FISHES OF KINKAID CREEK, ILLINOIS

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The primary objective of this study was to determine the species composition of the fishes of Kincaid Creek and its possible potential as a fisheries resource. The ecology of the fishes was in part determined by a study of the physico-chemical characteristics of the habitat, the available food, and the stomach and intestinal contents of the fishes.

Description of Study Area

Kincaid Creek, a tributary of the Big Muddy River, is located approximately six miles west of Murphysboro, Jackson County, Illinois. It is approximately 22 miles long, drains 52 square miles, and has an average gradient of 11 feet per mile. An estimated 60% of the drainage area is forested, with the remainder about evenly divided between pastures and intertilled crops. The creek flows through a narrow, steep-walled valley which seldom exceeds one quarter of a mile in width. The creek bottom is narrow, firm, and covered with rocks, gravel, and sand, except for the lower three miles which are sometimes covered with silt. The flow is normally clear and swift, but is subject to severe water-level fluctuations following heavy rainfall.

In the lower extent of Kincaid Creek the banks are steep and the stream bed as deep as 25 feet. Riffles occur only where debris dams the flow. The stream bed is free of sharp meanders and liberally obstructed with logs, drifts, and snags. Recorded depths range from two to seven feet. Normal flow at this section was 40.8 cubic feet per second in mid-April, and 0.6 cubic feet per second in early July. Water levels may rise as much as 19 feet when backwater from the Big Muddy River encroaches on this area. During periods of flooding, backwater from the Big Muddy River may stop the flow of Kincaid Creek, or even cause it to flow in a reversed direction. In either case, a deposit of silt results from the reduced velocity of the silt-laden waters. This silt is ''flushed'' away by subsequent high water flowing into the Big Muddy River. When not covered with this silt layer, the stream bottom is generally firm and sandy.

The middle reaches of the creek pass through a narrow, steep-walled valley. The banks are generally steep, with the stream bed as deep as 20 feet. The stream is free of sharp meanders and bordered on one side by a steep valley wall. The stream bottom is largely sand with some gravel, bedrock, and larger stones. Large pools and riffles occur and are liberally filled with rocks, tree trunks, and snags. Pools 10 to 25 feet wide and up to 400 feet in length are interspersed with riffles from 10 to 75 feet long. The normal flow in this area was recorded at 10.8 cubic feet per second in mid-April and 1.0 cubic foot per second in early July. Water levels fluctuate as much as 15 feet.

The headwaters flow through an area of moderately rugged, timbered hills. The banks are generally steep with the stream bed as deep as 20 feet. The stream meanders sharply and is characterized by vertical banks and trees toppled into the water. A definite pool-riffle development is present with the pools 8 to 15 feet wide and up to 40 feet long, interspersed with riffles up to 40 feet long. The stream bottom is sandy, mixed with gravel and stones. The normal flow was recorded at 3.5 cubic feet per second in mid-April and 0.2 cubic foot per second in early July. Water levels vary as much as 16 feet.

During the study period water temperatures varied from 38° to 85° F. and tended to fluctuate with the air temperature. The pH was fairly uniform at all sections and ranged from 7.2 to 8.0. Dissolved oxygen varied from 5.2 to 9.3 p.p.m., which is well within the range of fish requirements (Moore, 1942). Turbidity was generally moderate but fluctuated with water-level changes caused by heavy rainfall. In general, the most extreme turbidities were found in the upper and lower reaches of the creek (Table 1). The entire stream is characterized by the rapid clearing of the water following heavy rainfall.

Methods of Study

The study period extended from February 18 to July 4, 1958. Three sampling stations were established along the main channel of Kinkaid Creek and two on tributaries (Roman numerals I through V, Fig.1). These stations were selected to represent different types of habitat. A collection site consisted of a pool and associated riffle.

Surface temperature and pH were determined in the field, using a Taylor field kit and a hand thermometer. Water samples for dissolved oxygen analysis were fixed in the field and returned to the laboratory where determination in p. p. m. was made by the Winkler method (Welch, 1948). Turbidity was determined in the laboratory by use of a Hellige turbidimeter. Water samples were collected with standard collection bottles and a Kemmerer water sampler. Volume of stream flow was calculated with the aid of a Gurley Model 622-E flow meter.

Three collections were taken at each station, beginning in early March and ending in late June. Immediately after capture all fish were preserved in 10% formalin and returned to the laboratory for examination. A 12- by 4-foot, knotted, 1-mesh minnow seine with 0.25-inch mesh was employed at all stations except I. It could not be used at I due to snags, rocks and deep water.

An electrical shocking device consisting of a D. C., 180-volt, 250-watt, portable generator proved particularly useful for collecting during clear water conditions. A minnow seine was employed downstream to capture any stunned fish that floated with the current.

Fyke and hoop nets were utilized at stations I and IV where deep water, vertical banks, and snags limited the use of other types of collecting gear.

Sodium cyanide (Bridges, 1958) was used as a means of making a single collection at each station except I, in late June. When fish

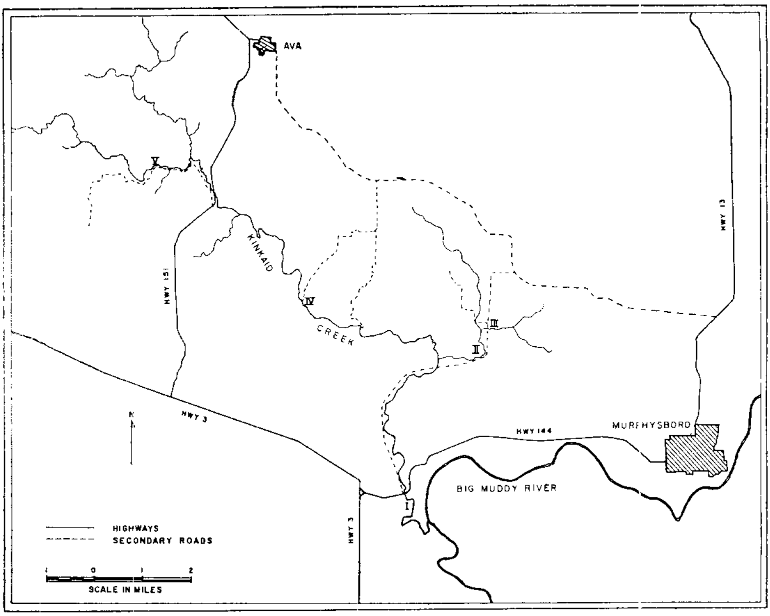

Fig. 1.—Kincaid Creek drainage.

were exposed to concentrations of 1 p.p.m. sodium cyanide they became distressed and surfaced, and thus were easily netted. Although previous use of this method had been limited to farm ponds, it proved successful for stream collecting. A minnow seine was employed downstream from the collecting area to capture disabled fishes carried by the current. At Station IV the stream flow was diverted by use of an earthen dam and a canvas divider, forming a pool through which no current flowed. This pool was then poisoned and the fishes collected.

Plankton samples were taken by pouring 20 liters of water through a plankton net. Water for such samples was collected from the surface one foot of pools. Samples were examined with the use of a Sedgewick-Rafter counting cell and a compound microscope.

Several attempts were made to collect samples of bottom fauna from deep pools, but in general this proved unproductive, due to the hard, sandy bottom and the consequent lack of organisms. For this reason, all samples of bottom fauna were taken from shallow, rocky riffles using a Surber bottom sampler. Samples were preserved in 10% formalin and returned to the laboratory for examination.

Stomach or intestinal analyses were made on all species of fishes collected. One hundred was arbitrarily selected as the approximate maximum number of a species to be examined when sufficient fish were available. A detailed analysis was purposely avoided because only an

TABLE 1.—Physico-chemical Data from Kinkaid Creek, Illinois, April to July 1958.[1]

Station	Date	Air temp. °F.	Water temp. °F.	pH	Dissolved O_2 p.p.m.	Turbidity p.p.m.
I	19 April	74	66	7.5	7.2	32
IV		74	62	7.3	7.4	15
V		60	60	7.2	7.5	18
I	3 May[2]	..	..	7.7	7.1	285
II		..	..	7.3	7.4	93
V		..	..	7.4	7.6	330
I	6 May	72	60	7.3	5.8	165
II		72	62	7.3	8.3	36
III		72	58	7.9	9.3	18
V		72	62	7.4	5.1	36
I	4 July	83	76	7.3	5.7	27
II		88	85	8.0	7.2	11
III		88	85	7.4	6.7	11
IV		87	79	7.3	5.2	20
V		84	75	7.5	5.2	20

[1] Includes only samples taken from various stations during same day.
[2] 12 hours following estimated one-inch rain.

index to possible food consumption was the desired objective In fishes with poorly defined stomachs the intestinal content was examined. Although 1,258 fish were examined, only general references are made to these data in this article.

A gross gonadal examination was made of all specimens opened for stomach or intestinal analysis. An effort was made to determine from these observations the approximate spawning periods for each species.

If fewer than 25 specimens were collected of any given species the results of the food analysis and gonadal examinations were arbitarily considered inconclusive and consequently not included in this paper.

Fish Populations

A total of 38 species and one hybrid cross were taken (Table 2). In the following discussion the status of each species from Kinkaid Creek is reviewed, in addition to presenting results of food habit and gonadal examinations.

Single specimens of the longnose gar, *Lepisosteus osseus* (Linnaeus); shortnose gar, *Lepisosteus platostomus* Refinesque; and bowfin, *Amia calva* Linnaeus, were taken at station I during flood stage.

Gizzard shad, *Dorosoma cepedianum* (LeSueur).—Three taken at station I during high water.

River carpsucker, *Carpiodes carpio* (Rafinesque).—One taken at station I during flood stage.

White sucker, 0.9% of total number fish collected. This species subsisted mainly on bottom ooze, detritus, and dipterous larvae. Spawning during April and May.

Spotted sucker, *Minytrema melanops* (Rafinesque).—One adult female, taken in mid-April from station IV, contained well-developed eggs and possibly was migrating toward the headwaters to spawn.

Creek chubsucker, 0.6%. Spawning during late April and May.

TABLE 2.—Fishes Collected in Kinkaid Creek, Illinois, March to June 1958.[1]

Common Name[2]	Scientific Name[3]	Number of species by station					
		I	II	III	IV	V	Total
White sucker	*Catostomus commersoni* (Lacepede)		17	6	2	1	26
Creek chubsucker	*Erimyzon oblongus* (Mitchill)		5	5	6	1	17
Golden redhorse	*Moxostoma erythrurum* (Rafinesque)		17	1	20		38
Creek chub	*Semotilus atromaculatus* (Mitchill)		51	71	111	30	263
Emerald shiner	*Notropis atherinoides* (Rafinesque)				21		21
Red shiner	*Notropis lutrensis* (Baird and Girard)		28	9	76	87	200
Redfin shiner	*Notropis umbratilis* (Girard)		7	9	29	32	77
Sand shiner	*Notropis deliciosus* (Girard)		26	10	149	154	339
Silverjaw minnow	*Ericymba buccata* (Cope)		1			28	29
Suckermouth minnow	*Phenacobius mirabilis* (Girard)		7	23	21	9	60
Bluntnose minnow	*Pimephales notatus* (Rafinesque)		58	186	424	116	784
Stoneroller	*Campostoma anomalum* (Rafinesque)		20	111	139	50	320
Channel catfish	*Ictalurus punctatus* (Rafinesque)	1			5		6
Yellow bullhead	*Ictalurus natalis* (LeSueur)		17	21	11	3	52
Black bullhead	*Ictalurus melas* (Rafinesque)	2	8	8	3		21
Blackstripe topminnow	*Fundulus notatus* (Rafinesque)	1	6	2	4	2	15
Pirateperch	*Aphredoderus sayanus* (Gilliams)		3	3	4		10
Log perch	*Percina caprodes* (Rafinesque)			1	22	4	27
Blacksided darter	*Percina maculata* (Girard)			2	6	10	18
Orangethroat darter	*Etheostoma spectabile* (Agassiz)		1	20	11	9	41
Fantail darter	*Etheostoma flabellare* (Rafinesque)			40	129	16	185
Johnny darter	*Etheostoma nigrum* (Rafinesque)		14	9	19	11	53
Green sunfish	*Lepomis cyanellus* (Rafinesque)		28	33	17	7	85
Longear sunfish	*Lepomis megalotis* (Rafinesque)		21	9	15		45
Bluegill	*Lepomis macrochirus* (Rafinesque)	1	3	4			8
Orangespotted sunfish	*Lepomis humilis* (Girard)		10	14	3	3	30
White crappie	*Pomoxis annularis* (Rafinesque)	22					22
Totals (including species listed in text)		42	354	599	1,250	573	2,818

[1] To facilitate printing, species of lowest occurrence are listed in the text only.
[2] Phylogenetic order from Jordan, *et al.*, 1930.
[3] Eddy, 1957.

Golden redhorse, 1.3%. All specimens but one were captured with aid of sodium cyanide. Food analyses could be made for June only because of lack of representatives for other study months. Primary foods were dipterous larvae, detritus, and crustaceans. Spawning previous to late June.

Carp, *Cyprinus carpio* (Linnaeus).—Five taken at station I.

Creek chub, 9.3%.—Main foods were terrestrial insects, dipterous larvae, and plant materials. Spawning during April and May.

Emerald shiner, 0.7%.—All specimens taken same day from a deep swift riffle at station IV.

Red shiner, 7.1%.—Major foods were terrestrial insects, aquatic insects, and bottom ooze. Major spawning after June.

Redfin shiner, 2.7%.—Taken at all stations except I. Food habits of this fish differed from the other shiners in that it fed primarily on terrestrial insects during entire collecting period. Spawning began in June and extended into July.

Sand shiner, 12.0%.—Stomachs revealed bottom ooze, aquatic insects, and dipterous larvae. Spawning during late May and June.

Silverjaw minnow, 1.0%.—Collecting stations at which this species was collected indicated it to be best adapted to ecological conditions found in headwaters. Examinations of 30 individuals revealed this species fed primarily on dipterous larvae, bottom ooze, and aquatic insects. Spawning in May and early June.

Suckermouth minnow, 2.1%.—Feeds predominantly on dipterous larvae and detritus. Spawning peak in May.

Bluntnose minnow, 27.8%.—This was most abundant of all fishes and was basically a bottom feeder on dipterous larvae, bottom ooze, and plant material. Spawning after June.

Stoneroller, 11.3%. — This bottom feeder subsisted mainly on bottom ooze and dipterous larvae. Spawning peak in late April and May.

Channel catfish, 0.2%.—From deep water at stations I and IV. Although this is one of the more important sport fishes in the Big Muddy River, it appearently was not well established in Kinkaid Creek.

Yellow and black bullheads, 1.8 and 0.7%, respectively.—Stomachs of 46 yellow bullheads revealed crustaceans and aquatic insects as main foods. Spawning in May and early June.

Tadpole madtom, *Noturus gyrinus* (Mitchill).—Three collected from small tributaries at stations II and III.

Blackstripe topminnow, 0.5%.—Spawning began in late June.

Pirateperch, 0.3%.—Conclusive spawning data could not be obtained due to lack of specimens; however, some spawning in late April and early May.

Log perch, 0.9%.—Stomachs of 27 log perch revealed mainly aquatic insects, dipterous larvae, and terrestrial insects. Gonads of fish collected in late May were spent, indicating that spawning had occurred.

Blacksided darter, 0.6%. — Captured exclusively from deep pools bordered with debris. All but one specimen collected with sodium cyanide. Gonads spent when taken in late June.

Orangethroat darter, 1.4%.—Subsisted mainly on dipterous larvae, aquatic insects, and crustaceans. Spawning during late April and May. The author could not find a record of the orangethroat darter in southern Illinois. It is possible that this species has been collected and misidentified as the rainbow darter, *Etheostoma caeruleum* Storer.

Fantail darter, 6.6%.—Fed mainly on dipterous larvae, aquatic insects, and crustaceans. Spawning in late May and early June.

Johnny darter, 1.9%.—Taken at all stations except I. Foods were primarily dipterous larvae and aquatic insects. Peak of spawning probably in late May.

Spotted bass, *Micropterus punctulatus* (Rafinesque).—Single sub-adult collected at station II and another at IV. Although the habitat appeared to be favorable for this species, it was not well established in Kinkaid Creek.

Green sunfish, 3.0%.—The most abundant sport fish. Stomach analyses of 63 fish revealed primarily crustaceans, terrestrial insects, and small cyprinid fishes. Spawning peak in late June.

Longear sunfish, 1.6%.—Stomachs of 45 fish revealed primary foods to be aquatic insects, crustaceans, and terrestrial insects. Peak of spawning during June.

Bluegill. Eight specimens.

Orangethroat sunfish, 1.1%.—Stomachs of 28 fish revealed crustaceans, aquatic insects, and dipterous larvae as primary foods consumed. Spawning during May and early June.

Warmouth, *Chaenobryttus coronarius* (Bartram).—Single specimen, station IV.

White crappie, 0.8%.—Not well established in Kinkaid Creek; probably migrates upstream during periods of high water. Stomachs of 22 indicated subsistence primarily on small cyprinid fishes and crustaceans.

Black crappie, *Pomoxis nigromaculatus* (LeSueur).—Four specimens, station I.

Interrelationship Among Species

Predation among the fishes of Kinkaid Creek was low during the study. The lack of large predator fishes was a major factor. The crappies, green sunfish, longear sunfish, and creek chub were the principal predators. Starrett (1950) found that little predation exisited among similar fishes in the Des Moines River, Iowa, during the same period, but that it increased in late summer and fall as the aquatic nymphs and larvae decreased. This would possibly hold true in Kinkaid Creek, but to a more marked degree. With the coming of the dry summer months, the flow of Kinkaid Creek normally decreases, reducing the size of pools and riffles. The construction of the available habitat will naturally bring the fishes into a more confined situation and will limit the available food sources. In addition to these factors, the appearance of the recently hatched spawn would make predation more probable.

It is difficult to demonstrate harmful interspecies competition among fishes for food. Lagler (1944) stated that the fact that two or more species of fishes feed on the same organisms does not mean such competition is harmful to one of the species. If these food items are sufficiently abundant, no harm will come from such competition.

There was no apparent relationship between the comparative number of available riffle organisms and the diet of the fishes. A sizable proportion of the consumed food supply apparently came from a source other than riffles, possibly from other portions of the creek, blown in by winds, dropped from overhanging vegetation, or washed from the surrounding watershed. No attempt was made to sample these sources or determine a percentage of the overall food supply derived from them.

It was concluded from the small number of empty stomachs and from evidence of low predation among the fishes, that harmful interspecies competition for food was not great.

Plankton was studied separately due to its size and utilization by smaller fishes (Bajkov, 1932). Samples were collected from pools from April to early July. The largest numbers appeared in July, when 73, 53 and 33 plankters per liter were taken from stations I, IV, and V, respectively. Such an extremely low count may be attributed to the constantly flushing action of spring rains. Shelford and Eddy (1929) found that "new" water in the Sangamon River, Illinois, contained practically no plankton after nine days.

Bajkov (1932) stated that the greatest cause of mortality among fish fry is the lack of food, especially plankton organisms. It is probable that the most harmful interspecies competition for food is among the fish fry which feed on plankton.

Discussion

It is evident from the collections that there are few catchable size sport fishes in Kinkaid Creek. Management procedures are impractical, due mainly to the lack of access roads, excessive flooding, and absence of desirable sport species. A large scale impoundment would be the principal requirement to improve sport fish habitat. Such an impoundment has been proposed repeatedly in the past. As recently as 1957, official mention has been made of Kinkaid Creek as a possible site for such a project (Department of Registration and Education, 1957). The construction of such an impoundment would have definite benefit toward increasing suitable sport fishing habitat at slight loss of productive farmland and wildlife habitat. Until such an impoundment is constructed, the primary fisheries resource of Kinkaid Creek is its bait fish population. Collection of bait species is facilitated by the abundance of suitable pools at stations II, III, and V. Lack of access roads prevents proper utilization of other areas where bait fishes are equally abundant.

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Literature Cited

Bajkov, A. D. 1932. Fish population and productivity of lakes. Trans. Amer. Fish. Soc., 62:307-316.

Bridges, W. R. 1958. Sodium cyanide as a fish poison. U. S. Fish and Wildl. Serv., Spec. Sci. Fish. Rept. 253, 11 pp.

Department of Registration and Education. 1957. Potential water resources of southern Illinois. Ill. State Water Surv. Div., Rept. Invest. 31, 97 pp.

Eddy, Samuel. 1957. How to know the freshwater fishes. Dubuque, Iowa, Wm. C. Brown Co., 253 pp.

Jordan, David S., Barton W. Evermann, and Howard W. Clark. 1930. Check list of the fishes of North and Middle America. U. S. Govt. Print. Off., Wash., D. C., 670 pp.

Lagler, Karl F. 1944. Problems of competition and predation. Trans. 9th N. Amer. Wildl. Conf., pp. 212-219.

Moore, Walter G. 1942. Field studies on the oxygen requirements of certain freshwater fishes. Ecol., 23(3):319-329.

Shelford, V. E., and S. Eddy. 1929. Methods for the study of stream communities. Ecol., 10:382-391.

Starrett, Wm. C. 1950. Distribution of the fishes of Boone County, Iowa, with special reference to the minnows and darters. Amer. Midl. Nat., 43:112-127.

Welch, Paul S. 1948. Limnological methods. New York, McGraw-Hill Co., 381 pp.

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