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THE FISH POPULATION OF THE MAIN STREAM OF THE BIG MUDDY RIVER[1]

WILLIAM M. LEWIS[2]
Southern Illinois University, Carbondale

The Big Muddy River is one of the principal tributaries of the Mississippi River (fig. 1). The river's basin extends 105 miles from north to south, 70 miles from east to west, and covers an area of 2,360 square miles. Water-level fluctuations of the river amount to as much as 20 to 30 feet. High waters on the Mississippi frequently cause a reversal of current in the Big Muddy as far up stream as 40 miles. The river channel throughout most of its course is 20 to 50 feet wide and 50 to 70 feet deep. The banks are almost entirely mud. In the main stream there are a few outcrops of rock and at least one area of gravel bottom. These rock formations are sandstone, which is quite abundant in at least five of the river's eight principal tributaries. The immediate shoreline of the river and its tributaries is quite heavily forested, but much of the watershed is cultivated or pastured.

At least two other studies pertinent to the present discussion have been conducted on the Big Muddy. Walker (1952) investigated the river's physico-chemical characteristics. He summarized his findings in part as follows:

> The chemical conditions of the Big Muddy were usually above the minimum requirements for fish. The occurrence of obviously toxic pollution was spasmodic and localized, and the most toxic conditions were confined to the tributaries. The major pollutants were sewage, creosols, silt, garbage wastes, iron, and other coal-mine wastes.
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> It is probable that the sub-lethal effect of these pollutants is even more important than the lethal effect. Such harm as reduction of food organisms, destruction of spawn, and the rendering of fish impalatable are only a few of the less obvious effects. Pollution quite likely makes the river less suitable for sport fishes such as largemouth bass and channel catfish.

Schuster (1953) investigated the water quality of the Big Muddy. He drew the following conclusions:

(1) Bacterial counts indicate some degree of sewage pollution in the Big Muddy River.

(2) The B.O.D. values of the waters sampled fall within normal limits.

(3) The D.O. content was always above a critical minimum, and averaged highest in per cent saturation when water temperatures were highest.

(4) The chloride content of the Pond Creek tributary is unusually high for the locality, and is the cause of higher than normal values in the Big Muddy River.

(5) The hydrogen ion concentration indicated a slightly alkaline condition during the low water stages, and a slightly acid one at high water stages.

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[2] The writer wishes to recognize the contributions made by William Bain, David Elder, George Zebrun, Donald Mitchell, Darrell Louder, and Gerald Gunning. During the past three years they sampled and made observations on the fish population of the Big Muddy River.

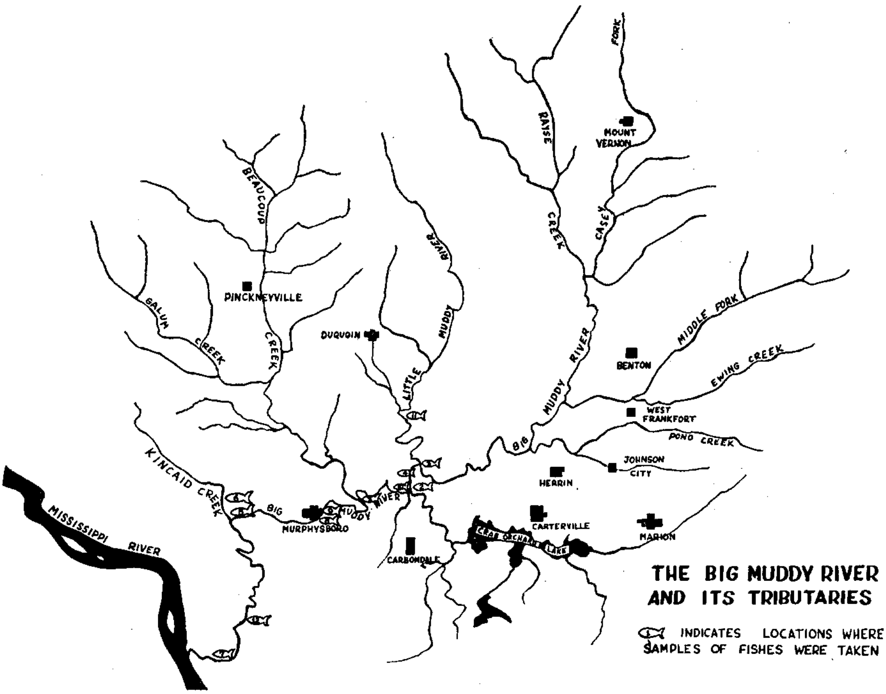

FIG 1.

(6) The ionic content of the waters sampled is mainly chlorides (probably sodium chloride) as evidenced by the correlation of specific conductance measurements with p.p.m. of chlorides.

(7) Turbidity values averaged moderately low, and were mainly due to erosion silt.

(8) Water temperatures closely followed the air temperatures, indicating no appreciable water contribution from springs or hot industrial wastes.

In a supplementary report Mr. Schuster described a fish kill which he observed on June 16, 1953. He reported hundreds of dead fish of all species and some turtles and mussels in Crab Orchard Creek and immediately below its effluence with the Big Muddy. He observed this kill some two or three days after it occurred. He pointed to a possible correlation with a rain which he suggested might have washed toxic materials into the river. There is a tie plant located on the watershed of Crab Orchard Creek.

On February 11, 1954, personnel from the Southern Illinois University fish laboratory sampled Crab Orchard Creek above and below the effluence of Piles Fork, a tributary draining the tie plant area. There was found to be an abundance of fish one-quarter of a mile above the effluence but none at or below it for a distance of approximately three miles. This creosote pollution is probably more important than it might appear. The creosote accumulates in the tie storage area and is washed into the river during rainy periods. Hence the concentration of the material in the river varies. The periods of greatest kill may go unobserved. This same situation applies to mine waste. In fact at least one coal washing plant collects its waste in settling ponds which are periodically opened and drained into the river. Heavy fish kills have been associated with this practice.

Sampling the Fish Population

Three methods were utilized to sample the fish population. During April and May 1951, Mr. Bain fished more-or-less continuously with two wing nets. He also ran catfish baskets occasionally. The hoopnets used were of three mesh sizes: 2, 1½, and 1 inch bar measure. The wing nets were of two sizes: 2½ and 2 inch bar measure. Both types of nets varied from 2 to 4 feet in diameter. The nets were set parallel to the bank and were lifted at three-day intervals. The samples in this series were taken from the Big Muddy at points 1, 2, and 3 (fig. 1). These samples were obtained during relatively high water stages. The sampling stations were very similar in habitat.

During the period August 22 to October 16, 1951, intensive sampling at points 4, 5, 6, and 7 (fig. 1) was done with an electric shocker. The shocker consisted of boat-mounted electrodes powered by a 230 volt 6.3 amp. 160 cycle A. C. electrical generator. During this period the river was at what might be called a normal stage. The habitat afforded by the stations appeared to be the same with the exception of variations in the proximity of pollution sources.

Electrical sampling was also carried out during the period May 25 to July 13, 1953. With the exception of one sample at point 4 all samples were taken at point 8. An additional electrical sample was taken at point 8 on October 9, 1953.

During October 1953 a series of seine samples was taken. The seine used was one-quarter inch mesh minnow seine. At that time the river was low and seining was quite easily carried out. Samples were taken at points 4, 7, 8, 10, 11, and 12 (fig. 1).

Summary.—Water level fluctuations have a pronounced effect upon the capture of fish by the methods used. In the case of the Big Muddy, high water was conducive to higher catches in hoopnets but lower catches by electrical shock. Seining was possible only at very low water stages. The methods of catch are selective. The hoopnets used would obviously be selective as to fish size purely on the basis of the mesh size. They are also known to be selective as to species at least under some conditions. Largemouth bass in clear water are not vulnerable to hoopnets. The electrical shock method is very effective for largemouth bass, carp, and gizzard shad. It appears less effective for crappie, sunfish, buffalo, gar, and catfishes. The minnow seining is suited primarily to minnows and to young fish of other species.

Fish Taken in Samplings

Commercial fishes. — The European carp, *Cyprinus carpio* Linnaeus; largemouth buffalo, *Ictiobus cyprinellus* (Valenciennes); smallmouth buffalo, *Ictiobus bubalus* (Rafinesque); and freshwater drum, *Aplodinotus grunniens* Rafinesque, are abundant in the Big Muddy and dominate the river's fish population. The result is that the majority of the fishing in the river is of a commercial nature.

The blue sucker, *Cycleptus elongatus* (LeSueur), was not taken in our electrical sampling, but several hundred large ripe fish were taken by a commercial fisherman at point 9. These fish apparently ascend the Big Muddy to spawn.

The channel catfish, *Ictalurus lacustris* (Walbaum); blue catfish, *Ictalurus furcatus* (Valenciennes); and shovelhead catfish, *Pilodictis olivaris* (Rafinesque), are rather scarce in the Big Muddy. It is difficult to arrive at an estimate of the population of these fish because they are less vulnerable to the type of electrical shocker used. But, even so, the river is not considered to be very productive of catfish, and our seining during low water did not yield any young catfish.

Relevant to the commercial fishery of the river, Starrett and Parr (1951) reported ten part-time fishermen and one full-time fisherman operated during the year of 1951. They reported the following catch:

Carp	19,167	pounds
Buffalo fish	7,415	,,
Drum	849	,,
Catfish	396	,,

It is of interest that the commercial catch, which is made primarily by hoopnets, is best during high water.

Bait fishes.—The bait fishes of the river are:

Steel-colored minnow, *Notropis whipplii* (Girard)
Emerald shiner, *Notropis atherinoides* Rafinesque
Bluntnose minnow, *Hyborhynchus notatus* (Rafinesque)

The steel-colored minnow is the only bait species abundant enough to be of any interest, and it is not available except during low water, usually in hot weather, at which time it is hard to handle.

Game fishes.—The fish that might be classed as game fish include the following:

White crappie, *Pomoxis annularis* Rafinesque
Black crappie, *Pomoxis nigromaculatus* (LeSueur)
Yellow bass, *Morone interrupta* Gill
White bass, *Lepibema chrysops* (Rafinesque)
Bluegill, *Lepomis macrochirus* Rafinesque
Warmouth, *Chaenobryttus coronarius* (Bartram)
Largemouth bass, *Micropterus salmoides* (Lacepede)
Eastern sauger, *Stizostedion canadense* (Smith)
Walleye, *Stizostedion vitreum* (Mitchill)

The white crappie is the only species abundant enough to support any significant amount of recreational fishing. Crappie fishing is usually good at certain points along the river when the water is not too high and turbid. The crappie that are caught are frequently large ones.

Miscellaneous fishes.—A total of 14 species fall into the miscellaneous category. These are:

Gizzard shad, *Dorosoma cepedianum* (LeSueur)
Longnose gar, *Lepisosteus osseus* Rafinesque
Highfin sucker, *Carpiodes velifer* (Rafinesque)
Carpsucker, *Carpiodes carpio* (Rafinesque)

Blackstripe topminnow, *Fundulus notatus* (Rafinesque)
Mosquito fish, *Gambusia affinis* (Baird & Girard)
Bowfin, *Amia calva* Linnaeus
Orangespot sunfish, *Lepomis humilis* (Girard)
Golden eye, *Amphiodon alosoides* (Rafinesque)
American eel, *Anguilla bostoniensis* (LeSueur)
Northern redhorse, *Moxostoma aureolum* (LeSueur)
River darter, *Imostoma shumardi* (Girard)
Logperch, *Percina caprodes* (De Kay)
Eastern burbot, *Lota lota* (LeSueur)

The gizzard shad is the most prominent and is found in great schools. It is a forage fish for bass and other game fishes, but the game fishes are not abundant enough to utilize it. It is of no value as a sport or pan fish.

Both the longnose and shortnose gars are abundant in the river and are highly efficient predators. It is likely that the river possesses a gar-shad economy which is independent of a carp and catostomid-invertebrate economy.

Fisheries Management of the Big Muddy

In regard to the game fish population, it appears that the important or possibly the controlling factors are: extreme water level fluctuations, lack of spawning facilities, and creosote and mine waste pollution.

The control of water-level fluctuations is certainly within the realm of reason. By the construction of more lakes and by other means, we will hold more much-needed water on the watersheds of our rivers. Ultimately we will have complete control over all the significant water fluctuations of these streams. When this is accomplished and chemical pollution is eliminated, we can make use of now-rapidly-developing management techniques to produce more recreational fishing in these streams.

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