

The Fishes of Goose Creek, Jefferson County, Kentucky: A Stream Under the Influence of Urban Development¹

DAVID S. WHITE², FREDERICK C. HILL³, AND KIM H. HAAG⁴

Department of Biology and Water Resources Laboratory, University of Louisville,
Louisville, Kentucky 40208

ABSTRACT

Goose Creek is a small, springfed stream beginning to show the influence of urban development along its banks. During the study, 63 species of fishes were collected in Goose Creek and annotations are given for each. Although sedimentation and discharges from sewage treatment plants are beginning to affect the distribution of fishes, the populations were extensive and possibly even enhanced by the additional nutrients that entered the stream during the study period. At present, Goose Creek not only has an assemblage of fishes that inhabit small streams, but is utilized by many species from the Ohio River as a breeding and foraging ground.

INTRODUCTION

Although much is known of the fishes and limnology of the Ohio River and its larger tributaries, little has been published on the numerous small streams directly tributary to the river. Krumholz et al. (1962) examined the fish populations at the mouths of many of the smaller streams in the Louisville area and listed the species inhabiting those areas. Minckley's (1963) study on Doe Run, a torrent spring stream 60 km downstream from Louisville, allows some comparisons with Goose Creek; however, Doe Run is atypical of most streams entering the Ohio River. Other published records of smaller streams along this section of the Ohio are extremely limited.

Within the counties in Kentucky and Indiana comprising the greater metropolitan area of Louisville, 42 first to fourth order (Horton 1945, Kuehne 1962) tributaries enter the Ohio River. In the course of the developing city, most of those tributaries have been drastically altered as habitats for fishes and other aquatic animals, and, unfortunately, we know little

of the original faunas and the changes that have occurred.

Goose Creek, although beginning to feel the pressures of urban expansion, is one of the few remaining streams in the Louisville area along which there are relatively undisturbed reaches. This paper provides a detailed account of the fishes and limnological data of Goose Creek so that we may note the changes that take place within the next few years as urbanization continues.

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² Present address: University of Oklahoma Biological Station, Kingston, Oklahoma 73439.

³ Present address: Department of Biology, Bloomsburg State College, Bloomsburg, Pennsylvania 17815.

⁴ Present address: Department of Biology, Universiti Pertanian, Selangor, Malaysia.

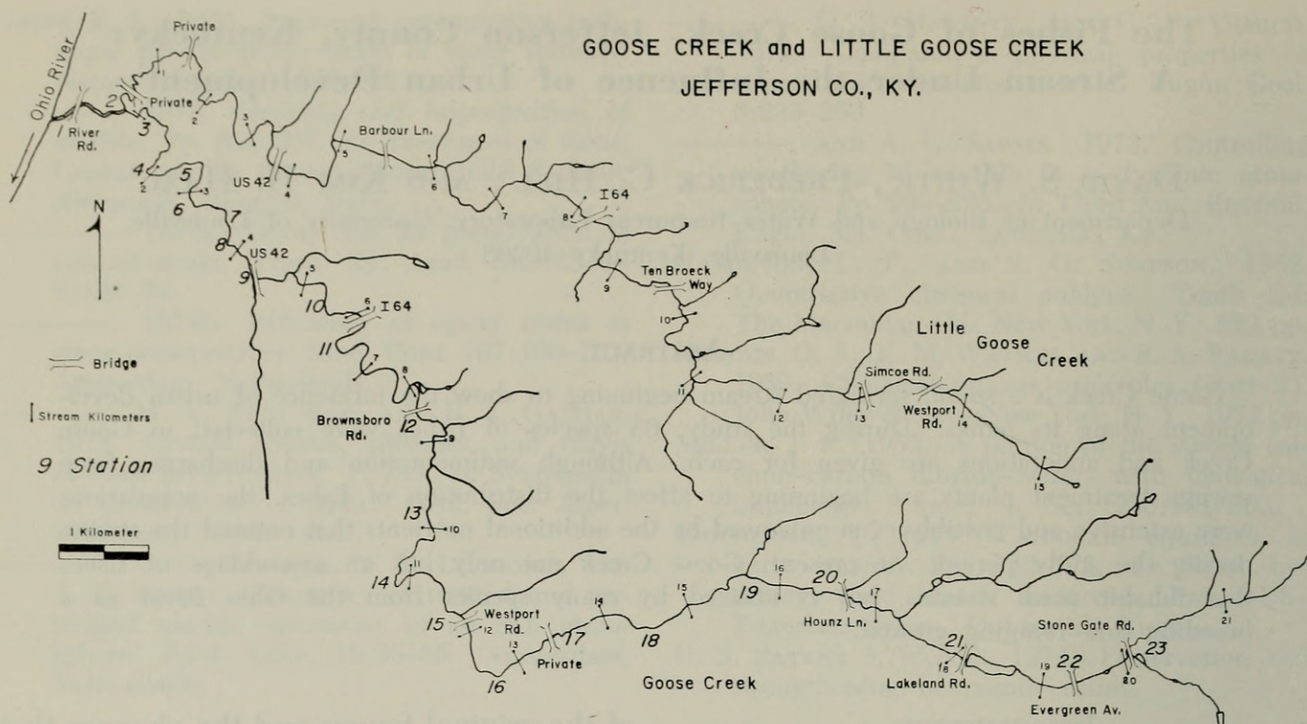


FIG. 1. Map of Goose Creek, Jefferson County, Kentucky, showing locations of sampling stations.

METHODS

From September 1971 to July 1973, fish were collected at least monthly from 23 stations on Goose Creek with occasional samples from Little Goose Creek at Barbour Lane (Fig. 1). A boat equipped with an electrofisher (Larimore et al. 1950) was used to collect fishes from the deeper pools and backwaters. In the shallower portions of the stream, a handheld shocker, common sense seines, bag seines, and dip nets were used in the collections. Both the handheld and boat electrofishers were powered by a Sears 1250-watt alternator. Records and measurements were taken in the field to prevent reduction or elimination of less abundant types; however, representatives of each species were preserved and deposited in the University of Louisville Fish Collections, Louisville, Kentucky.

Identifications were made using Trautman (1957), Clay (1962), and Eddy (1969). With the exception of *Notropis cornutus chrysocephalus* (Resh et al. 1973), both the scientific and common names follow those given by Bailey et al. (1970).

In February, April, July, and October 1972, population estimates were made at Stations 2, 9, and 15 using successive re-

moval (DeLury 1947). Using an IBM-360a computer and programs developed by the Water Resources Laboratory, University of Louisville, weights (kg/ha) and numbers (no/ha) were calculated for each population estimate.

Physical and chemical parameters of Goose Creek were analyzed following the procedures given in *Standard Methods for the Examination of Waste and Waste Water* (American Public Health Association 1971). Discharge, conductivity, pH, total alkalinity, dissolved oxygen, and chlorine were measured in the field.

In addition to the data from this study, a collection by Krumholz et al. (1962) in June 1958, Cat. No. 9228, University of Louisville, from the area of Station 2 was used as a comparison. Field notes were supplied by Krumholz.

STUDY STREAM

At its mouth, Goose Creek (Fig. 1) is a fourth order (Horton 1945, Kuehne 1962) tributary to the Ohio River that drains approximately 60 km² of woods, fields, and residential areas in northeastern Jefferson County, Kentucky. Arising near Anchor-age, Kentucky, the main stem flows west

then northwest for approximately 22 km. The principal tributary, Little Goose Creek, parallels Goose Creek for more than 15 km and joins the main stem 0.8 km upstream from the Ohio River.

Goose Creek can be divided into 4 distinct regions by physical characteristics and by the extent of urban development. Stations 1 and 2 are in backwaters of the Ohio River, with Station 1 extending from the mouth to the River Road bridge. During the summer, numerous boats are moored along the banks and it is common to see much of the surface covered by gasoline and oil. The boat traffic and wakes from passing barges on the Ohio River often cause considerable turbulence throughout this station. Station 2 essentially is a continuation of Station 1; however, the bridges at River Road coupled with several large log jams provide a barrier against turbulence from the mouth. Station 2 extends from the River Road bridges to the confluence of Goose and Little Goose creeks. This portion of the backwater is 10–20 m wide and 2–7 m deep with a substrate of deep silt to hard mud with occasional patches of sand. The riparian lands of Stations 1 and 2 are primarily pasturage.

At the confluence of the 2 streams, there is a shallow mud riffle distinctly separating the backwater from the continuous pool stations. The pool, Stations 3–9, is in the floodplain of the Ohio River, ranging from 10 to 2 m wide and from 3 to 0.5 m deep over a substrate of hard mud with occasional deposits of silt and sand. Individual stations were created by dividing the long pool into 7 sections, each approximately 250 m long. Station 9 consists of 7 small pools separated by shallow sand riffles. This station resembles the riffle pools of Stations 10–15; however, with the slightest high water, and for some time after each rain, Station 9 becomes indistinguishable from the long pool. There has been little urban development along this portion of the stream and it contains some very old undisturbed stands of cottonwood, sycamore, maple, and walnut.

The stream at Stations 10 to 15 flows

over Lower and Middle Silurian limestones and Corydon soils (McFarlan 1943). Bottom materials are gravel and rubble with occasional outcroppings of bedrock. This section is characterized by numerous pools up to 5 m wide, 20 m long, and 1 m deep connected by fast-flowing riffles. A few small farms border the stream between Stations 12 and 15, but, although there are several private homes along the creek, the area has not been developed extensively.

In its upper 10 km (Stations 16–23), the stream flows over bedrock of Middle Devonian limestone and Lower and Middle Silurian shales, limestones, and shaley limestones (McFarlan 1943). In most places, the stream is no more than a few centimeters deep with occasional gravel bottomed pools up to 0.5 m deep. Above Station 15, urban development has increased rapidly in the past 20 years. U. S. Geological Survey maps (corrected in 1950) showed fewer than 100 homes and buildings within 1 km of Goose Creek. By 1971, the number of homes and buildings within 1 km of the creek had increased to more than 300 with an additional 1,000 new buildings within the drainage basin.

Although the stream bed at Stations 16–23 had not been changed greatly, it now flows in and around numerous apartment complexes, back yards, schools, and small parks. Though many of the private homes are 20 to 30 years old, most of the schools and apartment complexes have been constructed within the past 10 years. To handle wastes from this developing area, 2 municipal sewage treatment plants and 19 package treatment plants were emptying their effluents into Goose and Little Goose creeks as of late 1972.

There is little aquatic vegetation along most sections of Goose Creek, though many of the pools are lined with duckweed *Lemna minor* during late summer. The major components of the benthic invertebrate fauna consist of *Lirceus* spp. and *Asellus militaris* (Isopoda); *Gammarus* sp. and *Crangonyx* sp. (Amphipoda); *Baetis* spp. and *Stenonema* spp. (Ephemeroptera);

TABLE 1.—PHYSICAL AND CHEMICAL PARAMETERS OF GOOSE CREEK AT STATIONS 2, 9, AND 15.
NUMBER OF SAMPLES IN PARENTHESES

	Station 2		Station 9		Station 15	
	Range	Mean	Range	Mean	Range	Mean
Discharge (m ³ /sec)	—	—	0.14–0.68	0.30 (10)	0.06–0.38	0.12 (4)
Turbidity (SiO ₂ ppm)	17–145	34 (11)	9–140	25 (11)	15–298	145 (4)
Conductivity (μmho/cm)	275–410	350 (8)	380–475	430 (8)	380–440	400 (4)
pH	6.2–7.8	— (8)	7.0–7.6	— (8)	7.2–7.6	— (4)
Total hardness (ppm)	132–168	150 (8)	140–200	175 (8)	120–183	170 (4)
Total alkalinity (ppm)	82–125	98 (8)	129–168	152 (8)	140–168	152 (4)
Dissolved oxygen (% sat)	56–72	— (14)	100–140	— (14)	100–108	— (4)
Calcium (ppm)	32.2–44.8	36.8 (8)	40.5–55.0	50.2 (8)	40.2–48.1	45.2 (4)
Magnesium (ppm)	9.1–13.6	12.1 (8)	10.2–17.9	15.6 (8)	6.1–15.3	11.5 (4)
Iron (ppm)	—	0.0 (1)	—	0.3 (1)	—	0.6 (1)
Sulfate (ppm)	8.0–75.0	24.0 (8)	6.0–67.0	23.0 (8)	27.3–73.2	44.5 (4)
Nitrate (ppm)	0.52–17.2	3.4 (8)	5.0–214.3	47.6 (8)	6.5–250.0	68.7 (4)
Nitrite (ppm)	0.00–0.08	0.01 (8)	0.00–1.60	0.31 (8)	0.03–2.19	0.77 (4)
Chlorine (ppm)	0.0–tr	0.0 (8)	0.0–0.5	0.2 (8)	0.2–0.8	0.5 (4)
Total phosphate (ppm)	1.0–5.2	3.6 (8)	1.8–19.5	8.3 (8)	3.7–23.7	9.1 (4)
Temperature (°C)	5–28	13.6 (21)	4–25	13.0 (21)	6–22	14.0 (4)

Cheumatopsyche spp. (Trichoptera); *Simulium vittatum* and several genera of Chironomidae (Diptera); *Stenelmis sexlineata* (Coleoptera); and *Physa integra*, *Sphaerium* spp., and *Corbicula manilensis* (Mollusca). Though occasional shells of *Anodonta grandis* were noted, no live unionids were found.

A summary of the physical and chemical characteristics of Goose Creek is given in Table 1. The discharges from tributaries and effluents during 1972 were composed primarily of ground water, with more than half the volume coming from 18 major tributary springs. In the period of lowest recorded flow (17 August 1972), approximately a third of the total discharge at Station 9 was estimated to come from the municipal and package sewage treatment plants. Because Station 2 is in the backwater of the Ohio River, discharge could not be measured satisfactorily. The net flow in the backwater is quite small and results in stagnation during the summer.

Most chemical properties are well within the ranges given for other streams in this area of Kentucky (Minckley 1963, Neff and Krumholz 1973, Krumholz and Neff 1975). Except in the backwater, oxygen levels were at or above saturation. Levels of nitrites, nitrates, and total phosphates

occasionally were quite high because of inefficient operation of one or more treatment plants; however, no fish kills were reported or observed.

The stream always is slightly turbid and colored. After each rain, the turbidity increases rapidly, particularly at Station 15 because of construction along the upper portions of Goose Creek.

The distribution of water temperatures for Goose Creek at Stations 2, 9, and 15 are shown in Fig. 2. The springs keep the water temperature below air temperature in the summer and rarely is there ice during winter. The temperatures at Station 2 reflect the temperatures of the Ohio River, i.e., elevated in summer as a result of little net flow.

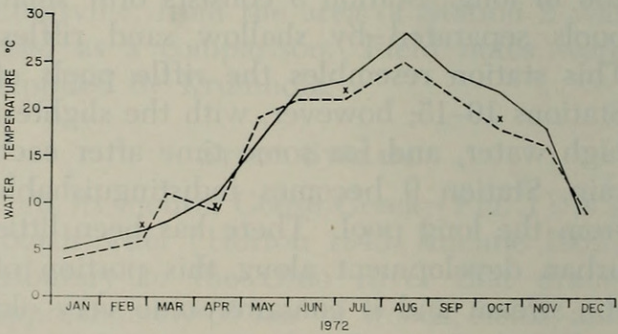


FIG. 2. Water temperatures of Goose Creek, Jefferson County, Kentucky, during 1972: Station 2 (—), Station 9 (---) and Station 15 (x).

ANNOTATED LIST OF FISHES

Sixty-three species representing 37 genera and 15 families of fishes were collected. The following list includes the species from Goose Creek and 2 species collected only from Little Goose Creek. Those marked with an asterisk (*) were taken also in the 1958 collection (UL 9228) from Station 2, and all species taken then were collected during this study.

LEPISOSTEIDAE

Lepisosteus osseus. Longnose gar.—Small specimens up to 200 mm occasionally taken from lower stations. Most abundant in early fall. Adults abundant in Ohio River but rarely enter Goose Creek.

Lepisosteus platostomus. Shortnose gar.—One 320-mm adult taken in fall from backwater area.

ANGUILLIDAE

Anguilla rostrata. American eel.—One large specimen netted after being injured by boat.

CLUPEIDAE

Alosa chrysochloris. Skipjack herring.—Large specimens occasionally taken from backwater area. Common in Ohio River but rarely enters Goose Creek.

Dorosoma cepedianum. Gizzard shad*.—Abundant from Stations 1 to 15. Both an immigrant from the Ohio River and a permanent resident in Goose Creek. Large schools containing several hundred young of the year often seen. In fall, schools of several hundred adults enter Goose Creek from the Ohio River to forage in the lower reaches of the stream.

ESOCIDAE

Esox americanus vermiculatus. Grass pickerel.—Two small specimens taken from backwater area.

CYPRINIDAE

Campostoma anomalum. Stoneroller.—Present in most collections from Stations 9 to 20. Most abundant in deeper pools

from Stations 9 to 15. Breeding not observed anywhere in the stream, but tuberculate males had freely flowing milt until until early June.

Carassius auratus. Goldfish.—Occasionally taken from backwater area. One large specimen weighed over 6 kg.

Cyprinus carpio. Carp*.—Abundant in lower reaches of stream. Large gravid females entered from the Ohio River during early spring. Males rarely taken. A second population of 1-, 2-, and 3-year-old fish was present at Stations 13 to 16 in pools below major sewage effluents.

Ericymba buccata. Silverjaw minnow.—Not abundant. Collected from pools at Stations 9 to 15.

Hybopsis storeriana. Silver chub*.—One specimen taken from backwater.

Notemigonus crysoleucas. Golden shiner*.—Two specimens, one from Station 3 and another from Station 9.

Notropis ardens. Rosefin shiner.—Occasional specimens taken from Stations 10 to 15. One male with tubercles and in breeding coloration taken in early May. No breeding observed.

Notropis atherinoides. Emerald shiner.—Most abundant fish in stream. Schools containing several thousand fish were present throughout the year. Numbers decreased from Stations 1 to 9. Replaced at Station 9 by the bluntnose minnow.

Notropis blennioides. River shiner*.—Occasional immigrants from the Ohio River taken from backwater area.

Notropis cornutus chrysocephalus. Striped shiner.—Occasional specimens taken from pools at Stations 9 to 15.

Notropis spilopterus. Spotfin shiner.—Taken with, but not as abundant as, the rosefin or striped shiners.

Notropis stramineus. Sand shiner.—One specimen taken from backwater area.

Pimephales notatus. Bluntnose minnow*.—

Most abundant species above Station 9. Breeding observed in early May in tributary to Station 15.

Rhinichthys atratulus. Blacknose dace.—Abundant in riffles and tributaries at Stations 13 to 16. Breeding observed in early June in shallow pools with sand and fine gravel.

Semotilus atromaculatus. Creek chub.—Occasionally taken between Stations 9 and 16. Large, tuberculate males taken in early May but no spawning observed.

CATOSTOMIDAE

Carpiodes carpio. River carpsucker*.—Large specimens taken from backwater area. Very abundant in the Ohio River.

Carpiodes cyprinus. Quillback.—Four specimens taken in backwater area.

Catostomus commersoni. White sucker*.—Occasionally taken with golden redhorse and spotted sucker from Stations 1 to 9. Replaces those species above Station 9 where it is quite abundant. Breeding observed in late May over riffles at Stations 13, 14, and 15. Very tolerant of sewage effluents entering around those stations.

Hypentelium nigricans. Northern hog sucker.—Very common in the riffles at Stations 9 to 15. Breeding observed in early April. Young of the year abundant in shallow areas of pools by first of August.

Ictiobus bubalus. Smallmouth buffalo.—Three large specimens taken from backwater area.

Ictiobus niger. Black buffalo.—Several large specimens taken throughout the year from backwater area.

Minytrema melanops. Spotted sucker*.—Most abundant catostomid at Stations 1 to 9. Often taken in association with golden redhorse and white sucker. Breeding observed in riffles at Station 9. Young do not leave breeding area until second or third year.

Moxostoma anisurum. Silver redhorse.—

One small specimen taken from backwater area.

Moxostoma carinatum. River redhorse.—One large specimen taken from backwater area.

Moxostoma duquesnei. Black redhorse.—Occasional large specimens taken at Stations 1 to 5.

Moxostoma erythrurum. Golden redhorse*.—Common in deeper pools at Stations 1 to 9. Most abundant below the log jams at Stations 4, 5, and 6. Breeding observed in early May in riffles at Station 9.

ICTALURIDAE

Ictalurus melas. Black bullhead*.—Common in pools at Stations 9 to 15. Occasionally taken from backwater area.

Ictalurus natalis. Yellow bullhead.—One large specimen taken from deep pool at Station 15.

Ictalurus nebulosus. Brown bullhead.—Two specimens, one each at Stations 9 and 15.

Ictalurus punctatus. Channel catfish.—Specimens up to 2 kg common in early spring at Stations 1 to 4. Most abundant when Ohio River rises.

Noturus gyrinus. Tadpole madtom*.—Occasionally taken with the brindled madtom at Stations 2 to 9.

Noturus miurus. Brindled madtom.—Occasionally taken at Stations 2 to 9.

Pylodictis olivaris. Flathead catfish.—One large specimen taken from backwater area.

APHREDODERIDAE

Aphredoderus sayanus. Pirate perch.—Three specimens taken from backwater area.

CYPRINODONTIDAE

Fundulus notatus. Blackstripe topminnow*.—Common from Stations 1 to 16. Most abundant in areas of little or no flow. Specimens were observed but not collected at

Stations 1 to 9 as this species is resistant to electrofishing gear.

POECILIIDAE

Gambusia affinis. Mosquitofish.—Common throughout length of stream. Most abundant in patches of duckweed.

PERCICHTHYIDAE

Morone chrysops. White bass.—Several small specimens taken in early spring from backwater area.

CENTRARCHIDAE

Ambloplites rupestris. Rock bass.—Collected in deeper pools at Stations 2 to 15 but never abundant.

Lepomis cyanellus. Green sunfish*.—Several large specimens taken at Stations 2 to 15.

Lepomis gulosus. Warmouth*.—Taken in moderate numbers from deeper pools at Stations 2 to 15.

Lepomis humilis. Orangespotted sunfish*.—Four specimens taken at Stations 2 to 5.

Lepomis macrochirus. Bluegill*.—Very abundant and taken at all stations. Young of the year and adults present together around stumps, log jams, and undercut areas of the bank. Nests built and spawning observed at Stations 9 to 16 in late June.

Lepomis megalotis. Longear sunfish*.—Abundant and usually taken with bluegill. Not found above Station 16. Fish active on nests; spawning observed at same time and in same pools as bluegill. Young of the year taken from backwater area in early August.

Lepomis microlophus. Redear sunfish.—Occasionally taken at Stations 2 to 15 with bluegill and longear sunfish.

Micropterus dolomieu. Smallmouth bass.—Five small specimens taken at backwater area.

Micropterus punctulatus. Spotted bass*.—Several small specimens taken at Stations

2 to 9 with occasional specimens taken from deep pools at Stations 11 and 15. Not as abundant in backwater area where largemouth bass was dominant.

Micropterus salmoides. Largemouth bass*.—Most common of the 3 blackbasses. Several up to 1.3 kg taken from backwater area. Found in deeper pools at Stations 1 to 15. Spawning observed at Stations 10 and 11 in early June.

Pomoxis annularis. White crappie.—Occasional specimens taken at Stations 2 to 15.

Pomoxis nigromaculatus. Black crappie.—One large specimen taken from backwater area.

PERCIDAE

Etheostoma blennioides. Greenside darter.—Three specimens taken from Little Goose Creek.

Etheostoma caeruleum. Rainbow darter.—Abundant in riffles at Stations 9 to 15. Breeding observed in deeper areas of riffles during late April.

Etheostoma flabellare. Fantail darter*.—Most abundant of the darters. Present in the riffles at Stations 9 to 23. Males with breeding colors and tubercles present in April. Breeding not observed.

Etheostoma nigrum. Johnny darter.—A few specimens taken from Little Goose Creek.

Percina caprodes. Logperch.—Three large specimens taken from backwater area.

Stizostedion canadense. Sauger.—A few small specimens taken from backwater area. Common in Ohio River.

SCIAENIDAE

Aplodinotus grunniens. Freshwater drum*.—Abundant in backwater area during spring. Several also taken at Stations 3 to 9.

COTTIDAE

Cottus carolinae. Banded sculpin.—Five specimens taken from Little Goose Creek.

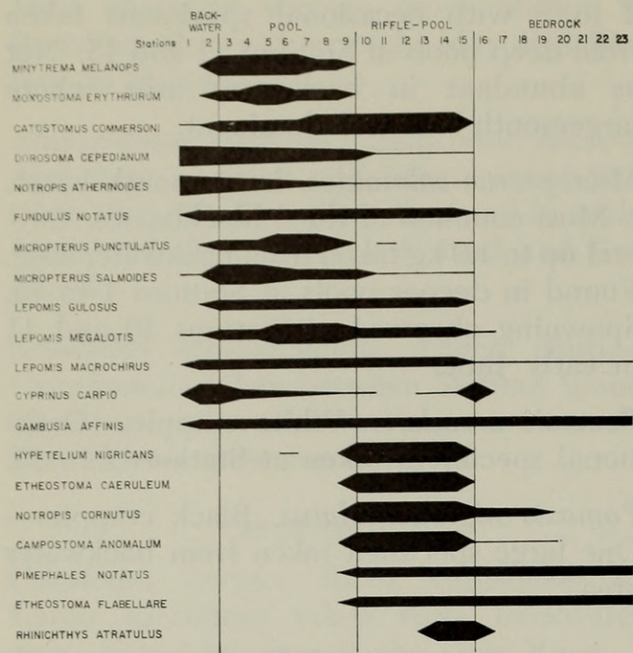


FIG. 3. Distribution of the common fishes in Goose Creek, Jefferson County, Kentucky. Width of line represents relative abundance of a species but not relationships between species.

DISCUSSION

The fish populations of Goose Creek do not differ notably from those of other north-central Kentucky streams (Charles 1957, Turner 1959, Minckley 1963, Hoyt et al. 1970). Distribution and habitats of the species were similar to the descriptions by Forbes and Richardson (1920), Trautman (1957), and Minckley (1963); and all species collected in Goose Creek had been reported previously from Ohio River tributaries by Gerking (1945), Trautman (1957), Krumholz et al. (1962) and others.

Physically, the stream can be divided into 4 distinct regions each with its characteristic species. Fig. 3 depicts the range and relative abundance of the more abundant fishes in each region of Goose Creek during 1972. Only *Lepomis macrochirus* and *Gambusia affinis* were collected at every station. Other than *Dorosoma cepedianum* and *Notropis atherinoides*, very few fish of any species were collected at Station 1. Boat traffic within that section of the creek and the wakes from barges and other boats on the Ohio River together with the extremely silty substrate was not favorable for either the stream or river fishes. The

large log jams at the foot of Station 2 provided a good habitat for *Cyprinus carpio* and the larger Centrarchidae. The only sport fishing ever observed on Goose Creek was at Station 2 where many people fished from the River Road bridges and from the banks; however, no creel census was attempted. Of the 63 species in Goose Creek, 46 were collected in the backwater of Stations 1 and 2. Twenty of the 46 were recorded only from the backwater, most of which were waifs from the Ohio River including *Morone chrysops*, *Pylodictis olivaris*, *Moxostoma carinatum*, *Ictiobus bubalus*, and others.

Above Station 2 there was a more orderly longitudinal succession of stream fishes. Most species were confined to or were most abundant in one particular region of the stream. *Minytrema melanops* and *Moxostoma erythrurum* were most numerous in Stations 1 to 6 and were replaced in the riffle-pool stations by *Catostomus commersoni* and *Hypentelium nigricans*. The major predators of the pool stations, *Micropterus punctulatus* and *M. salmoides*, were replaced in the riffle-pool region by *Lepomis megalotis* and *L. gulosus*. The most abundant species of the backwater and pool, *Dorosoma cepedianum* and *Notropis atherinoides*, were replaced in the riffle-pools by *Campostoma anomalum* and *Pimephales notatus*. Only six of the 63 species were taken above Station 15. At the bedrock stations, the water usually was too shallow to support any but the smallest species (Fig. 3). The intrastream distribution of the Goose Creek fishes closely parallels what Minckley (1963) observed for Doe Run.

The species collected in Goose Creek did not utilize the stream equally but can be divided artificially into 3 groups (Table 2): (1) fishes that completed their life cycle in Goose Creek, not normally found in the Ohio River except as waifs; (2) species with permanent populations in both Goose Creek and the Ohio River; and (3) those using Goose Creek during only certain parts of the year or their life cycle. *Noturus* and some *Ictalurus* (bullheads) are

TABLE 2.—CLASSIFICATION OF THE FISHES OF GOOSE CREEK AS INDICATED BY THEIR UTILIZATION OF THE STREAM: (1) THOSE COMPLETING THEIR LIFE CYCLE IN GOOSE CREEK AND NOT NORMALLY FOUND IN THE OHIO RIVER; (2) FISHES WITH PERMANENT POPULATIONS IN BOTH GOOSE CREEK AND THE OHIO RIVER; AND (3) THOSE SPECIES USING GOOSE CREEK DURING ONLY PARTS OF THE YEAR OR OF THEIR LIFE CYCLE

1	2	3
<i>Esox americanus vermiculatus</i>	<i>Dorosoma cepedianum</i>	<i>Lepisosteus osseus</i>
<i>Camptostoma anomalum</i>	<i>Carassius auratus</i>	<i>L. platostomus</i>
<i>Ericymba buccata</i>	<i>Cyprinus carpio</i>	<i>Anguilla rostrata</i>
<i>Notropis ardens</i>	<i>Notropis atherinoides</i>	<i>Alosa chrysochloris</i>
<i>N. cornutus chrysocephalus</i>	<i>Moxostoma erythrurum</i>	<i>Hybopsis storeriana</i>
<i>N. spilopterus</i>	<i>Lepomis macrochirus</i>	<i>Notemigonus chrysoleucas</i>
<i>Pimephales notatus</i>	<i>L. megalotis</i>	<i>Notropis blennioides</i>
<i>Rhinichthys atratulus</i>	<i>L. microlophus</i>	<i>N. stramineus</i>
<i>Semotilus atromaculatus</i>	<i>Micropterus punctulatus</i>	<i>Carpionodes carpio</i>
<i>Catostomus commersoni</i>	<i>M. salmoides</i>	<i>C. cyprinus</i>
<i>Hypentelium nigricans</i>	<i>Pomoxis annularis</i>	<i>Ictiobus bubalus</i>
<i>Minytrema melanops</i>		<i>I. niger</i>
<i>Fundulus notatus</i>		<i>Moxostoma anisurum</i>
<i>Gambusia affinis</i>		<i>M. carinatum</i>
<i>Ambloplites rupestris</i>		<i>M. duquesnei</i>
<i>Lepomis cyanellus</i>		<i>Ictalurus punctatus</i>
<i>L. gulosus</i>		<i>Pylodictis olivaris</i>
<i>Etheostoma blennioides</i>		<i>Aphrododerus sayanus</i>
<i>E. caeruleum</i>		<i>Morone chrysops</i>
<i>E. flabellare</i>		<i>Lepomis humilis</i>
<i>E. nigrum</i>		<i>Micropterus dolomieu</i>
<i>Percina caprodes</i>		<i>Pomoxis nigromaculatus</i>
<i>Cottus caroliniae</i>		<i>Stizostedion canadense</i>
		<i>Aplodinotus grunniens</i>

not included in the categories as we felt our collection methods did not sample their populations adequately.

Group (1) is the characteristic stream fauna usually not taken in larger rivers (Trautman 1957, Forbes and Richardson 1920, Krumholz et al. 1962). Of the 63 species collected, 22 fell into this category. Most of them prefer the riffles or small pools between Stations 8 and 15; although, others such as *Minytrema* are backwater and pool fishes.

Group (2) contains 11 of the 63 species. These are river and lake species found year round in the Ohio River and in the backwater and pool stations of Goose Creek. Even though they exist in great numbers in the Ohio River, most, particularly the Centrarchidae, return to a smaller stream to spawn.

Group (3) is composed primarily of those fishes that have sporadic migrations into Goose Creek. As indicated in the

annotations, many were represented by 1 specimen or by a single collection, usually from the backwater; and thus, they might not be counted as true residents of the creek. At times, the transient species were quite numerous at Station 2. In the winter and spring, Group (3) species composed as much as 90 percent by weight of the total catch, the most abundant being *Ictalurus punctatus* and *Aplodinotus grunniens*. The transient species utilized Goose Creek for spawning, seasonal foraging, protection during periods of high water, and as a refuge for the young. Group (3) also includes many species that are not common in either Goose Creek or the Ohio River, e.g., *Moxostoma anisurum* and *Aphrododerus sayanus*.

With many of the species that spend their entire life cycles in Goose Creek, there were seasonal intrastream migrations, especially during spawning periods. This was most noticeable in the migrations of

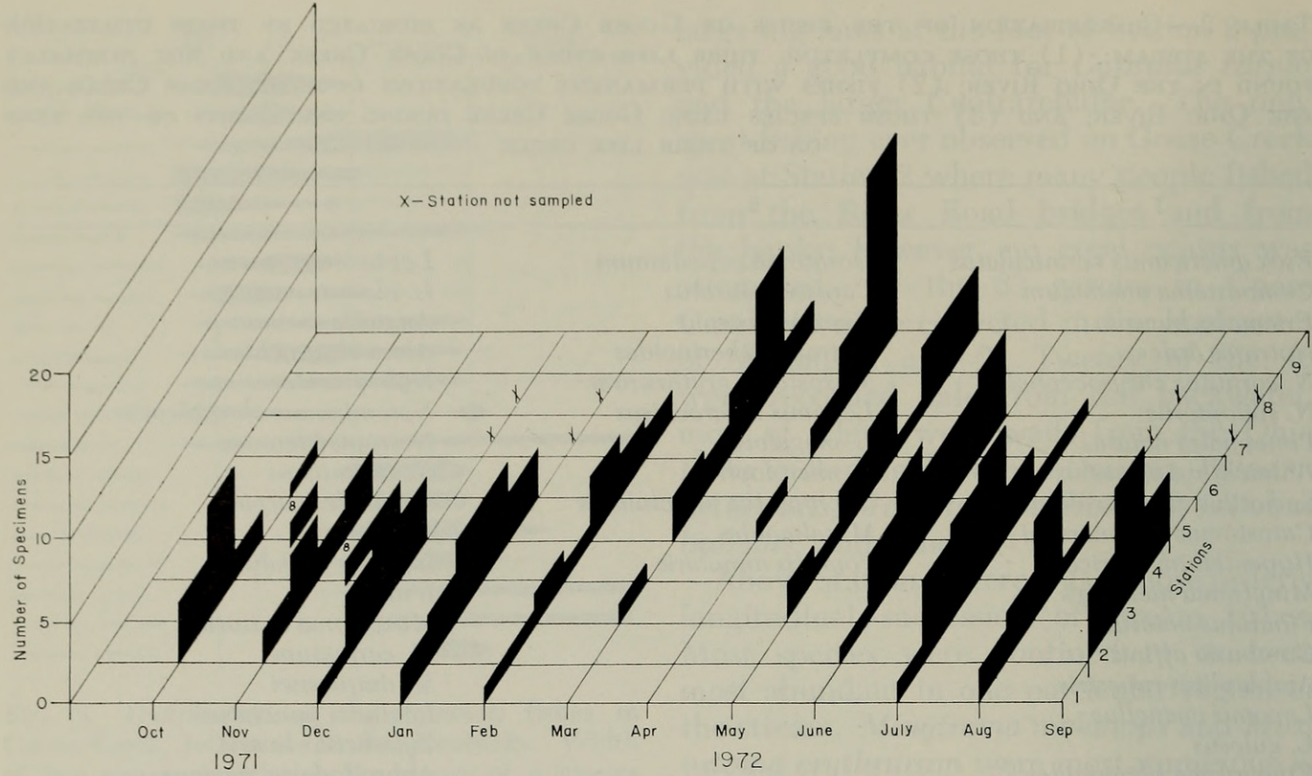


FIG. 4. Average number per month of adult *Minytrema melanops* taken in Stations 1 to 9 in Goose Creek, Jefferson County, Kentucky.

Minytrema melanops (Fig. 4). While 1- and 2-year-old *Minytrema* were found throughout the year at Station 9, adults were present there only in the spring when they usually were absent from the lower pool stations. During the remainder of the year, the adults were most abundant at Stations 2 to 4. This pattern was similar for many Goose Creek species, though the times of migration varied greatly.

TABLE 3.—NUMBER OF SPECIES, ESTIMATED WEIGHTS (KG/HA), AND ESTIMATED POPULATIONS AT 3 STATIONS ON GOOSE CREEK DURING 1972

Station	Month	Number of species	kg/ha	no/ha
2	Feb	8	355	8,490
	Apr	10	265	8,250
	Jul	10	190	8,180
	Oct	9	180	4,270
9	Feb	11	145	5,680
	Apr	14	200	7,150
	Jul	10	130	6,900
	Oct	10	110	4,800
15	Feb	7	65	3,920
	Apr	10	80	4,720
	Jul	7	9	700
	Oct	5	6	660

Standing crops of the fishes from Goose Creek (Table 3) were calculated on the basis of the DeLury (1947) type estimates. Throughout the year, Station 2 had the greatest populations both in terms of numbers and weights. The 355 and 265 kg/ha recorded for February and April reflect the immigration of *Cyprinus carpio*, *Ictalurus punctatus*, and *Aplodinotus grunniens* from the Ohio River.

Station 9 had its greatest populations of fishes in April and July. The high weight in April (200 kg/ha) resulted from the spawning migrations of *Minytrema melanops* and *Moxostoma erythrurum* compared to July when spawners were mainly centrarchids.

Station 15, when sampled in February and April, had numerous schools of minnows, darters, and small sunfishes. In spring 1972, Goose Creek above Station 15 (Westport Road) was channelized and received a tremendous amount of silt from the construction of an apartment complex. The pools, which originally were 0.5 to 1.0 m deep with gravel over bedrock bottoms, had been covered completely by 25 to 30

cm of silt. Population estimates made in July and October 1972 showed a tremendous decrease in both the weights and numbers, although, most species previously collected were still present. The siltation eliminated all darters between Stations 12 and 16.

The effects of numerous sewage treatment plants on Goose Creek have not been investigated adequately enough to allow more than speculation on their present role in the stream ecology. No fish kills were seen by us or were reported during the study period. Even though large amounts of untreated sewage periodically entered Goose Creek, oxygen levels except in the backwater area were always at or above 100 percent saturation (Table 1). At present levels, the amount of sewage entering Goose Creek may be aiding fish production. For the total stream, Goose Creek averaged 143 kg/ha of fish. This is higher than 90 kg/ha determined for the Salt River (Hoyt et al. 1970) and in general is higher than other north-central Kentucky streams cited by Charles (1957) and Turner (1959).

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