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NOTES ON THE HABITAT CHARACTERISTICS OF THE BACKWATER DARTER, *ETHEOSTOMA ZONIFER* (HUBBS AND CANNON)

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INTRODUCTION

The backwater darter, *Etheostoma zonifer* (Hubbs & Cannon) is endemic to the Mobile River basin, has a narrow range in Mississippi and Alabama in streams immediately below the fall line (Collette, 1962; Kuehne and Barbour 1983), and is considered rare across its distribution (Mettee et al., 1987; Boschung, 1992). For example, Boschung (1989) reported the backwater darter in only 11 of 352 collecting sites in the Upper Tombigbee River drainage in Mississippi and Alabama. The backwater darter is recorded in only 9 of 2,693 collections from the Upper Tombigbee River system in Mississippi in the MSU Ichthyological Collection.

Little detailed data are available concerning the habitat characteristics of this species. Hubbs and Cannon (1935) described *E. zonifer* habitat as creek pools from Catoma Creek, Montgomery, Alabama, and noted that vegetation occurred at many of the collecting stations. Both Page (1983) and Kuehne and Barbour (1983) indicated that because *E. zonifer* is closely related to *E. gracile* (Girard) their habitat is presumed similar and characterized as turbid, sluggish water over a soft bottom. Pierson et al. (1986) collected the backwater darter in the Buttahatchee River near Greenwood Springs, Mississippi, but did not provide any habitat data. Boschung (1989) listed eleven pre-Tennessee-Tombigbee Waterway (TTW) collection sites for the backwater darter in the Upper Tombigbee River drainage in Mississippi and Alabama, and indicated it inhabits pools in small streams of slow to moderate current and are captured over sand or silt bottoms.

During the course of a survey of 39 small streams in the Upper Tombigbee River drainage in Mississippi, I collected two backwater darters from two locations in Broken Pumpkin Creek, Mississippi. Here I provide habitat data associated with these specimens, and provide accounts of unpublished field data from the other specimens collected in the Mobile River basin.

MATERIALS AND METHODS

I surveyed streams periodically during spring and summer 1990 and 1991 throughout the Upper Tombigbee River drainage in Mississippi using: 1) a 3.05 X 1.2 m bag seine constructed of 3.2 mm mesh netting, 2) dip nets made of 3.2 mm mesh netting or 3) small aquarium nets. I made 17 habitat measurements at each collecting site where any darters were collected (see Table 1). Backwater darter specimens are housed in the MSU Ichthyological Collection (MSU #'s 7974 and 7976). Field notes of collections where *E. zonifer* were present were obtained from J.P. Kelly, G.H. Clemmer, M. Pierson, and the University of Alabama Ichthyological Collection.

Table 1. Habitat data from two sites on Broken Pumpkin Creek where *E. zonifer* was collected on 24 May 1990. Mean values are based on three measurements. The amounts of litter covering the substratum, the amount of vegetation, and cover other than vegetation were scored as 1 (absence), 2 (intermediate amounts) and 3 (high amounts). Shading was scored as 1 = full sun; 2 = partial sun; 3 = temporary full shade; and 4 = permanent full shade. Stream order was determined using U.S. Geological Survey topographic maps (1:24,000 scale).

Variables	Site 1	Site 2
Max Depth (cm):	34.0	49.0
Mean Depth (cm):	23.6 $\pm$ 15.6	44.4 $\pm$ 4.9
Max Width (m):	6.9	6.3
Mean Width (m):	5.0 $\pm$ 1.2	6.1 $\pm$ 0.5
Water Temperature (°C):	18.0	18.0
Dissolved Oxygen (mg/L):	6.8	6.4
pH:	6.5	6.7
Conductivity (mOhm):	240.0	250.0
Turbidity (NTU):	45.1	63.4
Current Velocity (m/sec):	.003 $\pm$ .006	.003 $\pm$ .006
Bank Slope (°):	25.0	40.0
Litter:	1.0	2.0
Vegetation amount:	1.0	1.0
Other Cover:	2.0	2.0
Substratum:	Medium sand, some gravel	Hard mud pan, some gravel
Shading:	2.0	2.0
Stream Order:	3.0	3.0

RESULTS AND DISCUSSION

I made collections in six of the nine pre-TTW sites in Mississippi listed in Boschung (1989) plus other small drainages throughout the upper Tombigbee River drainage. Two of the original eleven sites were in Alabama; one site was flooded and was not sampled, and two sites have been

inundated by the construction of the TTW and were not sampled. I found *E. zonifer* only in Broken Pumpkin Creek with three other species of darters on 24 May 1990 (quad coordinates: T16N, R19E, S10). These were *Etheostoma nigrum* Rafinesque (N=6), *E. chlorosomum* (Hay) (N=3), and *E. whipplei* (Girard) (N=35). The two individuals of *E. zonifer* (16.2 and 21.4 mm standard length) were collected downstream of the bridge located about 0.6 km north of Bigbee Valley, Mississippi, off Highway 388. Table 1 presents the habitat measurements for each station. Although only two individuals were collected, the habitat data indicate that these backwater darters were living in turbid, slow current habitats which is similar to the description in Page (1983) and Kuehne and Barbour (1983). Furthermore, these two stations were characterized by high conductivity and no vegetation, but intermediate amounts of other cover such as logs and branches (Table 1). A review of field notes associated with specimens housed in various museums (37 cataloged collections with habitat data; see Tables 2 and 3) indicated that backwater darters are found: 1) in slightly to moderately turbid waters (eight collections indicated clear); 2) in currents that range from none to moderate (but three collections indicated fast or swift); 3) associated with none or some vegetation (but one collection indicated dense vegetation); and 4) typically in sand, silt, or clay substratum with some gravel or rubble. These qualitative data support the data from Broken Pumpkin Creek for the comparable variables except for the presence of vegetation. All of the unpublished data except for 14 collections (Table 3) plus the initial data of Hubbs and Cannon (1935) indicate that vegetation was present at all sites where *E. zonifer* has been collected.

Based on the effort associated with this study and comments in Boschung (1989, 1992), it is clear that the backwater darter has been and is currently rare throughout the Mobile River basin. Results from this study can not address the habitat requirements of the backwater darter from a number of sites or requirements based on large number of collections from a single stream. It does, however, provide some quantitative and qualitative data concerning specific environmental conditions where *E. zonifer* specimens were collected, particularly prior to the completion of the TTW which upon completion obviously eliminated some of these habitats in directly affected streams. Additional quantitative work must be completed to verify the specific habitat requirements of the backwater darter so that appropriate conservation measures can be put in place to protect this rare species.

ACKNOWLEDGMENTS

This project was funded by the Mississippi Wildlife Heritage Fund, Jackson, Mississippi. I want to thank Mike Papay, James Key, and Cindy Taylor for field assistance. Stephen T. Ross verified the specimens of the backwater darter and provided the collection data from his data base on the MSU Ichthyological Collection. J.P. Kelly, G.H. Clemmer, and M. Pierson graciously provided their field notes and R. Mayden allowed use of the UAIC field notes.

LITERATURE CITED

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Table 2. Listing of unpublished records of *E. zonifer* from the Mobile River drainage. Museum numbers with an * are those for which habitat data were available.

Source (Collection #)	Collectors	Location	Counts	Museum Number
Mississippi State University	J.P. Kelly et al.	Luxapallila Creek [Mississippi]	1	MSU 5150*
	G.H. Clemmer et al.	Trim Cane Creek	1	MSU 1596*
		Nichols Creek	1	MSU 6417*
		Tombigbee River	4	MSU 2825*
		Tombigbee River	2	MSU 3337*
		Tombigbee River [all Mississippi]	1	MSU 4666*
	B. Teels C.A. Schultz	Sun Creek [Mississippi]	1	MSU 7023
Malcolm Pierson (Personal Collection)	M. Pierson C.A. Schultz	Tributary of Magowah Creek [Mississippi]	3	XMP 12.14*
Auburn University	M. Pierson C.A. Schultz	Broken Pumpkin Creek [Mississippi]	1	AUM 21737*
Mississippi Museum of Natural History	M. Pierson	Word Creek [Mississippi]	2	MMNS 10368*
University of Alabama Ichthyological Collection	H. Harima M.F. Mettee	Mattubby Creek [Mississippi]	1	UAIC 4305.21*
	M.R. Mundy T.S. Jandebeur	Buttahatchee River [Mississippi]	1	UAIC 4432.21*
	M. Pierson C.A. Schultz	Nichols Creek [Mississippi]	2	UAIC 9556.01
	A.F. Hemphill H.T. Boschung	Chilatchee Creek [Alabama]	1	UAIC 526.01*
		Prairie Creek [Alabama]	2	UAIC 536.01*
	J.D. Williams J.C. Hall R. Ambrose	Townsend Haney Creek [Alabama]	1	UAIC 1279.09*
	J.D. Williams N. Williams	Wallahatchee Creek [Alabama]	1	UAIC 1353.07*
	J.D. Williams J.C. Hall	Line Creek [Alabama]	2	UAIC 1471.10*
		Tributary of Coleman Creek [Alabama]	2	UAIC 1472.11*

Table 2. Continued.

Source (Collection #)	Collectors	Location	Counts	Museum Number
University of Alabama Ichthyological Collection	J.D. Williams J.C. Hall	Tributary of Bugnall Creek [Alabama]	3	UAIC 1473.11*
		Moores Creek [Alabama]	5	UAIC 1474.09*
		Opintolocco Creek [Alabama]	1	UAIC 1480.15*
		Tributary of Opintolocco Creek [Alabama]	3	UAIC 1481.08*
		Coleman Creek [Alabama]	2	UAIC 1484.12*
	J.D. Williams C. Knight	Johnsons Creek [Alabama]	4	UAIC 1510.08*
	Charles Tucker Carol Tucker	Washington Creek [Alabama]	1	UAIC 2123.13*
		Washington Creek [Alabama]	2	UAIC 2128.08*
	C. Tucker H. Harima	Mud Creek [Alabama]	1	UAIC 2390.11*
		Bogue Chitto Creek [Alabama]	1	UAIC 2392.24*
		Tatum Creek [Alabama]	4	UAIC 2394.08*
		Dry Creek [Alabama]	1	UAIC 2395.14*
	C. Tucker J.C. Hall	Bear Creek [Alabama]	1	UAIC 2409.04*
	M. Pierson E. Tyberghein	Cahaba River [Alabama]	1	UAIC 7194.25*
	M. Pierson S. Pierson	Cahaba River [Alabama]	2	UAIC 7701.19*
	M. Pierson S. Krotzer	Tallapoosa River [Alabama]	1	UAIC 9261.20*

Table 2. Continued.

Source (Collection #)	Collectors	Location	Counts	Museum Number
University of Alabama Ichthyological Collection	M. Pierson S. Krotzer	Line Creek [Alabama]	1	UAIC 9265.18*
	M. Pierson	Ramer Creek [Alabama]	4	UAIC 9267.10*
	C. Stephenson L. Strick M. Langford	Opintlocco Creek [Alabama]	16	UAIC 9695.24*
	C. Stephenson K. Frazer	Wallahatchee Creek [Alabama]	3	UAIC 9703.07
	M. Pierson	Pintlalla Creek [Alabama]	1	UAIC 9710.11*

Table 3. Habitat data for *E. zonifer* for unpublished records of M. Pierson, Mississippi State University, Auburn University, Mississippi Museum of Natural History, and University of Alabama. T=temperature; DO=dissolved oxygen; Turb=turbidity; Veg=vegetation; Sub=substratum. *=current velocity for these collections are a maximum for the general location (Clemmer, per. comm.). Collectors presented only as the first individual on the original field sheets (see Table 2).

Collectors	T (°C)	DO (mg/L)	PH	Depth (cm)	Width (m)	Turb	Current	Veg	Sub
J.P. Kelly									
[MSU 5150]	20.0			<122		turbid	slight		sand/silt/gravel
G.H. Clemmer									
[MSU4666]	12.0				10.7	clear, white	moderate	none	sand/silt
[MSU3337]	19.0			107	9.1	slightly turbid	moderate	none	mud/gravel/rubble
[MSU2825]	24.5			137	26	slightly turbid	moderate	some	gravel/sand
[MSU6417]*	23.0			168	23	slightly turbid	moderate to fast	some	gravel/mud
[MSU1596]*	24.0			152	46	moderately turbid	fast	some	gravel/mud
M.Pierson									
[AUM21737]				<183	<6.1	clear	slow	root filaments	clay/sand/gravel
[XMP12.14]				<92	<9.2	slightly turbid	slack water	some	sand/silt/gravel
[MMNS10368]	28.3			<92	1.5-4.6	slightly turbid	slight		sand/clay
[UAIC7194.25]	25.5					cloudy/ plankton	slow to swift	sparse *Justicia*	gravel/sand/silt
[UAIC9261.20]				shallow	9.1-18.2	clear	slow to moderate	root masses	sand/silt/gravel

Table 3. Continued.

Collectors	T (°C)	DO (mg/L)	PH	Depth (cm)	Width (m)	Turb	Current	Veg	Sub
M. Pierson (continued)									
[UAIC9265.18]						slightly turbid	slow	root masses	soapstone/gravel/ sand/silt
[UAIC9267.10]					7.6-9.1	slightly turbid	moderate	none	sand/silt
[UAIC9556.01]									
[UAIC9710.11]				<91	6.1-9.1	turbid	none	flooded veg	silt/soft clay
J.D.Williams									
[UAIC1279.09]	23.5			<61	3.1-4.6	clear	moderate	none	gravel/sand
[UAIC1353.07]	22.7			<122	4.6-6.1	clear murky	moderate to slow	aquatic plants	mud
[UAIC1471.10]	23.0			>122	0.9-4.6	murky	none	algae/ aquatic plants	mud
[UAIC1472.11]	18.0			46	3.1-4.6	clear	slow to moderate	some algae	sand
[UAIC1473.11]	22.0			<61	3.6-4.6	clear	moderate	some algae	sand
[UAIC1474.09]	25.0			<488	4.6-6.1	murky	still	some algae	mud
[UAIC1480.15]	19.0			<122	4.6-6.1	dark stained	still	some algae	mud
[UAIC1481.08]	22.0			<61	3.1-3.6	murky	none	none	mud
[UAIC1484.12]	23.0			<91	6.1-7.6	murky	still	algae	mud
[UAIC1510.08]	15.0			<61	<6.1	murky	none	none emergents	mud
H.Harima									
[UAIC4305.21]	25.5	6.5	7.0	<92	1.2-7.6	milky, turbid	slow to moderate	dense	gravel/clay
M.R.Mundy									
[UAIC 4432.21]	27.0			<122	<18.3	slightly turbid	moderate to swift	submerged and rooted	gravel/sand/silt
A.F.Hemphill									
[UAIC526.01]	25.0			46	0.6-1.8	murky	slow	none	mud/sand/clay
[UAIC536.01]	25.0			<16	3.05	murky	none-pool almost dry	none in water	silt/sand
C.Tucker									
[UAIC2123.13]				<31	<3.1	slightly cloudy	slow to moderate	none	Selma chalk
[UAIC2128.08]				<91	<4.6	cloudy	slow	none	Selma chalk
[UAIC2390.11]	18.0			<61	3.1	cloudy	none	none	clay
[UAIC2392.24]	18.3			<91	<12	clear to cloudy	slow to swift	none	gravel/sand/silt
[UAIC2394.08]	18.3			<91	6.1	black	none	none	covered with rotting leaves
[UAIC2395.14]	19.5			<122	<4.6	clear	slow	cattails	marl
[UAIC2409.04]	11.2			<107	<9.1	stained	slow	aquatic plants	mud/leaves

Table 3. Continued.

Collectors	T (°C)	DO (mg/L)	PH	Depth (cm)	Width (m)	Turb	Current	Veg	Sub
C.Stephenson [UAIC9695.24]				isolated pools		turbid	stagnant-slow	none	sand

MINUTES

Business Meeting
19th Annual Meeting
Southeastern Fishes Council

The Southeastern Fishes Council met 15 April 1993 in the Oceans Room of the Cavalier Hotel, Virginia Beach, VA. Chairman Bruce Bauer called the meeting to order at 4:30 PM local time.

Committee Reports

Secretary's Report:

Minutes of the 1992 Business Meeting appeared in *Proceedings* Issue #27. They were approved without corrections. No button was produced for the 19th Annual Meeting because no artwork received. We are presently seeking artwork of important southeastern fish species for the 20th Annual Meeting button. Anyone with original artwork that they wish to have considered is invited to send the artwork to the Secretary, Hank Bart, preferably by January 15th, 1994.

Treasurer's Report:

The Treasurer's Report from the 1992 Business Meeting, appearing in *Proceedings* Issue #27 contained errors which are corrected as follows: total expenses which appeared as $742.26 should have read $724.26 changing the checking balance to $1,145.12 and the total assets to $3,613.04.

In updating the mailing list it was noted that only 106 of the 196 individuals/institutions on the list had paid annual dues by the time of the Annual Meeting (the deadline for dues payment according to the BYLAWS). Of 167 individuals on the list, only 103 had paid dues in 1993, 34 had last paid dues in 1992, 14 had last paid in 1991, 5 had last paid in 1990, and 9 had not paid since 1989 or earlier (the remaining two are life members). It was reported that individuals that were not current on dues would be sent a letter asking them to update their membership by June 15th 1993 in order to keep their names on the mailing list. This would be the policy for keeping the mailing list current with membership in subsequent years.

All 29 institutions on the mailing list were sent 1993 dues notices but only three had paid dues by the 1993 meeting date. Several others (mostly libraries) questioned the dues notice because they had not been billed for the *Proceedings* in the past. After a brief discussion, it was agreed that all who receive the *Proceedings* should pay for it, especially in view of the Council's plan to improve the quality of the publication. Stephen Ross suggested that the word "dues" be changed to "subscription" on notices sent to institutions, and Werner Wieland suggested that the amount charged for subscriptions be equal to current dues.

Accounting through 4-7-93	
Checking Account Balance as of 4/2/92	$1,466.73*
Dues, Button Sales & other contributions (through 4/2/92)	$1,070.00
Dividends	$ 25.33
Expenses (through 4/2/92)	
Postmaster	$ 30.95
Proceedings, Issue #26	$ 305.67
Proceedings, Issue #27	$ 326.34
Checking Account Balance (through 4/7/93)	$2,296.20
Pain Webber Cash Fund (through 12/31/93)	$2,245.00
TOTAL ASSETS (4/7/93)	$4,541.20

*Checking account balance adjusted to reflect a $20 dues deposit and $1.61 in earned dividends which were not included in last year's Treasurer's Report. This is the reason for the discrepancy in the checking balance in the previous and current reports.

Editor's Report:

The following report was presented on behalf of the Managing Editor, Steve Stevenson, and Desk-top Publishing Editor, George Sedberry, both of whom sent regrets for their not being able to attend the meeting and deliver their reports in person. Steve Stevenson reports that two manuscripts are in the works for issue #28, one note and one full article. Manuscripts are needed for subsequent issues. George Sedberry reports that he was not at all satisfied with the printing of issue #27. The camera ready copy he is producing looked great so the problem appears to have been the photo offset process that was used in printing. George is shopping around for better printers. He would appreciate any ideas or suggestions from members on ways of improving the final