04
Sauger	50	1.92
Walleye	1	0.04
Freshwater drum	60	2.31
Total	909	
No. of species	29	
Average per net night		1.21

Table 16. Electrofishing catch-per-unit-effort data for selected species from the Ohio River during 1978-1988.

	Greenup	Meldahl	Markland	McAlpine	Cannelton	Newburgh	Uniontown	Smithland	Pool 52	Pool 53
Gizzard shad	421.9	67.6	133.8	56.6	148.3	184.6	155.0	326.3	267.4	613.9
Common carp	9.6	14.0	5.1	2.2	3.3	2.7	4.1	3.4	17.5	24.3
Blue catfish	0.0	0.0	0.0	0.0	0.0	0.0	0.9	7.4	9.8	6.7
Channel catfish	5.4	6.9	5.7	2.0	4.5	1.6	3.5	6.4	15.6	43.2
Flathead catfish	4.6	3.0	2.3	1.7	2.8	3.0	6.0	4.5	2.5	0.9
White bass	7.1	5.5	2.4	3.5	4.2	33.1	5.9	6.7	9.2	15.8
Striped bass	7.7	1.6	1.3	0.0	1.0	163.9	106.4	51.1	47.1	19.6
Hybrid striped bass	2.0	3.2	0.0	0.0	0.0	0.0	0.0	2.5	1.5	1.7
Bluegill	19.2	26.9	30.5	2.3	38.8	8.9	10.0	26.4	37.8	25.6
Smallmouth bass	3.0	1.4	2.7	4.0	2.9	7.9	0.0	0.0	2.1	25.6
Spotted bass	6.8	5.6	3.7	6.1	6.7	6.3	14.2	22.7	21.4	3.6
Largemouth bass	11.9	7.9	8.4	8.0	20.9	3.4	7.1	23.7	16.5	6.3
White crappie	9.6	6.6	8.2	0.0	16.6	1.4	0.0	9.3	7.2	7.6
Black crappie	3.2	0.0	2.0	0.0	0.0	1.1	0.9	2.5	2.9	12.4
Sauger	8.3	4.8	2.8	3.3	4.1	13.7	1.9	1.7	2.1	2.1
Walleye	1.7	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0
Freshwater drum	12.0	22.9	10.7	6.2	11.1	6.7	44.6	8.8	53.1	50.7

Table 17. Habitat selection tendencies of select species collected with electrofishing gear during surveys on the Ohio River from 1978-1988.

Species	Mainstem	Tailwater	Structural backwater	Backwater	Average catch per effort
Gizzard shad	413.5	146.3	203.7	422.7	296.6
S.E.	246.2	56.1	121.8	193.6	
Common carp	10.7	6.6	4.3	13.6	8.8
S.E.	4.1	2.7	0.7	2.8	
Blue catfish	3.0	5.9	10.0	6.7	6.4
S.E.	-	-	0.5	-	
Channel catfish	7.5	19.9	8.3	9.9	11.4
S.E.	2.6	2.8	3.3	4.6	
Flathead catfish	2.7	6.3	4.8	3.6	4.3
S.E.	0.9	3.1	2.6	1.1	
White bass	5.7	13.6	8.5	4.3	8.0
S.E.	1.2	5.3	4.7	1.2	
Striped bass	41.1	57.7	64.2	10.2	43.3
S.E.	37.9	53.4	58.1	9.1	
Hybrid striped bass	1.5	2.2	2.3		2.0
S.E.	-	0.5	-		
Bluegill	18.3	23.0	12.0	60.8	28.5
S.E.	4.8	13.9	7.0	9.7	
Smallmouth bass	5.4	4.2	3.5	2.4	3.9
S.E.	1.5	1.4	-	0.8	
Spotted bass	7.9	17.8	23.6	9.0	14.6
S.E.	2.2	5.3	18.7	4.6	
Largemouth bass	22.4	13.3	15.3	30.8	20.5
S.E.	6.0	4.9	4.4	9.1	
White crappie	1.2	1.5	4.5	16.0	5.8
S.E.	-	-	2.8	4.1	
Black crappie	2.0	2.1	2.1	6.8	3.2
S.E.	-	-	0.4	2.4	
Sauger	4.2	8.3	12.0	4.6	7.3
S.E.	1.4	5.3	11.1	0.8	
Walleye		1.7	8.0		4.9
S.E.		-	-		
Freshwater drum	13.4	28.7	20.8	23.7	22.9
S.E.	3.4	16.5	12.2	6.2	
Average Catch per effort for each habitat	35.3	21.1	24.0	41.7	

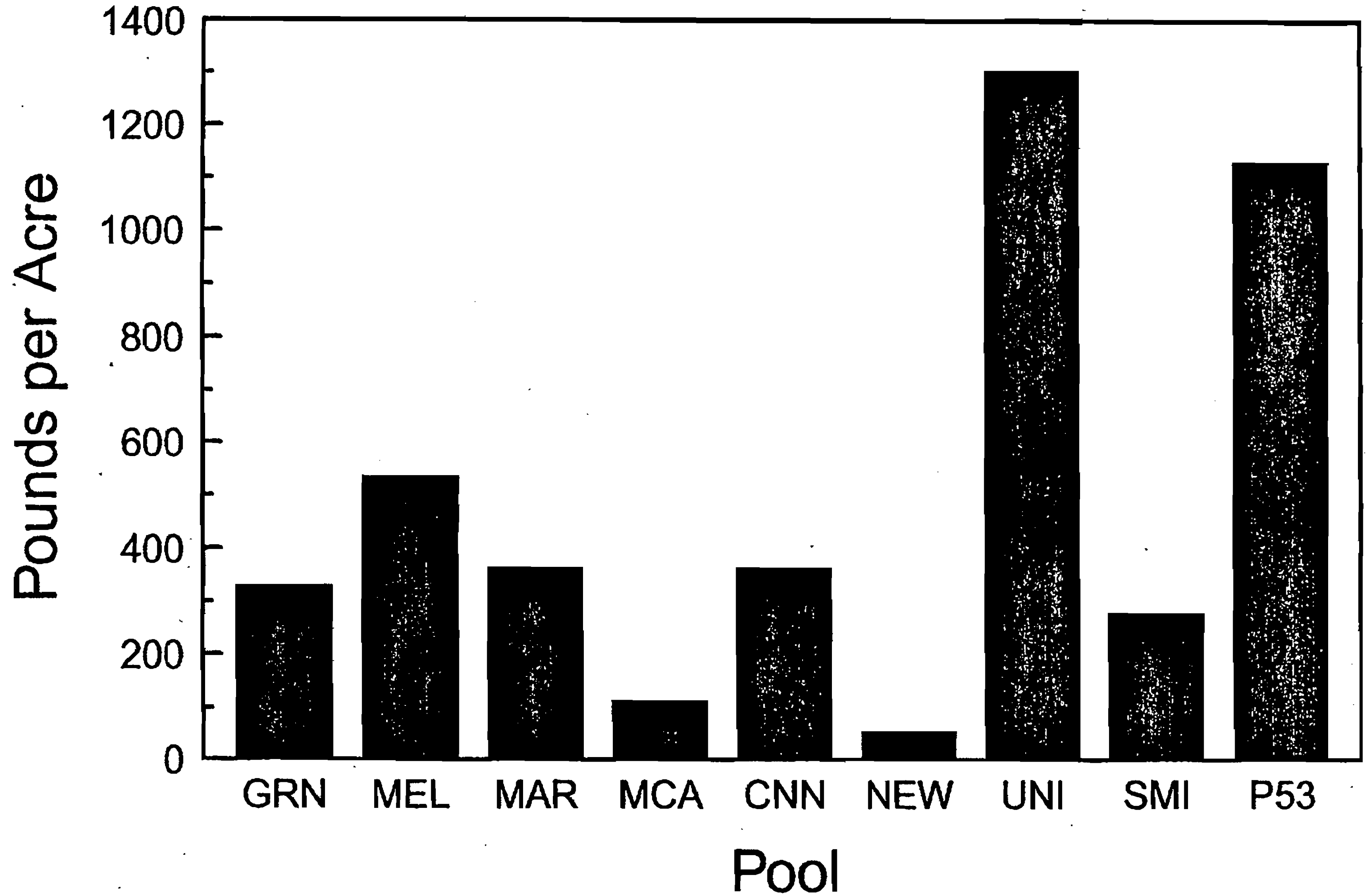

Figure 1. Summary of fish biomass estimates from twenty-seven rotenone surveys in nine navigational pools of the Ohio River from 1978-1987.

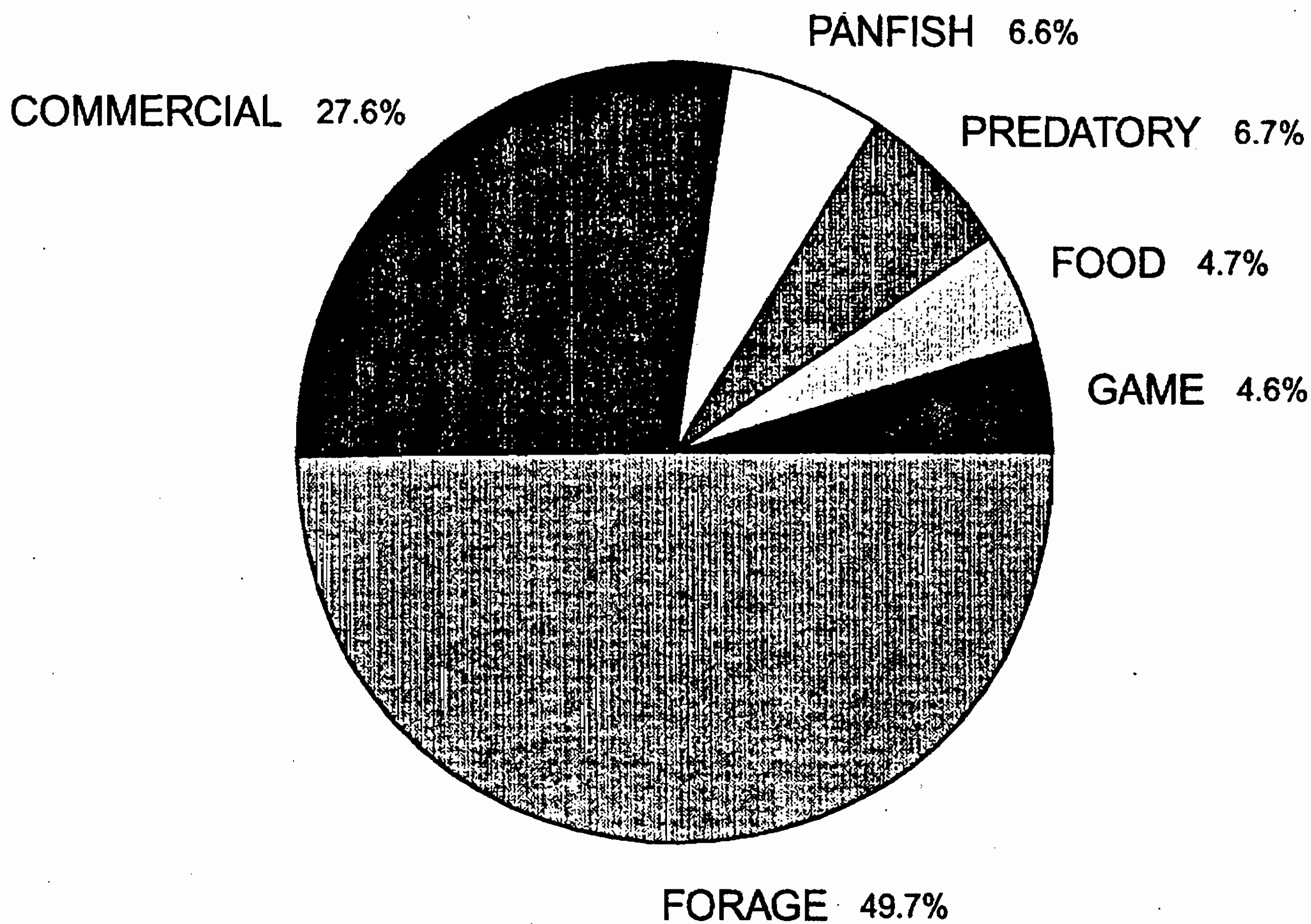

Figure 2. Biomass composition (%) of Ohio River fishes by groups as surveyed from twenty-seven rotenone surveys in nine navigational pools of the Ohio River from 1978-1987.

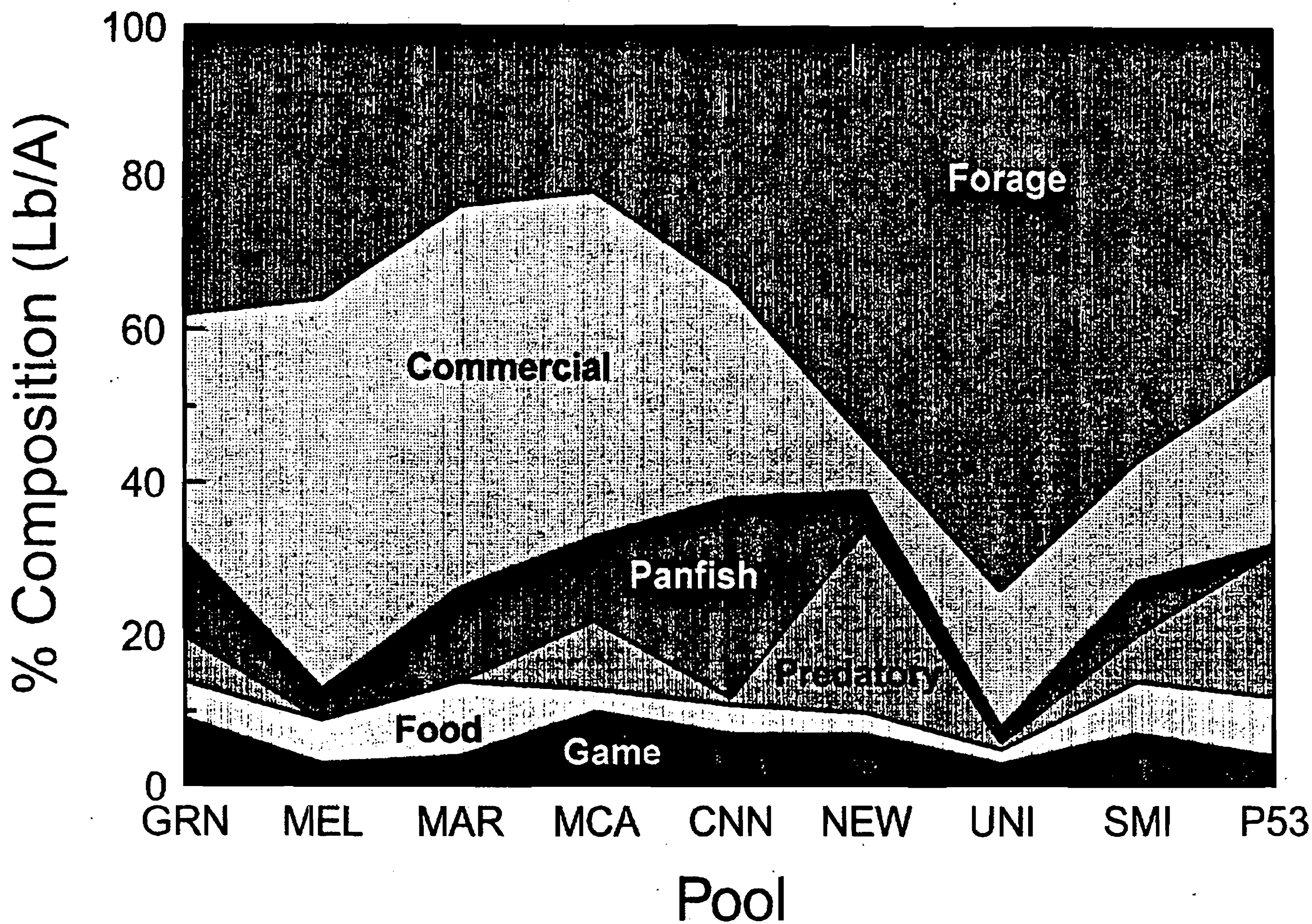

Figure 3. Percent composition (lb/acre) of fish groups from twenty-seven rotenone surveys in nine navigational pools of the Ohio River from 1978-1987.

Appendix Table 1. Objectives, problems and strategies of a draft strategic management plan for select fish species in the Ohio River.

Ohio River Management Goal: To attain maximum sport fishing opportunities in the Ohio River.

Striped Bass

Objectives:

(1) To establish and maintain an annual average legal tailwater harvest rate of 18 lb/acre of striped bass which average 4.0 lb in weight or 22 inches in length by 1995.

(2) To establish an angler catch per hour objective for striped bass in the Ohio River by 1995.

(3) To attain a minimum of 20% of man hours/acre fishing for striped bass in each tailwater.

Problem

The Department lacks current data for monitoring progress toward these objectives.

Strategy

Conduct tailwater creel surveys to the extent necessary to assess progress.

Problem

While it is assumed that stocking is necessary, the numbers, frequency, and location of stocking needed to attain the objectives is unknown.

Strategy

Continue stocking striped bass and determine the relative contributions of stocked and naturally-produced fish.

Problem

Surveys suggest that angler perceptions regarding contamination levels in Ohio River fish could reduce participation and preclude attainment of striped bass objectives.

Strategy

Measure contamination levels in Ohio River striped bass, publish findings, and alter objectives and strategies as appropriate.

Problem

Limited access to some tailwaters precludes fisherman use.

Strategy

Provide boat ramp access no more than 5 miles downstream from each tailwater.

Coordinate with Corps of Engineers to provide bank and boat access to tailwaters.

Problem

Intentional or mistaken harvest of undersize striped bass and harvest in excess of established creel limits will preclude attainment of harvest objectives.

Strategy

Emphasize enforcement of creel and size limits on the Ohio River.

Establish an aggregate size and creel limit for white bass, yellow bass, striped bass, and hybrid striped bass on the Ohio River.

Problem

Incidental mortality of striped bass captured in commercial gill nets may impede attainment of objectives.

Strategy

Determine the impacts of commercial gill netting on striped bass objectives.

Problem

Lack knowledge of striped bass staging and spawning sites in the Ohio River, which precludes protection of these sites.

Strategy

Determine where striped bass spawning sites are located in the Ohio River and develop strategies to protect these areas.

Largemouth Bass

Objectives:

(1) Attain and maintain an average catch rate of one 12 inch or larger largemouth bass per two hours of fishing.

(2) Attain and maintain an average harvest rate of one 12 inch or larger largemouth bass per 4 hours of fishing.

Problem

The Department lacks current data for monitoring progress toward achieving these objectives.

Strategy

Conduct creel surveys to the extent necessary to assess progress.

Problem

The efficacy of the current creel and size limits in attaining catch and harvest objectives is unknown.

Strategy

Evaluate the effectiveness of current creel and size limits.

Retain current creel and size limits until their effectiveness is evaluated.

Problem

The Department is uncertain that its objectives for largemouth bass are satisfactory to anglers.

Strategy

Determine angler expectations for largemouth bass fishing.

Problem

The cumulative impact of delayed mortality from tournament fishing may impede progress toward objectives but is currently unknown.

Strategy

Assess the relevant impacts of tournament fishing on catch and harvest rates.

Problem

The development and siltation of backwater areas is reducing and degrading largemouth bass habitat and fishability to some unknown extent.

Strategy

Provide the Department's environmental review section with information it needs to assess impacts of proposed actions on backwater habitat.

Quantify and qualify the backwater areas of the Ohio River and assess the extent of the problem.

Renovate areas degraded by siltation and work with other government agencies to solve the siltation problems.

Problem

Limited access to some areas of the river constrains angler use.

Strategy

Construct and maintain boat ramps in appropriate locations.

White and Black Crappie

Objectives:

(1) To establish an angler catch per hour objective for crappie (both species) in the Ohio River by 1995.

(2) To maintain an annual average legal harvest rate of 1.0 lb/acre of crappie which average 10 inches or 0.5 lb in weight by 1998.

(3) To maintain a minimum of 15% of all man-hours spent fishing in the Ohio River for crappie.

Problem

The Department lacks current data for monitoring progress toward these objectives and whether these objectives are satisfactory to angling.

Strategy

Conduct backwater creel surveys to the extent necessary to assess progress.

Problem

Surveys suggest that angler perceptions regarding contamination levels in Ohio River fish could reduce participation and preclude attainment of crappie objectives.

Strategy

Measure contamination levels in Ohio River crappie, publish findings, and alter objectives and strategies as appropriate.

Problem

The efficacy of the current creel limits in attaining catch and harvest objectives is unknown.

Strategy

Evaluate the effectiveness of current creel limits.

Retain current creel limits until their effectiveness is evaluated.

Problem

The development and siltation of tributary and backwater areas is reducing and degrading crappie habitat and fishability to some unknown extent.

Strategy

Provide the Department's environmental review section with information it needs to assess impacts of proposed actions on backwater habitat.

Quantify and qualify the backwater areas of the Ohio River and assess the extent of the problem.

Renovate areas degraded by siltation and work with governmental agencies to reduce the siltation problem.

Problem

Limited access to some areas of the river constrains fisherman use.

Strategy

Provide improved information on the Ohio River sport fishery and access to the public.

Provide a comprehensive database on the Ohio River crappie fishery to facilitate management decisions that positively affect the resource.

White Bass

Objectives:

(1) To establish an angler catch per hour objective for white bass in the Ohio River by 1995.

(2) To maintain a minimum of 5.0% of all man hours spent fishing in a tailwater for white bass.

(3) To maintain an annual average legal tailwater harvest rate of 20 lb/acre of white bass which average 0.8 lb in weight or 12 inches in length.

Problem

The Department lacks current data for monitoring progress toward these objectives.

Strategy

Conduct tailwater creel surveys to the extent necessary to assess progress.

Problem

Surveys suggest that angler perceptions regarding contamination levels in Ohio River fish could reduce participation and preclude attainment of white bass objectives.

Strategy

Measure contamination levels in Ohio River white bass on a regular basis, publish findings, and alter objectives and strategies as appropriate.

Problem

Limited access to some tailwaters precludes fisherman use.

Strategy

Provide boat ramp access no more than 5 miles downstream from each tailwater.

Coordinate with Corps of Engineers to provide bank, pier, and boat access to tailwaters.

Problem

The Department is uncertain that its objectives for white bass are satisfactory to anglers.

Stragegy

Determine angler expectations for white bass fishing.

Problem

Information concerning the recreational fishery value of the Ohio River is not available for public use.

Strategy

Provide improved information on the Ohio River sport fishery and access to the public.

Sauger

Objectives:

(1) To establish an angler catch per hour objective for sauger in the Ohio River by 1995.

(2) To maintain a minimum of 15% of all man-hours spent fishing in a tailwater for sauger.

(3) To maintain an annual average legal tailwater harvest rate of 30 lb/acre of sauger which averages 0.6 lb in weight or 13 inches in length by 1998.

Problem

The Department lacks current data for monitoring progress toward these objectives.

Strategy

Conduct tailwater creel surveys to the extent necessary to assess progress.

Problem

The Department is uncertain that its objectives for sauger are satisfactory to anglers.

Strategy

Determine angler expectations for sauger fishing.

Problem

The efficacy of the current creel and lack of size limits in attaining catch and harvest objectives is unknown.

Strategy

Evaluate the effects of current creel limit and absence length limits.

Retain current sauger regulations until their effectiveness is evaluated.

Problem

Information concerning the recreational fishery value of the Ohio River is not available for public use.

Strategy

Provide improved information on the Ohio River sport fishing and access to the public.

Problem

Surveys suggest that angler perceptions regarding contamination levels in Ohio River fish could reduce participation and preclude attainment of sauger objectives.

Strategy

Measure contamination levels in Ohio River sauger, publish findings, and alter objectives and strategies as appropriate.

Problem

Limited access to some tailwaters precludes fisherman use.

Strategy

Provide boat ramp access no more than 5 miles downstream from each tailwater.

Coordinate with Corps of Engineers to provide bank and boat access to tailwaters.

Problem

Lack of knowledge of sauger spawning sites in the Ohio River, which precludes protection of these sites.

Strategy

Determine where sauger sites are located in the Ohio River and develop strategies to protect these areas.

Paddlefish

Objective:

(1) To determine current paddlefish population parameters and document exploitation levels in the Ohio River.

Problem

The Department does not know at what levels paddlefish are being harvested from the Ohio River via commercial and sport anglers.

Strategy

Determine commercial and sport fishing exploitation.

Problem

Surveys suggest that paddlefish fillets and roe from the Ohio River contain excessive levels of contaminants.

Strategy

Measure contaminant levels in Ohio River paddlefish fillets and roe and advise appropriate authorities who are responsible for commercial sales of these products.

Problem

Lack knowledge of paddlefish spawning sites in the Ohio River, which precludes protection of these sites.

Strategy

Determine where paddlefish spawning sites are located in the Ohio River and develop strategies to protect these areas.

Problem

The inter-pool and river movement patterns of paddlefish precludes a single state agency from examining basic population parameters.

Strategy

Coordinate fish studies between states through the auspices of Mississippi Inter-State Cooperative Resource Agreement (MICRA) and the Ohio River Fish Management Team.

Lake Sturgeon

Objective:

(1) To restore a population of lake sturgeon in the lower Ohio River by year 2010.

Problem

The Department does not know if conditions exist in the lower Ohio River that would allow the re-introduction of lake sturgeon.

Strategy

Determine habitat requirements of the lake sturgeon and whether these requirements can be met in the Ohio River.

Work with MICRA to make this a cooperative project.

Problem

The Department does not know if the existing commercial fishery of the lower Ohio River will adversely impact lake sturgeon introductions.

Strategy

Examine available information from other states regarding susceptibility of sturgeons to various types of commercial gear.

Internal and external public involvement should be initiated prior to this introduction if significant problems associated with commercial fishing are known to exist.

Problem

The Department does not know how and to what extent the construction of the Olmstead Dam will have on reintroduction of lake sturgeon.

Strategy

Work with USFWS and possibly conduct some Habitat Evaluation Procedures (HEP) in various sections of the lower river (above and below proposed dam site).

Channel Catfish

Objective:

(1) To establish an angler catch per hour objective, percentage of all man-hours spent fishing, and harvest rates (with the withdrawal of channel catfish from the Ohio River fish contaminants list).

Problem

The Department lacks current data for monitoring progress toward these objectives.

Strategy

Conduct creel surveys to the extent necessary to assess progress.

Problem

The Department is uncertain that objectives for channel catfish will be satisfactory to anglers.

Strategy

Determine angler expectations for channel catfish fishing.

Problem

Surveys suggest that angler perceptions regarding contamination levels in Ohio River fish could reduce participation and preclude attainment of channel catfish objectives.

Strategy

Measure contamination levels in Ohio River channel catfish, publish findings, and alter objectives and strategies as appropriate.

Measure contaminant levels in different sizes (age classes) of Ohio River channel catfish.

Problem

Limited access to some tailwaters precludes fisherman use.

Strategy

Provide boat ramp access no more than 5 miles downstream from each tailwater.

Coordinate with Corps of Engineers to provide bank and boat access to tailwaters.

Problem

The Department does not know at what levels channel catfish are being harvested from the Ohio River via commercial anglers.

Strategy

Devise a method that can be used to determine the commercial harvest levels of commercial anglers in the Ohio River.

Problem

The Department does not know how and to what extent the construction of the Olmstead Dam will have on channel catfish populations in the Ohio River below Smithland Dam.

Strategy

Work with USFWS and possibly conduct some Habitat Evaluation Procedures (HEP) in various sections of the lower river (above and below proposed dam site).