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ABSTRACT

We determined the distribution and status of *Etheostoma tecumsehi*, the Shawnee darter, an endemic of Pond River (Green River drainage), Kentucky, in 2002. We compiled historical and current distribution information, and sampled 30 sites. Prior to this study, *E. tecumsehi* was known from 20 sites in the upper Pond River system. We found young-of-the-year and adult *E. tecumsehi* at 24 of 30 sampling sites extending from the headwaters downstream to and including the Elk Pond Creek system. *Etheostoma tecumsehi* is relatively common and was found at more sites than any other species encountered. Mean patch density at eight sites ranged from 0/m^2 to 4.58/m^2 (± 2.16 2SE). *Etheostoma tecumsehi* appears to be secure, in part, because it inhabits many headwater streams with suitable habitat. We recommend monitoring of activities that increase stream temperature, reduce base flow, block dispersal routes, or fragment and isolate populations.

INTRODUCTION

Etheostoma tecumsehi, the Shawnee darter, is a member of the *Etheostoma spectabile* complex (Percidae; subgenus *Oligocephalus*) and is endemic to the headwaters of Pond River (Green River drainage) in western Kentucky (Ceas and Page, 1997). Because of its small range (ca. 600 km^2; Ceas, 1998) and presumed habitat degradation (i.e., pollution, impoundment construction), Ceas and Page (1997) recommended *E. tecumsehi* be considered for listing as threatened under the Endangered Species Act by the United States Fish and Wildlife Service (USFWS). We conducted this study to determine the distribution and status of *E. tecumsehi*.

STUDY AREA

Pond River drains 1,968 km^2 of Christian, Hopkins, McLean, Muhlenberg, and Todd counties in western Kentucky and discharges into the Green River at river km 87.7 (Harker et al., 1981; Warren and Cicerello, 1982). The Pond River system lies within the Pennsylvanian age Shawnee Hills Section of the Interior Low Plateaus Province, but streams on the southern periphery dissect the Dripping Springs Escarpment and lie in the Mississippian age Highland Rim Section.

In the southern half of the Pond River system (the upper watershed), where *E. tecumsehi* has been collected, headwater streams are high gradient with abundant gravel, sand, and cobble riffles and narrow forested floodplains (Fig. 1). Larger streams such as the East Fork Pond River (EF) and those in the system interior are low gradient with silt, sand, gravel, and clay substrates and broad floodplains containing wetland habitats. Forested riparian zones, albeit sometimes narrow, shade most streams, but extensive row crops and pasture, the dominant land uses, fragment upland woods. Many streams are impounded for flood control, apparently by the U.S. Department of Agriculture, Natural Resources Conservation Service (formerly Soil Conservation Service). Others such as Buck Fork Pond River and Jarrels Creek are channelized. Coal occurs only in the northern portion of the southern half of the system. Mining has occurred adjacent to lower McFarland and Jarrels creeks and near the confluence of West and East Forks Pond rivers.

In the northern half of the system (the lower watershed), the Pond River and many tributaries are low gradient with soft substrates, abundant organic material, and few riffles. Streams with higher gradients and gravel or bedrock bottoms are present mainly along the system periphery. Extensive riparian wetlands and oxbow lakes are present along the river and its tributaries, many of which are channelized. Agriculture is the primary land use

and oil wells are scattered throughout the region. Broad areas have been surface-mined for coal, leaving abandoned mine lands and highly degraded terrestrial and aquatic habitats. Many streams, including the entire mainstem Pond River, do not support or only partially support designated uses (e.g., aquatic life, drinking water, fish consumption) because of pollutants and other factors (e.g., low pH, PCBs, pathogens, chlorides, habitat alteration, silt) emanating from degraded areas (Kentucky Division of Water [KDOW], 1996; 2002).

MATERIALS AND METHODS

We reviewed and summarized collection records for *E. tecumsehi* (Appendix). Between May and December 2002 we sampled for *E. tecumsehi* and other fish species using a 1.8 m x 3.0 m seine (3.2 mm mesh) at a total of 30 sites (Fig. 1). Of these sites, 25 were sampled qualitatively. At 3 of the 25 sites sampled qualitatively and 5 additional sites we also quantitatively sampled *E. tecumsehi* to determine patch density of the species. Our efforts included re-sampling 11 historical sites (Table 1). We also sampled shallow creeks and headwater streams, targeting riffles of gravel and cobble along with adjacent pools and runs – typical habitats for members of the *E. spectabile* complex (Ceas and Page, 1997). For qualitative sampling, we made 10-25 seine sets/hauls per site expending greater effort at sites yielding no or few *E. tecumsehi*. We selected quantitative sampling sites via pilot studies to determine the presence of *E. tecumsehi*. We sampled habitat patches (1.2 – 12.6 m^2) by disturbing the substrate - typically gravel, sand, and cobble in riffles - and allowing the current to wash dislodged individuals downstream into a seine (i.e., a kick set). To estimate patch density at a site, we divided the mean number of *E. tecumsehi* collected by mean patch size. In each patch, we characterized habitat by measuring stream depth at three points and by recording dominant substrate. We measured current velocity in each patch by timing a floating object through a given distance three times. At the 22 non-quantitative sites, we determined habitat characteristics subjectively.

RESULTS

Prior to this study, *E. tecumsehi* was known from 20 sites in the upper Pond River system (Appendix). The furthest downstream *E. tecumsehi* occurred was West Fork Pond River (WF) at KY 813, WF at Barnett Road, and McFarland Creek at Ackerson Schoolhouse Road. Only 1-2 individuals were taken at each of these lowland sites where suitable habitat is limited. *Etheostoma tecumsehi* was relatively common at several upland sites such as Shelton Branch (51 specimens in 1999), East Branch WF (25 specimens in 1999), and Forbes Creek (41 specimens in 2002). The type locality (East Branch WF, 4.4 km northwest of Fruit Hill) has been sampled more than any other site. Relatively few ($\leq$ 8) specimens were found at most (14) other sites, but this could be a collecting artifact due to non-targeted sampling.

Our 2002 survey showed that *E. tecumsehi* was widely distributed within the study area but exhibited highly variable abundances among sites. The species occurred at 24 of 30 sampling sites extending from the headwaters downstream to and including the Elk Pond Creek system (Table 1) and was the most widely encountered species in our survey (Table 2). The number of individuals found in 2002 at all sites ranged from one or a few at sites with apparently poor or limited habitat (e.g., sites 15, 21, and 22) to more than 20 at several small, upland stream sites (e.g., sites 1, 3, and 26). The species was not detected at sites with a preponderance of lowland habitat (e.g., sites 16-19) or those immediately downstream from impoundments (e.g., sites 4 and 20).

Estimated patch densities of *E. tecumsehi* at the 8 quantitative sites were highly variable and showed no relationship with measured physical characteristics of patches (Table 3). Mean patch density at the 8 sites ranged from 0/m^2 at WF at KY 813 (site 17) to 4.58/m^2 ($\pm$ 2.16 2SE) at Buck Creek at KY 189 (site 3; Table 3). It should be noted that mean patch densities for sites are likely positively biased because we sampled habitat patches presumed to contain *E. tecumsehi*. Across sites, mean patch density (n = 7 after removing site 17) was not correlated with mean patch velocity (Pearson r = - 0.43, p $\leq$ - 4.643) or mean patch depth (r = - 0.05, p $\leq$ -1.127 E+07). Across all patches where *E. tecumsehi* was present (n = 29), patch density was not correlated with velocity (r = - 0.11, p $\leq$ 0.5768) or depth (r = - 0.09, p $\leq$ 0.6351). The ranked relative abundance of fish species most frequently encountered with *E. tecumsehi* in quantitative samples was *E. flabellare*, *Lythrurus fasciolaris*, *Semotilus atromaculatus*, *E. squamiceps*, *L. chrysocephalus*, *E. kennicotti*, *Pimephales notatus*, *Campostoma oligolepis*, and *E. nigrum*. At qualitative sites, the ranked relative abundance of darter species was *E. tecumsehi*, *E. squamiceps*, *E. kennicotti*, *E. flabellare*, *E. nigrum*, *Percina sciera*, *E. gracile*, *E. blennoides*, *P. maculata*, *P. phoxocephala*, *E. histrio*, and *E. asprigene*.

We observed that *E. tecumsehi* moved from riffles into adjacent pools as stream flow declined. In May, brilliantly colored males and gravid females inhabited gravel and cobble riffles, runs, and flowing pools. Young-of-the-year (YOY) individuals first occurred in samples in early June. At this time as flow declined and riffles were nearly dry, adults and YOY used the same habitats, but both groups were more abundant in pools of some streams (e.g., sites 10 and 13). Some streams ceased flowing in July and *E. tecumsehi* was stranded in isolated pools in smaller streams (e.g., sites 23, 24, and 26) or occupied the only remaining flowing riffles in larger streams (e.g., site 22).

DISCUSSION

Etheostoma tecumsehi is widely distributed and is relatively common in small streams ranging from the southern Pond River system headwaters downstream to, and including, the Elk Pond Creek system. We are confident it is more widely distributed and abundant than our current study indicates. For example, there are numerous additional streams in the upper system that could potentially support *E. tecumsehi*. Many of these streams are inaccessible or could not be sampled during the timeframe of our study. We also observed that YOY *E. tecumsehi* were abundant at several sites, although these individuals were not included in our analyses.

We concur with Ceas and Page (1997) that *E. tecumsehi* is restricted to upland tributaries of the upper Pond River system. Fish sampling in the northern (lower) Pond River system (i.e., downstream from Elk Pond Creek) has not revealed *E. tecumsehi* or any members of the *E. spectabile* complex (Harker et al., 1981; Warren and Cicerello, 1982; Retzer et al., 1983; Bell and Rold, 2002). Unpublished data from the KDOW, Southern Illinois University at Carbondale (SIUC), and the Kentucky State Nature Preserves Commission (KNP) confirm this. While *E. tecumsehi* appears to be common at numerous sites within its small range, we also recognize that many aquatic systems, including headwater streams along the lower Pond River system periphery, have been degraded and destroyed by surface mining and by stream channelization associated with agriculture (Harker et al., 1981; Kentucky Division of Water, 1996; 2002).

We found that *E. tecumsehi* was more abundant than syntopic *E. flabellare* and that numbers of *E. tecumsehi* were comparable to those reported for other members of the *E. spectabile* complex. *Etheostoma flabellare*, a common inhabitant of small, upland streams in Kentucky (Burr and Warren, 1986), was the second-most frequently encountered species in quantitative samples. Whereas *E. tecumsehi* patch density ranged from 0 to 4.58 /m^2 (± 2.16 2SE), mean *E. flabellare* site density per m^2 (± 2SE) was 0.14 (± 0.10), 0.37 (± 0.22), 0.40 (± 0.58), and 0.09 (± 0.12) at sites 1, 2, 6, and 10, respectively. In comparison, *E. burri* abundance determined via mark and recapture in two Missouri streams was 1.58 and 2.18 / m^2 (Martin et al., 1999). Assignment of a special concern conservation status to *E. burri* was deemed not warranted pending results of additional surveys in other tributaries (Martin et al., 1999). In similar survey work, the density of *E. spectabile* in an Ohio stream was found to be 1.35 / m^2 (Ingersoll et al., 1984).

The fishes most frequently collected with *E. tecumsehi* (Table 2) are all common inhabitants of small upland Kentucky streams (Burr and Warren, 1986). Sites not yielding *E. tecumsehi* generally had low gradient, fine bottom materials, organic debris, and few riffles. These sites contained fishes characteristic of lowland Kentucky streams (e.g., *Lepisosteus oculatus*, *Lythrurus fumeus*, *Erimyzon oblongus*, *Noturus gyrinus*, *Lepomis humilis*, and *E. asprigene*).

Etheostoma tecumsehi appears to be secure, in part, because it inhabits many headwater streams with abundant suitable habitat. This dispersed distribution pattern confers a level of protection not available to organisms inhabiting less common habitats such as medium-sized rivers and springs (Etnier, 1997). However, *E. tecumsehi* is vulnerable to habitat degradation because the flow and water quality of headwater streams are tied more closely to local land use than are larger streams. Most streams in the Pond River system have 7-day, 10-year low flows of zero, even those with watersheds as large as EF at KY 189 near Apex with a drainage area of 502 km^2 (Ruhl and Martin, 1991). With the possible exception of WF at KY 813 (site 17), all streams in the upper Pond River system have smaller watersheds than EF at KY 189. We observed several upper Pond River system streams that were reduced to isolated pools during the relatively dry summer of 2002. Some headwater streams normally cease flowing in summer, but conversion of forests to other uses could have increased the duration and extent of zero flow periods. Continued clearing of upland and riparian forests could negatively affect *E. tecumsehi*, especially during drought years, by raising stream water temperature and reducing ground water inflows that maintain base stream flow.

Population isolation and fragmentation via impoundments could also influence long-term viability of *E. tecumsehi*. Downstream movement and gene flow in many streams is precluded by flood control reservoirs present in the Pond River headwaters that have isolated numerous populations (Fig. 1). Migrating *E. tecumsehi* would encounter stocked predatory game fishes (e.g., *Lepomis* spp., *Micropterus* spp.), inhospitable reservoir habitat, and dams that block dispersal routes and fragment populations. In light of these potential threats, we recommend a re-survey in 5-10 years to re-examine the status of *E. tecumsehi*. In the interim, the potential impact on *E. tecumsehi* of any reservoir proposed for construction in the upper Pond River system should be determined.

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TABLE 1. Sampling Locations for *Etheostoma tecumsehi* within the Pond River system, Kentucky, including dates, number collected, and habitat characteristics.

Site	Location	Date	No. coll.	Habitat	Substrate
1	Trib. to Buck Fork Pond R. at Flat Rock Rd. ford, Todd Co.	6-May/10-Jun-02	22/2	upland	gravel/sand
2	* Forbes Cr. at KY 189, Christian Co.	6-May/10-Jun-02	13/0	upland	gravel/sand/bedrock
3	* Buck Cr. at KY 189, Christian Co.	6-May/10-Jun-02	72/68**	upland	gravel/sand/cobble
4	Coal Cr. at KY 189, Christian Co.	6-May-02	0	upland	gravel/cobble
5	* Kate Br. at Blue Hole Rd., Todd Co.	29-May-02	23	upland	bedrock/gravel/cobble
6	Wolf Br. at Blue Hole Rd., Todd Co.	29-May-02	15	upland	cobble/boulder/gravel
7	* Shelton Br. at Shanklin Rd., Todd Co.	29-May-02	obs.	upland	gravel/cobble/boulder
8	* Buck Fork Pond R. at KY 507, Todd Co.	10-Jun-02	4	intermediate	gravel/sand/cobble
9	Thompson Cr. at Cavanaugh Rd., Christian Co.	11-Jun-02	10	upland	cobble/gravel

TABLE 1 *(cont'd)*

Site	Location	Date	No. coll.	Habitat	Substrate
10	Trib. to WF Pond R. on Macedonia-Crofton Rd., Christian Co.	11-Jun-02	18	upland	gravel/cobble/sand
11	Trib. to Buck Fork Pond R., 1.4 km ESE W. Union Church, Christian Co.	11-Jun-02	7**	upland	gravel
12	Weathers Br. at Froghop Rd., Christian Co.	11-Jun-02	10	upland	gravel/cobble
13	* Dulin Cr. at KY 800, Christian Co.	11-Jun-02	19**	upland	bedrock/boulder
14	Trib. to Dulin Cr. at KY 800, Christian Co.	11-Jun-02	67**	upland	bedrock/gravel/boulder
15	* McFarland Cr. at Cemetery Rd., Christian Co.	12-Jun-02	1	lowland	sand/gravel
16	* McFarland Cr. at Ackerson School Rd., Christian Co.	12-Jun-02	0	lowland	gravel/debris
17	* West Fork Pond R. at KY 813, Hopkins/Muhlenberg cos.	1-Jul-02	0	lowland	cobble/gravel/debris
18	Pond R. at Mt. Carmel-Pond R. Rd., Hopkins/Muhlenberg cos.	1-Jul-02	0	lowland	silt/mud/sand
19	Jarrels Cr. at Greens Chapel Rd., Muhlenberg Co.	1-Jul-02	0	lowland/ channelized	mud/debris
20	Coal Cr. at Coal Cr. Rd., Christian Co.	2-Jul-02	0	upland	clay/gravel/sand
21	Bull Cr. at Coal Cr. Rd., Christian Co.	2-Jul-02	1	upland	clay/gravel
22	* East Fork Pond R. at KY 171, Todd Co.	2-Jul-02	3	intermediate/ channelized	gravel/cobble/boulder
23	Pepper Cr. at KY 107, Todd Co.	2-Jul-02	22	upland	sand/mud/cobble
24	Horse Cr. at KY 171, Todd Co.	2-Jul-02	7**	upland	bedrock/gravel/sand
25	* East Fork Pond R. at Shanklin Rd., Todd Co.	2-Jul-02	8+	intermediate	cobble/boulder
26	McFarland Cr. at Pennyrile Parkway, Christian Co.	3-Jul-02	120**	upland	gravel/clay/bedrock
27	Trib. to Cow Cr. along Squire Graves Rd., Todd Co.	18-Dec-02	27	upland	cobble/boulder/gravel
28	Caney Cr. at KY 171, Muhlenberg Co.	18-Dec-02	3	upland	clay/gravel
29	Long Cr. at Gene T. Jones Rd., Muhlenberg Co.	18-Dec-02	11	upland	gravel/sand
30	Trib. to Elk Pond Cr. at Depoy-Sharon Rd., Muhlenberg Co.	18-Dec-02	5	upland	gravel

* = site sampled historically; ** = young-of-the-year observed.

TABLE 2. Species list for fishes collected from the Pond River basin, Kentucky, in 2002. See Table 1 for site localities.

	Sites																												
Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Lepisosteus oculatus																		X												
Campostoma oligolepis	X	X	X	X	X	X	X	X	X	X			X	X	X					X	X	X		X	X	X	X	X	X	
Cyprinella whipplei				X												X	X	X			X	X								
Cyprinus carpio																	X													
Hybognathus nuchalis																					X									
Luxilus chrysocephalus	X	X	X	X		X		X	X					X						X	X								X	
Lythrurus fasciolaris		X	X					X	X							X				X	X							X		
Lythrurus fumeus																X	X					X								
Lythrurus umbratilis			X								X														X				X	
Notemigonus crysoleucas																X									X		X			
Notropis boops								X																						
Phoxinus erythrogaster					X	X						X	X	X																
Pimephales notatus		X	X	X		X	X	X	X	X	X		X	X			X	X		X	X	X	X	X	X			X	X	X
Pimephales promelas							X																							
Pimephales vigilax																	X	X				X								
Semotilus atromaculatus			X		X	X			X	X	X	X	X	X						X	X		X	X	X		X	X	X	X
Catostomus commersoni		X				X				X			X											X	X					
Erimyzon oblongus	X		X					X	X						X					X	X		X	X						
Minytrema melanops				X																										
Moxostoma erythrurum				X													X					X								
Ameiurus natalis															X		X					X			X					
Noturus gyrinus																	X													
Noturus miurus																	X													
Esox americanus	X														X	X	X			X	X	X								
Aphredoderus sayanus																	X	X												
Labidesthes sicculus				X													X	X				X								
Fundulus notatus				X				X									X				X	X			X		X		X	
Fundulus olivaceus															X	X	X					X								
Gambusia affinis															X		X		X											
Centrarchus macropterus															X	X				X	X									
Lepomis cyanellus			X			X		X	X				X	X	X		X			X	X	X	X	X	X				X	
Lepomis gulosus											X					X	X		X					X						
Lepomis humilis																		X				X								
Lepomis macrochirus		X		X			X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X		X		X	
Lepomis megalotis	X	X	X	X	X			X	X		X	X		X	X	X	X		X	X	X	X	X	X			X	X		
Lepomis microlophus															X															
Lepomis miniatus																X	X			X										
Micropterus punctulatus		X						X	X								X	X												
Micropterus salmoides				X												X				X				X	X					
Pomoxis annularis																		X		X		X			X					
Pomoxis nigromaculatus																						X								
Etheostoma asprigene																	X		X											
Etheostoma blennioides		X																X												
Etheostoma flabellare	X	X	X	X		X		X	X	X															X			X	X	
Etheostoma gracile																		X	X											
Etheostoma histrio																		X												
Etheostoma kennicotti		X	X	X				X	X							X	X						X						X	
Etheostoma nigrum		X	X					X		X						X	X	X	X			X							X	
Etheostoma squamiceps	X	X	X	X			X	X	X	X	X	X			X	X				X	X	X	X	X	X			X	X	
Etheostoma tecumsehi	X	X	X		X	X	X	X	X	X	X	X	X	X	X						X	X	X	X	X	X	X	X	X	X	X
Percina maculata	X	X						X											X			X								
Percina phoxocephala																		X												
Percina sciera																X	X	X				X								

TABLE 3. Estimated *Etheostoma tecumsehi* density and habitat characteristics at eight sites in the Pond River, Kentucky, in 2002. See Table 1 for descriptions of site localities. N = number of habitat patches sampled; A = mean patch size (range in parentheses); E = mean estimated site density (number per m^2); D = mean depth (range in parentheses); V = velocity; Substrate = dominant particle type; CW = channel width. E, D, and V +/- 2SE.

Site	N	A (m^2)	E (#/m^2)	D (cm)	V (m/sec)	Substrate	CW (m)
1	7	4 (4)	1.07 ± 0.30	7 (5-10) ± 1.46	0.2 ± 0.07	gravel/sand	10.4
2	7	3.9 (2.6-5)	0.22 ± 0.31	11 (6-14) ± 2.45	0.34 ± 0.21	gravel/sand/bedrock	14.6
3	5	2.4 (1.2-4.9)	4.58 ± 2.16	14 (11-18) ± 2.57	0.09 ± 0.09	gravel/sand/cobble	11.2
5	5	7.5 (4-11)	0.32 ± 0.25	14 (9-18) ± 2.8	0.47 ± 0.30	bedrock/gravel/cobble	6.8
6	5	4 (4)	1.4 ± 0.73	16 (5-26) ± 7.40	0.42 ± 0.15	cobble/boulder/gravel	10
7	5	4 (4)	0.95 ± 1.20	28 (15-51) ± 12.38	0.38 ± 0.16	gravel/cobble/boulder	8.5
10	6	3.6 (2.1-4.9)	0.46 ± 0.47	18 (5-35) ± 8.30	0.03 ± 0.05	gravel/cobble/sand	8
17	3	7.5 (3.9-12.6)	0	14 (12-16) ± 2.58	0.67 ± 0.03	cobble/gravel/debris	12.7

APPENDIX. Summary of all known *Etheostoma tecumsehi* collection records prior to this study. Collection locations are followed by date, source and/or catalog number, and the number of specimens in parentheses. Institutions and acronyms are: Illinois Natural History Survey (INHS); Kentucky Division of Water (KDOW); Kentucky State Nature Preserves Commission (KNP); Southern Illinois University (SIUC); and Western Kentucky University (WKU).

East Branch West Fork Pond River, 4.4 km NW Fruit Hill, Johnson Mill Rd., Christian Co., 7 Jul 1975, Retzer et al., (1983) (?); 22 Aug 1979, Retzer et al., (1983) (2); 22 Mar 1990, INHS 58147 (19); 23 Apr 1992, INHS 27900 (13); 3 Apr 1993, INHS 29566 (18); 26 Mar 1994, INHS 32400 (26); 22 Apr 1994, INHS 32703 (22); 4 Apr 1995, INHS 36033 (10); 4 Apr 1995, INHS 37504 (1); 1Apr 1999, SIUC 35226 (25); 14 Aug 2001, KNP (3). **Dublin [Dulin] Creek**, 1.2 km NE Fruit Hill [KY 800], Christian Co., 10 Mar 1979, Retzer et al., (1983), SIUC 556 (3). **Buck Fork Pond River**, 3.2 km W Allegre [KY 507], Todd Co., 10 Mar 1979, Retzer et al., (1983), SIUC 2215 (3). **Coal Creek**, 1.6 km N Haleys Mill, Christian Co., 11 Mar 1979, Retzer et al., (1983) (6). **West Fork Pond River**, 1.6 km SE Mt. Carmel [KY 813], Hopkins Co., 6 Aug 1979, Retzer et al., (1983), SIUC 1330 (1). **East Branch [Fork] Pond River**, 0.8 km N Kirkmansville [KY 171], Todd Co., 22 Aug 1979, Retzer et al., (1983), SIUC 2203 (8). **[East Fork] Pond River**, 3.2 km NE Allegre [Shanklin Rd.], Todd Co., 22 Aug 1979, SIUC 2184 (6). **West Branch [Buck Fork] Pond River**, 5.6 km W Kirkmansville [KY 107], Christian Co., 22 Aug 1979, Retzer et al., (1983), SIUC 566 (1); 14 Aug 1980, Harker et al., (1981), SIUC 9124 (3); 14 Aug 2001, KNP (1). **Trib [Kate Branch?] to East Fork Pond River**, 3.2 km NW Cedar Grove [Blue Hole Rd.], Todd Co., 22 Aug 1979, Retzer et al., (1983), SIUC 2189 (16). **West Fork Pond River**, at Barnett [Apex-Orange] Rd., 0.2 km SW Barnett [Apex-Orange] Rd. and No. 5 Schoolhouse Rd. jct., Christian Co., 5 Aug 1980, Harker et al., (1981), Retzer et al., (1983), SIUC 7123 (1). **Forbes Creek**, at KY 189, Christian Co., 14 Aug 1980, Harker et al., (1981), Retzer et al., (1983) (30); 21 Feb 2002, WKU (41). **Shagland [Shelton] Branch West Fork Pond River**, 2.4 km N Allegre [Shanklin Rd.], Todd Co., 11 Apr 1985, INHS 68340 (13); 1 May 1989, INHS 64799 (7); 18 Apr 1996, INHS 38656 (26); 1 Apr 1999, SIUC 35235 (51). **West Fork Pond River [Thompson Creek?]**, near Kelly, Christian Co., no date, Retzer et al., (1983) (?). **McFarland Creek**, at Ackerson Schoolhouse Rd. and Wynn-Red Hill Rd., Christian Co., 20 Jun 2001, KDOW (2). **West Fork Pond River**, at Ralston Rd.- J.P. Grace Rd., Christian Co., 20 Jun 2001, KDOW (1). **Buck Fork Pond River**, 5 km SW Kirkmansville [River Rd?], Christian Co., 9 Aug 2001, WKU (13). **Buck Creek**, at KY 189, Christian Co., 9 Aug 2001, WKU (66). **West Fork Pond River**, at KY 800, Christian Co., 14 Aug 2001, KNP (1). **Trib to West Fork Pond River** at Fuller Rd. ca. 4.8 km SE Crofton, Christian Co., 17 Dec 2001, N. Lang, pers comm (6). **McFarland Creek**, 7 km NE Crofton [Cemetery Rd], Christian Co., 21 Feb 2002, WKU (4).

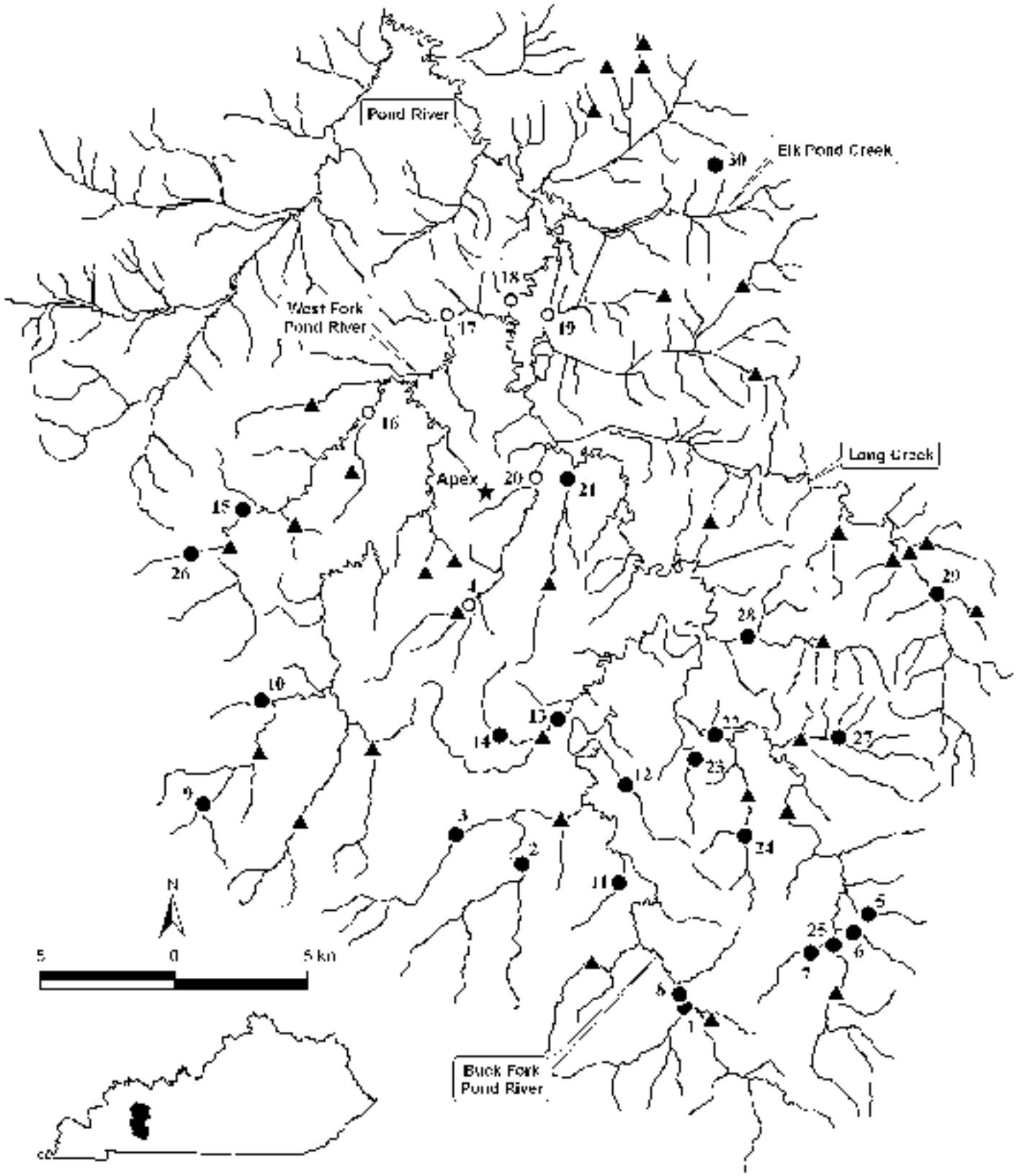

FIGURE 1. Pond River, Green River drainage, 2002 sampling sites for *Etheostoma tecumsehi* (dots) and reservoir dam locations (triangles).