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Abstract

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NEW RECORDS, DISTRIBUTION, AND STATUS OF TEN RARE FISHES IN THE TRADEWATER AND LOWER GREEN RIVERS, KENTUCKY

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INTRODUCTION

In view of the historical and present interest in Kentucky fishes (Woolman 1892, Evermann 1918, Clay 1975, Burr 1980), it is surprising that so little published information is available regarding the fishes of the Tradewater and lower Green rivers. The Tradewater River still represents a void in the knowledge of the states' ichthyofauna, although our understanding of the fish fauna of the lower Green River was expanded by a recent distributional study of portions of the drainage by Retzer et al. (1982). Other work is limited to sport fishery surveys (Turner 1959, Carter 1970, Golden and Twilley 1976, Axon 1980, Laflin 1980) and distributional information involving one or a few species (Hoyt 1979; Burr et al. 1980; Lee et al. 1980; Warren 1980, 1981, 1982). The work of Woolman (1892) included one collection each from the Tradewater, Rough, and Green rivers, which serve as valuable, although scant, historical documentation of the ichthyofauna of this area.

During 1979-80, the Kentucky Nature Preserves Commission (KNPC) conducted a biological survey of the Tradewater and lower Green rivers as part of a regional environmental impact statement. This data was utilized to facilitate the recognition and designation of environmentally sensitive areas (Harker et al. 1980, 1981). Identification of the best remaining aquatic habitats was accomplished through an extensive search and compilation of scientific literature, museum records, and the examination of the aquatic biota data obtained during the aforementioned survey. The work resulted in the recognition of several high-quality aquatic systems and documented the poorly known biota. As a result of the ichthyofaunal surveys, several species previously unknown from the area and others thought to be extirpated were recorded. A description of the study area, discussion of ichthyological findings, and an overview of the threats to the aquatic ecosystems of the area are the primary objectives of this report.

STUDY AREA

The study area lies within the Shawnee Hills Section of the Interior Low Plateaus Province (Quarterman and Powell 1978), an area regarded by some authors as the Western Kentucky Coal Field (Fig. 1). Within the Shawnee Hills Section, several topographic and geologic features serve to differentiate various aquatic habitat types. The most prominent relief feature, the Dripping Springs Escarpment, forms a semi-circular boundary to the east, south and west, and serves as the divide between the Cumberland River drainage and the Green-Tradewater systems. The Ohio River forms the northern boundary. The Green River drains the major part of the region (11,000 sq km) and essentially bisects the area in its northwestward path to the Ohio River. The comparatively small Tradewater River lies to the southwest along the western margin of the Shawnee Hills Section and drains the remainder of the region (2755 sq km), excluding a few small watersheds that discharge directly into the Ohio River.

Streams on the periphery of the study area have dissected the Dripping Springs Escarpment and have given this inward sloping cuesta a rugged appearance. These are generally high gradient streams with rocky substrates and narrow, undeveloped floodplains. In contrast, streams of the interior are characteristically low gradient, with soft substrates and wide, highly alluviated floodplains harboring numerous riparian wetlands and oxbows. The transition in habitat type is most pronounced at the contact zone of the Mississippian Age strata of the escarpment with the Pennsylvanian deposits of the region's interior.

The Green River receives several major tributaries as it flows northwest through the Escarpment toward the interior of the region. Three of these, the Mud, Pond, and Rough rivers, have their headwaters in the rugged escarpment region, debouch into the lowlands of the interior, and thus offer a wide variety of aquatic habitats. Panther Creek, another major Green River tributary, is essentially within the interior and is lowland in character.

The smaller Tradewater River originates near the Dripping Springs Escarpment but has limited upland habitat, since it flows primarily through the deep alluvial and Pennsylvanian deposits of the interior lowlands. Northeastern tributaries to the Tradewater River, such as Clear and Cane creeks, comprise some of the largest wetlands in the state. In contrast, smaller southwestern tributaries (e.g., Donaldson, Piney, and Sandlick creeks) lying near the escarpment offer the only available upland habitat in the drainage.

COLLECTION SITES

Thirty collection sites are listed below and referenced by site number in Fig. 1. In addition to stream name, each site includes major drainage in parentheses, locality, county, and the collection date. Species collected at each site are indicated by number, the identities of which can be determined by reference to Table 1. Species numbers 36, 52, 62, 65, 67 and 72 were not actually taken at any of the 30 sites listed below, but were collected in the segment or sub-basin indicated in Table 1.

1. Piney Creek (Tradewater R.), 0.3 km above mouth, Crittenden Co., 11 September 1980. Species: 3, 5, 10, 12, 13, 22, 31, 35, 37, 39, 43, 45, 46, 51, 53, 54, 57, 58, 59, 60, 61, 66, 68, 82.
2. Land Branch (Tradewater R.), 10.2 km NNW of Fryer and 8.9 km NW of Dalton, Caldwell Co., 22 August 1980. Species: 3, 5, 12, 27, 28, 34, 35, 43, 45, 46, 48, 50, 51, 53, 55, 58, 60.

3. Weirs Creek (Tradewater R.), 6.4 km WSW of Nebo, Hopkins Co., 13 August 1980. Species: 1, 2, 3, 7, 43, 45, 46, 51, 53, 58, 59, 60, 66, 68.
4. Rose Creek (Tradewater R.), 13.3 km N of Beulah and 4.2 km NW of Coiltown, Hopkins Co., 12 August 1980. Species: 3, 5, 7, 12, 34, 35, 43, 45, 46, 48, 49, 50, 51, 53, 58, 66, 68.
5. Clear Creek (Tradewater R.), slough parallel to KY 109 and 0.3 km S of KY 109 and County Road 1034 junction, Hopkins Co., 14 July 1980. Species: 5, 12, 28, 35, 43, 45, 48, 51, 53, 58, 60, 68.
6. Flynn Fork (Tradewater R.), 1.9 km above mouth, Caldwell Co., 8 August 1980. Species: 5, 15, 19, 22, 24, 25, 27, 33, 35, 39, 43, 45, 46, 48, 50, 51, 53, 54, 58, 61, 68, 70, 71, 73, 78.
7. Montgomery Creek (Tradewater R.), directly above mouth, Caldwell Co., 7 August 1980. Species: 3, 5, 12, 16, 17, 22, 24, 25, 27, 31, 34, 35, 39, 43, 45, 46, 48, 50, 51, 53, 54, 58, 59, 66, 70, 78.
8. Cypress Slough (Green R.), 0.3 km S of Green River and 4.0 km NW of mouth of Race Creek, Henderson Co., 9 September 1980. Species: 5, 12, 16, 22, 28, 34, 43, 44, 46, 51, 53, 54, 58, 61, 68.
9. Deer Creek (Green R.), KY 370 crossing, 5.0 km above mouth, Webster Co., 20 August 1980. Species: 3, 5, 10, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 27, 31, 32, 33, 35, 37, 39, 42, 43, 44, 46, 50, 51, 53, 54, 57, 58, 61, 68, 78, 82.
10. Long Falls Creek (Green R.), KY 136 crossing, 4.8 km above mouth, McClean Co., 28 August 1980. Species: 3, 5, 6, 8, 10, 13, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 27, 33, 34, 35, 37, 46, 47, 50, 53, 54, 57, 58, 61, 82.
11. Cypress Creek (Pond R.), KY 939 crossing, 5 km above mouth, McClean Co., 28 August 1980. Species: 2, 3, 7, 10, 13, 18, 20, 21, 23, 30, 37, 42, 43, 44, 46, 47, 49, 50, 51, 53, 54, 58, 60, 61, 68, 80, 82.
12. Green River (Ohio R.), immediately below US Lock and Dam No. 2 at Calhoun, McClean Co., 13 and 20 June 1978. Species: 26.
13. Rough River (Green R.), US Lock and Dam No. 1, 12.1 km above mouth, Ohio Co., 26 August 1980. Species: 4, 6, 15, 18, 20, 21, 22, 23, 37, 41, 42, 57, 58, 59, 69, 80, 81, 82.
14. Rock House Slough (Rough R.), 3.4 km NNE of Hartford and 8.6 km NNW of Beaver Dam, Ohio Co., 25 September 1980. Species: 5, 12, 28, 43, 44, 46, 48, 51, 53, 58, 59, 68.
15. Muddy Creek (Rough R.), US 231 crossing, 5.0 km above mouth, Ohio Co., 25 September 1980. Species: 3, 5, 6, 12, 15, 17, 18, 19, 21, 22, 25, 27, 31, 33, 35, 44, 46, 47, 48, 50, 53, 54, 59, 61, 68, 73, 78.
16. Long Pond (Pond R.), 2.6 km NE of White Plains, Hopkins Co., 15 August 1980 and 29 September 1981. Species: 3, 5, 9, 12, 16, 17, 20, 22, 23, 43, 44, 46, 47, 49, 50, 51, 53, 54, 55, 56, 58, 59, 60, 66, 68, 78.
17. Cypress Creek (Pond R.), KY 175 crossing and 1.6 km S of Muhlenberg-McClean county line, Muhlenberg Co., 8 November 1978. Species: 47, 53, 54, 61, 68, 78.
18. Cypress Creek (Pond R.), KY 81 crossing and 6.7 km WNW of Central City, Muhlenberg Co., 7 November 1978 and 27 August 1980. Species: 2, 5, 7, 17, 22, 28, 34, 35, 43, 44, 46, 48, 49, 50, 51, 53, 54, 58, 60, 61, 68, 78, 82.
19. Little Cypress Creek (Pond R.), 4.2 km NW of Central City off Clarks Road, Muhlenberg Co., 6 November 1978. Species: 2, 5, 28, 46, 49, 51, 53.
20. Jacobs Creek (Green R.), 1.6 km above mouth and 1.6 km S of Paradise Steam Plant, Muhlenberg Co., 29 April 1980. Species: 1.
21. Rocky Creek (Mud R.), 1.5 km above mouth of Hazel Creek, Muhlenberg Co., 24 September 1980. Species: 5, 16, 39, 43, 44, 46, 50, 53, 54, 58, 59, 61, 73.
22. Mud River (Green R.), KY 949 crossing and 13.0 km below mouth of Biggerstaff Creek, Butler Co., 27 August 1980 and 22 September 1980. Species: 3, 6, 13, 16, 17, 18, 20, 22, 23, 37, 40, 42, 44, 46, 47, 53, 54, 57, 61, 64, 69, 71, 75, 79, 80, 81.
23. Mud River (Green R.), Dunmor-Forgey Mill Road bridge and 0.6 km below mouth of Biggerstaff Creek, Butler Co., 22 September 1980. Species: 3, 6, 10, 12, 13, 15, 16, 17, 18, 19, 20, 22, 23, 33, 37, 40, 43, 44, 46, 50, 51, 53, 54, 56, 58, 61, 64, 68, 69, 71, 73, 75, 78, 79, 81.
24. Mud River (Green R.), 13.4 km above mouth of Wolf Lick Creek, Logan Co., 30 October 1980. Species: 15, 18, 19, 22, 24, 29, 46, 54, 61, 64, 71, 73, 79.
25. Muddy Creek (Green R.), KY 70 crossing, 8.5 km above mouth, Butler Co., 1 October 1980. Species: 3, 6, 13, 15, 16, 17, 18, 19, 20, 22, 23, 31, 33, 37, 39, 41, 44, 46, 47, 50, 51, 53, 54, 57, 58, 60, 61, 68, 70, 71, 73, 75, 78, 81, 83.
26. Green River (Ohio R.), 0.9 km below mouth of Barren River at US Lock and Dam No. 4, Butler Co., 2 October, 1980. Species: 3, 13, 14, 20, 23, 41, 46, 50, 57, 69, 75, 76, 80, 81, 82.
27. Green River (Ohio R.), 800 m upstream from confluence with Barren River, Butler Co., 13 July 1979. Species: 26.
28. Green River (Ohio R.), 200 m below KY 185 crossing and 2.6 km below mouth of Bear Creek, Butler Co., 30 September 1980. Species: 3, 6, 10, 11, 13, 17, 18, 20, 22, 23, 29, 37, 38, 40, 41, 46, 47, 53, 57, 63, 64, 71, 74, 76, 77, 79, 80, 81, 83.
29. Green River (Ohio R.), below US Lock and Dam No. 5 and 0.6 km below mouth of Bear Creek, Butler Co., 1 October 1980. Species: 6, 11, 13, 14, 18, 20, 23, 37, 38, 44, 47, 57, 64, 75, 76, 77, 79, 83.
30. Sandlick Creek (Tradewater R.), 3.9 km above mouth, Christian Co., 15 July 1980. Species: 5, 12, 15, 17, 19, 22, 23, 25, 43, 45, 51, 53, 58, 59, 66, 71.

SELECTED SPECIES ACCOUNTS

Several of the more important distributional findings are summarized in the following species accounts. Each species account includes the collection site number followed in parentheses by the total number of specimens. All scientific and common names follow Robins et al. (1980). Voucher specimens are housed at the Kentucky Nature Preserves Commission (KNPC), Eastern Kentucky University (EKU), Western Kentucky University (WKU), and the Kentucky Department of Fish and Wildlife Resources (KFW).

A list of all species collected from the Tradewater and lower Green rivers is presented in Table 1. For purposes of presenting the data, the lower Green River was divided into three natural sub-basins (Mud River, Pond River, and Rough River downstream of Rough River Reservoir Dam) and two arbitrarily defined segments (lower and middle Green river). The lower Green River segment encompasses the Green River and tributaries from the confluence with the Ohio River upstream to the mouth of the Rough River. The middle Green River segment includes the Green River and tributaries (exclusive of the previously defined sub-basins) from the mouth of the Rough River upstream to and including the Nolin River.

Lepisosteus oculatus (Winchell). Spotted gar.
Sites: 3(2), 20(1).

The spotted gar is rare in Kentucky, with only one previous record in the Ohio River system above the mouth of the Tradewater River (Burr 1980, pers. comm.). Most Kentucky records are confined to the Gulf Coastal Plain Province of western Kentucky. The collections reported herein represent the first substantiated records of the species in the Green and Tradewater rivers. The Tradewater River specimens were secured from a shallow (0.3-0.6 m) wetland in association with dense beds of lizards tail (*Saururus cernuus*) and spatter-dock (*Nuphar* sp.). The proximity and similarity of habitats along the Ohio River floodplain and in other segments of the lower Green River suggest that the spotted gar occurred throughout these areas in recent times. The rareness of the spotted gar in Kentucky collections may partly be a collecting artifact, inasmuch as the species is not readily collected with small seines. However, with the continuing demise of the favored aquatic vegetation and wetland habitats, *L. oculatus* must be considered threatened throughout its Kentucky range (Branson et al. 1981).

Hybognathus hayi Jordan. Cypress minnow.
Site: 16(16).

Hybognathus hayi was previously believed to be restricted to the Gulf Coastal Plain Province of extreme southwestern Kentucky (Burr et al. 1980). The collection from Pond River is an addition to the known fauna of the Green River and a 173 km eastward range extension in Kentucky. This and southwestern Indiana populations (Gerking 1945) represent the easternmost distribution of this southern species in the Ohio River valley. The specimens were obtained from an isolated Pond River oxbow (0.3-2.3 m deep), which to date does not appear to receive any mining pollution, although the surrounding watersheds and the Pond River are impacted by large surface mines. Burr et al. (1980) stated that, because of planned stream modification projects in the Gulf Coastal Plain Province of Kentucky, populations of *H. hayi* should be considered at least threatened. The future of the relictual Green River population is uncertain, but current mining trends suggest that the population is endangered. Branson et al. (1981) considered the cypress minnow to be threatened in Kentucky.

Cycleptus elongatus (Lesueur). Blue sucker.
Sites: 12(2), 27(2).

Although once relatively common in the Ohio River (Rafinesque 1820, Henshall 1888, Trautman 1957) and probably its large tributaries, the blue sucker was recently listed as rare in Kentucky by Burr (1980). The two records reported here are apparently the first published accounts for the species from the Green River. Of the two specimens from Site 12, one is presently in the Western Kentucky University collection (not examined), and the other is deposited at the Kentucky Department of Fish and Wildlife Resources (KFW 1825). Six to eight other individuals were observed but not collected (D. Bell, pers. comm.). The collection was made immediately below the US Lock and Dam No. 2 discharge valves with the aid of a boat-mounted electrofishing unit. Two blue suckers were collected at Site 27, approximately 241 km upstream from the confluence of the Green and Ohio rivers, by gill net over a gravel and clay bottom and subsequently released (J. Sickel, pers. comm.). Dam construction, siltation caused by reduction in current velocity, and pollution have been suggested as the causes of the decline of this strongly migratory species (Pflieger 1975, Smith 1979). However, the rareness of the blue sucker may in part be attributed to the difficulty of sampling deep-water habitat with fast current now typically limited to areas below navigation dams. Nonetheless, based on current knowledge, the blue sucker must be regarded as threatened in Kentucky (Branson et al. 1981).

Erimyzon sucetta (Lacepede). Lake chubsucker.
Sites: 2(4), 5(6), 8(4), 14(8), 18(3), 19(1).

Burr (1980) regarded *E. sucetta* as one of the rarest fish species in Kentucky with only five substantiated records, two of which were from the Green River (Warren 1980). The localities reported herein augment the distribution of the species in the Green River system and represent the first records of the species from the Tradewater River. The lake chubsucker was taken infrequently with its congener *E. oblongus,* although these suckers are sympatric in portions of Kentucky. The former species occupied well-vegetated backwaters and sloughs, whereas the latter frequented flowing waters. Most collections of both species yielded juvenile specimens; adults or sub-adults were uncommon. *Erimyzon sucetta* is currently listed as of undetermined status in Kentucky (Branson et al. 1981). Our efforts indicate a widespread but spotty distribution in the remnants of the once vast lowlands of the Green River and an even more limited distribution in the Tradewater River.

Elassoma zonatum Jordan. Banded pygmy sunfish.
Sites: 4(51), 11(4), 16(5), 18(29), 19(2).

The banded pygmy sunfish was thought to be restricted to the Gulf Coastal Plain Province of Kentucky (Clay 1975) until an apparent relictual population was reported from Cypress Creek, a remnant cypress wetland, in the Pond River system (Warren 1980). Since that time additional collections were made from lower Cypress Creek and Long Pond in the Pond River. These Green River system populations represent the eastern edge of the range of the species in the Ohio River valley. Of further interest was the discovery of *E. zonatum* in the Tradewater River. This locality is geographically intermediate between the Green River populations and those in the Gulf Coastal Plain Province, indicating that *E. zonatum* was once widely distributed across the western one-third of Kentucky. The decimation of wetland habitats in both the Green and Tradewater rivers has undoubtedly played a major role in producing the sporadic, isolated distributional pattern presently observed in these drainages. Branson et al. (1981) considered *E. zonatum* to be of special concern in Kentucky.

Lepomis punctatus (Valenciennes). Spotted sunfish.
Sites: 16(2), 23(1).

Lepomis punctatus was virtually unknown in Kentucky until Burr and Mayden (1979) and Burr (1980) reported the species from seven localities in the Gulf Coastal Plain Province of extreme southwestern Kentucky, where it apparently is never common. The Green River collections represent an addition to the fauna of this drainage system, as well as the eastern limit of the range of the species in the Ohio River valley. Both collection sites are relatively undisturbed with regard to mining or other disruptive influences. The apparent isolation of the spotted sunfish in these Green River tributaries is certainly associated with the demise of appropriate habitat. Smith (1979) noted similar decimation of the species' range in Illinois within historical times. Because of the apparent stability of the populations in southwestern Kentucky, *L. punctatus* is listed as of special concern statewide (Branson et al. 1981), although the isolated Green River populations are threatened by future mining and oil extraction.

Etheostoma asprigene (Forbes). Mud darter.
Sites: 1(1), 6(1), 8(1), 9(1), 10(2), 11(11), 15(2), 17(4), 18(2), 21(2), 22(2), 23(24), 24(1), 25(22).

The mud darter is common in some extreme western Kentucky streams, with most collections from tributaries to the Mississippi and lower Ohio rivers (Burr 1980). Burr (1980) and Retzer et al. (1982) reported several collections from the lower Green River, some of which refer to those presented here. The fourteen sites reported herein indicate the presence of the species in the Tradewater River drainage and a much larger distribution in the lower Green River drainage than was previously known. Collections were made from streams and sloughs that characteristically had sluggish flow and soft substrates, habitat qualities consistent with those observed by Clay (1975) and Retzer et al. (1982). The mud darter was not listed by Branson et al. (1981), and widespread occurrence of the species in western Kentucky should insure the maintenance of viable populations in the state.

Etheostoma chlorosomum (Hay). Bluntnose darter.
Sites: 1(7), 3(15), 4(7), 7(7), 16(5), 30(1).

The bluntnose darter is relatively rare east of the Gulf Coastal Plain Province, with only three recent records from the Tradewater River drainage and one verified specimen from Deer Creek, Grayson County, in the Green River system (Burr 1980, pers. comm.). Five additional localities have been identified in the Tradewater River drainage, along with a second record for the Green River. Habitat conditions at the collection sites generally consisted of standing or gently flowing water over a silt or mud bottom littered with logs, twigs, and detritus. The bluntnose darter is relatively common in the lower Cumberland River drainage and westward (Burr 1980), and therefore was not assigned a special status code by Branson et al. (1981). However, the status of the species in the Tradewater and Green river drainages is at best tenuous and further eastward range extensions are not likely. Extensive surveys in these drainages have not yielded additional locations (Harker et al. 1980, 1981, Retzer et al. 1982), and known populations are threatened by mineral development.

Etheostoma histrio. Jordan and Gilbert. Harlequin darter.
Sites: 13(4), 22(14), 23(9), 26(2).

The harlequin darter is sporadically distributed and uncommon in several direct Mississippi River tributaries in western Kentucky (Burr 1980). In the Green River drainage, only one location was known as a result of a Rough River collection made by Woolman (1892), which was recently located and verified (B. M. Burr, pers. comm.). Recent Green River drainage collections revealed another location for the harlequin darter in the Rough River, and disclosed additional populations in the Mud River and in the Green River mainstem. A summary of habitat and distribution in the Green River system was presented elsewhere (Warren

1982). Branson et al. (1981) listed *E. histrio* as threatened in Kentucky, based on the few extant populations and its apparent absence from extensive sections of the Green River (Harker et al. 1980, 1981, Laflin 1980, Retzer et al. 1982). Its existence in the Green River is threatened with future oil and coal extraction.

Percina ouachitae (Jordan and Gilbert). Saddleback darter.
Sites: 22(31), 23(22), 24(5), 28(1), 29(2).

The saddleback darter is another relatively common member of the ichthyofauna of the Gulf Coastal Plain Province (Burr 1980) and, like *Etheostoma histrio,* is known from the Green River drainage only as a result of a single recently located and verified collection by Woolman (1892) (Williams and Etnier 1977). Our collections extend the range of *P. ouachitae* in the Interior Low Plateaus Province to include the Mud River and a 32 km segment of the Green River between US Lock and Dam Nos. 4 and 5 (Warren 1982). A summary of habitat characteristics and distribution in the Green River was presented by Warren (1982). Branson et al. (1981) listed the status of *P. ouachitae* as uncertain, largely because of relatively stable populations in the Gulf Coastal Plain Province. However, in the remainder of its Kentucky range the status of the species must be considered tenuous, based on the limited number of extant populations located in recent surveys (Harker et al. 1980, 1981, Laflin 1980, Retzer et al. 1982) and the potential for adverse impacts to aquatic systems from widespread mineral development.

DISCUSSION

Many of the species discussed have a major portion of their ranges in the Gulf Coastal Plain Province (Lee et al. 1980). The occurrence of species such as *Lepisosteus oculatus, Hybognathus hayi, Erimyzon sucetta, Elassoma zonatum, Lepomis punctatus, Etheostoma histrio* and *Percina ouachitae* in the Shawnee Hills, especially the Green River system, indicates a much stronger Gulf Coastal Plain influence on the ichthyofauna of the lower Ohio River valley than was previously known. Additionally, the discontinuous distribution of these species and others in the Shawnee Hills indicates that a great deal of habitat alteration has occurred. Although some of these changes can be associated with Pleistocene events (Retzer et al. 1982), historical changes have also had far-reaching effects on the region's fishes. The available evidence suggests that other Gulf Coastal Plain species occur or have been extirpated from the region as well. A brief overview of types and the prevalence of past and present habitat alteration will illustrate this point.

As discussed earlier, both geologic and physiographic features have influenced the aquatic habitat types within the Shawnee Hills. These same features have also had a profound influence upon man's activities. Within the large interior of the Shawnee Hills lie rich Pennsylvanian deposits of coal, gas, and oil. In addition, the low-rolling hills and broad, highly alluviated floodplains are prime agricultural land. The byproducts of the development of these resources, acid mine drainage, erosion and siltation, oil field wastes, wetland drainage and clearing, and urban and agricultural expansion, have exacted a toll on the aquatic resources of the region. Moreover, the rapidity of development in the absence of comprehensive planning has vastly reduced the number and extent of streams containing representative habitat types and ichthyofauna.

Our assessment of this situation indicates that the most critical problems in regard to the conservation of native ichthyofauna are those associated with the extraction of fossil fuels. At present, coal is extracted by area-wide surface mining. These mines cover tens of square kilometers, and result literally in the digging up of everything in their path, including stream channels and wetlands. (1980, 1981) and Retzer et al. (1982) were completely devoid of fishes and macroinvertebrates.

Perhaps the most acute problem stemming from both deep and surface mining, aside from physical destruction of aquatic habitats, is the formation of acid drainage. Acid waters from active and abandoned mine lands are degrading whole ecosystems, perhaps beyond repair. Personal observations and previous investigations (Grubb and Ryder 1972) indicate that major segments of the Tradewater River flow acid much of the time. Clear Creek, the largest extent of wetland in the Shawnee Hills and a major contributor of acid to the Tradewater River (Grubb and Ryder 1972), has been regarded as one of the environmental disasters of the century (Neichter 1972). This sorry tale is repeated in the Pond River, a major Green River tributary, where Drakes, Flat, Lewis, and Isaacs creeks, to name but a few, flow acid much of the time. Many streams surveyed by Harker et al.

Compounding the acid mine drainage problem is the influx into wetlands and streams of thousands of tons of silt from the barren expanses of active and abandoned surface mines. This material causes drastic changes in the biota, as well as drainage and flooding patterns. Dredging, channelization, wetland drainage, and other short-term proposals are frequently implemented hurriedly, with little thought or effort expended toward solution of the ultimate problem of soil and spoil erosion.

Another less visible but nevertheless critical pollution problem in the Shawnee Hills is the toxic effluent emanating from numerous oil wells dotting the landscape. All too often brines and waste oil are drained or pumped into the nearest wetland, stream, or sinkhole. In Henderson County alone approximately 20% of the swamp vegetation has been killed or severely damaged by toxic oil well effluents (Converse and Cox 1967). Charles (1964) documented drastic reductions in both the quantity and quality of the biota, including the ichthyofauna, in sections of the Green River receiving oil well effluent. Our efforts to procure fishes from several wetlands and oxbows adjacent to oil wells were futile or at best produced a meager catch. Analyses of the water quality and algal flora suggested that these wetlands more closely approximate brackish water habitat than freshwater ecosystems. Until the problems associated with fossil fuel development are solved or mitigated to environmentally acceptable levels, attempts to solve less pressing problems, such as sewage treatment disposal, will be futile.

Unfortunately, the prognosis for the fishes and indeed entire aquatic ecosystems in the Shawnee Hills Section is poor. Acceleration of coal mining and oil extraction promises to further aggravate current problems. Furthermore, the recent trend to relax environmental controls and regulations threatens to undermine past gains. Only through continued study and increased public awareness of the value of our unique aquatic natural heritage will representative remnants of the streams and wetlands in the Shawnee Hills be saved for future generations.

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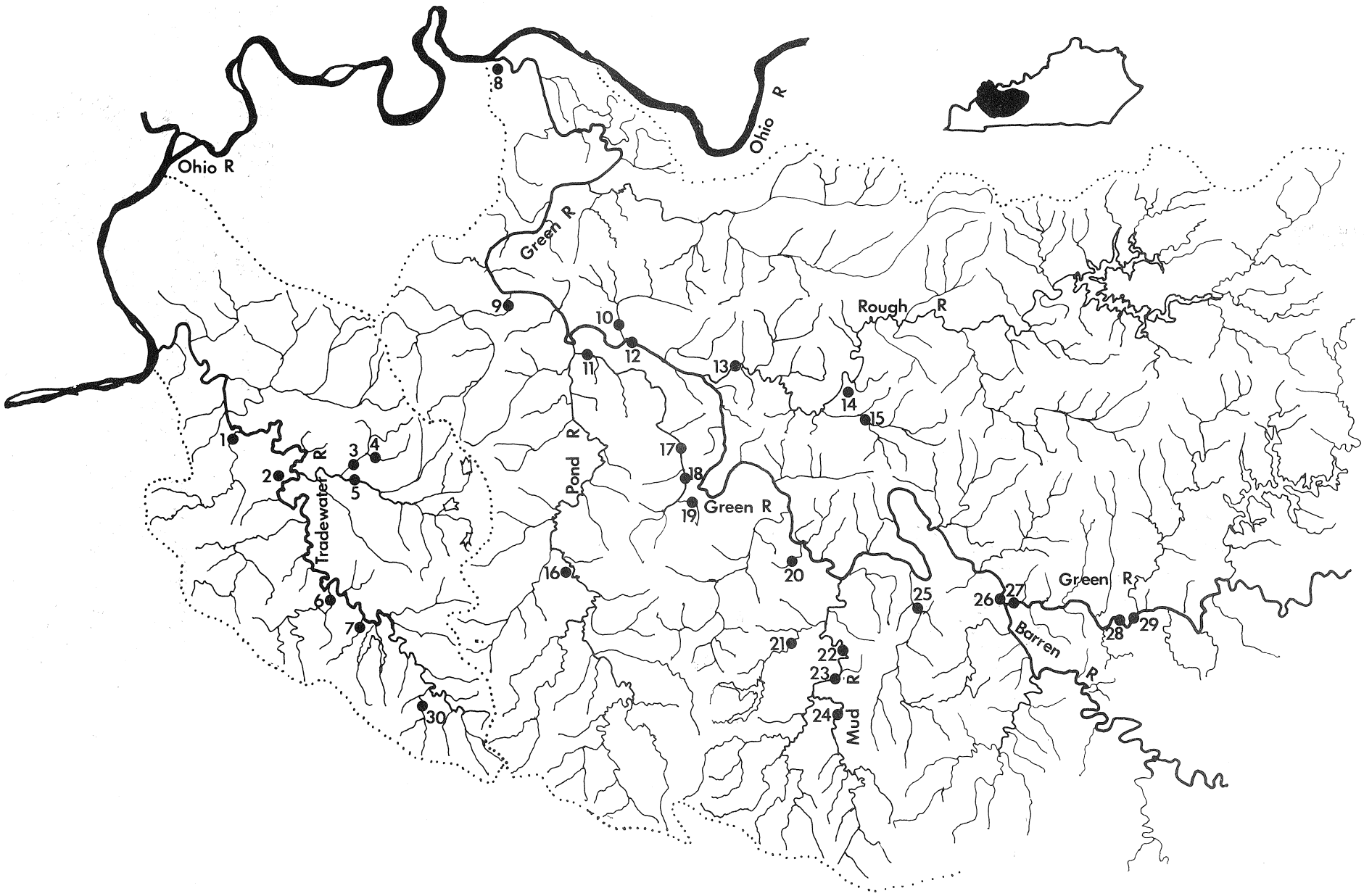

Figure 1. Tradewater and lower Green River collection sites in the Shawnee Hills Section of western Kentucky.

Taxa	Tradewater	Lower Green	Pond	Rough	Mud	Middle Green	
1. *Lepisosteus oculatus*	●					●	1.
2. *Amia calva*	●	●	●				2.
3. *Dorosoma cepedianum*	●	●	●	●	●	●	3.
4. *Hiodon tergisus*				●			4.
5. *Esox americanus vermiculatus*	●	●	●	●	●	●	5.
6. *Campostoma anomalum*		●	●	●	●	●	6.
7. *Cyprinus carpio*	●	●	●	●			7.
8. *Ericymba buccata*		●					8.
9. *Hybognathus hayi*			●				9.
10. *Hybognathus nuchalis*	●	●	●		●	●	10.
11. *Hybopsis aestivalis*						●	11.
12. *Notemigonus crysoleucas*	●	●	●	●	●		12.
13. *Notropis atherinoides*	●	●	●	●	●	●	13.
14. *Notropis buchanani*		●		●		●	14.
15. *Notropis chrysocephalus chrysocephalus*	●	●	●	●	●	●	15.
16. *Notropis emiliae emiliae*	●	●	●	●	●	●	16.
17. *Notropis fumeus*	●	●	●	●	●	●	17.
18. *Notropis spilopterus*		●	●	●	●	●	18.
19. *Notropis umbratilis cyanocephalus*	●	●	●	●	●	●	19.
20. *Notropis whipplei*		●	●	●	●	●	20.
21. *Phenacobius mirabilis*		●	●	●			21.
22. *Pimephales notatus*	●	●	●	●	●	●	22.
23. *Pimephales vigilax*	●	●	●	●	●	●	23.
24. *Semotilus atromaculatus*	●	●	●	●	●	●	24.
25. *Catostomus commersoni*	●	●	●	●		●	25.
26. *Cycleptus elongatus*		●				●	26.
27. *Erimyzon oblongus claviformis*	●	●	●	●	●	●	27.
28. *Erimyzon sucetta*	●	●	●	●			28.
29. *Hypentelium nigricans*					●	●	29.
30. *Ictiobus bubalus*			●				30.
31. *Minytrema melanops*	●	●		●	●	●	31.
32. *Moxostoma duquesnei*		●					32.
33. *Moxostoma erythrurum*	●	●	●	●	●	●	33.
34. *Ictalurus melas*	●	●	●	●		●	34.
35. *Ictalurus natalis*	●	●	●	●		●	35.
36. *Ictalurus nebulosus nebulosus*		●					36.
37. *Ictalurus punctatus*	●	●	●	●	●	●	37.
38. *Noturus eleutherus*						●	38.
39. *Noturus gyrinus*	●	●	●		●	●	39.
40. *Noturus miurus*			●		●	●	40.
41. *Noturus nocturnus*				●		●	41.
42. *Pylodictis olivaris*		●	●	●	●		42.

Taxa	Tradewater	Lower Green	Pond	Rough	Mud	Middle Green	
43. *Aphredoderus sayanus gibbosus*	●	●	●	●	●	●	43.
44. *Fundulus notatus*		●	●	●	●	●	44.
45. *Fundulus olivaceus*	●			●			45.
46. *Gambusia affinis affinis*	●	●	●	●	●	●	46.
47. *Labidesthes sicculus sicculus*		●	●	●	●	●	47.
48. *Centrarchus macropterus*	●	●	●	●	●	●	48.
49. *Elassoma zonatum*	●		●				49.
50. *Lepomis cyanellus*	●	●	●	●	●	●	50.
51. *Lepomis gulosus*	●	●	●	●	●	●	51.
52. *Lepomis humilis*		●					52.
53. *Lepomis macrochirus macrochirus*	●	●	●	●	●	●	53.
54. *Lepomis megalotis megalotis*	●	●	●	●	●	●	54.
55. *Lepomis microlophus*	●	●	●	●			55.
56. *Lepomis punctatus*			●		●		56.
57. *Micropterus punctulatus*	●	●	●	●	●	●	57.
58. *Micropterus salmoides salmoides*	●	●	●	●	●	●	58.
59. *Pomoxis annularis*	●	●	●	●	●		59.
60. *Pomoxis nigromaculatus*	●	●	●		●	●	60.
61. *Etheostoma asprigene*	●	●	●	●	●	●	61.
62. *Etheostoma barbouri*						●	62.
63. *Etheostoma bellum*						●	63.
64. *Etheostoma blennioides blennioides*			●		●	●	64.
65. *Etheostoma caeruleum*						●	65.
66. *Etheostoma chlorosomum*	●		●				66.
67. *Etheostoma flabellare*			●		●	●	67.
68. *Etheostoma gracile*	●	●	●	●	●	●	68.
69. *Etheostoma histrio*				●	●	●	69.
70. *Etheostoma kennicotti*	●		●		●	●	70.
71. *Etheostoma nigrum nigrum*	●		●	●	●	●	71.
72. *Etheostoma spectabile*			●				72.
73. *Etheostoma squamiceps*	●		●	●	●	●	73.
74. *Etheostoma zonale*						●	74.
75. *Percina caprodes caprodes*				●	●	●	75.
76. *Percina copelandi*						●	76.
77. *Percina evides*						●	77.
78. *Percina maculata*	●	●	●	●	●	●	78.
79. *Percina ouachitae*					●	●	79.
80. *Percina phoxocephala*		●	●	●	●	●	80.
81. *Percina sciera*	●		●	●	●	●	81.
82. *Aplodinotus grunniens*	●	●	●	●		●	82.
83. *Cottus carolinae carolinae*				●	●	●	83.

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