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First Arkansas Records for Bigscale Logperch Percina macrolepida Stevenson (Pisces: Percidae), with Comments on Habitat Preference and Distinctive Characters

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Abstract

Fish samples were collected with seines and rotenone from 21 localities representing five major habitat types along the Red River in Arkansas. The bigscale logperch, *Percina macrolepida*, was found at 11 of those sites, providing the first records of that species from the state. The primary preferred habitat parameters for bigscale logperch are no current, a sand and/or silt substrate, and a water depth of 1.0-2.0 m. *Percina macrolepida* is morphologically very similar to the widespread and common logperch, *P. caprodes*, but can be distinguished from all forms of that species in Arkansas by a combination of characters. Snout shape and the presence of scales on the breast, prepectoral area, and along the posterior edge of the preopercle in *P. macrolepida* are the most useful distinguishing features.

Introduction

The bigscale logperch, *Percina macrolepida*, was originally described from Texas specimens by Stevenson (1971). Its known distribution at that time was the Colorado, Guadalupe, Brazos, San Jacinto, Trinity, and Devil's river drainages in Texas, the Rio San Carlos in Coahuila, Mexico, and Lake Texoma (Red River drainage) and its tributaries in Oklahoma. Subsequently, native populations were also reported from the Sabine River in eastern Texas and western Louisiana (Stevenson and Thompson, 1978), and from the middle and upper Pecos River in New Mexico (Stevenson, 1980). Stevenson and Thompson also reported two specimens from the Red River mainstream in Oklahoma below Denison Dam: one from near Kemp City in Bryan Co., and one near the U.S. Hwy 259 bridge in McCurtain Co. (approximately 18 km upstream from the Arkansas state line). The bigscale logperch also has been accidentally introduced into California (Sturgess, 1976), where it has established widespread populations in the Sacramento-San Joaquin system. More recently, introduced populations have been reported from northern Colorado (Platania, 1990).

The North American darter genus *Percina* contains about 40 species divided into nine subgenera, representing the larger members of the darter tribe (Etheostomatini). *Percina macrolepida* is a member of the subgenus collectively known as logperches (*Percina*). There are currently seven recognized species within this subgenus with the logperch, *P. caprodes*, the most widely distributed member. *Percina caprodes* is found over most of eastern North America from Hudson Bay and Great Lakes drainages, south throughout some Atlantic coastal drainages and in most of the Mississippi River basin, including Arkansas (Robison and Buchanan, 1988). *Percina macrolepida* has the southwesternmost range of any species of *Percina* and is the second most widely distributed logperch.

Percina macrolepida is morphologically very similar to *P. caprodes*, and Stevenson (1971) referred to the two as sibling species. *Percina caprodes* is found in practically all stream drainages of Arkansas (Robison and Buchanan, 1988) and is a highly variable species. Morris and Page (1981), in a study of variation in western logperches, recognized three distinct forms inhabiting Arkansas:

(1) *P. c. caprodes* is found in Ouachita and Red river drainages (Little River) of the state but not in mainstem Red River habitats. It is distinguished on the basis of high scale counts, narrow lateral bars, and the absence of an orange submarginal band in the first dorsal fin.

(2) *P. c. fulvitaenia* occurs in the Arkansas River drainages of the state and has low scale counts, wider lateral bars, and a broad orange or yellow-orange submarginal band in the first dorsal fin of adult males (females may also have a yellow to orange submarginal band).

(3) *P. c. fulvitaenia* x *P. c. caprodes* inhabits the White River drainage and is currently considered to represent intergrades between the first two subspecies. This diagnosis was based mainly on the variability of the development of the orange band in the first dorsal fin and is not fully accepted by all current researchers. Further study of the systematics of this form is needed.

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Stevenson (1971) provided characters for distinguishing the bigscale logperch from central Texas populations of logperch which were then included in *P. caprodes*. Subsequently, the central Texas populations of *P. caprodes* were recognized as a distinct species, *P. carbonaria*, the Texas logperch (Morris and Page, 1981). Morphometric characteristics of larval and juvenile bigscale logperch from the West Fork of the Trinity River Basin, Texas, were described by Simon and Kaskey (1992). Some of Stevenson's characters used to distinguish *P. macrolepida* from central Texas populations of logperch are not valid for distinguishing *P. macrolepida* from the three distinct forms of *P. caprodes* occurring in Arkansas. We herein report the first confimed records of *P. macrolepida* from Arkansas, its preferred habitat characteristics, and characters for distinguishing that species from Arkansas populations of *P. caprodes*.

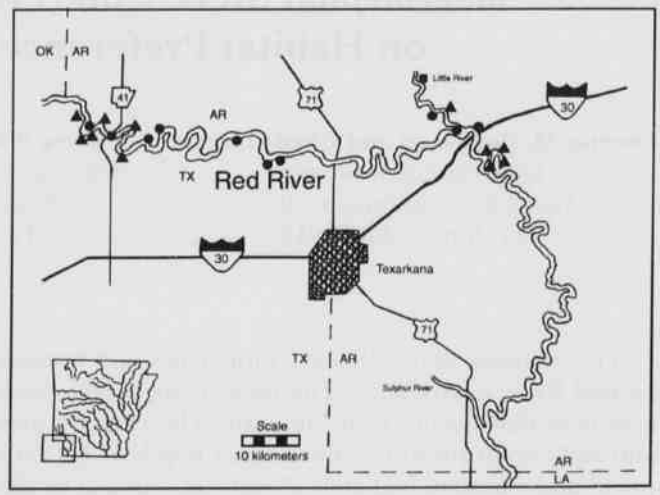

Fig. 1. Fish sampling sites along the Red River in southwestern Arkansas, July 1995. Solid triangles represent sites where *Percina macrolepida* was found. The solid square (Little River) represents a *P. macrolepida* record from the Henderson State University vertebrate collection.

Materials and Methods

The Arkansas portion of the Red River is approximately 217 river km long. Our sampling sites, which were distributed from near the Oklahoma state line downstream to about 6.4 km south of Fulton in Hempstead Co. (Fig. 1), were confined to the upper 53% of the river in Arkansas to maximize the possibility of finding *P. macrolepida*. Fish collections were made between the hours of 0900 and 2000 on 23-26 July 1995 with an ichthyocide (rotenone) and with 6 x 0.9 m and 9 x 1.8 m nylon seines of 3.2 mm mesh. Specimens of all species collected were preserved in 10% formalin and later transferred to 45% isopropanol. All fish species present at each site were identified in the laboratory from the preserved samples, and specimens were deposited in the Westark Community College zoology collection (WZC).

Twenty-one collections were made in five distinct habitat types:

(1) Main channel (four collections), the mainstream of the river along seinable point bars and islands.

(2) Chute (one collection), a swiftly flowing section or branch of the river separated from the mainstream by an island.

(3) Backwater (10 collections), an area of quiet, permanent water off the main channel of the river behind an island or sandbar and connected to the main channel by one or two passageways.

(4) Sandbar pool (two collections), a large, temporary pool of water, generally exceeding 0.5 m in depth, left behind on a sandbar or island after a recent drop in river level.

(5) Oxbow lake (four collections), a meander scar lake periodically inundated by the river.

Three of the backwater collections were made in the Little River within 2.5 km of its confluence with the Red River.

Several physical parameters were recorded at each locality to determine the summer habitat preference of the bigscale logperch. Water temperature, maximum depth, depth of capture, substrate composition, current (estimated as none, slow, moderate, or swift), and Secchi disk visibility (an indicator of turbidity) were determined.

Thirteen meristic and morphological characters were examined to determine the best features for distinguishing *P. macrolepida* from Arkansas populations of logperch, *P. caprodes*. Counts and measurements were made following Hubbs and Lagler (1964), except the diagonal (transverse) scale rows which were counted from the anal fin origin to the first dorsal fin. Standard length (SL) was measured to the nearest mm with dial calipers. Scales on the breast, on the top of the head (supraoccipital region), in the prepectoral area, and on the edge of the preopercle (exposed or embedded along the thin posterior edge) were recorded as present or absent.

Five pigmentation features were studied. They are as follows: (1) presence or absence of a broad orange or yellow-orange submarginal band in the first dorsal fin, (2) the number of vertical bars along the side of the body counted from the occiput to the hypural plate (all bars which extended distinctly below the lateral line were counted), (3) the number of lateral bars which meet ventrally (usually on the caudal peduncle) with their corre-

sponding member from the other side, (4) the occurrence of a vertical subocular bar (teardrop pattern beneath eye), and (5) the occurrence of a horizontal bar beneath the orbit. Snout shape was classified as either pointed (but not fleshy) or conical (fleshy, bulbous, and usually protruding far beyond the upper lip).

Differences between *P. macrolepida* and *P. caprodes* population means for number of lateral line scales, number of diagonal scale rows, and number of vertical bars along the side of the body were tested for statistical significance with a Student's t-test. Arkansas collections of *P. caprodes* examined for comparison with *P. macrolepida* came from the Ouachita River drainage (Lake Hamilton, Westark Zoology Collection-0852), the Arkansas River drainage (Blue Mountain Lake, WZC-1137; and Nimrod Lake, WZC-1421), and the White River drainage (Greers Ferry Lake, WZC-1138). Twenty lots of logperch in the Henderson State University (HSU) vertebrate collection were also examined.

Results

We collected 246 specimens of *P. macrolepida* from 10 of the 21 sites sampled (Fig. 1). At another site, one bigscale logperch was observed swimming briefly near the surface in response to the applied rotenone but was not captured. Thirty-eight of the specimens were taken from river backwater habitats (35 of those from the Red River and three from the Little River), and 208 were caught in Fifty-one Cutoff Lake, an oxbow in Hempstead Co. which is annually inundated by the Red River. No bigscale logperch were found in the main channel, sandbar pools, or in a chute.

The preferred summer habitat parameters for *P. macrolepida* are quiet water, sand or silt substrate, and water depth of 1.0-2.0 m. No specimens were found in habitat having any noticeable current, and only one specimen was collected in shallow water. Eighty-nine individuals (36.2%) were caught over sand substrate, 11 (4.5%) over silt substrate, 145 (58.9%) over mixed sand and silt substrate, and one (0.4%) over gravel substrate.

The water was very turbid at all sites sampled, a condition typical of the Red River in Arkansas throughout the year. Secchi disk visibility ranged from 20-46 cm in the Red River, 38-61 cm in the oxbow lake, and was 79 cm in the Little River. Water temperature ranges for these three areas were 26.7° (spring-fed backwater) -31.1°C, 28.3° - 30.0°C, and 30°C, respectively. All river backwaters where *P. macrolepida* occurred, except one, ranged in surface area from 0.2-12.0 ha; one bigscale logperch was caught in a small (0.001 ha), shallow (0.36 m), gravel-bottom pool immediately adjacent to the main channel of the Red River. There was little or no vegetation or cover at most sites where bigscale logperch were found. The Little River backwater had three small patches of *Potamogeton* along its north bank, but the three *P. macrolepida* collected at that locality were not taken near the vegetation. Two of the Red River backwaters had roots, logs and stumps, and three of the oxbow lake sites had standing timber and some logs. Each river backwater where *P. macrolepida* was found had a connection to the main channel. Backwaters completely cut off from the main channel yielded no specimens.

Of the 10 backwaters sampled having all of the prime habitat parameters for bigscale logperch, seven produced specimens of that species. Generally, less than 10% of a given backwater locality was sampled. Fifty-one Cutoff Lake had the largest population of *P. macrolepida* (84.6% of all specimens collected). All four samples taken from that oxbow lake yielded bigscale logperch. The largest of those lake samples was a 0.1 ha area sampled with rotenone which produced 136 specimens.

Other fish species collected at all sites where *P. macrolepida* occurred were typical of Coastal Plain habitats in Arkansas. Thirty-three species were collected from Fifty-one Cutoff Lake, and other darters found there were *Etheostoma chlorosomum*, *E. gracile*, and *P. shumardi*. In the Red River backwaters where *P. macrolepida* was found, 49 species were collected including the darters, *E. asprigene*, *E. chlorosomum*, *E. collettei*, *E. gracile*, *P. sciera*, and *P. shumardi*. The one Little River backwater where bigscale logperch were found produced 26 species including the darters *E. gracile* and *P. sciera*.

Table 1 compares 13 characters of *P. macrolepida* with the three forms of *P. caprodes* in Arkansas. The frequency distributions of lateral line scales (Table 2) and of diagonal scale rows (Table 3) are also compared for all four forms.

Discussion

There are six characters that are most reliable for distinguishing *P. macrolepida* from all three forms of *P. caprodes*. One of the most useful characters is snout shape (Fig. 2). In *P. macrolepida*, the snout is pointed, not fleshy, and rarely protrudes prominently past the front of the upper lip; the snout of *P. caprodes* is conical, bulbous and fleshy, usually projecting well in front of the upper lip. Sometimes juvenile *P. caprodes* specimens less than 55 mm SL have a pointed, nonprotruding snout (especially *P. c. caprodes*), and 11% of Arkansas *P. macrolepida* have a moderately conical to very conical, protruding snout.

The presence of scales on the breast is a character that is unique to *P. macrolepida* among the members of the subgenus *Percina*. The entire genus *Percina* is characterized by the presence of one or two large stellate scales

Table 1. Comparison of characters of *Percina macrolepida* from the Red River with those of the three forms of *P. caprodes* occurring in Arkansas. Percentages indicate the % of individuals showing that character.

Character	*P. macrolepida* Red R. dr. N=246	*P. c. caprodes* Ouachita R. dr. N=119	*P. c. fulvitaenia* Arkansas R. dr. N=106	*P. c. fulvitaenia* X *P. c. caprodes* White R. dr. N=138
Snout shape+	Pointed, not fleshy (89%)	Conical and fleshy (86%)	Conical and fleshy (85%)	Conical and fleshy (92%)
Breast Scales+	Present (83%)	Absent (98%)	Absent (100%)	Absent (98%)
Prepectoral scales +	Present (79%)	Absent (95%)	Absent (99%)	Absent (98%)
Scales on edge of preopercle+	Present (74%)	Absent (99%)	Absent (98%)	Absent (97%)
Mean diagonal scale rows+	24.9	28.7**	28.3**	31.3**
Mean lateral line scales	85.6	89.1**	85.7	87.5**
Vertical bars along side: range ($\bar{x}$)+	12-20 (16.1)	10-19 (14.3)**	11-17 (14.7)**	10-18 (14.9)**
Vertical bars meeting ventrally	0 (0.4%) 1 (73.2%) 2-7 (26.4%)	0 (38.7%) 1 (59.7%) 2 (1.6%)	0 (0%) 1 (72%) 2-4 (28%)	0 (1.4%) 1 (88.4%) 2-4 (10.2%)
Scales on top of head	Present (53%)	Absent (89%)	Absent (91%)	Absent (96%)
Orange band in first dorsal fin	Absent	Absent	Present	Variable
Vertical subocular bar (teardrop)	Absent 77% Faint 15% Distinct 8%	Absent 58% Faint 21% Distinct 21%	Absent 0% Faint 16% Distinct 84%	Absent 24% Faint 47% Distinct 29%
Horizontal bar beneath orbit	Absent 1% Faint 32% Distinct 67%	Absent 25% Faint 52% Distinct 23%	Absent 6% Faint 28% Distinct 66%	Absent 17% Faint 51% Distinct 32%
Standard length range (mm)	33-76	37-116	51-77	44-92

+ Designates a character that distinguishes *P. macrolepida* from all three forms of *P. caprodes*.

** Indicates a *P. caprodes* mean that is significantly different ($p<0.01$) from the *P. macrolepida* mean for that character.

on the breast between the bases of the pelvic fins in both sexes. Therefore, the use of the presence of scales on the breast to identify *P. macrolepida* refers to scales occurring anywhere on the breast anterior to the pelvic fin bases. The number of breast scales present in bigscale logperch is highly variable, and very often the breast scales are embedded and difficult to see. Arkansas specimens rarely have a fully scaled breast; usually there are one or a few scattered, embedded or exposed scales with prominent ctenii (Fig. 3). The breast of *P. caprodes* is scaleless (except for the one or two enlarged scales between the pelvic fin bases). All forms of *P. caprodes* lack scales in the prepectoral area, on the edge of the preopercle, and on top of the head, whereas *P. macrolepida* usually has scales in

Table 2. Lateral line scale counts for Arkansas populations of *Percina macrolepida* and *P. caprodes*.

	No. of lateral line scales																					
Species and drainage	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	N	$\bar{X}$	SD	CV
Percina macrolepida Red R.	1	1		2	3	9	26	40	38	33	49	20	15	8		1				246	85.6	2.3	2.7
P. caprodes caprodes Ouachita R.								1	3	4	15	34	18	10	13	14	5		2	119	89.1	2.1	2.4
P. c. fulvitaenia Arkansas R.				2		3	6	10	25	28	17	8	7							106	85.7	1.8	2.1
P. c. fulvitaenia X							1	5	18	19	23	31	23	8	5	3	1	1		138	87.5	2.0	2.3
P. c. caprodes White R.																							

Table 3. Diagonal scale row counts (from origin of anal fin to first dorsal fin) for Arkansas populations of *Percina macrolepida* and *P. caprodes*.

	No. of diagonal scale rows																				
Species and drainage	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	N	$\bar{X}$	SD	CV
Percina macrolepida Red R.	2	5	20	22	50	58	49	26	11	2		1					246	24.9	1.8	7.2
P. caprodes caprodes Ouachita R.						1	10	22	26	22	19	15	1	3			119	28.7	1.7	5.9
P. c. fulvitaenia Arkansas R.			1		3	9	16	30	27	13	6	1					106	28.3	1.5	5.3
P. c. fulvitaenia X							2	4	17	23	26	28	30	7	1		138	31.3	1.7	5.4
P. c. caprodes White R.																				

those areas.

The presence of scales on top of the head is not a very useful character for identifying Arkansas *P. macrolepida*, although it is an excellent feature for distinguishing central Texas populations of that species. Stevenson and Thompson (1978) noted the variation in the number of scales on top of the head of bigscale logperch and reported an eastward cline in that feature. Virtually 100% of central Texas specimens have head scales, with a reduction in number occurring eastward to the Sabine River. The lower number (53%) of Arkansas specimens having scales on top of the head probably represents the eastern end of that cline. Arkansas specimens also have higher mean lateral line scale counts and a lower percentage (74%) of individuals with scales on the edge of the preopercle than central Texas populations. These and other features studied may also represent clinal variation. Arkansas bigscale logperch with scales on the edge of the preopercle usually have 1-3 scales; a few individuals have as many as seven or eight scales.

Mean number of diagonal scale rows is the only scale count found to be reliable for separating *P. macrolepida* from all Arkansas forms of *P. caprodes* ($p<0.01$). The mean number of vertical bars along the side of the body also differed significantly. However, the significant mean differences for those two features are not as useful as the

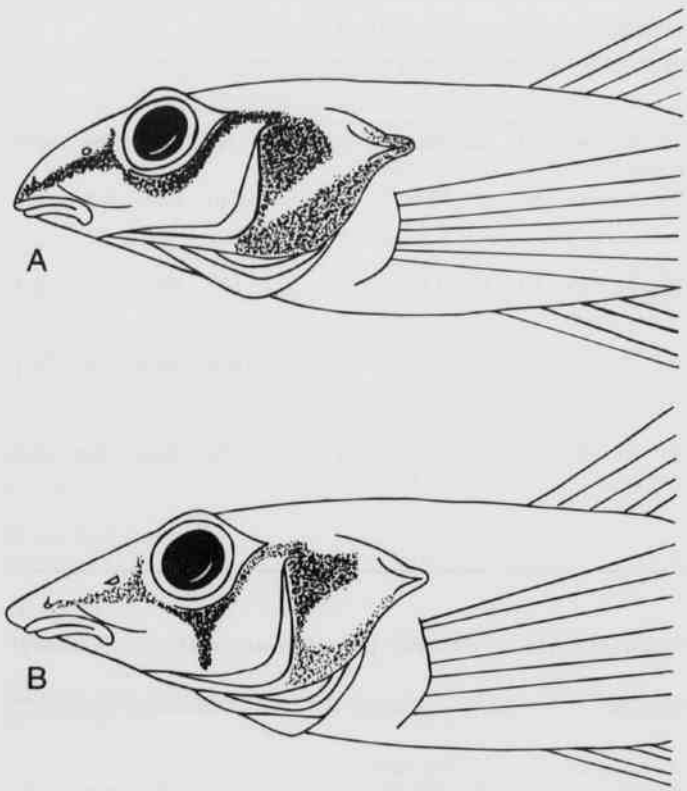

Fig. 2. Comparison of typical snout shape and head pigmentation patterns of (A) *Percina macrolepida* and (B) *P. caprodes* (pigmentation of illustrated specimen is typical of *P. c. fulvitaenia*.

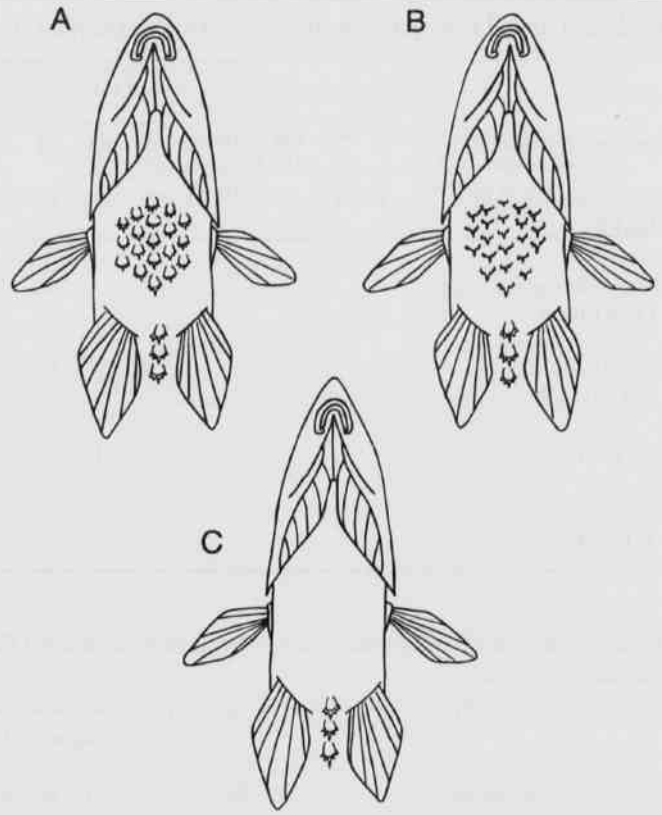

Fig. 3. Ventral views of *Percina macrolepida* showing (A) exposed scales on breast and (B) embedded scales on breast, and *P. caprodes* (C) showing breast with scales absent.

other characters when attempting to identify only one or two individuals; they are more appropriate when a larger series of specimens is involved.

In addition to the above characters, Stevenson (1971) used lateral line scale counts, absence of an orange band in the first dorsal fin, the number of lateral bars meeting ventrally, absence of a vertical subocular bar, and presence of a horizontal bar beneath the orbit to further distinguish *P. macrolepida* from central Texas populations of *P. c. carbonaria* (now elevated to full specific status, *P. carbonaria*). None of these latter characters can be used to distinguish *P. macrolepida* from all three forms of *P. caprodes* in Arkansas, but some of them are valid for separating the bigscale logperch from one or two of the three forms of *P. caprodes*. The bigscale logperch is significantly different ($p<0.01$) in mean number of lateral line scales from the two forms of *P. caprodes* occurring in the Ouachita and White river drainages, but not from the form in the Arkansas River drainage. It differs from Arkansas River drainage *P. caprodes* (but not from the other two forms) in usually lacking a vertical subocular bar and in lacking an orange submarginal band in the first dorsal fin. Yellow chromatophores are often scattered in the first dorsal fin membranes of *P. macrolepida* but are not concentrated in any one area into a submarginal band.

Stevenson (1971) and Sturgess (1976) noted that *P. macrolepida* is a smaller species than *P. caprodes*, an observation supported by our data. Maximum standard lengths reported for bigscale logperch are 87 mm in Texas (Stevenson, 1980) and 104 mm in California (Moyle, 1976). *Percina caprodes* is a much larger species, attaining a maximum size in Arkansas of approximately 178 mm (Robison and Buchanan, 1988). The largest *P. macrolepida* collected in our study was 76 mm SL.

Percina macrolepida is apparently widely distributed along the Red River of Arkansas in the appropriate habitats. Prior to our study only two records were known from the Red River downstream from Lake Texoma. Both of those records (consisting of one specimen each) were from the Oklahoma portion of the river between Denison Dam and the Arkansas state line, a distance of approximately 209 km (Stevenson and Thompson, 1978). The

number and size range of specimens collected in our study indicate that the bigscale logperch probably maintains established breeding populations in Arkansas, rather than occurring only occasionally as waifs from upstream populations. It is also very likely that *P. macrolepida* occurs throughout the lower 47% of the Red River in Arkansas not sampled in our study.

Other researchers have generally reported similar habitat preferences for bigscale logperch to those indicated by our data. Jackson (1984) showed that juveniles had a strong mid-day affinity for littoral areas of Lake Texoma having relatively deep sand substrates, although night collections (between 2000 and 0600 hours) showed juveniles occurring over a greater variety of substrate. Areas with thin sand cover or no sand had fewer young. Adults did not reflect this substrate affinity to the same degree and were often collected from wave-swept locations having clay substrates with little sand. Moyle (1976) described the preferred habitat of *P. macrolepida* introduced into the Sacramento-San Joaquin system of California as lakes or slow moving stretches of muddy bottomed, turbid sloughs of the Delta and lower Sacramento River. In Colorado, bigscale logperch were found in a lake and in an irrigation canal in slow current over sand-silt substrates (Platania, 1990). Stevenson (1971) reported that *P. macrolepida* occurred in large numbers in reservoirs in Texas and avoided the turbulent areas of streams. However, its habitat in central Texas appears to be more variable than what we found in the Red River. In streams of the Edwards Plateau (Colorado and Guadalupe river systems), it occurs syntopically with *P. carbonaria* often over a gravel-rubble substrate in swift (nonturbulent) current.

Our data indicate that oxbow lakes associated with the Red River provide optimum habitat conditions for bigscale logperch. Only a small fraction of Fifty-one Cutoff Lake was sampled, and the 208 specimens collected there indicate that the lake has a large population. It is not known whether other Red River oxbow lakes have similar populations, but on topographic maps there are 73 oxbow lakes along the Red River in Arkansas. Most of those lakes are located no farther than 1.6 km from the main channel of the river, and none is more than 3.2 km away. Forty-five of the lakes are within the river levees or are located along sections of the river having no levees and they are probably inundated by the river in most years. All oxbow lakes associated with the river are inundated by unusual flood events such as the one that occurred in 1990. Therefore, it is possible that a substantial number of oxbow lakes along the Red River in Arkansas have large populations of *P. macrolepida*. Even though the main channel of the river does not provide optimum habitat for *P. macrolepida*, it almost certainly serves as a vital dispersal route for that species.

Habitat requirements may exclude syntopy of the bigscale logperch with *P. caprodes* in Arkansas, although the two species are syntopic in some Lake Texoma drainages in Oklahoma. *Percina caprodes* does occur (sometimes in large numbers) in practically all large reservoirs in Arkansas. In those reservoirs, it is almost always associated with at least some gravel or rocky substrate and usually clear or only moderately turbid water. Even though *P. caprodes* is relatively more tolerant of environmental variations and disturbances than most darters, it avoids high turbidity and silty substrates and is probably not able to survive in the Red River habitats preferred by *P. macrolepida*.

It is possible that the two species may occur syntopically in the Little River of Arkansas. *Percina caprodes* inhabits the headwaters of that river above Millwood Reservoir, and we found *P. macrolepida* downstream from that reservoir near the mouth of Little River. Tumlison et al. (1992) reported collecting specimens of *P. caprodes* from the Little River immediately below Millwood Dam in Little River Co. in February 1991. We have examined the two specimens (HSU-1229) from that collection and reidentified them as *P. macrolepida*. Another logperch specimen (HSU-26) was taken on 21 April 1991 from Beard's Lake in Hempstead Co., about 1.6 km east of where the HSU-1229 *P. macrolepida* were found. We identified the HSU-26 logperch as *P. c. caprodes*, demonstrating the close proximity (if not syntopy) of these two species of logperch in Little River drainages. Lake Millwood is another possible area for syntopy.

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