Transactions of the Illinois Academy of Science
(1989), Volume 82, 1 and 2, pp. 71-84

FISH DISTRIBUTION IN RICHLAND CREEK, AN URBANIZING STREAM BASIN IN SOUTHWESTERN ILLINOIS

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ABSTRACT

Richland Creek drains 238 square miles of the Greater St. Louis Metropolitan Area in southwestern Illinois. It is subject to mine runoff, urban, and agricultural pollution. A total of 27 fish collections made in the basin included 32 species. The main channel is degraded but Prairie du Long Creek retains six species characteristic of good quality, high gradient streams. Records of the slender madtom and orangethroat darter are significant range extensions in Illinois.

INTRODUCTION

Richland Creek basin drains parts of Monroe, Randolph, and St. Clair counties in southwestern Illinois (FIGURE 1). It is some 28 miles long, nine miles wide, and drains approximately 238 square miles. Richland Creek itself has been channelized for 12 miles below Belleville (Lopinot, 1971) and now flows 38.4 miles in a southerly direction to join the Kaskaskia River Canal near Canal Mile 22 in Randolph County.

Part of the area along Richland Creek lies in the extreme southwestern portion of the Springfield Plain, and part in the Mt. Vernon Hill Country; both subdivisions of the Till Plains Section in the Central Lowland Province. Geomorphology of both

Springfield Plain and Mt. Vernon Hill Country is largely bedrock controlled. The Mt. Vernon Hill Country is dissected by streams and has few broad uplands. The Springfield Plain includes flat areas with shallow stream entrenchment, as well as areas with linear drift and isolated mounds of eroded drift (Leighton *et al.*, 1948).

Most of the Richland Creek system is typical of Illinois prairie streams flowing through areas of glacial till; with somewhat turbid water, and substrate of silt, mud, and sand with some gravel. However, reaches of Prairie du Long Creek, especially Kopp and Rockhouse Creeks, have eroded to bedrock and are more like Ozark streams (Pflieger, 1971, 1975), with clear water, and bedrock, boulder, sand, and gravel substrates.

The basin is recognized as one of the major potential urban development areas within the greater St. Louis Metropolitan Area. Approximately 5.7% of the basin is presently urbanized (U.S. Army Corps of Engineers, 1984). Existing urban development, including the communities of Belleville, Swansea, O'Fallon, and Shiloh, is concentrated in the upper portion of the basin. This primary zone of development in the northern basin is part of the advancing, urbanizing front of the metropolitan area. The basin is heavily utilized for row crops and pastureland and has a history of coal mining operation. Various portions of the drainage are thus subjected to different combinations of urban runoff, domestic sewage, agricultural runoff, and mine drainage.

Unfortunately, the basin was not sampled by Forbes and Richardson (1908) and long-term historical comparison of fish faunas thus is not possible. The first recorded scientific fish collections in the basin were made at four localities by personnel of the Illinois Natural History Survey and Department of Conservation at various times from 1959 through 1968. A total of 20 species was taken. These records were included on Smith's (1979) distribution maps for Illinois fishes.

In 1982 the Illinois Department of Conservation made six rotenone collections, totaling 4,103 fishes. In 1983 we made 21 seine collections, totaling 7,246 specimens. These collections show that, although the basin has been highly modified, and fish kills are not unusual, it still supports, particularly in Prairie du Long Creek, a surprisingly rich fish fauna which includes at least 32 species. We can hope that this information on distribution of fishes in the basin will contribute to rational development of the basin, to preservation and even enhancement, of its aquatic habitats.

MATERIALS AND METHODS

We made 21 collections (FIGURE 1, TABLE 1), comprising 7,246 fishes representing 30 species and one hybrid combination, between 27 June and 12 August 1983. Collections were made using either a 10 by 6-foot nylon 3/16-inch Delta mesh seine or a 15 by 4-foot nylon ¼-inch Delta mesh seine, or both, during daylight hours.

Data supplied by the Illinois Department of Conservation on six 1982 rotenone collections are included in FIGURE 1 and TABLE 1. These collections totaled 4,103 specimens representing 27 species and compliment our collections, which were concentrated in smaller tributaries. Data are presented on 11,349 specimens representing 32 species and one hybrid combination. Scientific and common names follow Robins *et al.*, (1980). Site data for these collections are given below.

COLLECTION SITES

Collection sites have been located by road crossings or direction and distance to nearest town or landmark. Date of collection follows each locality and the total number of fishes collected is given in parenthesis. A brief aquatic habitat description of the collection site and pertinent comments follow.

Richland Creek Main Channel

1. Richland Creek at Old Collinsville Road; 27 June 1983, (2), water murky with red stained banks, flow one cfs, bottom gravel size coal and silt over clay, width 12 to 15-feet, depth to 2½ feet, instream cover trash (wood), roots, and some undercut banks, forested overstory provided shade, observed dead ten-inch black bullhead, seined 25 minutes.

2. Richland Creek at Highway 159-158 interchange; 27 June 1983, (19), water clear with strong sewage odor, flow three to four cfs, bottom mud to rubble, width 15 to 20-feet, depth to three-feet predominantly one to 1½ feet, instream cover trash with some willow roots and undercut grass banks. Observed dead: Three black bullheads, one largemouth bass (one-foot), one green sunfish, seined 45 minutes.

3. Richland Creek at J19 west of Douglas; 27 June 1983, (12), water murky with strong sewage odor, flow 10-12 cfs, bottom mud with some gravel, width to 25-feet, depth to three-feet, predominantly 1½ to 2-feet, filamentous algae present, stream previously channelized, little instream cover and no overhead cover, seined 30 minutes.

4. Richland Creek at Illinois Department of Conservation (IODC) rotenone sampling station; T 1S, R 8W, Section 34, 5 August 1982, (63).

5. Richland Creek at IODC rotenone sampling station; T 2S, R 8W, Section 3, 5 August 1982, (1,237).

6. Richland Creek at IODC rotenone sampling station; T 2S, R 8W, Section 27, 27 July 1982, (1,415).

7. Richland Creek at IODC rotenone sampling station; T 3S, R 8W, Section 15, 29 July 1982, (279).

8. Richland Creek near Long Lake; 12 August 1983, (296), water turbid with sewage odor, flow ten cfs, bottom clay with rubble under bridge, width 40 to 50-feet, depth to four-feet average 2½ feet, stream previously channelized, instream cover fallen trees, logs and some roots, large number of *Cambusia* caught in two small backwater areas, seined 30 minutes.

Wolf Creek

9. Wolf Creek at Old Smelter Road; 27 June 1983, (105), water murky, flow one cfs, bottom gravel and mud, width 3 to 10-feet, depth one to 1½ feet, instream cover sparse with some roots, grass, limbs and logs, overhead cover 100%. *Notemigonus*, *Catostomus*, *Lepomis gulosus*, *Ictalurus punctatus*, and large *Ictalurus melas* were captured in a bridge culvert (50-feet long, 8-feet wide, 2½ feet deep with a concrete bottom covered with mud), seined one hour.

Douglas Creek

10. Douglas Creek on Douglas Road (J19) west of Highway 159; 27 June 1983, (272), flow two cfs, bottom mud, sand and fine gravel, width 5 to 20-feet, depth generally less than one-foot, instream cover roots, overhead cover nearly 100%, seined 45 minutes.

11. Douglas Creek at Press Road southeast of Smithton; 27 June 1983, (139), water green and murky, sewage odor with white foam on water, flow two cfs, bottom clay and sand with some gravel, predominantly pools with chutes, width 5 to 20-feet, depth to three-feet — one-foot average, little instream cover with some roots, overhead cover nearly 100% except near bridge, seined 45 minutes.

Kinney Branch

12. Kinney Branch at road ½ mile from Richland Creek; 28 June 1983, (149), water murky, flow less than one cfs, bottom clay, mud, sand with some rock, width to ten-feet, depth less than two-feet, instream cover grass overhang and some roots, seined 40 minutes.

West Fork

13. West Fork at P-57 south of intersection with P-66; 10 August 1983, (339), water clear, flow less than one cfs, bottom bedrock, clay, sand and gravel, width to 20-feet, depth to three-feet average 1½ feet, instream cover overhanging trees, roots, logs and grass along bank, seined 1½ hours.

14. West Fork at County Road P-60 approximately four miles southeast of Millstadt; 10 August 1983, (570), water flow less than one cfs, bottom gravel with some mud, width to 30-feet, depth to four-feet — average two-feet, instream cover tree roots, logs and undercut banks, seined 50 minutes.

15. West Fork at Highway 159; 28 June 1983, (206), water highly turbid after rain, flow five cfs (after rain), bottom sand and silt, width 15 to 30-feet, depth to four-feet — average 1½ feet, instream cover logs, cut bank and overhanging grass, seined 50 minutes.

16. West Fork at IDOC rotenone sampling station; T 2S, R 8W, Section 15, 9 August 1982, (636).

Prairie du Long Creek

17a. Prairie du Long Creek on P-57 approximately five miles south of Millstadt; 10 August 1983, (343), flow one cfs, bottom: Long sandy stretch with areas of sand and large rocks, width to 40-feet — average 20-feet, depth to 2½ feet — average one-foot, instream cover rocks and some tree roots, seined one hour.

17b. IDOC rotenone sampling station, 28 July 1982, (475).

18. Prairie du Long Creek ¾ miles southeast of Floraville; 11 August 1983, (717), water clear, flow two cfs, bottom predominantly sand, with sand and gravel, width to 20-feet, depth to four-feet — average two-feet, well developed pool and riffle sequences, instream cover undercut banks and grass overhang, seined 55 minutes.

19. Prairie du Long Creek at Club Congress Road; 10 August 1983, (175), water flow two to three cfs, bottom sand, gravel, and some mud, width to 20-feet —average ten-feet, depth to five-feet — average two-feet, instream cover roots and rocks, seined 45 minutes.

20. Prairie du Long Creek at Highway 156; 12 August 1983, (41), water turbid, little current, width 30-feet, depth to five-feet, bottom sand and clay with mud shoreline, site appeared to have been channelized, instream cover numerous logs and some overhanging grass, seined 30 minutes.

21. Prairie du Long Creek at Highway 159 south of Hecker; 12 August 1983, (104), water turbid, three cfs, width to 20-feet, depth to three-feet — average two-feet, instream cover considerable roots, logs, debris making seining difficult, seined 45 minutes.

Gerhardt Creek

22. Gerhardt Creek at St. Clair-Monroe County line; 10 August 1983, (425), water flow one cfs, bottom predominantly rock and sand with some mud, width to 30 feet — average 15-feet, depth to three-feet, pool riffle sequence, instream cover undercut roots, many crayfish caught in each seine haul, seined 44 minutes.

Kopp Creek

23. Kopp Creek on Kopp Road; 11 August 1983, (699), water clear, very little flow, bottom bedrock and bedrock with mud layers and sand; rock and gravel riffles, width to 20-feet, depth to two-feet — average one-foot, pool and riffle sequence, little instream cover, seined 45 minutes.

Walters Creek

24. Walters Creek at Klein School Road; 11 August 1983, (1,368), water clear, little flow, bottom bedrock with some mud over bedrock, width 10 to 15-feet, depth to two-feet — average less than one-foot, predominantly pools with short riffles, instream cover rocks and overhanging grass and roots, seined 40 minutes.

Rockhouse Creek

25. Rockhouse Creek at Highway J crossing; 11 August 1983, (1,072), water clear, flow one cfs, bottom bedrock with rocks, riffles gravel and rock, width to 30-feet, depth to two-feet — average one-foot, instream cover rock overhangs and some roots, seined 50 minutes.

Black Creek

26. Black Creek at Brickley Road northeast of Red Bud; 12 August 1983, (193), water clear to murky with strong sewage smell, little flow, bottom firm clay, sand, mud, and gravel, width 30 to 40-feet below bridge — to 15-feet above bridge, depth to three-feet below bridge — to 1½ feet above bridge, instream cover roots and considerable trash, seined 20 minutes.

RESULTS

Smith's (1979) distribution maps show 20 species occurring at four localities in Richland Creek. The collections reported here bring the list of fishes known from Richland Creek to 33 species. Smith (1979) reported bigmouth buffalo, *Ictiobus cyprinellus*, which was not found in either subsequent sampling effort.

The most numerically abundant fishes found in this study were the minnows *Semotilus atromaculatus*, (16% of total fishes, 20 sites) and *Pimephales notatus* (12%, 11 sites). Creek chubs were generally distributed throughout the drainage, except for upper Richland Creek. They tended to be relatively more abundant in headwater streams. Bluntnose minnows prefer hard bottomed pools in creeks and small rivers (Smith, 1979). This is reflected in our collections. All but 17 specimens were from the upper tributaries of Prairie du Long Creek.

Mosquito fish, *Gambusia affinis*, (11%, 10 sites) was third in total abundance. It was concentrated in lower parts of the drainage in shallow slack water habitat.

Red shiners, *Notropis lutrensis*, (10%, 21 sites) were widespread throughout the drainage, except for upper Richland Creek. Fathead minnows, *P. promelas*, (9.6%, 14 sites) although widespread in the drainages, were concentrated in the lower part of the main channel. Bigmouth shiners, *Notropis dorsalis*, (8.7%, 17 sites) were generally abundant in the tributaries and present in the lower main channel. The central stoneroller, *Campostoma anomalum*, (8.8%, 16 sites) was most abundant in the upper parts of Prairie du Long and West Fork of Richland Creek. Together these six minnows and the mosquito fish made up 65.2% of the total fishes collected.

Green sunfish, *Lepomis cyanellus*, (6.9% of total numbers, 22 sites) and bluegill, *Lepomis macrochirus*, (2.2%, 22 sites) were the most widespread species.

Blackstripe topminnows, *Fundulus notatus*, occurred at 17 sites scattered throughout the state. The common bullhead in the system was the yellow bullhead, *Ictalurus natalis*, 3.3% of the total, taken at 16 sites. White suckers, *Catostomus commersoni*, occurred at 16 sites scattered throughout the basin, but were more abundant in the western tributaries. Two minnows, *Phenacobius mirabilis* and *Notropis umbratilis*, each occurred at 15 sites, primarily in the western tributaries. The redfin shiner made up 2.1% of the total fish caught.

Seven species were taken only in Prairie du Long Creek and its tributaries. Six of these are species normally associated with clear high-gradient streams with sand, gravel, and bedrock substrate; *Moxostoma erythrurum*, *Noturus exilis*, *Lepomis megalotus*, *Percina caprodes*, *Etheostoma spectabile*, and *E. nigrum*. The flier, *Centrarchus macropterus*, was taken in the lower base-level portion of the creek.

DISCUSSION

The three most significant causes of water quality degradation in the Richland Creek Basin are acid mine drainage, sewage treatment plant discharge, and agricultural runoff. These factors appear in sequence as one travels downstream from the northern to the southern regions of the Richland Creek Basin (Versar Inc., 1980).

Acid mine drainage, principally from abandoned coal mines in the northern headwaters, causes extremely high levels of iron, manganese, sulfates, and dissolved solids in the northern part of Richland Creek. These effects were observed, to a lesser extent, all the way to the creek's confluence with the Kaskaskia River. We

have seen the headwaters running blood red after a storm event, and ferric hydroxide precipitate coated the stream banks at the confluence with the Kaskaskia River.

Sewage treatment plant (STP) discharges are the only major point sources in the Basin. Most of the eight STP discharges are located near the Belleville and Swansea area. More than six million gallons/day (ten cfs) are discharged from the Belleville area. Thus, the water flow down to the confluence with Douglas Creek is often mostly treated water and the effects of these discharges are evident downstream of Belleville. Elevated levels of fecal coliforms, ammonia, total Kjeldahl nitrogen, nitrate, orthophosphate, and total phosphorus occur downstream of Belleville, and historical data indicate that during low summer flows, Richland Creek is occasionally almost anaerobic in this area. Douglas Creek receives discharges from Millstadt and Smithton, and Kinney Branch receives discharges from Freeburg (Versar Inc., 1980).

Much of the remainder of Richland Creek Basin is impacted by agricultural runoff, which results in high concentrations of microbes, nutrients, and suspended solids. During our work in the basin, we saw many examples of the worst possible agricultural practices: Fields plowed to the channel edge; and row crops planted on steep slopes with the rows running straight downhill to huge erosion gullies.

Urban runoff from Belleville probably also degrades Richland Creek, but its effects are difficult to isolate due to the polluted character of the creek in this reach. A few housing developments are already scattered throughout the basin, and problems with urban runoff will undoubtedly increase with time.

The number of fish species collected per site reflects water quality conditions, and was generally low in the highly polluted main channel and higher in smaller tributary streams. The worst sites were in the main channel above its confluence with Douglas Creek (TABLE 1).

The distribution and abundance of *Pimephales promelas* and *P. notatus* in Richland Creek reflected the stream's pollution pattern. *P. promelas* was more abundant than *P. notatus* in the polluted main channel, but *P. notatus* was more abundant in the tributary streams where *P. promelas* rarely occurred. Pflieger (1975) noted that *P. promelas* was tolerant of high temperatures, extreme turbidity, and low oxygen. Keevin (1978) found *P. promelas* to be the most abundant species in the polluted urban streams of St. Louis and St. Louis County regardless of stream bottom type. Smith (1979) noted that *P. promelas* is usually abundant where *P. notatus* is absent, suggesting that it cannot compete successfully with species of similar habitat.

Prairie du Long Creek and its tributaries contain seven species not found by us in the main channel. Six of these species were characteristic of high quality streams. Two species, *Noturus exilis* and *Etheostoma spectabile*, represent range extensions in the Kaskaskia River basin. *N. exilis* was previously known only from the headwaters, and *E. spectabile* from only two tributaries in the middle reaches of the Kaskaskia River (Smith, 1979).

Land owners in the Prairie du Long basin told us that fish kills were not uncommon. Much of the basin has poor soil management practices such as row crops planted on steep slopes. Nevertheless, the fish fauna reflects the Ozark-like rugged natural beauty of the area. We strongly urge planners and developers to recognize and preserve this aesthetic resource.

ACKNOWLEDGMENTS

This study was funded by the St. Louis District, U.S. Army Corps of Engineers. Anthony Meier, Leo Nico, and Eric Thomerson assisted in our field collections. We thank the many landowners who gave us permission to collect on their property and appreciate the anecdotal information most of them offered. Butch Atwood and Bill Boyd supplied the IDOC collection data. Dr. Lawrence Page provided INHS collection data.

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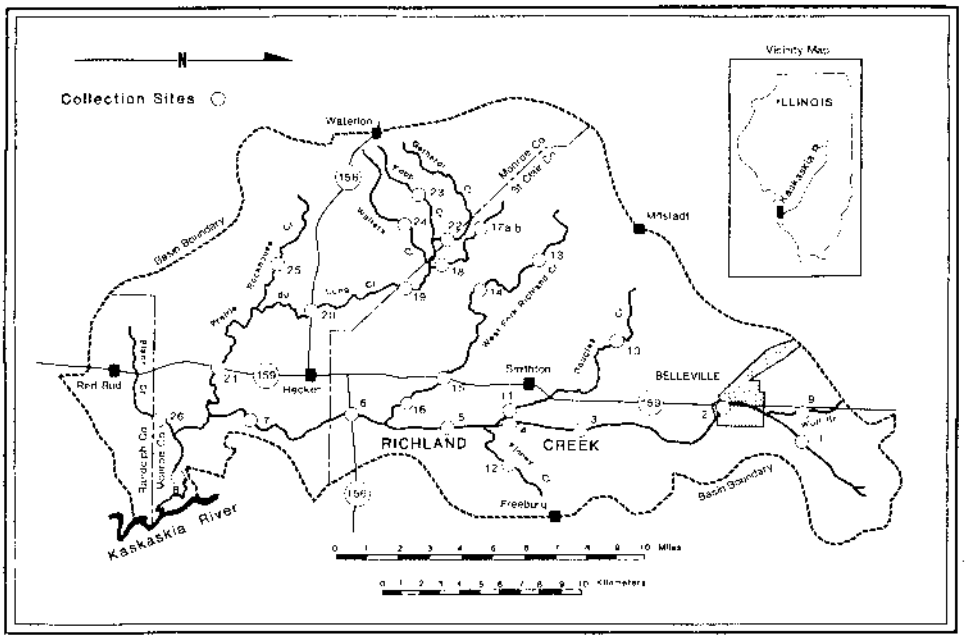

Figure 1. Location of fish sampling sites.

Table 1. Fishes collected from Richland Creek (Number of Individuals)

SITE NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Dorosoma cepedianum	—	—	—	—	—	—	2	—	—	—	—	—	—	—
Cyprinus carpio	—	—	—	—	—	—	10	—	—	—	—	—	—	—
Notemigonus crysoleucas	—	1	1	—	3	—	1	—	10	—	—	2	—	—
Semotilus atromaculatus	—	—	—	9	132	144	33	22	—	61	24	83	58	162
Phenacobius mirabilis	—	—	—	—	—	—	1	—	—	1	3	1	5	1
N. dorsalis	—	—	—	—	39	32	4	3	—	120	72	22	13	23
N. lutrensis	—	—	1	—	6	4	10	11	—	29	26	2	27	5
N. stramineus	—	—	—	—	4	—	2	—	—	12	3	—	—	—
N. umbratilis	—	—	—	—	—	—	—	6	—	4	1	—	—	24
Pimephales notatus	—	—	—	—	1	3	—	2	—	—	—	—	—	—
P. promelas	—	1	8	—	225	785	45	2	—	2	—	1	1	1
Campostoma anomalum	—	—	—	—	7	6	10	—	—	10	—	5	87	300
Moxostoma erythrurum	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Catostomus commersoni	—	—	—	—	—	4	—	—	1	3	1	—	12	10
Erimyzon oblongus	—	—	—	—	—	2	—	—	—	—	—	—	4	—
Ictalurus melas	—	—	—	—	4	3	—	—	39	—	—	—	1	1
I. natalis	—	—	—	—	12	182	31	3	—	—	—	6	1	1
I. punctatus	—	—	—	—	—	1	—	—	1	—	—	—	—	—
Noturus exilis	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Aphredoderus sayanus	—	—	—	—	—	1	2	—	—	1	—	—	—	—
Fundulus notatus	—	2	—	1	36	3	1	1	—	4	1	—	—	—
Gambusia affinis	—	—	—	17	638	123	64	244	—	—	—	1	—	—
Micropterus salmoides	1	4	—	—	—	1	2	—	12	—	—	—	52	5
Lepomis cyanellus	—	11	1	31	117	113	—	1	6	21	3	20	58	11
L. gulosus	—	—	—	—	—	—	—	—	1	2	—	—	1	—
L. macrochirus	1	—	1	5	11	1	57	1	35	2	5	5	19	26

L. megalotus	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Centrarchus macropterus	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Percina caprodes	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Etheostoma gracile	—	—	—	—	1	7	1	—	—	—	—	—	—	—
E. nigrum	—	—	—	—	—	—	—	—	—	—	—	—	—	—
E. spectable	—	—	—	—	—	—	—	—	—	—	—	—	—	—
L. macrochirus/														
L. cyanellus hybrid	—	—	—	—	1	—	3	—	—	—	—	1	—	—
Total # Individuals	2	19	12	63	1,237	1,415	279	296	105	272	139	149	339	570
Total # Species	2	5	5	5	15	18	17	11	8	14	10	11	14	13

Table 1 (Continued). Fishes collected from Richland Creek (Number of Individuals)

SITE NUMBER	15	16	17a	17b	18	19	20	21	22	23	24	25	26	Total
Dorosoma cepedianum	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Cyprinus carpio	—	—	—	—	—	—	—	—	—	—	—	—	—	10
Notemigonus crysoleucas	—	—	—	—	—	—	—	—	—	—	—	—	—	18
Semotilus atromaculatus	26	179	65	139	84	7	—	—	72	280	65	140	29	1,814
Phenacobius mirabilis	3	19	6	—	4	4	—	—	13	—	2	30	3	96
N. dorsalis	—	7	53	1	174	—	—	—	8	81	218	97	17	984
N. lutrensis	95	9	153	16	134	91	8	19	99	2	48	340	—	1,135
N. stramineus	—	—	3	—	7	—	—	—	5	—	—	14	—	50
N. umbratilis	20	5	27	2	23	17	11	14	24	—	46	5	5	234
Pimephales notatus	—	11	5	—	83	4	—	—	70	79	832	274	—	1,364
P. promelas	—	2	—	—	—	—	—	—	—	—	2	1	19	1,095
Campostoma anomalum	3	45	5	83	83	1	—	—	42	222	76	17	—	1,002
Moxostoma erythrurum	—	—	—	—	—	—	—	—	8	—	—	14	—	22
Catostomus commersoni	4	17	1	33	1	1	—	1	14	7	4	3	—	117
Erimyzon oblongus	—	—	—	—	—	—	—	—	—	—	—	—	—	6
Ictalurus melas	2	25	—	2	—	—	—	3	—	—	—	—	—	80
I. natalis	1	91	3	25	3	1	—	—	2	1	—	14	2	379
I. punctatus	—	—	—	1	—	—	—	—	—	—	—	—	—	3
Noturus exilis	—	—	2	1	—	—	—	—	9	—	6	7	—	25
Aphredoderus sayanus	—	1	—	—	—	—	—	—	—	—	—	—	1	6
Fundulus notatus	3	26	—	—	14	5	7	3	—	—	1	6	3	117
Gambusia affinis	—	—	—	—	—	—	—	53	1	—	—	3	104	1,248
Micropterus salmoides	—	1	—	8	—	1	—	—	2	—	—	—	—	89
Lepomis cyanellus	42	183	4	71	3	3	—	1	3	11	4	—	10	785
L. gulosus	—	—	—	—	—	—	—	—	—	—	—	—	—	4
L. macrochirus	5	4	2	19	17	15	13	4	16	—	—	42	—	249

L. megalotus	—	—	2	3	6	7	2	1	—	—	—	—	—	21
Centrarchus macropterus	—	—	—	—	—	—	—	4	—	—	—	—	—	4
Percina caprodes	—	—	—	—	—	—	—	—	—	—	—	1	—	1
Etheostoma gracile	—	9	—	—	—	—	—	—	—	—	—	—	—	18
E. nigrum	—	—	12	71	81	16	—	—	25	13	63	54	—	335
E. spectable	—	—	—	—	—	2	—	1	12	3	1	10	—	29
L. macrochirus/														
L. cyanellus hybrid	2	—	—	—	—	—	—	—	—	—	—	—	—	7
Total # Individuals	206	634	343	475	717	175	41	104	425	699	1,368	1,072	193	11,399
Total # Species	11	17	15	15	15	15	5	11	18	10	14	19	10	32