Population Status and Monitoring of the Imperiled Barrens Topminnow, *Fundulus julisia*

2013 Monitoring Report

Submitted to:

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Executive Summary

1. Populations of the imperiled Barrens Topminnow (BTM), *Fundulus julisia*, have been monitored annually since 2002, shortly after initiation of a multi-agency captive breeding and reintroduction program. In 2013 there are only two known wild populations and 27 sites where reintroduction has been attempted across the species' range on the Barrens plateau in Cannon, Coffee, De Kalb, Franklin, Grundy, and Warren counties, Tennessee. Once found in three river systems. native populations are currently restricted to a single river system (Collins River of the Caney Fork system).

2. A total of 35 sites were sampled for BTMs in 2013 with crews of 3-11 persons using seines, with all but one collection in February and March. These included 23 of 27 sites with current or past BTM stockings, 5 sites with known wild populations, and 7 other sites, one yielding wild BTMs. Monitoring methods generally standardized protocols first implemented in 2009.

3. Eight hundred and four BTMs were collected at 17 of the 35 sites, including native populations from 4 sites and 12 collections at stocked sites. BTM abundances ranging from 1 to 174, mean was 47.3 BTMs per sites (large standard deviation of 57.1). Western Mosquitofish, *Gambusia affinis*, were present at 15 of the 35 sites. Greenbrook Pond had the largest number of BTMs for a stocked site (n = 174) and Benedict Springs (Type Locality) had the largest number at a native site (n = 171); no Western Mosquitofish were present at either site.

4. In 2013 the number of sites documented with natural recruitment of BTMs (n = 8) was the same as the 2012 survey but lower than previous survey years (2011, n = 10; 2010, n = 12; 2009, n = 11). Only one native site and one stocked site with recruitment had Western Mosquitofish present, indicating that BTMs have difficulty reproducing and recruiting when this competitor is present.

5. Three stocked sites (Collier Spring, Short Spring, and Vervilla) had stocking discontinued in 2008 to assess BTM success without additional input of specimens. Population Viability Scores have been stable in Collier Spring since 2009 and were stable from 2009-2012 for Short Spring (45 to 60) but in 2013 there was a decrease to 20. At the Vervilla site viability scores have dropped since Western Mosquitofish invaded the site during high water in May of 2010, and in 2013 no BTMs were found.

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Introduction

The Barrens Topminnow, *Fundulus julisia*, was recognized as distinct from other topminnows by C.L. Hubbs when he was sorting a TVA collection in 1938. The species was described in 1982 by Williams and Etnier. Its sister species is the Whiteline Topminnow, *F. albolineatus*, which was last seen in 1889 from the only spring it was ever documented in (Big Spring, Huntsville, Alabama). The Barrens Topminnow (BTM) is restricted to the Barrens Plateau of the Highland Rim physiographic province in south-central Tennessee, where it was historically distributed across the upper ends of three drainages: the Duck and Elk rivers of the Tennessee River drainage and the Collins River of the Caney Fork in the Cumberland River drainage (Fig. 1). BTM habitat includes springs, spring runs, and spring-fed ponds and creeks (Fig.2) (Williams & Etnier 1982, Etnier & Starnes 1993).

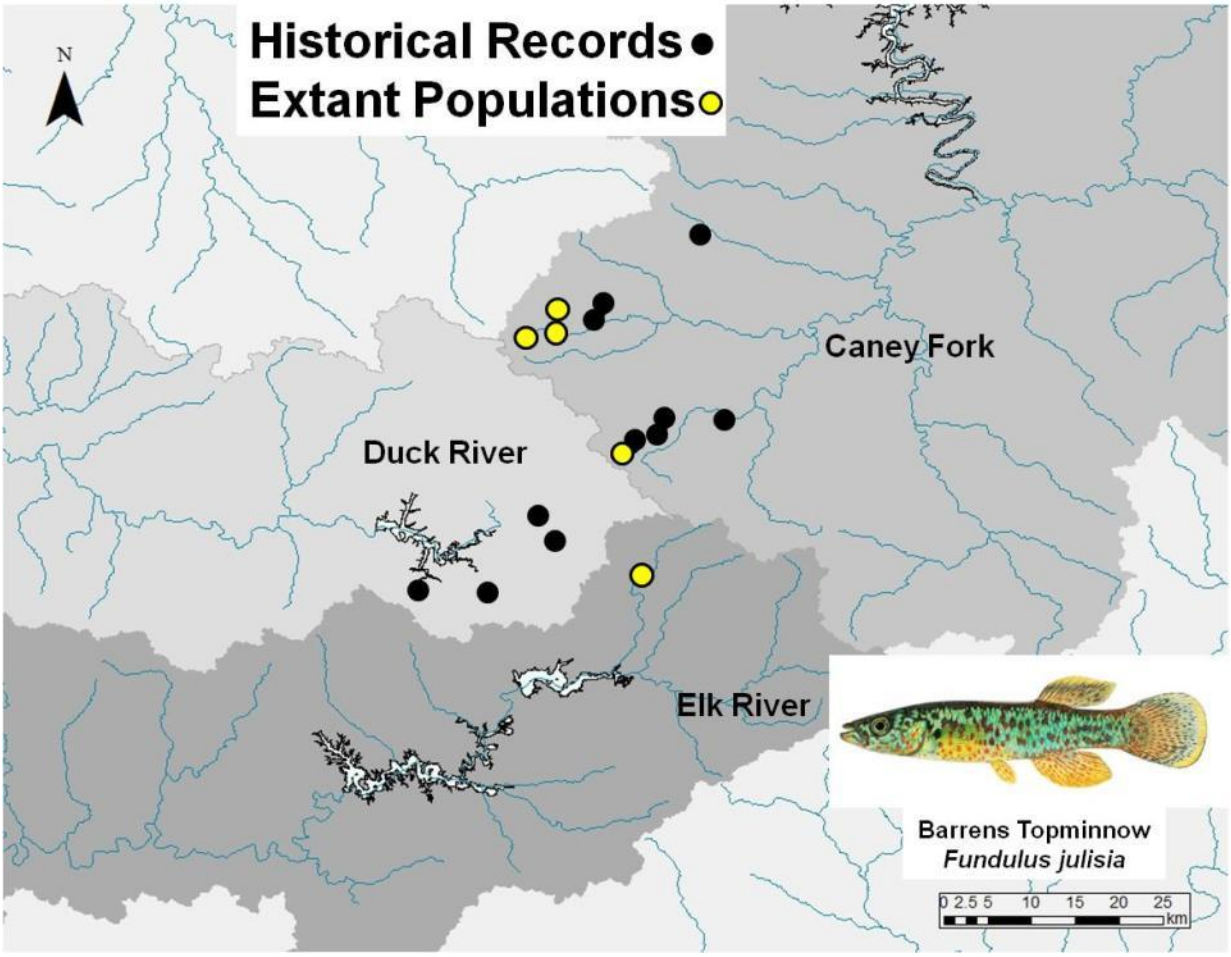

Figure 1. Historical and current distribution for native populations of the Barrens Topminnow, *Fundulus julisia*.

Figure 2. Habitat for Barrens Topminnows, *Fundulus julisia*. A) Spring pool, Benedict Spring at type locality, and B) spring-fed McMahan Creek.

Due to habitat destruction, drought, and an invasive species the BTM is now restricted to only three native populations, two in the Collins River of the Caney Fork and one in the Elk River (Fig. 1). Habitat destruction includes impoundments, modification of spring habitat, groundwater removal, and urbanization. The Western Mosquitofish, *Gambusia affinis,* is not native to the Barrens Plateau but has been introduced widely. This invasive species outcompetes BTMs and is a predator of larval BTMs (Etnier & Starnes 1993, Goldsworthy & Bettoli 2006, Laha & Mattingly 2007, Westhoff et al. 2013). The decrease in populations and modification of specialized spring habitat led BTMs to be proposed for federal listing as endangered with critical habitat in 1977 and again in 1979 after procedural changes in the ESA, but the proposal was never finalized (USFWS 1977, 1979). The Barrens Topminnow Working Group was formed in 2001 to preclude listing under the ESA by working with private landowners to protect wild populations and use propagation and stocking to re-establish populations in all three drainages; the first stockings occurred in 2001-2002 (Goldsworthy & Bettoli 2006) and have continued through 2012. Populations have been monitored annually since 2002 in a cooperative effort among biologists and students of Tennessee Technological University, U.S. Fish and Wildlife Service, Tennessee Wildlife Resources Agency, Conservation Fisheries, Inc., and other interested parties (Zuber & Mattingly 2012). In 2010 BTMs were petitioned for federal listing and are currently under status review (USFWS 2011).

Currently monitoring activities take place primarily during the winter and early spring when aquatic vegetation is minimal. This report gives the results of the 2013 monitoring efforts. Our primary objectives at each site were to:

(1) count and measure total lengths of individual BTMs at most reintroduced and native sites;
(2) assess recruitment of BTMs, with recruitment defined as encountering at least one BTM <30 mm total length;
(3) count individuals and measure volume of all individual Western Mosquitofish from a site
(4) count individuals of other fish species.

Methods

A crew of 3 to 11 persons used seines to sample each site. Sites were ranked as "small" or "large" following designations assigned in previous years. Small sites were sampled a minimum of 6 seine efforts and a maximum of 12. Large sites were sampled a minimum of 10 seine efforts and a maximum of 20. A stop rule was implemented when 80 BTMs were collected at a site after the minimum number of seine hauls was completed. If 80 BTMs were not collected sampling stopped at maximum number of seines. All species of fishes were counted for each seining effort. BTMs were measured to the nearest mm total length (TL). Length-frequency histograms were created for all sites where BTMs were collected. All Western Mosquitofish were preserved on-site and brought back to the laboratory for additional analyses.

Population Viability Scores (PVS) were assigned for each site based on multiple variables assessed during site visits. The definition of variables and associated rankings are presented in Appendix 1. The variables Abundance, Recruitment, Age Class Structure, and Hydrology "reward" the site for positive attributes that will presumably improve population viability. The variables Difficulty, Invasive Mosquitofish, Pollution/Threats, and Stocking presumably detract from population viability. The calculation is as follows:

$$5 * [(A+R+C+H) – (D+I+P+S)] = PVS$$

Length-frequency histograms from sites with greater than 80 BTMs were used to establish age classes, then these size/age classes were applied to sites with fewer than 80 BTMs to rate the Age Class Structure variable. Since all stocked BTMs are ≥ 30 mm TL, the presence of any specimens < 30 mm TL indicate recruitment at a site.

Appendix 2 contains data for each site that includes site name, location, date, collectors, counts of fish species collected per seining effort, and sizes of BTMs (if collected).

Results

A total of 35 sites were sampled for BTMs in 2013, with all but one collection in February and March (Figure 3, Table 1). These included 23 of 27 sites with current or past BTM stockings, 5 sites with known wild populations, and 7 other sites, one yielding wild BTMs.

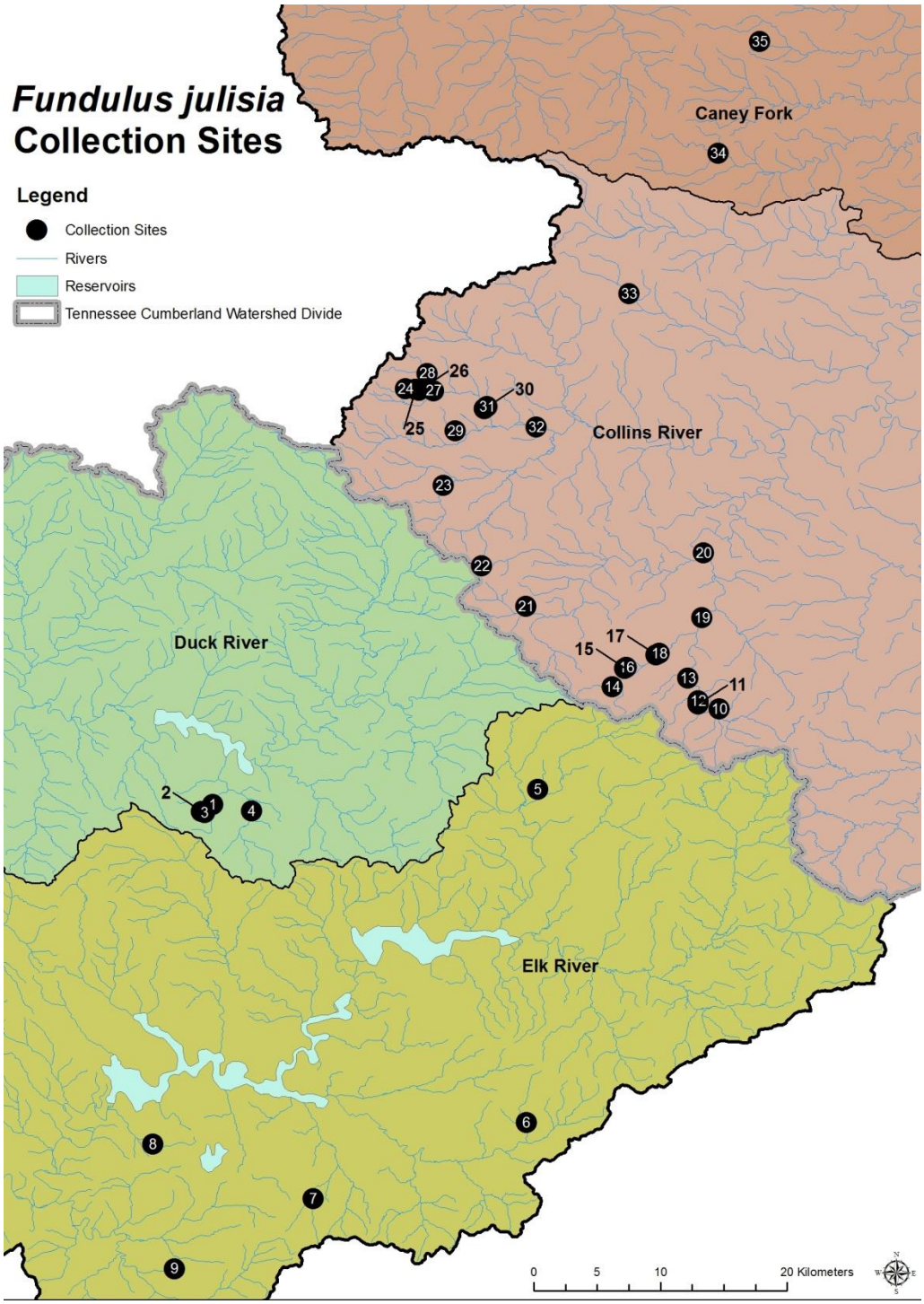

Figure 3. Locations of 35 sites sampled in 2013 for Barrens Topminnows, *Fundulus julisia*. Sites are 1) Marcum Sp. 2) Collier Sp. 3) Shamblee site 4) Short Sp. 5) Pond Sp. 6) Merkle Sp. 7) Farris Sp. 8) Hasty Site 9) Rattlesnake Sp. 10) Sherwood Sp. 11) Christian Sp. 12) Crooks site 13) Hancock Sp. 14) Cunningham Dairy Sp. 15) Clayborne Sp. 16) Sain Sp. 17) Upper Murray Sp. 18) Lower Murray Sp. 19) Ramsey Barn Sp. 20) Vervilla Sp. 21) Benedict Sp. (Type Locality) 22) Jarrell Sp. 23) Pocahontas Sp. 24) Above Pedigo Hwy site 25) Just above Pedigo Hwy site 26) Pedigo Hwy site 27) Pedigo Farm site 28) McMahan Creek Woodland Estates 29) Cooper Branch 30) Unnamed spring McMahan Creek 31) Unnamed tributary McMahan Creek 32) Lance Sp. 33) Charles Creek 34) Blue Sp. 35) Greenbrook Pond.

BTMs were found at 17 sites. No BTMs were found in one natural population (Pond Spring) despite two visits (14 March & 16 May) but were present at Benedict Spring and three sites in upper McMahan Creek. A native BTM population was also found at one of the seven "other" sites sampled and were collected at 12 of 23 stocked sites sampled (Figure 4, Table 1).

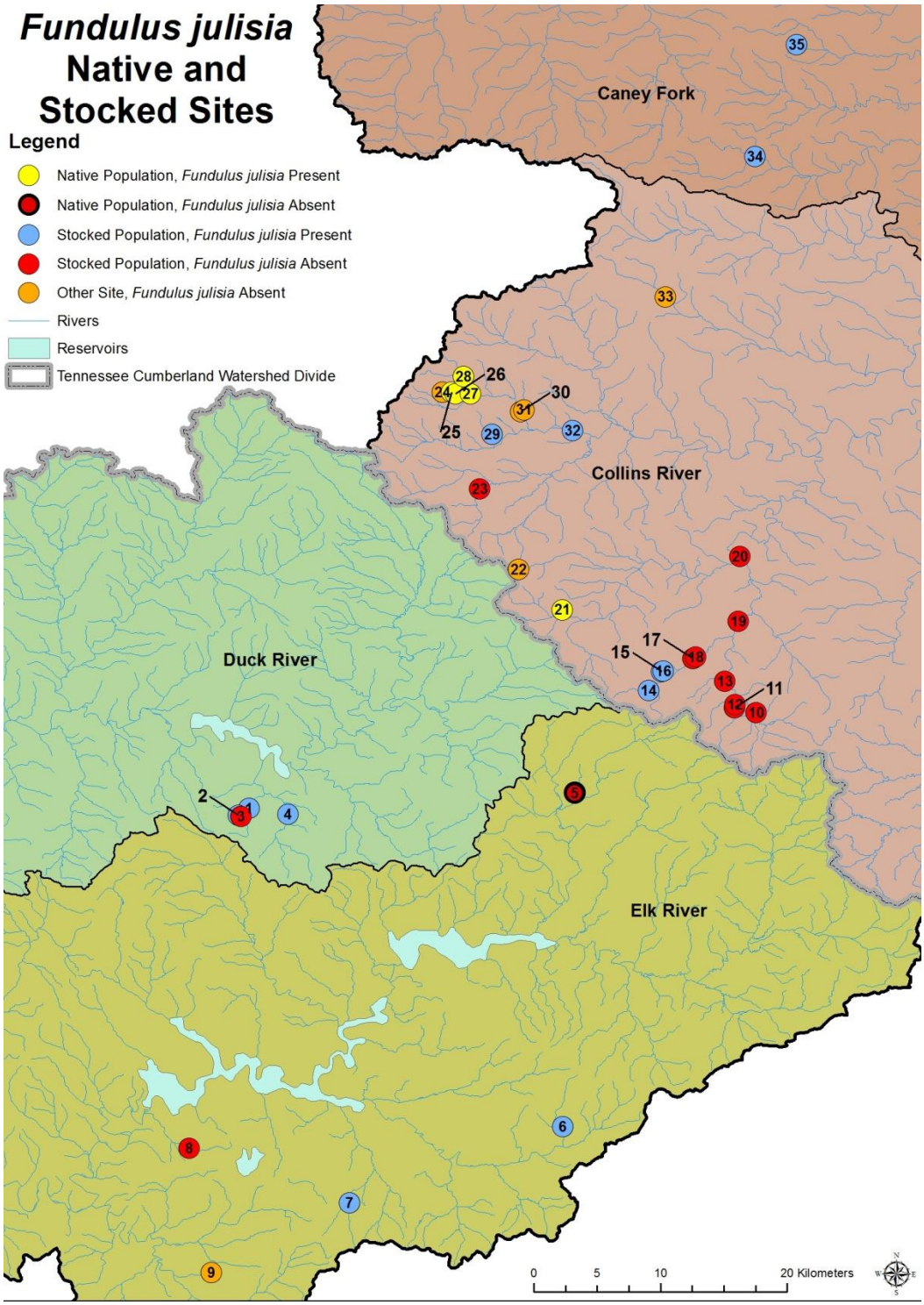

Figure 4. Presence/absence of Barrens Topminnows, *Fundulus julisia* at 35 sites sampled in 2013. See Figure 3 legend for site name corresponding to site number.

Four of the five sites with wild BTMs present showed signs of reproduction with the presence of specimens < 30 mm TL; the one site with no small BTMs was just upstream of the Pedigo Highway site. Only 4 of the 12 stocked sites with BTMs had small specimens present (Marcum, Collier, Lance, and Greenbrook) (Figure 5, Table 1).

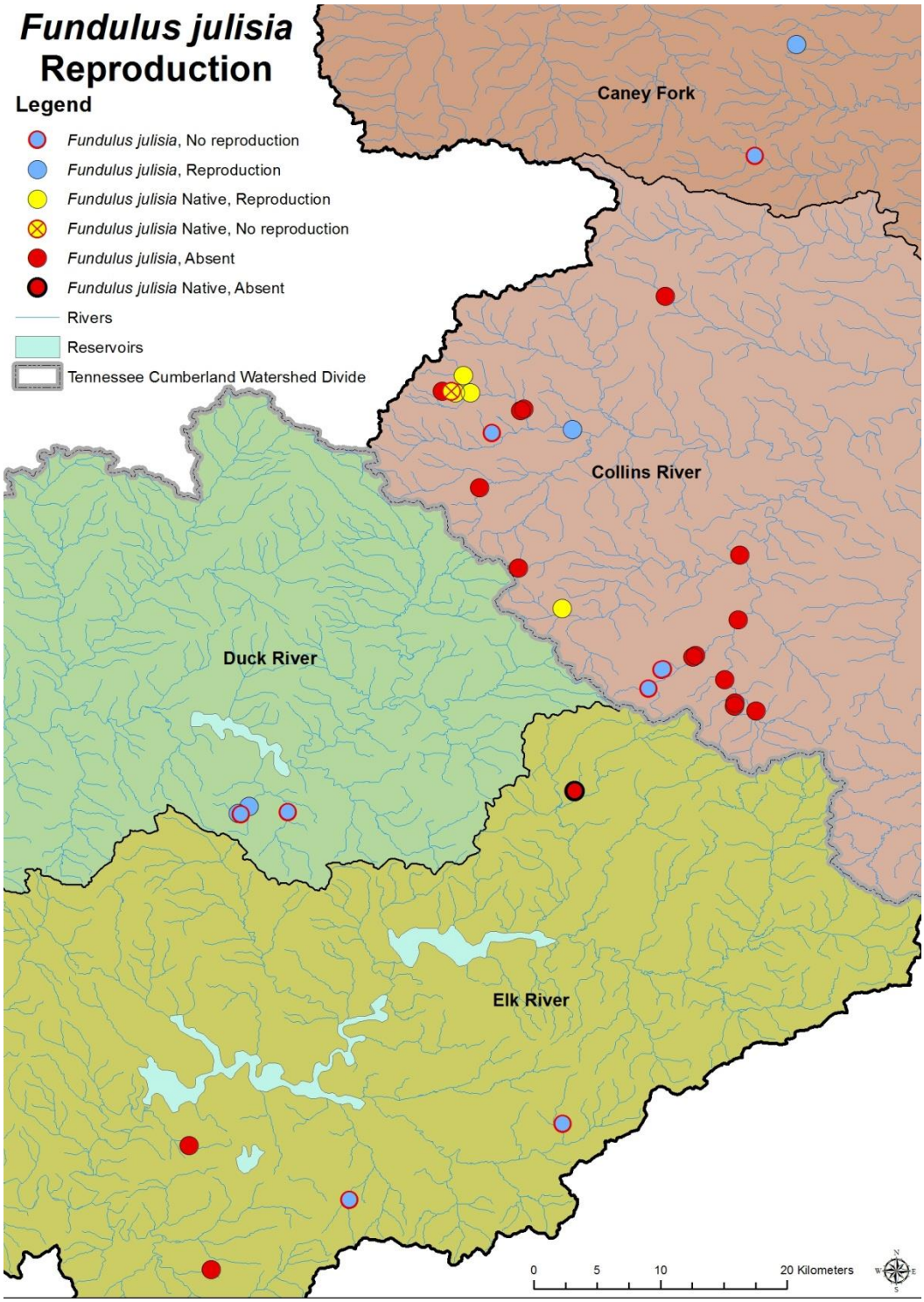

Figure 5. Presence/absence and reproduction of Barrens Topminnows, *Fundulus julisia*, at 35 sites sampled in 2013.

Gambusia were present at 15 of 35 sites. Nine of these sites had no BTMs and four of the six sites with *Gambusia* and BTMs had no small BTM specimens present. Only one native and one reintroduced site had *Gambusia* and small BTMs present, Pedigo Farm and Lance Spring respectively (Figure 6, Table 1).

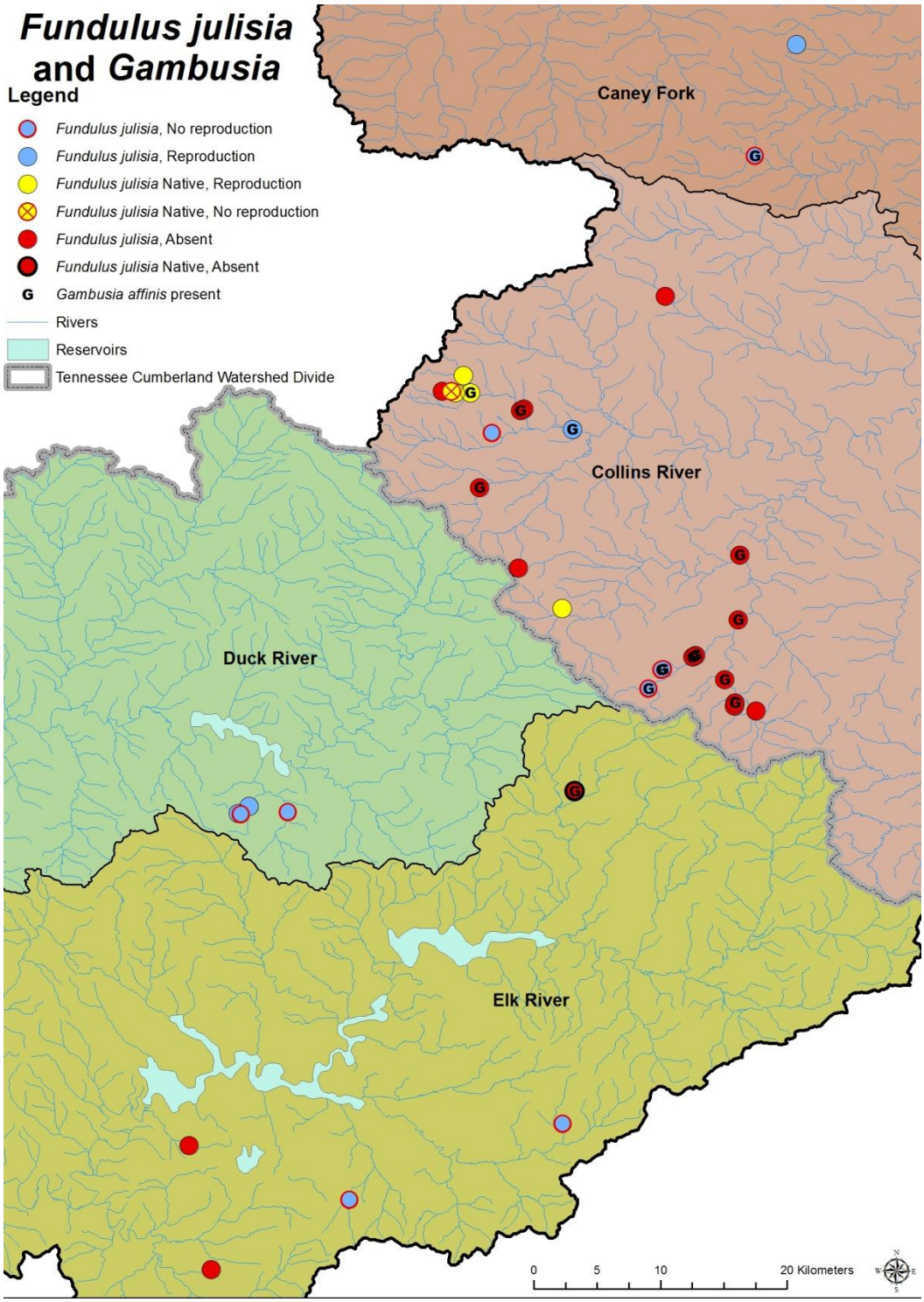

Figure 6. Presence/absence and reproduction of Barrens Topminnows, *Fundulus julisia*, and presence of Western Mosqitofish, *Gambusia affinis*, at 35 sites sampled in 2013.

A total of 804 BTMs were collected in 2013. The largest native population was at Benedict Spring (n=171). The smallest native population (n=16) was just upstream of the Pedigo Highway site; this was the only natural population site that did not have small BTMs. The only natural population site with *Gambusia* present was the Pedigo Farm site, where BTMs were abundant (n=96) and apparently reproducing based on the presence of small specimens. The largest collection with reintroduced BTMs was at Greenbrook Pond (n=174), the smallest was at Blue Spring (n=1). Except for Lance Spring (n=9), all reintroduced sites with small BTMs present had 25 or more specimens collected and no *Gambusia* present. Of the eight reintroduced site with no small BTMs, half had *Gambusia* present and all but two (Clayborne, n=29, and Cunningham Dairy, n=27) had < 10 specimens (Table 1, Appendix 2).

There were four sites (Marcum, Pedigo Hwy, Pedigo Farm, and Greenbrook) with more than 80 BTMs that were used to establish age classes based on length-frequency histograms. Age classes were defined as 22-36, 37-56, 57-71, and > 72 mm TL. These size/age classes were applied to sites with fewer than 80 BTMs to rate the Age Class Structure variable used in PVS. PVS ranged from a high of 65 to a low of -45. Only 10 of 35 sites had positive PVS, including all native sites with BTMs present (5 sites). Only 2 sites with positive PVS had *Gambusia* present (Pedigo Farm and Lance). The majority of sites with PVS of zero or negative (13 of 25) had *Gambusia* present (Table 1).

Table 1. Number of Barrens Topminnows (BTMs), *Fundulus julisia*, collected in each of the last five years and number stocked in the last five years for 35 sites sampled in 2013. Sites with native BTMs are in bold. Sites with Western Mosquitofish, *Gambusia affinis*, present in 2013 are marked with an asterisk. Number of BTMs collected with double asterisk indicate recruitment.

Site	Number BTMs collected in 2013	Number BTMs collected in 2012	Number BTMs collected in 2011	Number BTMs collected in 2010	Number BTMs collected in 2009	Number BTMs stocked 2008-12
Marcum	82**	125**	187**	102**	130**	3079
Collier	35**	30**	38**	81**	141**	0
Shamblee	0	0	0	–	3	0
Short	4	21**	65**	15**	20**	0
***Pond Spring**	0[a]	25	12	110**	118	0
Merkle	3	10**	32**	18**	30**	1274
Faris	7	1	23**	16	18	1148
Hasty Site	0	–	–	–	0	93
Rattlesnake Spring	0	–	–	–	–	0
Sherwood	0	2	–	4	–	1311
Christian[b]	0	–	–	–	–	0
*Crooks[b]	0	9	–	0	–	736
*Hancock	0	0	2	10	0	218
*Cunningham Dairy	37	–	–	192**	–	333[c]
*Clayborne	29	0	18	8	36**	578
*Sain	6	0	0	–	0	0
*Upper Murphy	0	–	–	–	–	0
*Lower Murphy	0	–	–	–	–	0
*Barn Ramsey	0	3	36	106**	207**	175
*Vervilla	0	2	33**	90**	288**	0
Benedict (Type)	171**	–	–	–	–	0[d]
Jarrell	0	–	–	–	–	0
*Pocahontas (Davis)	0	–	0	0	–	949
Upstream Pedigo	0	–	–	–	–	0
Just upstream Pedigo	16	–	–	–	–	0
Pedigo Hwy	101**	113**	62**	139**	–	0
***Pedigo Farm**	96**	57**	100	200**	–	0
Woodland Estates	25**	–	–	–	–	0
Cooper	8	41**	12	0	52**	1159
*Unnamed Spring	0	–	–	–	–	0
Unnamed Tributary	0	–	–	–	–	0
*Lance	9**	6	26**	85**	6**	726
Charles Creek	0	–	–	–	–	0
*Blue (Herndon)	1	5	21**	20	8**	2226
Greenbrook	174**	309**	177**	379**	202**	400
Totals	*804*	*759*	*844*	*1383*	*1259*	*14,405*

[a] Pond Spring was visited twice.

[b] Previous collections labeled "Crooks" may have included both Christian and Crooks 2013 sites.

[c] Total stocked includes subtraction of 500 BTMs for Cunningham Dairy for translocation.

[d] Benedict (Type) population rescued and restocked in 2006-07, 2007-08, 2008-09, and 2010-11.

Table 2. Population Viability Scores (PVS) for 35 sites sampled in 2013 for Barrens Topminnows (BTM), *Fundulus julisia* over the last five years. Sites are arranged by most viable BTM population in 2013. Sites with native BTMs are in bold. Sites with Western Mosqitofish, *Gambusia affinis*, present in 2013 are marked with an asterisk.

Site	2013 PVS	2012 PVS	2011 PVS	2010 PVS	2009 PVS
Pedigo Hwy	65	55	55	65	–
Greenbrook	65	55	45	60	65
Benedict (Type)	60	–	–	–	–
Woodland Estates	60	–	–	–	–
Collier	45	35	70	65	70
Marcum	40	35	50	85	55
***Pedigo Farm**	25	5	5	65	–
*Lance	25	0	5	40	-10
Short	20	55	45	60	55
Just upstream Pedigo	5	–	–	–	–
*Cunningham Dairy	0	–	–	65	–
*Sain	0	-10	-25	–	-25
Faris	-5	-15	30	0	-10
*Clayborne	-5	-25	-20	5	0
Rattlesnake Spring	-5	–	–	–	–
Hasty Site	-10	–	–	–	-25
Merkle	-15	30	35	30	35
Christian[a]	-15	–	–	–	–
*Pocahontas (Davis)	-15	–	-10	-20	–
Upstream Pedigo	-15	–	–	–	–
Cooper	-15	40	-5	-30	45
Unnamed Tributary	-15	–	–	–	–
Charles Creek	-15	–	–	–	–
***Pond Spring**	-17.5[b]	0	10	65	–
Shamblee	-20	-15	-40	–	-5
Sherwood	-20	-25	-20	-25	–
*Hancock	-20	-25	-20	-15	-15
*Lower Murphy	-20	–	–	–	–
*Vervilla	-20	-25	10	25	80
*Blue (Herndon)	-20	-10	10	20	20
Jarrell	-25	–	–	–	–
*Upper Murphy	-30	–	–	–	–
*Barn Ramsey	-30	-35	20	65	55
*Unnamed Spring	-30	–	–	–	–
*Crooks[a]	-45	-30	–	-25	–

[a] PVS for Christian & Crooks sites were reported for "Crooks" in 2012 & 2010 and may represent one or both of the sites.

[b] Pond Spring was visited twice, with PVS of -15 and -20.

Results for each site are presented below. Sites are in the same order as presented in Figures 1 and 2.

Marcum Spring

Site Location: Duck River drainage 35.4088889 -86.205833
Date: 27 February 2013
Time: 9:40-11:45
Collectors: B.R. Kuhajda, M.T. Hamilton, R.L. Richardson, S.B. Bain
BTMs collected: 82
BTM Abundance rating: 6
BTM Recruitment rating: 3
BTM Age Class Structure rating: 3
Difficulty collecting rating: 0
Gambusia collected & volume: 0 & 0 ml
Gambusia rating: 0
Pollution/Threats rating: 2
BTM Stocking rating & year last stocked: 3 & 2012
Hydrology rating: 1
PVS: 40
Spring size: Large
Number seine hauls: 17
Habitat: *Sparganium*, lots of filamentous algae in pond at spring run entrance, *Sparganium* in isolated pool above pond. Bottom mud.
Comments: Bulldozer eliminated "pool 2" and filled in some of "pool 1", making a road assumed for timber extraction.

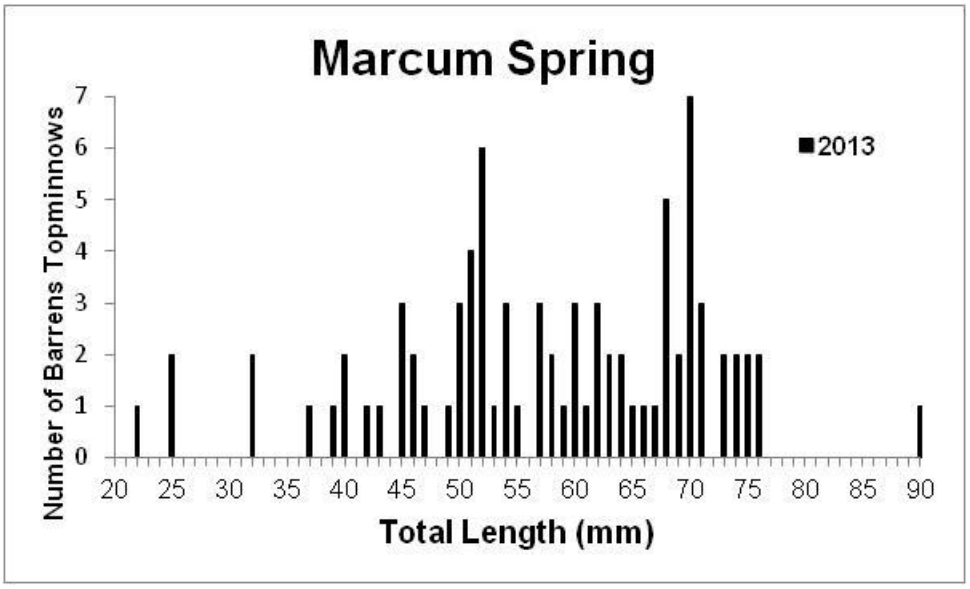

Photo 1. Marcum Spring. A) Pond and lower end of spring run and B) isolated pool off of spring run.

Photo 2. Marcum Spring. Pool on upper spring run mostly filled in by logging road.

Two BTMs were collected in the upper end of the fish pond near the confluence with the spring run, five BTMs were collected in the spring run (four at the lower end and one in the partially-filled pool at the logging road), and all other BTMs (75) were collected in the isolated pool next to the spring run. Three BTMs were < 30 mm TL and this is the fifth years in a row where small BTMs have been collected (Table 1), therefore recruitment is occurring consistently at Marcum Spring. With a PVS of 40 and a range of 35-85 over the last four years (Table 2) this population appears to be in good shape.

Collier Spring

Site Location: Duck River drainage 35.4039 - 86.2136
Date: 6 March 2013
Time: 9:40-10:10
Collectors: D.A. Neely, G.J. Knothe, B.W. Bingham, T.B. Watkins, S. Alexander
BTMs collected: 35
BTM Abundance rating: 4
BTM Recruitment rating: 3
BTM Age Class Structure rating: 3
Difficulty collecting rating: 2
Gambusia collected & volume: 0 & 0
Gambusia rating: 0

Pollution/Threats rating: 1
BTM Stocking rating & year last stocked: 0 & 2007
Hydrology rating: 2
PVS: 45
Spring size: Small
Number seine hauls: 12
Habitat: Filamentous algae, watercress, other aquatics. Bottom mud.
Comments: Few threats. Horse pasture with good ground cover. Good vegetative buffer around spring. Livestock are excluded from site.

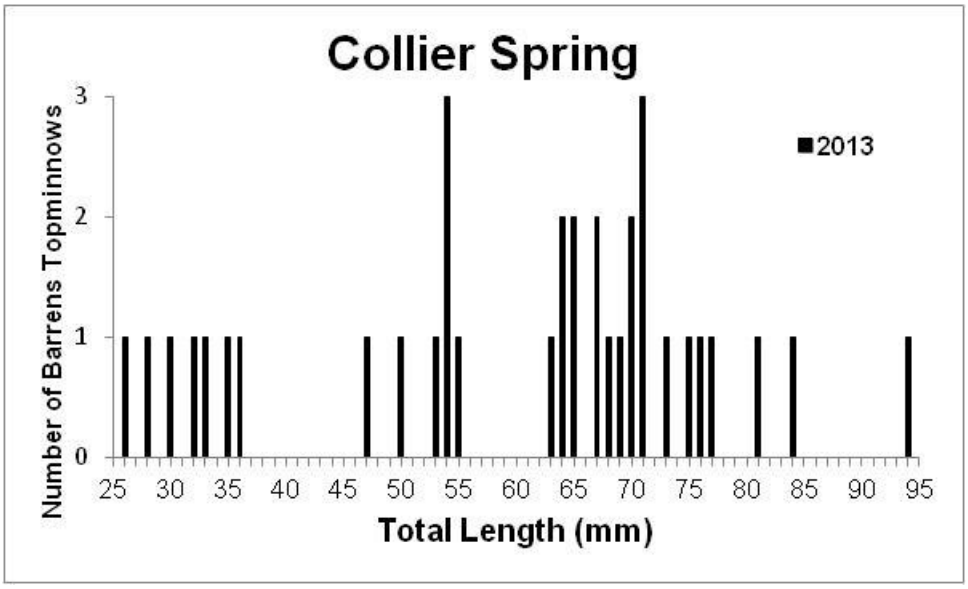

Photo 3. Collier Spring.

Two BTMs were < 30 mm TL and this is the fifth years in a row where small BTMs have been collected (Table 1), therefore recruitment is consistently occurring at Collier Spring. With a PVS of 45 and a range of 35-70 over the last four years (Table 2) this population appears to be in good shape.

Shamblee Site

Site Location: Duck River drainage 35.40311 -86.21155
Date: 27 February 2013
Time: 12:40-13:10
Collectors: B.R. Kuhajda, M.T. Hamilton, R.L. Richardson, S.B. Bain
BTMs collected: 0
BTM Abundance rating: 0
BTM Recruitment rating: 0
BTM Age Class Structure rating: 0
Difficulty collecting rating: 4
Gambusia collected & volume: 0 & 0
Gambusia rating: 0
Pollution/Threats rating: 2
BTM Stocking rating & year last stocked: 0 & 2007
Hydrology rating: 2

PVS: -20
Spring size: Small
Number seine hauls: 12
Habitat: *Sparganium* in upper end of pond, some watercress in creek. Bottom mud, gravel in "run".
Comments: S1-S3 *Spaganium* in upper end of pond. S7-S9 some watercress in creek.

Photo 4. Shamblee Site, where the unnamed tributary to Carroll Creek enters a pond.

No BTMs have been collected at this site since three individuals were collected in 2009 despite sampling in 2011, 2012, and 2013 (Table 1).

Short Spring

Site Location: Duck River drainage 35.4045 -86.1781
Date: 6 March 2013
Time: 10:45-11:30
Collectors: D.A. Neely, G.J. Knothe, B.W. Bingham, T.B. Watkins, S. Alexander
BTMs collected: 4
BTM Abundance rating: 0
BTM Recruitment rating: 1
BTM Age Class Structure rating: 2
Difficulty collecting rating: 0

Gambusia collected & volume: 0 & 0
Gambusia rating: 0
Pollution/Threats rating: 1
BTM Stocking rating & year last stocked: 0 & 2006
Hydrology rating: 2
PVS: 20
Spring size: Large
Number seine hauls: 22
Habitat: Filamentous algae present. Bottom bedrock, gravel, mud. Intact riparian zone.
Comments: Four BTMs caught at very top of spring pool. S21-22 were in upper portion of system at a small stream leading into site.

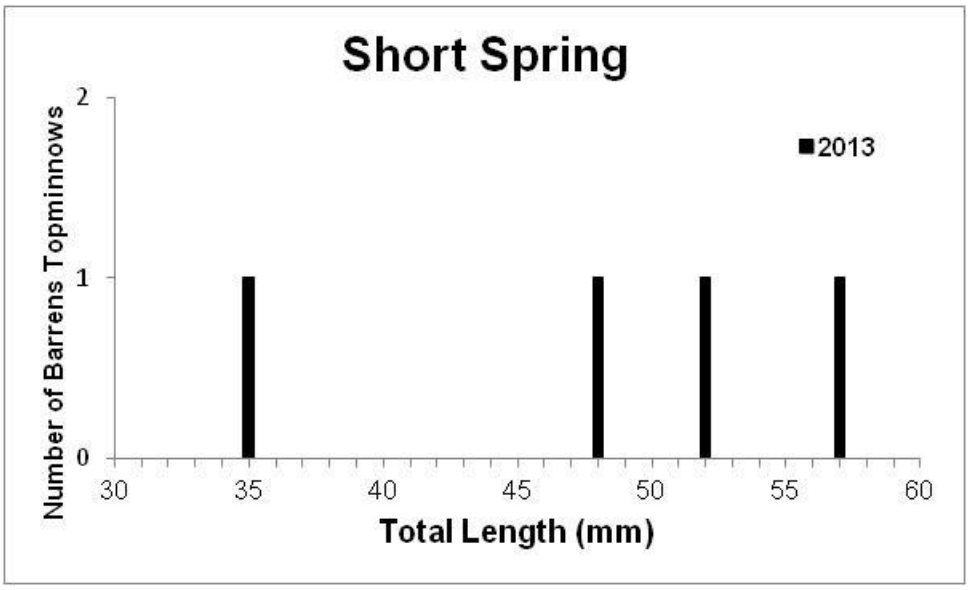

Photo 5. Short Spring, photo toward shallow end.

No BTMs < 30 mm TL were collected but one specimen was 35 mm TL. Since no stocking has occurred in Short Spring since 2006, this may indicate reproduction, especially since recruitment was present the previous four years (Table 1). With a PVS of only 20 compared to a range of 45-60 over the last four years (Table 2) this population appears to be in decline, but this may be sampling artifact since the shallower end of the spring was under-sampled.

Pond Spring (1st visit)

Site Location: Elk River drainage 35.4197 -85.9749
Date: 28 February 2013
Time: 11:15-12:20
Collectors: B.R. Kuhajda, B.W. Bingham, T.B. Watkins, M.T. Hamilton, J. Bowyer, B. Maynard, P. Rakes, J.R. Shute, C. Ruble, R. Xiques
BTMs collected: 0
BTM Abundance rating: 0
BTM Recruitment rating: 0
BTM Age Class Structure rating: 0
Difficulty collecting rating: 0
Gambusia collected & volume: 812 & 137 ml
Gambusia rating: 3

Pollution/Threats rating: 2
BTM Stocking rating & year last stocked: 0
Hydrology rating: 2
PVS: -15
Spring size: Large
Number seine hauls: 20
Habitat: Filamentous algae, Watercress, other aquatics present, very dense. Bottom mud.
Comments: 6 *H. flammea* preserved in EtOH. S1 = backup channel. S2 = backwater vegetation. S3 = heavy vegetation, large area, clean outflow. S6 = pond scum, main area. S7 = back in channel. S8 = same area as S7. S9 = back in mouth of inflow. S11 - S13 = creek branch. S15 = secondary backwater. S18, S19 = up side channel. S20 = mouth.

Photo 6. Pond Spring main pond on 28 February 2013.

Photo 7. Pond Spring side channel off main spring pond on 28 February 2013.

Pond Spring 2nd visit

Date: 16 May 2013
Time: 11:05-12:00
Collectors: B.R. Kuhajda, B.W. Bingham, T.B. Watkins, M.T. Hamilton, S. Farnsley, H. Klug, et al.
BTMs collected: 0
BTM Abundance rating: 0
BTM Recruitment rating: 0
BTM Age Class Structure rating: 0
Difficulty collecting rating: 0
Gambusia collected & volume: 839 & 289 ml
Gambusia rating: 4
Pollution/Threats rating: 2
BTM Stocking rating & year last stocked: 0
Hydrology rating: 2
PVS: -20
Spring size: Large
Number seine hauls: 12
Habitat: *Ceratophylum*, filamentous algae, *Sparganium, Ludwigia*, watercress, Lemnaceae present. Bottom mud/silt.

Comments: Seining difficult due to high water and dense aquatic vegetation. 22 *Gambusia* collected in S11 & 1 *Gambusia* in S12 not preserved. S1 at pond/side channel junction.

No BTMs were collected at this only native site in the Elk River drainage during either visit in 2013. This compares with 25 & 12 BTMs captured in 2012 and 2013 respectively, but no specimens were < 30 ml TL. Reproduction was last noted in 2010 with 3 of 110 BTMs < 30 mm TL (Table 1). PVS has dropped from 65 in 2010 to -17.5 (average of two visits) in 2013 (Table 2). All of these trends indicate that the native Pond Spring population of BTMs in is decline, may not be reproducing, and may potentially be extirpated. The cause of this could be the large number of *Gambusia* present in conjunction with cattle use and nutrification of the spring pond.

Merkle (Big) Spring

Site Location: Elk River drainage 35.18322 -85.98313
Date: 25 February 2013
Time: 9:15-9:30
Collectors: B.R. Kuhajda, D.A. Neely, T.B. Watkins, G.J. Knothe
BTMs collected: 3
BTM Abundance rating: 0
BTM Recruitment rating: 1
BTM Age Class Structure rating: 2
Difficulty collecting rating: 4
Gambusia collected & volume: 0 & 0
Gambusia rating: 0
Pollution/Threats rating: 1
BTM Stocking rating & year last stocked: 3 & 2012
Hydrology rating: 2
PVS: -15
Spring size: Small
Number seine hauls: 12
Habitat: Some *Ludwigia* present. Bottom cobble, sand, silt.
Comments: 2 teams & seines (A downstream seine 1-6 & B near springhead seine 7-12). S6 = shallow backwater. S7 = flowing pool & shallow backwater. S8 = riffle. S9 = moving pool & sticks. S10 = riffle with sticks. S11 = shallow pool at springhead. S12 = shallow riffle springhead.

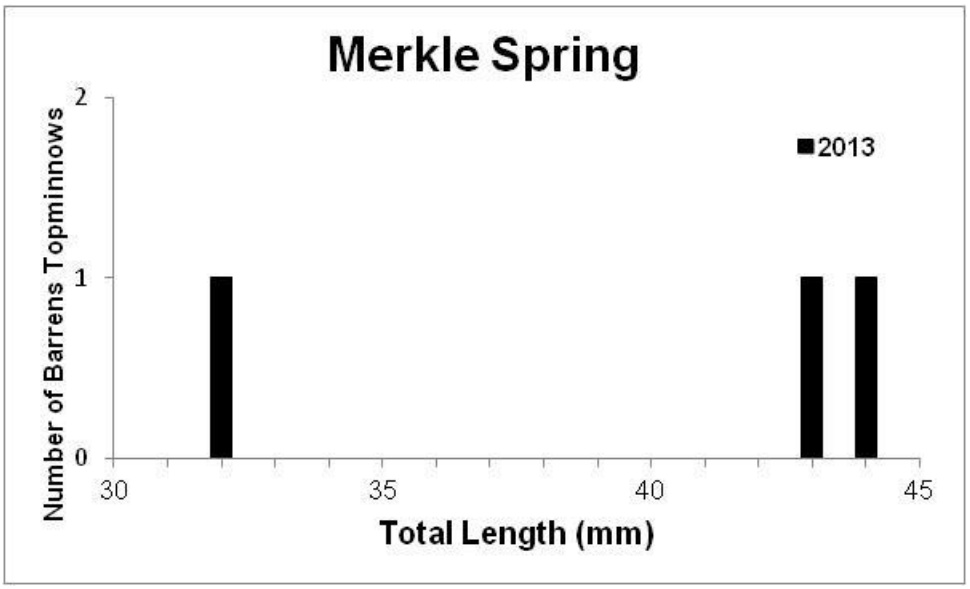

Photo 8. Merkle (Big) Spring toward spring head.

Photo 9. Merkle (Big) Spring downstream in spring run.

Only three BTMs were collected and none were < 30 mm TL, even though this site was stocked the previous year (2012) with 365 BTMs. The lack of small individuals is alarming since recruitment was present the previous four years (Table 1). With a PVS of -15 compared to a range of 30-35 over the last four years (Table 2) this population appears to be in decline. There was very little backwater habitat for BTMs, all specimens were collected in the little backwater habitat available. Looking further downstream for more appropriate habitat is recommended in future surveys.

Faris Spring

Site Location: Elk River drainage 35.1292 -86.13451
Date: 25 February 2013
Time: 10:50-11:20
Collectors: B.R. Kuhajda, D.A. Neely, T.B. Watkins, G.J. Knothe
BTMs collected: 7
BTM Abundance rating: 2
BTM Recruitment rating: 0
BTM Age Class Structure rating: 2
Difficulty collecting rating: 2
Gambusia collected & volume: 0 & 0
Gambusia rating: 0

Pollution/Threats rating: 2
BTM Stocking rating & year last stocked: 3 & 2012
Hydrology rating: 2
PVS: -5
Spring size: Small
Number seine hauls: 12
Habitat: Spring run 40 m long to fence from springhead. Cows in run on opposite side of fence from spring head. Watercress, little *Fontinalis*. Bottom mud.
Comments: Present: common snapper (photo), *Eurycea* aquatic, *Cambarus* sp. - 3 species, *Desmognathus* sp., *Pseudotriton* (photo). 30 *Hemitremia flammea* preserved in 95% EtOH. S12 = downstream into block net.

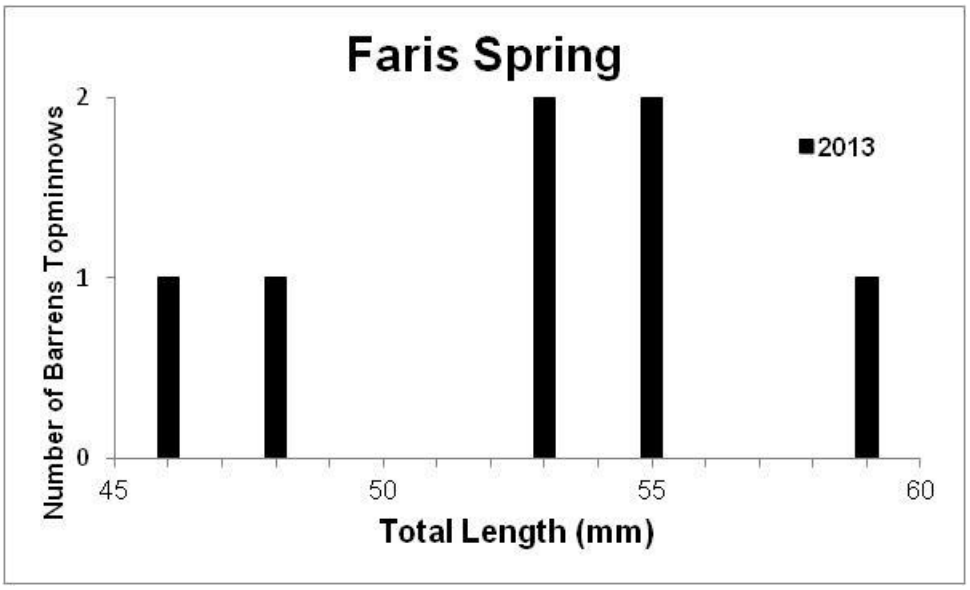

Photo 10. Faris Spring A) towards springhead and B) spring run showing lack of aquatic vegetation where cattle are allowed in the spring run.

Only seven BTMs were collected and none were < 30 mm TL, even though this site was stocked the previous year (2012) with 259 BTMs. The lack of small individuals in all but one year (2011) over the last five years indicates that this site may not be suitable for recruitment or small individuals migrate further downstream (Table 1). The PVS over the last five years is either negative or zero except for the score of 30 in 2011, which reflects the one year small BTMs were captured (Table 2).

Hasty Site (Hasty Spring run, Water Cure Spring run, & Water Cure Creek)

Site Location: Elk River drainage 35.16734 -86.24765
Date: 19 February 2013
Time: 14:10-14:40
Collectors: B.R. Kuhajda, D.A. Neely, G.J. Knothe
BTMs collected: 0
BTM Abundance rating: 0
BTM Recruitment rating: 0
BTM Age Class Structure rating: 0
Difficulty collecting rating: 2
Gambusia collected & volume: 0 & 0 ml
Gambusia rating: 0
Pollution/Threats rating: 1
BTM Stocking rating & year last stocked: 1 & 2008
Hydrology rating: 2
PVS: -10
Spring size: Small
Number seine hauls: ?
Habitat: Nasturtium present. Bottom cobble, gravel, silt.
Comments: Sampled lower Hasty Spring run near jct with Water Cure Creek and sampled Water Cure Creek proper. Also sampled lower spring run of Water Cure Spring 35.1675 -86.2457; only fish collected was a single *Cottus carolinae*. Water Cure Spring isolated from creek proper by a series of waterfalls, presumably due to incised creek.

Photo 11. A) Water Cure Creek and B) Water Cure Spring run.

Photo 12. Series of waterfall at lowermost end of Water Cure Spring run.

Home owners were not home to seek permission to sample Hasty Spring proper. This is the first time since 2009 that this site was surveyed. No BTMs found in either survey and the site scored low PVS both times (-10 & -25) (Table 1 & 2).

Rattlesnake Spring & wetland

Site Location: Elk River drainage 35.07924 -86.23265
Date: 19 February 2013
Time: 11:10-12:20
Collectors: B.R. Kuhajda, D.A. Neely, G.J. Knothe
BTMs collected: 0
BTM Abundance rating: 0
BTM Recruitment rating: 0
BTM Age Class Structure rating: 0
Difficulty collecting rating: 2
Gambusia collected & volume: 0 & 0 ml
Gambusia rating: 0
Pollution/Threats rating: 1
BTM Stocking rating & year last stocked: 0 & never
Hydrology rating: 2
PVS: -5

Spring size: Large
Number seine hauls: ?
Habitat: Filamentous algae, *Sparganium*, *Ludwigia*, *Nasturtium*, *Fontinalis* present. Mud, little gravel in spring run.
Comments: Extensive wetland with lots of aquatic vegetation, spring flow, & beaver dams. Some areas dug out by landowner, ponds connected to wetland. Ponds dug because spring stops flowing in drought.

Photo 13. Rattlesnake Spring.

Photo 14. Very extensive wetland fed by Rattlesnake Spring.

No BTM have ever been reported from or stocked at this site, but it seems an ideal site for introduction. There is extensive habitat, no *Gambusia* were present, and the landowner has dug ponds adjacent to the wetlands for fishes to take refuge in when the spring stops flowing in drought years.

Sherwood Spring & Hickory Creek

Site Location: Caney Fork drainage 35.4768 -85.8462
Date: 28 February 2013
Time: 9:25-10:20
Collectors: B.R. Kuhajda, B.W. Bingham, T.B. Watkins, M.T. Hamilton, J. Bowyer, B. Maynard
BTMs collected: 0
BTM Abundance rating: 0
BTM Recruitment rating: 0
BTM Age Class Structure rating: 0
Difficulty collecting rating: 2
Gambusia collected & volume: 0 & 0
Gambusia rating: 0
Pollution/Threats rating: 1
BTM Stocking rating & year last stocked: 3 & 2012
Hydrology rating: 2

PVS: -20
Spring size: Large
Number seine hauls: 20
Habitat: Some *Ludwigia*, other submerged aquatic vegetation present. Bottom gravel, sand.
Comments: S1-S3 above spring. S4-S8 in spring. S9-S20 below spring.

Photo 15. Sherwood Spring in Hickory Creek taking photo downstream.

No BTMs were collected in 2013 and only 4 and 2 BTMs were collected in 2010 and 2012. Additionally all PVS are -20 to -25 over the last 5 years in spite of the stocking of 245 BTMs in 2012 and a total of 1,311 from 2008-2012 (Tables 1 & 2). This site does not appear to be able to support a population of BTMs due to lack of backwater habitat. This may be due in part to the deeply incised stream bed (see background of Photo 15).

Christian Spring & spring run upstream Sherwood Road

Site Location: Caney Fork drainage 35.4803 -85.8613
Date: 12 March 2013
Time: 9:00-9:18
Collectors: B.R. Kuhajda, D.A. Neely, B.W. Bingham
BTMs collected: 0
BTM Abundance rating: 0
BTM Recruitment rating: 0

BTM Age Class Structure rating: 0
Difficulty collecting rating: 2
Gambusia collected & volume: 0 & 0
Gambusia rating: 0
Pollution/Threats rating: 2
BTM Stocking rating & year last stocked: 1 & 2009
Hydrology rating: 2
PVS: -15
Spring size: Small
Number seine hauls: 12
Habitat: Watercress, *Fontinalis* present. Bottom mud, rip-rap, gravel.
Comments: Started at downstream end of run upstream of road.

Photo 16. Christian Spring run upstream of Sherwood Road. Note modified run with rip-rap.

Photo 17. Christian Spring.

It is not clear if previous sampling labeled “Crooks” was only upstream, only downstream, or both upstream and downstream of Sherwood Road and it’s culvert. No BTMs were collected upstream of the culvert in 2013. Nine BTMs ≥ 65 mm TL were collected in 2012 either upstream and/or downstream of the road. No BTMs were collected in 2010 and the site was not sampled in 2009 or 2011 (Table 1). The site was last stocked with 369 BTMs upstream of the road in 2009. The PVS was -15 in 2003 compared to -30 and -25 in 2012 and 2010 (Table 2); these historical scores could be for Crooks site downstream of Sherwood Road. Some slow water habitat is present, but the run has recently been modified.

<u>Crooks Site, Christian Spring run downstream of Sherwood Road</u>

Site Location: Caney Fork drainage 35.4824 -85.8611
Date: 12 March 2013
Time: 9:23-9:55
Collectors: B.R. Kuhajda, D.A. Neely, B.W. Bingham
BTMs collected: 0
BTM Abundance rating: 0
BTM Recruitment rating: 0
BTM Age Class Structure rating: 0
Difficulty collecting rating: 4
Gambusia collected & volume: 4 & 1.5 ml

Gambusia rating: 1
Pollution/Threats rating: 5
BTM Stocking rating & year last stocked: 1 & 2009
Hydrology rating: 2
PVS: -45
Spring size: Small
Number seine hauls: 12
Habitat: Watercress, *Ludwigia*, flooded terrestrials present. Bottom mud, gravel.
Comments: Started immediately downstream of road.

Photo 18. Christian Spring run downstream of Sherwood Road at Crooks Site.

Photo 19. Christian Spring run just downstream of Sherwood Road at Crooks Site.

It is not clear if previous sampling labeled "Crooks" was only upstream, only downstream, or both upstream and downstream of Sherwood Road and it's culvert. No BTMs were collected downstream of the culvert in 2013. Nine BTMs ≥ 65 mm TL were collected in 2012 either upstream and/or downstream of the road. No BTMs were collected in 2010 and the site was not sampled in 2009 or 2011 (Table 1). The site was last stocked with approximately 400 BTMs in 2006, but 369 BTMs were stocked upstream of the road in 2009. The PVS of -45 was the worst of any 2013 site, this compares to -30 and -25 in 2012 and 2010 (Table 2); these historical scores could be for Christian Spring run upstream of Sherwood Road. Pockets of slow water habitat for BTMs are present, but the run receives runoff from a nearby cattle yard.

Hancock Spring

Site Location: Caney Fork drainage 35.4988 -85.8684
Date: 12 March 2013
Time: 10:52-11:15
Collectors: B.R. Kuhajda, D.A. Neely, B.W. Bingham
BTMs collected: 0
BTM Abundance rating: 0
BTM Recruitment rating: 0
BTM Age Class Structure rating: 0 & 0
Difficulty collecting rating: 2
Gambusia collected & volume: 58 & 30 ml

Gambusia rating: 1
Pollution/Threats rating: 2
BTM Stocking rating & year last stocked: 1 & 2009
Hydrology rating: 2
PVS: -20
Spring size: Small
Number seine hauls: 12
Habitat: Watercress, *Ludwigia* present. Bottom mud.
Comments: Spring & short deep run immediately enters Hickory Creek. Seined along W edge of spring.

Photo 20. Hancock Spring and run.

Photo 21. Hancock Spring run almost immediately entering Hickory Creek

No BTMs were collected in 2013 and only 2 and 10 BTMs have been collected over the last 5 years of surveys (20011 and 2010). No recruitment has been observed over this same time period. Additionally all PVS are -15 to -25 over the last 5 years in spite of the stocking of 218 BTMs over this time period (Tables 1 & 2). This site does not appear to be able to support a population of BTMs even though there is some backwater habitat in the spring. This may be due the close proximity of Hickory Creek and the presence of *Gambusia*.

Cunningham Dairy Spring

Site Location: Caney Fork drainage 35.4926 -85.9222
Date: 25 February 2013
Time: 13:00-13:30
Collectors: B.R. Kuhajda, D.A. Neely, T.B. Watkins, G.J. Knothe
BTMs collected: 37
BTM Abundance rating: 4
BTM Recruitment rating: 0
BTM Age Class Structure rating: 2
Difficulty collecting rating: 2
Gambusia collected & volume: 2 & 1 ml
Gambusia rating: 1
Pollution/Threats rating: 1

BTM Stocking rating & year last stocked: 3 & 2012
Hydrology rating: 1
PVS: 0
Spring size: Small
Number seine hauls: 12
Habitat: Pond with dense and varied aquatic vegetation. Bottom mud.
Comments: S9 *G. affinis*, 2 females (1 ripe) at shallow end of pond. S1 at dam. S3, S4, S5, S6 spring house area. S7, S8 towards shallow end. S9, S10 at shallow end. S12 other side from pump house.

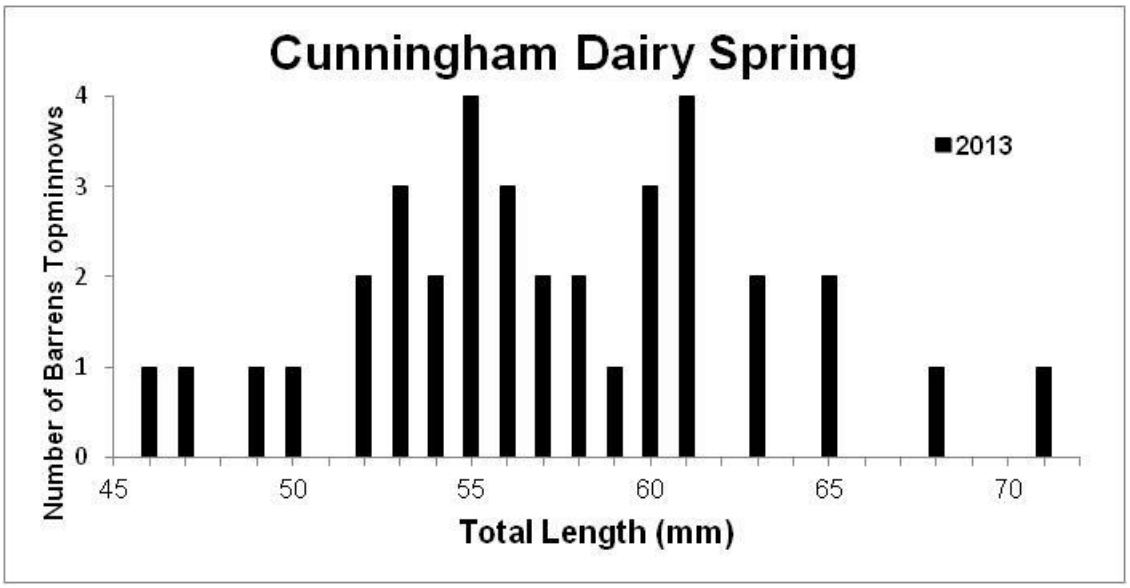

Photo 22. Cunningham Dairy Spring. The shallow end is in the foreground and the "dam" is at the far end of the spring just to the left of the pump house.

Even though we collected 37 BTMs representing two size/age classes there was no indication of recruitment and the PVS was 0. This contrasts to the only other survey in the last five years in 2010, where 192 BTMs were collected with specimens < 30 mm TL indicating recruitment and a PVS of 65 (Tables 1 & 2). The only habitat difference is the presence of two *Gambusia* in 2013 compared to none present in 2010 (Zuber & Mattingly 2012).

Clayborne Spring

Site Location: Caney Fork drainage 35.5076 -85.91313
Date: 25 February 2013
Time: 14:00-14:50
Collectors: B.R. Kuhajda, D.A. Neely, T.B. Watkins, G.J. Knothe
BTMs collected: 29
BTM Abundance rating: 4
BTM Recruitment rating: 3
BTM Age Class Structure rating: 2
Difficulty collecting rating: 4
Gambusia collected & volume: 523 & 114 ml
Gambusia rating: 3
Pollution/Threats rating: 1

BTM Stocking rating & year last stocked: 3 & 2012
Hydrology rating: 1
PVS: -5
Spring size: Small
Number seine hauls: 12
Habitat: Watercress, overhanging terrestial vegetation present. Bottom mud. Site series of pools connected to spring run.
Comments: BTMs very skinny. 12 *H. flammea* preserved in 95% EtOH. BTMs present in run to the right (looking upsteam) of the pump house. S1-S4 lower pool where previously stocked. S5 small pool just above. S11-12 pool below pump house.

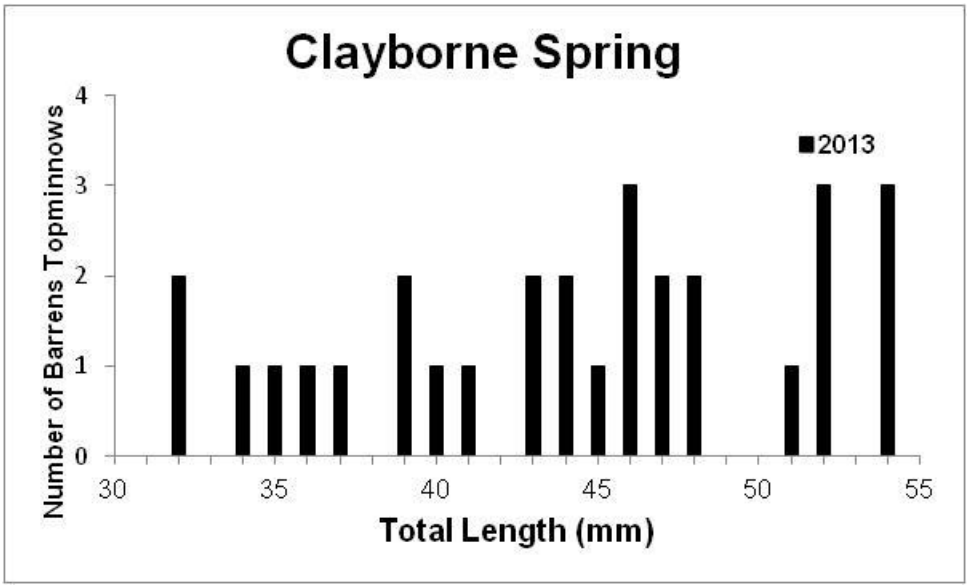

Photo 23. Clayborne Spring and series of pools.

Even though we collected 29 BTMs representing two size/age classes there was no indication of recruitment and the PVS was -5. No specimens < 30 mm TL have been collected since 2009 and PVS range from -25 to 5. Even with stocking 578 BTMs over the last 5 years and 338 in 2012, this population does not appear to be able to self-sustain in the presence of *Gambusia* (Tables 1 & 2).

Sain Spring

Site Location: Caney Fork drainage 35.5062 -85.912
Date: 12 March 2013
Time: 14:23-15:10
Collectors: B.R. Kuhajda, D.A. Neely
BTMs collected: 6
BTM Abundance rating: 2
BTM Recruitment rating: 0
BTM Age Class Structure rating: 1
Difficulty collecting rating: 2
Gambusia collected & volume: 137 & 133 ml
Gambusia rating: 1
Pollution/Threats rating: 2
BTM Stocking rating & year last stocked: 0 & 2005
Hydrology rating: 2
PVS: 0
Spring size: Small
Number seine hauls: 12
Habitat: *Ludwigia*, Lemnaceae, watercress, innundated terrestrials present. Bottom mud.
Comments: Most *F. julisia* in very shallow water to side of main channel - hand dragged the lead line. S1 top of Clayborne Spring run at fence downstream. S2-S3 in very shallow side water. S8-S10 lower end of Sain Spring run at confluence with Clayborne Spring run. S12 at barn and bricks.

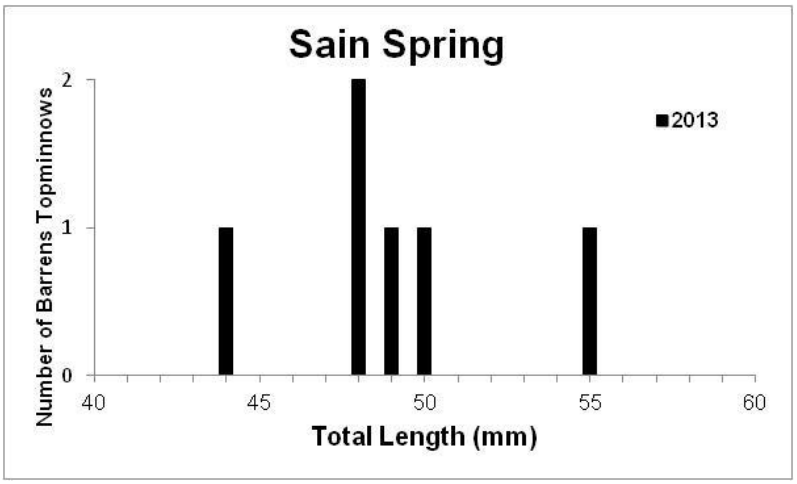

Photo 24. Sain Spring A) Sain Spring house and run and B) Sain Spring run's confluence with lower Clayborne Spring run

Photo 25. Sain/Clayborne spring run downstream of confluence.

Sain Spring run joins lower Clayborne Spring run on this property. It is assumed that the 6 BTMs collected at Sain Spring in 2013 were stocked in Clayborne Spring and moved downstream given that the only BTMs previously stocked in the Sain Spring site were in 2002 (56), 2003 (111), and 2005 (75). These 6 specimens represent the only time BTMs have been collected here in 2009, 2010, 2012, and 2013 surveys. No BTMs < 30 mm TL were collected in 2013 and the PVS was 0 compared to -10 to -25 in 3 of the last 4 years (Tables 1 & 2). The lack of deeper backwater habitat and the presence of *Gambusia* make this site inappropriate for a self-sustaining population.

Upper Murphy Spring

Site Location: Caney Fork drainage 35.515 -85.891
Date: 12 March 2013
Time: 13:10-13:45
Collectors: B.R. Kuhajda, D.A. Neely, B.W. Bingham
BTMs collected: 0
BTM Abundance rating: 0
BTM Recruitment rating: 0
BTM Age Class Structure rating: 0
Difficulty collecting rating: 2
Gambusia collected & volume: 605, 278 ml

Gambusia rating: 4
Pollution/Threats rating: 2
BTM Stocking rating & year last stocked: 0 & 2003
Hydrology rating: 2
PVS: -30
Spring size: Small
Number seine hauls: 12
Habitat: *Ludwigia*, watercress, Lemnaceae, filamentous algae (esp. at spring head & upper run) present. Bottom mud.
Comments: Visual survey prior to sampling - no *Fundulus julisia* seen. S1-S3 spring head. S4-S8 spring run. S9-S10 devegetated backwater. S11 run just above mouth at Little Hickory Creek. S12 just upstream S11.

Photo 26. Upper Murphy Spring towards spring head.

Photo 27. Upper Murphy Spring run (right) and side-channel with backwater (left).

This site was stocked in 2001-2003, and habitat for BTMs appears plentiful, but no specimens were found. Contributing factors include large numbers of *Gambusia* and nutrification, which is reflected in the PVS of -30 (Table 2). Brad Bingham reports that stocked BTMs left this spring system shortly after they were stocked.

Lower Murphy Spring

Site Location: Caney Fork drainage 35.5162 -85.8889
Date: 12 March 2013
Time: 12:30-13:00
Collectors: B.R. Kuhajda, D.A. Neely, B.W. Bingham
BTMs collected: 0
BTM Abundance rating: 0
BTM Recruitment rating:
BTM Age Class Structure rating: 0
Difficulty collecting rating: 2
Gambusia collected & volume: 238 & 86 ml
Gambusia rating: 2
Pollution/Threats rating: 2
BTM Stocking rating & year last stocked: 0 & 2005
Hydrology rating: 2

PVS: -20
Spring size: Small
Number seine hauls: 12
Habitat: *Ludwigia*, watercress, mint, *Polygonum*, little filamentous algae present. Bottom mud.
Comments: Visual survey prior to sampling - No *Fundulus julisia* seen.

Photo 28. Lower Murphy Spring.

Photo 29. Lower Murphy Spring run.

This site was stocked in 2002-2005, and habitat for BTMs appears plentiful, but no specimens were found. Contributing factors include large numbers of *Gambusia* and nutrification, which is reflected in the PVS of -20 (Table 2). Brad Bingham reports that stocked BTMs left this spring system shortly after they were stocked.

Barn Ramsey Spring

Site Location: Caney Fork drainage 35.5416 -85.8585
Date: 26 February 2013
Time: 9:35-10:30
Collectors: B.R. Kuhajda, D. A. Neely, T.B. Watkins, G.T. Knothe, B. Maynard
BTMs collected: 0
BTM Abundance rating: 0
BTM Recruitment rating: 0
BTM Age Class Structure rating: 0
Difficulty collecting rating: 2
Gambusia collected & volume: 270 & 156 ml
Gambusia rating: 3
Pollution/Threats rating: 2
BTM Stocking rating & year last stocked: 1 & 2008
Hydrology rating: 2

PVS: -30
Spring size: Large
Number seine hauls: 20
Habitat: Not much aquatic vegetation along shore except at end with spring, some rooted aquatics in middle of pond. Bottom mud.
Comments: 1/3 of hauls with snags.

Photo 30. Barn Ramsey Spring and pond.

No BTMs were collected in 2013. Three and 36 BTMs were found in 2012 & 2011 respectively with no signs of recruitment. This contrasts with 106 and 207 BTMs collected in 2010 and 2009 with recruitment based on specimens < 30 mm TL. This downward trend is also seen in the PVS of -30 and -35 in 2013 and 2012 compared to 65 and 55 in 2010 and 2009 (Tables 1 & 2). There is some nutrification, but the main issue is likely the abundant *Gambusia* present.

Vervilla

Site Location: Caney Fork drainage 35.5875 -85.8575
Date: 26 February 2013
Time: 11:52-12:52
Collectors: B.R. Kuhajda, D. A. Neely, T.B. Watkins, G.T. Knothe, B. Maynard
BTMs collected: 0

BTM Abundance rating: 0
BTM Recruitment rating: 0
BTM Age Class Structure rating: 0
Difficulty collecting rating: 2
Gambusia collected & volume: 705 & 161 ml
Gambusia rating: 3
Pollution/Threats rating: 0
BTM Stocking rating & year last stocked: 0 & 2007
Hydrology rating: 1
PVS: -20
Spring size: Large
Number seine hauls: 20
Habitat: Mostly filamentous algae. Bottom mud.
Comments: Dropped some G. affinis on ground at truck, so #s may be off but volume should be ok. Numbers of Gambusia reflect preserved specimens counted in lab.

Photo 31. Vervilla Site with series of spring-fed ponds.

Photo 32. Another spring-fed pond at the Vervilla Site.

In 2009 and 2010 there 288 and 90 BTMs collected with small specimens < 30 mm TL present. High water in May 2010 caused the dam at this site to be inundated which allowed *Gambusia* into the ponds. The number of BTMs dropped to 33 in 2011 but recruitment was still ongoing. Only 2 specimens were collected in 2012 and none in 2013, with a corresponding PVS of -25 and -20 respectively (Tables 1 & 2). *Gambusia* will have to be eliminated from this site and the dam raised before BTMs can be reestablished at the site.

Benedict Spring (Type Locality)

Site Location: Caney Fork drainage 35.5497 -85.9836
Date: 28 February 2013
Time: 13:30-13:45
Collectors: B.R. Kuhajda, B.W. Bingham, T.B. Watkins, B. Maynard, P. Rakes, J.R. Shute, C. Ruble, R. Xiques, FWS intern
BTMs collected: 171
BTM Abundance rating: 9
BTM Recruitment rating: 6
BTM Age Class Structure rating: 3
Difficulty collecting rating: 4
Gambusia collected & volume: 0 & 0
Gambusia rating: 0

Pollution/Threats rating: 1
BTM Stocking rating & year last stocked: 2 & 2011
Hydrology rating: 1
PVS: 60
Spring size: Small
Number seine hauls: 3
Habitat: Lizard tail, Watercress, filamentous algae. Bottom mud.
Comments: Specimens taken by CFI as brood stock.

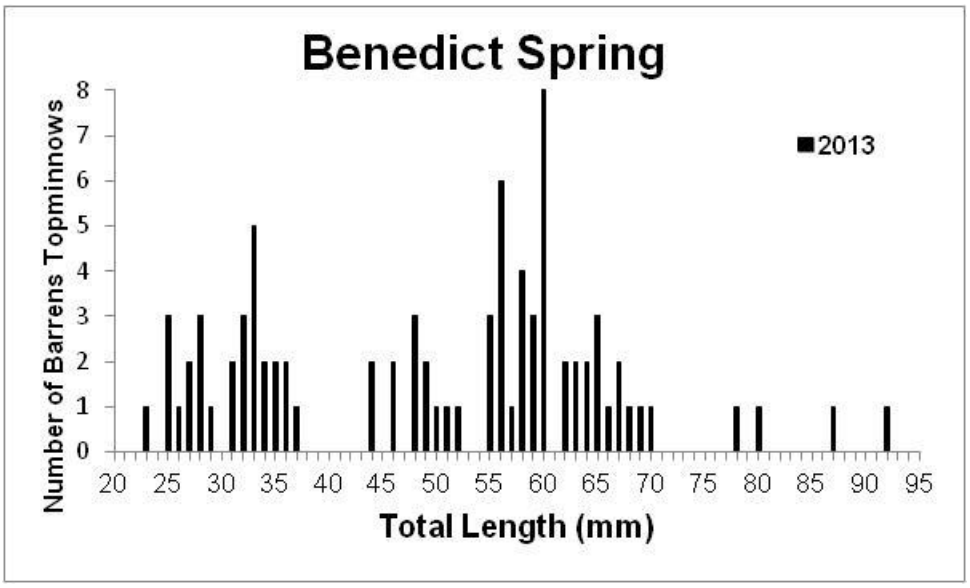

Photo 33. Benedict Spring (Type Locality).

This site had not been surveyed in the last five years because the spring went dry in 2006, 2007, 2008, and 2010. BTMs were rescued in each of these years and returned to the spring when water levels were stable. Only three seine hauls were made to collect 171 BTMs in 2013, including 11 specimens < 30 mm TL; there was no reason to make six seine hauls at this small site. The PVS was 60 (Tables 1 & 2).

Jarrell Spring

Site Location: Caney Fork drainage 35.5784 -86.0148
Date: 21 March 2013
Time: 12:40-13:06
Collectors: B.R. Kuhajda, B.W. Bingham, K.F. Alford, D.A. Neely
BTMs collected: 0
BTM Abundance rating: 0
BTM Recruitment rating: 0
BTM Age Class Structure rating: 0
Difficulty collecting rating: 2
Gambusia collected & volume: 0 & 0
Gambusia rating: 0
Pollution/Threats rating: 5
BTM Stocking rating & year last stocked: 0 & never

Hydrology rating: 2
PVS: -25
Spring size: Small
Number seine hauls: 12
Habitat: Filamentous algae, *Typha*, some Lemnaceae in spring run; filamentous algae, very little *Ludwigia* in spring pond. Bottom mud.
Comments: Landowner requested site visit to sample for and hopefully find BTMs due to a right of way issue. Spring heavily impacted by cattle, both physical and nutrients, pond was a muddy mess. Spring heads were surrounded by concrete "walls". S1-S2 top of spring. S3-S7 below spring on east side. S8 west side by fence. S9 top of spring run. S10-S11 spring run hauls. S12 spring run kick set.

Photo 34. Jarrell Spring toward spring head.

No historical records of past stocking, but land owner wanted us to sample, hoping to find BTMs to assist with right-of-way dispute. No BTMs collected. Habitat is very poor, issues with nutrification and physical degradation due to cattle having free access to spring. PVS was -20 (Tables 1 & 2).

Pocahontas (Davis) Spring

Site Location: Caney Fork drainage 35.6353704 -86.04225
Date: 8 March 2013

Time: 9:40-10:15
Collectors: D.A. Neely, B.R. Kuhajda, A.L. George
BTMs collected: 0
BTM Abundance rating: 0
BTM Recruitment rating: 0
BTM Age Class Structure rating: 0
Difficulty collecting rating: 0
Gambusia collected & volume: 1 & 1 ml
Gambusia rating: 1
Pollution/Threats rating: 1
BTM Stocking rating & year last stocked: 3 & 2012
Hydrology rating: 2
PVS: -15
Spring size: Small
Number seine hauls: 12
Habitat: Mint, *Ceratophyllum*, Watercress; *Fontinalis* by pump house. Bottom mud, cobble.
Comments: S1 lowest end of spring run. S2-S12 working up towards pump house through heavy vegetation. S10 huge leach. Caught 10 gravid female *Forbeschthys*. *Lithobates clamitans*, *Pseudotriton montanus*, *Desmognathus fuscus*, *Eurycea aquatica* in spring. *Eurycea bislineata* & photo from adjacent creek.

Photo 35. Pocahontas (Davis) Spring towards spring house and spring head.


Photo 36. Pocahontas (Davis) Spring run at junction with Pocahontas Branch.

Even though 949 BTMs have been stocked in this spring over the last five years not a single BTM has been collected in surveys in 2013, 2011, and 2010. PVS range from -10 to -20 (Tables 1 & 2). The spring and run is very shallow and may be inappropriate for BTMs to remain and/or be successful.

Upstream of Pedigo Highway Site 0.35 to 0.5 miles

Site Location: Caney Fork drainage 35.70290 -86.06606
Date: 21 March 2013
Time: 9:47-10:04
Collectors: B.R. Kuhajda, B.W. Bingham, K.F. Alford, D.A. Neely
BTMs collected: 0
BTM Abundance rating: 0
BTM Recruitment rating: 0
BTM Age Class Structure rating: 0
Difficulty collecting rating: 4
Gambusia collected & volume: 0 & 0
Gambusia rating: 0
Pollution/Threats rating: 0
BTM Stocking rating & year last stocked: 0 & never
Hydrology rating: 1

PVS: -15
Spring size: Small
Number seine hauls: 6
Habitat: Filamentous algae, sparse aquatic plant (*Juncus*) present. Bottom mud.
Comments: No fishes collected, only *Ambystoma* larvae. No apparent barrier for BTMs to move here, may be too forested when leafed. Outside temp 27 F. S1 some vegetation (hair algae) with undercut banks - set/kick (35.70401, -86.06879). S2 leaves, sticks & some filamentous algae - set/kick. S3 downstream haul - 1 *Ambystoma*. S4 leaves & undercut bank (skipped large section since S3) – *Ambystoma*. S5 bottom aquatic vegetation undercut bank, haul & kick, *Ambystoma*. S6 at fence crossing, creek widens and splits, *Ambystoma* (35.70383, -86.06444).

Photo 37. Unnamed tributary 0.35-0.5 miles upstream of Pedigo Highway site.

Photo 38. *Ambystoma* larval salamander.

New site upstream of often-sampled BTM site at TN Hwy 53, no BTMs or any other fishes found here, only *Ambystoma* larvae. May be ephemeral this far upstream and no appropriate habitat for BTMs.

Just upstream of Pedigo Highway Site 0.13 to 0.17 miles

Site Location: Caney Fork drainage 35.70380 -86.06217
Date: 21 March 2013
Time: 10:19-10:39
Collectors: B.R. Kuhajda, B.W. Bingham, K.F. Alford, D.A. Neely
BTMs collected: 16
BTM Abundance rating: 2
BTM Recruitment rating: 0
BTM Age Class Structure rating: 3
Difficulty collecting rating: 4
Gambusia collected & volume: 0 & 0
Gambusia rating: 0
Pollution/Threats rating: 1
BTM Stocking rating & year last stocked: 0 & never
Hydrology rating: 1
PVS: 5

Spring size: Small
Number seine hauls: 12
Habitat: No aquatic vegetation. Bottom mud, little gravel.
Comments: No *Ambystoma*. Lat/Long downstream-most spot with *F. julisia*. S1 set and kick, flowing water with gravel bottom (35.70380 -86.06217). S2 flow and lots of sticks/leaves, wheel ruts prominent (35.70379 -86.06148). S3-S7 same habitat as S2. S8-S9 moving upstream toward S1 site. S10-S12 upstream of S1 and a rock/log barrier.

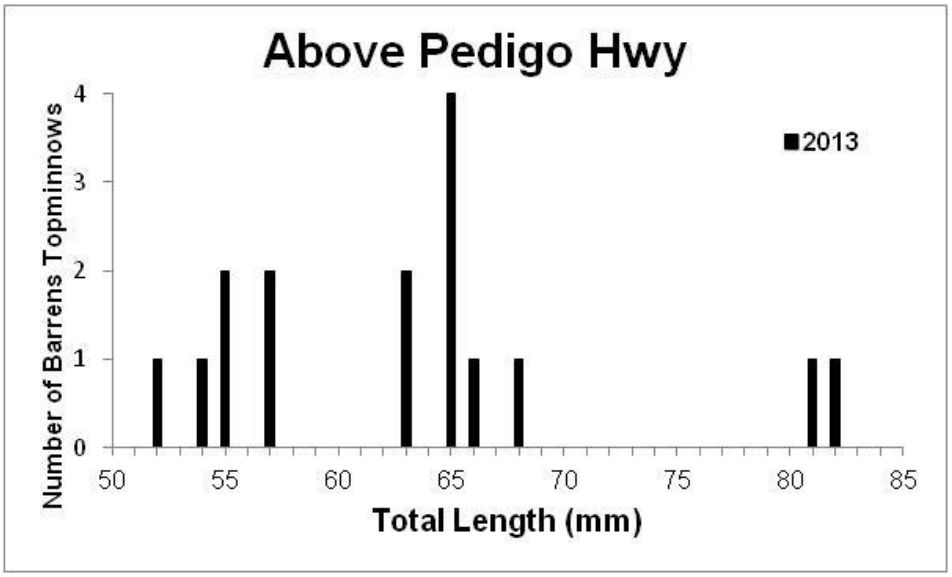

Photo 39. Unnamed tributary 0.13-0.17 miles upstream of Pedigo Highway site

This is a new site just upstream of the often-sampled BTM site at TN Hwy 53. Recent clearing of some trees with a bulldozer has created habitat for BTMs. Since no specimens <30 mm TL were found this is either a new expansion upstream or a site that harbors adults but is not useful for recruitment.

Pedigo Spring Run at TN Hwy 53

Site Location: Caney Fork 35.703 -86.0594
Date: 7 March 2013
Time: 10:20-10:50
Collectors: B.R. Kuhajda, B.W. Bingham, T.B. Watkins, M.T. Hamilton, K.G. McPheeters
BTMs collected: 101
BTM Abundance rating: 9
BTM Recruitment rating: 6
BTM Age Class Structure rating: 3
Difficulty collecting rating: 4
Gambusia collected & volume: 0 & 0
Gambusia rating: 0
Pollution/Threats rating: 2
BTM Stocking rating & year last stocked: 0 & never
Hydrology rating: 1
PVS: 65
Spring size: Small
Number seine hauls: 6
Habitat: Overhanging terrestrial grasses present. Bottom mud.
Comments: Only 97 BTM measurements recorded out of 101 captured. S1-S2 run upstream of road. S3 side channel. S4-S5 below road & above footbridge. S6 pool below fence.

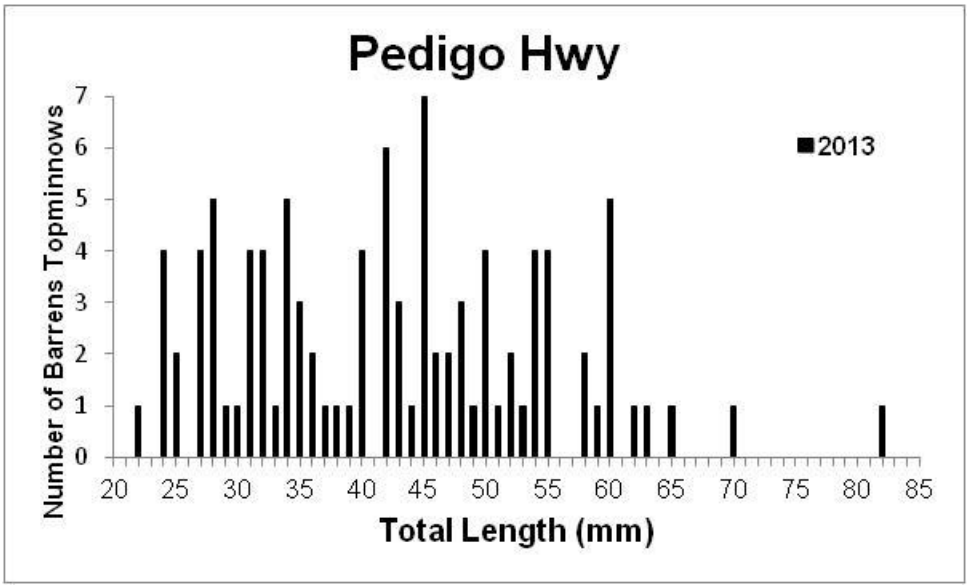

Photo 40. Unnamed tributary (Pedigo Hwy site) A) upstream & B) downstream of TN Hwy 53.

This site has had a PVS of 55-65 over the last four years and the best PVS score for a native population in our 2013 sampling, even though there is some erosion from cattle and bank instability in the pasture downstream of the highway. Recruitment is occurring every year and no *Gambusia* are present, but there is a concern that *Gambusia* could move upstream the 1 rkm from Lewis Creek at the Pedigo Farm site (Tables 1 & 2).

Pedigo Farm site at junction Lewis Creek and unnamed tributary

Site Location: Caney Fork drainage 35.7027 -86.0488
Date: 7 March 2013
Time: 10:30-11:40
Collectors: B.R. Kuhajda, D.A. Neely, P.L. Rakes, D.J. Alexander, J.B. Stenger, S. Sorenson, J. Hendricks
BTMs collected: 96
BTM Abundance rating: 6
BTM Recruitment rating: 6
BTM Age Class Structure rating: 3
Difficulty collecting rating: 4
Gambusia collected & volume: 303 & 104 ml
Gambusia rating: 3
Pollution/Threats rating: 5
BTM Stocking rating & year last stocked: 0 & never
Hydrology rating: 2
PVS: 25
Spring size: Large
Number seine hauls: 10
Habitat: Some watercress present. Bottom mud, gravel.
Comments:

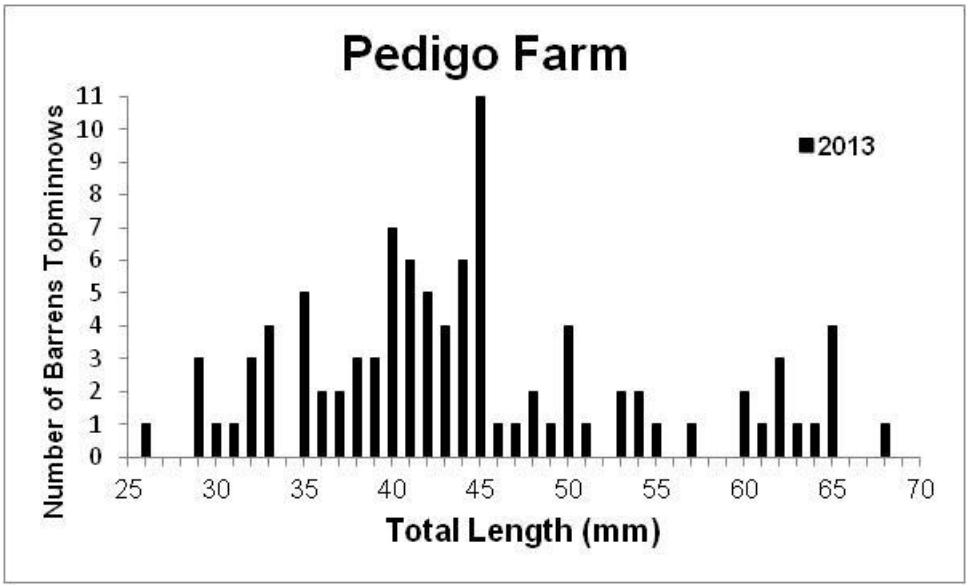

Photo 41. Lewis Creek at Pedigo Farm site.

Despite the presence of 303 *Gambusia*, the paucity of aquatic vegetation or overhanging shoreline vegetation, and the abuse of the stream by cattle, 96 BTMs were collected at this site, including 4 individuals < 30 mm TL. In the last 4 years 57-200 BTMs have been collected in surveys, small individuals were collected in 3 of 4 years, and PVS have all been positive (Tables 1 & 2). Are BTMs actually recruiting in the presence of *Gambusia* at this site or is this a sink population fed by BTM populations *Gambusia*-free upstream of this site?

McMahan Creek at Woodland Estates subdivision

Site Location: Caney Fork drainage 35.71496 -86.05357
Date: 14 March 2013
Time: 14:36-14:58
Collectors: B.R. Kuhajda, K.F. Alford, D.A. Neely, B.W. Bingham, G.J. Knothe, V. Caldwell, S. Silvey
BTMs collected: 25
BTM Abundance rating: 4
BTM Recruitment rating: 6
BTM Age Class Structure rating: 3
Difficulty collecting rating: 2
Gambusia collected & volume: 0 & 0
Gambusia rating: 0

Pollution/Threats rating: 1
BTM Stocking rating & year last stocked: 0 & never
Hydrology rating: 2
PVS: 60
Spring size: Small
Number seine hauls: 12
Habitat: Overhanging terrestrial vegetation, senescent aquatic vegetation, a little watercress present. Bottom bedrock, cobble, silt.
Comments: New "wild" site! Seined from large pool upstream of culvert to just above small spring run. *Fundulus julisia* along banks under overhanging terrestrial vegetation (mostly briers) along the length of the bank. EtOH - fin clips from all 25 *F. julisia* and 30 *H. flammea*.

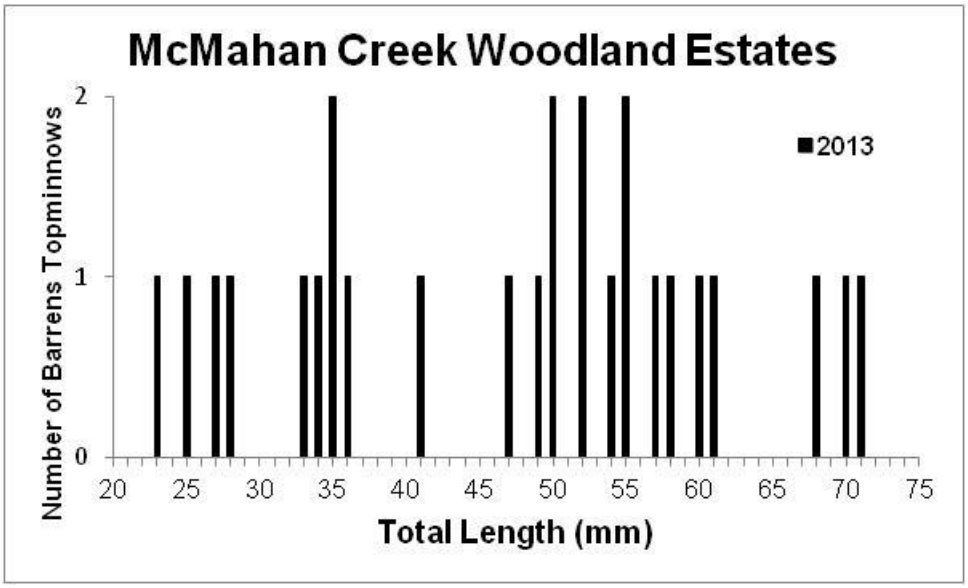

Photo 42. McMahan Creek at Woodland Estates subdivision.

This site has not been previously "officially" surveyed for BTMs. With 25 BTMs, 4 individuals < 30 mm TL, no *Gambusia*, and relatively undisturbed habitat, this site has a PVS of 60 (Tables 1 & 2).

Cooper Branch

Site Location: Caney Fork drainage 35.674 -86.0335
Date: 7 March 2013
Time: 8:55-9:30
Collectors: B.R. Kuhajda, D.A. Neely, B.W. Bingham, T.B. Watkins, S. Sorenson
BTMs collected: 8
BTM Abundance rating: 2
BTM Recruitment rating: 0
BTM Age Class Structure rating: 2
Difficulty collecting rating: 2
Gambusia collected & volume: 0 & 0
Gambusia rating: 0
Pollution/Threats rating: 2
BTM Stocking rating & year last stocked: 3 & 2012
Hydrology rating: 0
PVS: -15
Spring size: Small
Number seine hauls: 14
Habitat: *Fontinalis* present. Bottom bedrock, cobble.
Comments: 20x4 ft seine + 10x4 ft seine. Bottom of stream very uneven bedrock. . S1 pool haul. S2-S4 back kicks. S5-S10 big pool below bedrock waterfall. S11-S12 pool at spring. S13-S14 below road.

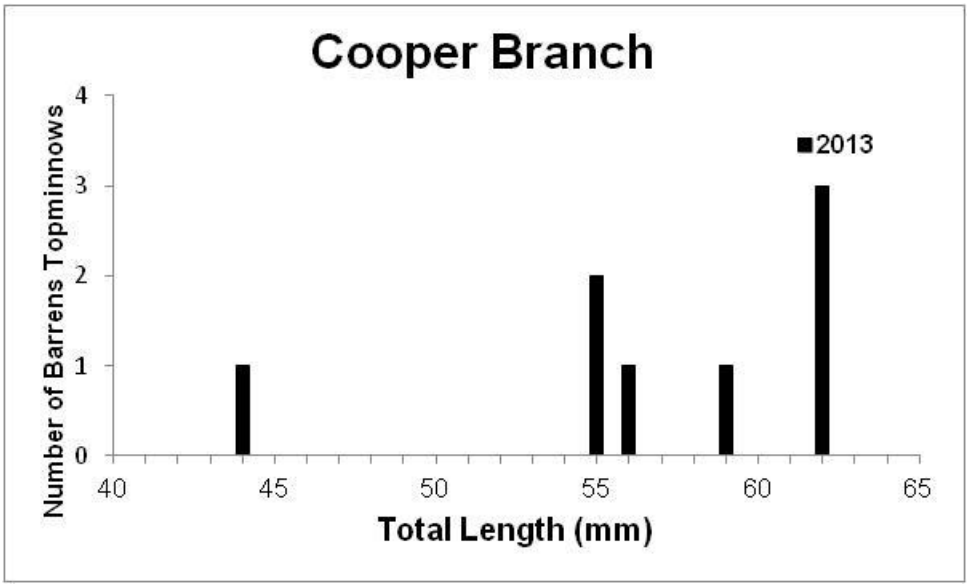

Photo 43. Cooper Branch A) upstream and B) downstream of Duke Road.

The BTM population at this site fluctuate widely from year to year, with only 8, 12, and no BTMs collected in 2013, 2011, and 2010 with no indication of recruitment. This contrasts with 41 and 52 BTMs, including individuals < 30 mm TL, in 2012 and 2009. Corresponding PVS are -15, -5, and -30 versus 40 and 45 (Tables 1 & 2). BTMs were stocked every year before surveys in 2013 back to 2009.

Unnamed spring just west of Lewis Road

Site Location: Caney Fork drainage 35.69005 -86.01314
Date: 8 March 2013
Time: 11:48-12:24
Collectors: B.R. Kuhajda, D.A. Neely, A.L. George
BTMs collected: 0
BTM Abundance rating: 0
BTM Recruitment rating: 0
BTM Age Class Structure rating: 0
Difficulty collecting rating: 2
Gambusia collected & volume: 420 & 112 ml
Gambusia rating: 3
Pollution/Threats rating: 2
BTM Stocking rating & year last stocked: 0 & never
Hydrology rating: 1
PVS: -30
Spring size: Small
Number seine hauls: 12
Habitat: Overhanging terrestrial vegetation present. Bottom mud.
Comments: Spring and spring run on west side of road.


Photo 44. Unnamed spring west of Lewis Road.

This is a site that may have been sampled in the past but has not been surveyed recently. Appropriate habitat for BTMs but none found, *Gambusia* were abundant, and the site had a PVS of -30 (Tables 1 & 2).

Unnamed tributary to McMahan Creek at Parker Road

Site Location: Caney Fork drainage 35.6915 -86.0109
Date: 8 March 2013
Time: 13:10-13:40
Collectors: B.R. Kuhajda, D.A. Neely, A.L. George
BTMs collected: 0
BTM Abundance rating: 0
BTM Recruitment rating: 0
BTM Age Class Structure rating: 0
Difficulty collecting rating: 2
Gambusia collected & volume: 0 & 0
Gambusia rating: 0
Pollution/Threats rating: 2
BTM Stocking rating & year last stocked: 0 & never
Hydrology rating: 1
PVS: -15

Spring size: Small
Number seine hauls: 12
Habitat: *Fontinalis* below road; *Ludwigia,* filamentous algae above road. Bottom cobble, bedrock, mud.
Comments: S10-12 above clogged culvert/road.

Photo 45. Unnamed tributary to McMahan Creek downstream of Parker Road.

Photo 46. Unnamed tributary to McMahan Creek upstream of Parker Road.

This is a site that may have been sampled in the past but has not been surveyed recently. Some habitat available for BTMs exists but none found, even though no *Gambusia* were present. This site had a PVS of -15 (Tables 1 & 2).

Lance Sprng

Site Location: Caney Fork drainage 35.6767 -85.9762
Date: 7 March 2013
Time: 12:50-14:00
Collectors: B.R. Kuhajda, D.A. Neely, B.W. Bingham, T.B. Watkins, M.T. Hamilton, P.L. Rakes, J. Hendricks, J.B. Stenger, D.J. Alexander, K.G Mcpheeters, S. Sorenson
BTMs collected: 9
BTM Abundance rating: 2
BTM Recruitment rating: 3
BTM Age Class Structure rating: 3
Difficulty collecting rating: 0
Gambusia collected & volume: 162 & 58 ml
Gambusia rating: 2
Pollution/Threats rating: 2
BTM Stocking rating & year last stocked: 1 & 2009?
Hydrology rating: 2

PVS: -25
Spring size: Large
Number seine hauls: 20
Habitat: *Ludwigia*, watercress, mint, other aquatic vegetation present. Bottom mud.
Comments: S1: below pump house at square pool. S21: scour hole isolated by the road, 3 *Lepomis cyanellus* collected. 2 teams: S1-10 Team A & S11-20 Team B. 148 preserved Gambusia counted and included in volume.

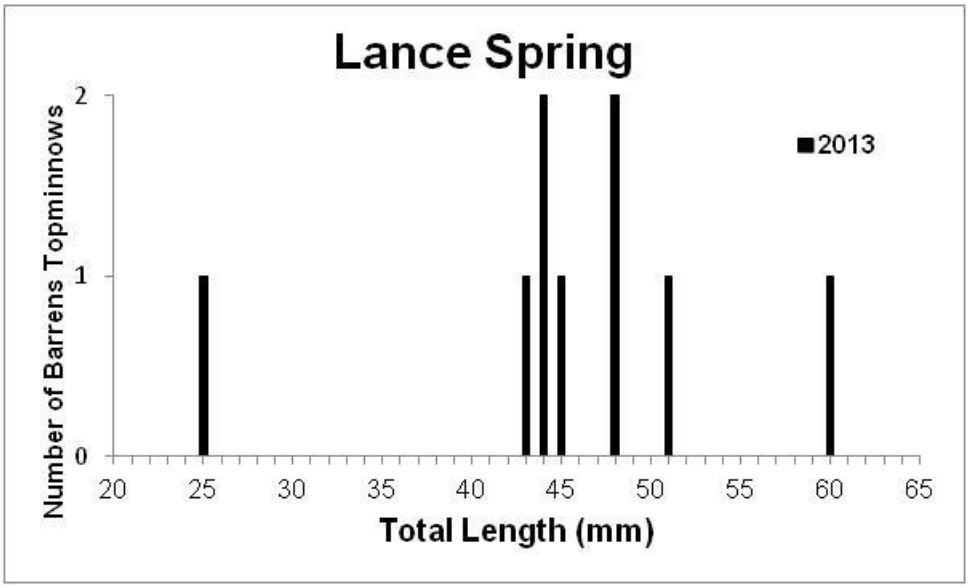

Photo 47. Pump house on Lance Spring.

Photo 48. Lance Spring A) main pool and B) side pool with BTMs.

Although only 9 BTMs were collected, one was < 30 mm TL, suggesting that recruitment is ongoing. Small specimens were collected in three of four previous surveys, including the 2009 survey when only six BTMs were collected. PVS range from 40 to -10 over the last 5 years (Tables 1 & 2). These highly variable PVS may be more indicative of the difficulty in collecting due to the dense aquatic vegetation and large area of Lance Spring rather than a fluctuating BTM population, but the presence of *Gambusia* is a reason for concern.

Charles Creek at TN Hwy 287

Site Location: Caney Fork drainage 35.7716 -85.9103
Date: 21 March 2013
Time: 14:14-14:28
Collectors: B.R. Kuhajda, D.A. Neely, K.F. Alford
BTMs collected: 0
BTM Abundance rating: 0
BTM Recruitment rating: 0
BTM Age Class Structure rating: 0
Difficulty collecting rating: 4
Gambusia collected & volume: 0
Gambusia rating: 0
Pollution/Threats rating: 1
BTM Stocking rating & year last stocked: 0 & never?
Hydrology rating: 2
PVS: -15
Spring size: Small
Number seine hauls: 12
Habitat: Sparse *Fontinalis* and very little filamentous algae on stream edge. Bottom bedrock, gravel. Stream incised, no shallows or undercut banks.
Comments: Historical site but no BTM habitat present. Only sampled on east side of the bridge; on west side observed many *Campostoma* and *Hemitremia*, no BTMs. S6 pool. S7 stick & leaf cover. S8 riffle & pool. S9 pool over to shoreline debris overhang. S10 leaf litter. S11 pool haul.


Photo 49. Charles Creek downstream of TN Hwy 287.

A historical site; no BTMs were collected in 2013. The stream is incised which has eliminated backwater habitat for BTMs, and this site has a PVS of -15. This site has not been sampled in the previous four surveys (Tables 1 & 2).

Blue (Herndon Spring) run and small spring in side channel

Site Location: Caney Fork drainage 35.871066 -85.846877
Date: 14 March 2013
Time: 11:39-12:45
Collectors: B.R. Kuhajda, J.D. Steventon, G.J. Knoethe, E.T. Robinson, K.F Alford, D.A.Neely, M.T. Hamilton, R.L. Richardson, V. Caldwell, S. Silvey
BTMs collected: 1
BTM Abundance rating: 0
BTM Recruitment rating: 0
BTM Age Class Structure rating: 1
Difficulty collecting rating: 0
Gambusia collected & volume: 171 & 56 ml
Gambusia rating: 2
Pollution/Threats rating: 2
BTM Stocking rating & year last stocked: 3 & 2012
Hydrology rating: 2

PVS: -20
Spring size: Large
Number seine hauls: 20
Habitat: Unknown stringy emergent aquatic vegetation, *Fontinalis*, *Sparganium* present. Bottom mud, silt, gravel.
Comments: Did not collect Blue Spring proper, too deep; collected in "run". Team A 12 seine hauls: S1-10, S19, S20. Team B 8 seine hauls: S11-18. BTM collected in deeper water below small springhead. 1 BTM, 30 *H. flammea* fin clips in EtOH. 150 preserved *Gambusia* in volume measurement from S11-18. S11 backwater, floating veg. S12 main stream, floating veg. S13, 14, 16 side channel near a spring head. S15 at spring head. S17 *Sparganium* - 2nd seine haul through habitat (S10 first haul). S18 lots of vegetation including *Fontinalis*.

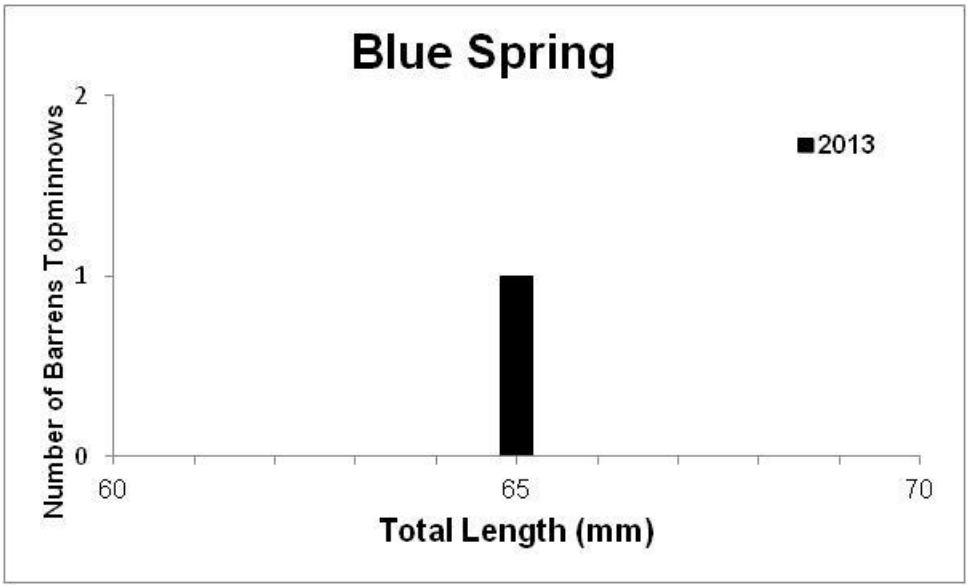

Photo 50. Blue (Herndon) Spring A) spring run and B) small spring in side channel.

Only a single BTM was collected in 2013 despite 605 BTMs stocked in 2012 and 2226 BTMs stocked over the last 5 years. The number of BTMs captured in the last five years is ≤ 21, small BTMs have only been collected in two surveys (2011 & 2009), and PVS range from -20 to 20 (Tables 1 & 2). The difficulty in sampling with large amounts of aquatic vegetation present could possibly contribute to these low BTM numbers, but the presence of *Gambusia* is likely a contributor to the low PVS.

Greenbrook Pond

Site Location: Caney Fork drainage 35.949510 -85.818216
Date: 14 March 2013
Time: 8:45-9:20
Collectors: B.R. Kuhajda, G.J. Knoethe, K.F. Alford, J.D. Steventon, E.T. Robinson, M.T. Hamilton, R.L. Richardson, B.W. Bingham, D.A. Neely, S. Silvey, V. Caldwell
BTMs collected: 174
BTM Abundance rating: 9
BTM Recruitment rating: 6
BTM Age Class Structure rating: 3
Difficulty collecting rating: 4
Gambusia collected & volume: 0 & 0
Gambusia rating: 0
Pollution/Threats rating: 2
BTM Stocking rating & year last stocked: 1 & 2009
Hydrology rating: 2
PVS: 65
Spring size: Large
Number seine hauls: 21
Habitat: Run with no aquatic vegetation. Bottom mud, silt.
Comments: Two collecting teams, S1-S15 in spring run, S16-S21 in pond. In run alternated sides, running 2 seines at a time but numbering them each separately; last seine haul above bridge at base of first tree (west bank). Fin clips from 10 pond and 10 run specimens.

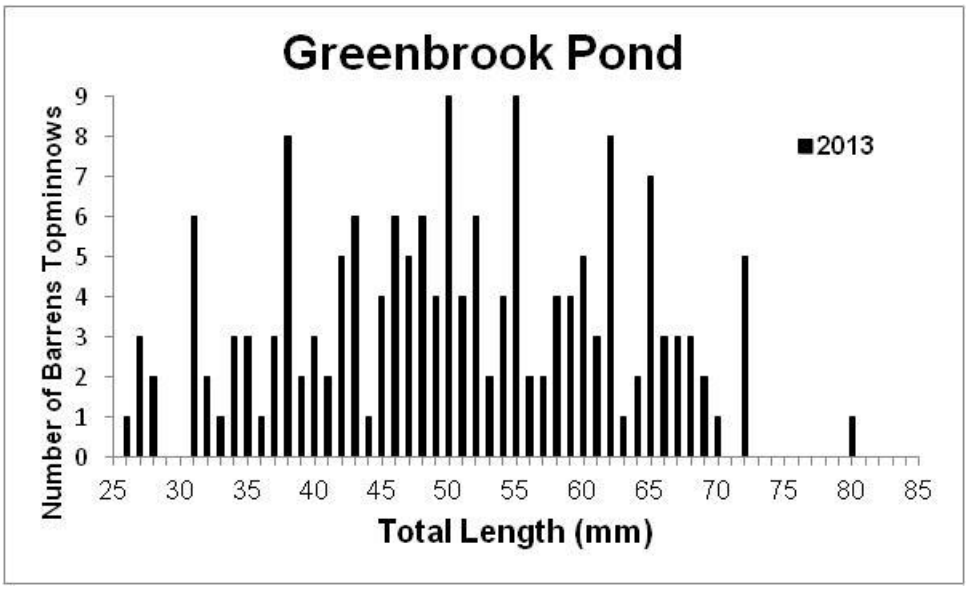

Photo 51. Greenbrook Pond.

Photo 52. Spring run flowing out of Greenbrook Pond.

This site had the highest number of BTMs collected our 2013 survey (174) and the highest or near-highest numbers over the last five years, with specimens < 30 mm TL in all five years. PVS scores range from 45-65 (Tables 1 & 2). This is by far the most successful reintroduction site in the BTM program.

Discussion

Even though the 2013 survey represents the greatest number of sites surveyed for BTMs (n = 35, 15 more sites than any previous survey), the number of sites with BTMs or the total number of BTMs collected did not increase. The increase in sites surveyed did give an increase in sites with *Gambusia* present, from 10 sites in 2011 and 2012 to 15 sites in 2013. In 2013 the number sites documented with natural recruitment of BTMs (n = 8) was the same as the 2012 survey but lower than previous survey years (2011, n = 10; 2010, n = 12; 2009, n = 11) (Table 3). Only one native site and one stocked site with recruitment had *Gambusia* present, indicating that BTMs have difficulty reproducing and recruiting when this competitor is present.

Three stocked sites (Collier Spring, Short Spring, and Vervilla) had stocking discontinued in 2008 to assess BTM success without additional input of specimens. PVS have been stable in Collier Spring since 2009. PVS in Short Spring were stable from 2009-2012 for (45 to 60) but decreased in 2013 to 20, but this may have been due to the lack of sampling artifact since most of the seining was done in deeper sections of the pond.. At the Vervilla site viability scores have dropped since Western Mosquitofish invaded the site during high water in

May of 2010, and in 2013 no BTMs were found. This clearly illustrates the impact that Western Mosquitofish have on BTM populations.

Table 3. Number of sites sampled for Barrens Topminnows (BTMs) and sites with BTMs present, number of BTMs collected and number stocked in the year previous to a survey, number of sites with Western Mosquitofish *Gambusia affinis* present, and number with recruitment of BTMs over last eight years of BTM surveys.

Survey year	Number of sites sampled	Number of sites with BTMs	Number of BTMs collected	Number of BTMs stocked the previous year at sites	Number of sites with Mosquitofish *Gambusia affinis*	Number of sites with BTM recruitment
2013	35	17	804	2655	15	8
2012	20	16	759	2807	10	8
2011	19	16	844	1367	10	10
2010	20	17	1383	2865	8	12
2009	17	14	1259	2401	7	11
2008	19	13	1025	1957	7	6
2007	15	?	714	3944	7	7
2006	10	?	211	4589	3	4

Acknowledgements

Brad W. Bingham and T. Bryan Watkins helped us find all of the sites surveyed in 2013. Field assistance was provided by Brad W. Bingham, T. Bryan Watkins, Matt T. Hamilton, Kathlina F. Alford, Anna L. George, Kyle G. McPheeters, J. Ben Stenger, Rachel L. Richardson, Elaine T. Robinson, Jacob D. Steventon, Sarah Farnsley, Hope Klug, Greg Knothe, Brandon Maynard, J. Bowyer, P. L. Rakes, J.R. Shute, Crystal Ruble, Rebeccca Xiques, Danny J. Alexander, Sarah Sorenson, J. Hendricks, V. Caldwell, and S. Silvey. Maps were created by Sarah C. Hazzard.

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Appendix 1

Population Viability Score variables, ratings, and associated parameters to determine Population Viability Scores for BTM sites

Appendix 1. Population viability score variables, ratings, and associated parameters.

Variable	Rating	Parameters
Abundance (A)	0	0-4 BTMs
	2	5-20 BTMs
	4	21-40 BTMs
	6	41-100 BTMs
	9	>100 BTMs
Recruitment (R)	0	0 < 40 mm TL
	3	1-2 BTMs < 30 mm TL or 3 BTMs 30-39 mm TL
	6	At least 3 BTMs < 30 mm TL
Age Class Structure (C)	0	None
	1	One age class
	2	Two age classes
	3	Three or more age classes
Hydrology (H)	0	Site nearly dry, little surface flow, well below base flow AND/OR major physical barrier to upstream/downstream BTM movement
	1	Site partially dry, somewhat below base flow AND/OR minor physical barrier to upstream/downstream BTM movement
	2	Site well-watered, at or above base flow AND no obvious physical barrier to upstream/downstream BTM movement
Difficulty (D)	0	Difficult sampling, inefficient seining due to vegetation, depth, substrate, or turbidity
	2	Moderate sampling difficulty
	4	Easy sampling with few impediments to seining
Invasive Mosquitofish (I)	0	Mosquitofish not present
	1	Mosquitofish volume < 50 ml
	2	Mosquitofish volume 50-100 ml
	3	Mosquitofish volume 101-200 ml
	4	Mosquitofish volume 201-1000 ml
	5	Mosquitofish volume > 1000 ml
Pollution/Threats (P)	0	Site in good condition and adjacent land use practices present no immediate threats
	1	Site with adjacent land use practices presenting minor threats from chemical, fertilizer, soil erosion, human or agricultural wastes, residential or commercial development, road building, water withdrawal, etc.
	2	Site with adjacent land use practices presenting moderate threats from those listed above
	5	Site with adjacent land use practices presenting severe threats from those listed above
Stocking (S)	0	Site has not been stocked with BTMs in > 5 years
	1	Site has not been stocked with BTMs in 3-5 years
	2	Site has not been stocked with BTMs in 1-2 years
	3	Site has not been stocked with BTMs in < 1 years

Appendix 2

Site name, location, date, collectors, counts of fish species collected per seining effort, and sizes of BTMs for each site for 2013 Barrens Topminnow (BTM) surveys

Site Name:	Marcum Spring - Duck River drainage 35.4088889 -86.205833																		
Date:	27 February 2013																		
Time:	9:40-11:45																		
Collectors:	B.R. Kuhajda, M.T. Hamilton, R.L. Richardson, S.B. Bain																		
	Number per seine haul																		**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**	**S16**	**S17**	**Total no.**	**hauls present**
Fundulus julisia		1	1	4						1	4	11	6	38	8	4	4	82	11
Lampetra aepyptera																		0	0
Campostoma oligolepis																		0	0
Chrosomus erythrogaster																		0	0
Clinostomus funduloides																		0	0
Hemitremia flammea																		0	0
Luxilus chrysocephalus																		0	0
Lythrurus fasciolaris																		0	0
Notropis telescopus																		0	0
Pimephales notatus																		0	0
Pimephales promelas				4		13	16	37							2		3	75	6
Rhinichthys obtusus																		0	0
Semotilus atromaculatus																		0	0
Catostomus commersonii																		0	0
Erimyzon oblongus																		0	0
Ameriurus natalis																		0	0
Forbesichthys agassizii																		0	0
Fundulus catenatus																		0	0
Gambusia affinis																		0	0
Cottus carolinae																		0	0
Cottus sp. cf. *bairdi*																		0	0
Lepomis auritus																		0	0
Lepomis cyanellus																		0	0
Lepomis macrochirus																		0	0
Lepomis megalotis																		0	0
Micropterus salmoides		1	1															2	2
Etheostoma basilare																		0	0
Etheostoma crossopterum																		0	0
Etheostoma duryi																		0	0
Etheostoma forbesi																		0	0
Etheostoma luteovinctum																		0	0
Etheostoma sp. *spectabile*																		0	0
Number of specimens	0	2	2	8	0	13	16	37	0	1	4	11	6	38	10	4	7	159	Total
Number of species	0	2	2	2	0	1	1	1	0	1	1	1	1	1	2	1	2	3	Total
Fundulus julisia (mm TL)	90 F	60	40	32	37	52 M	47	62	51	49	70	57	70	65	64	62	53	60	
	46	45	58	70	46	63	75	51	61	52	52	76	70	68	73	76	52	40	
	74	59	54	66	62	70	51	74	68	71	55	58	73	69	70	71	69	71	
	75	60	57	68	68	70	51	67	63	57	68	43	50	64	54	45	42	54	
	52	52	50	50	25	45	25	39	32	22									

Site Name:	Collier Spring - Duck River drainage 35.4039 -86.2136													
Date:	6 March 2013													
Time:	9:40-10:10													
Collectors:	D.A. Neely, G.J. Knothe, B.W. Bingham, T.B. Watkins, S. Alexander													
	Number per seine haul													**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Total no.**	**hauls present**
Fundulus julisia	15	6	4		8	1		1					35	6
Lampetra aepyptera													0	0
Campostoma oligolepis													0	0
Chrosomus erythrogaster													0	0
Clinostomus funduloides													0	0
Hemitremia flammea													0	0
Luxilus chrysocephalus													0	0
Lythrurus fasciolaris													0	0
Notropis telescopus													0	0
Pimephales notatus													0	0
Pimephales promelas													0	0
Rhinichthys obtusus													0	0
Semotilus atromaculatus													0	0
Catostomus commersonii													0	0
Erimyzon oblongus													0	0
Ameriurus natalis													0	0
Forbesichthys agassizii													0	0
Fundulus catenatus													0	0
Gambusia affinis													0	0
Cottus carolinae													0	0
Cottus sp. cf. *bairdi*													0	0
Lepomis auritus													0	0
Lepomis cyanellus													0	0
Lepomis macrochirus													0	0
Lepomis megalotis													0	0
Micropterus salmoides													0	0
Etheostoma basilare													0	0
Etheostoma crossopterum													0	0
Etheostoma duryi													0	0
Etheostoma forbesi													0	0
Etheostoma luteovinctum													0	0
Etheostoma sp. *spectabile*													0	0
Number of specimens	15	6	4	0	8	1	0	1	0	0	0	0	35	Total
Number of species	1	1	1	0	1	1	0	1	0	0	0	0	1	Total
Fundulus julisia (mm TL)	36	94	32	47	75	76	67	54	81	33	30	26		
	64	84	67	70	77	71	71	73	64	70	55	69		
	54	71	65	50	63	65	53	54	35	68	28			

Site Name:	Shamblee Site - Duck River drainage 35.40311 -86.21155													
Date:	27 February 2013													
Time:	12:40-13:10													
Collectors:	B.R. Kuhajda, M.T. Hamilton, R.L. Richardson, S.B. Bain													
	Number per seine haul													**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Total no.**	**hauls present**
Fundulus julisia													0	0
Lampetra aepyptera													0	0
Campostoma oligolepis													0	0
Chrosomus erythrogaster													0	0
Clinostomus funduloides													0	0
Hemitremia flammea													0	0
Luxilus chrysocephalus													0	0
Lythrurus fasciolaris													0	0
Notropis telescopus													0	0
Pimephales notatus													0	0
Pimephales promelas													0	0
Rhinichthys obtusus													0	0
Semotilus atromaculatus													0	0
Catostomus commersonii													0	0
Erimyzon oblongus													0	0
Ameriurus natalis													0	0
Forbesichthys agassizii													0	0
Fundulus catenatus													0	0
Gambusia affinis													0	0
Cottus carolinae													0	0
Cottus sp. cf. *bairdi*													0	0
Lepomis auritus													0	0
Lepomis cyanellus		1		1			1						3	3
Lepomis macrochirus	3	104	8	3		6	1	2	1		2	6	136	10
Lepomis megalotis													0	0
Micropterus salmoides							1	1					2	2
Etheostoma basilare													0	0
Etheostoma crossopterum													0	0
Etheostoma duryi													0	0
Etheostoma forbesi													0	0
Etheostoma luteovinctum													0	0
Etheostoma sp. *spectabile*													0	0
Number of specimens	3	105	8	4	0	6	3	3	1	0	2	6	141	Total
Number of species	1	2	1	2	0	1	3	2	1	0	1	1	3	Total

Site Name:	Short Spring - Duck River drainage 35.4045 -86.1781
Date:	6 March 2013
Time:	10:45-11:30
Collectors:	D.A. Neely, G.J. Knothe, B.W. Bingham, T.B. Watkins, S. Alexander

	Number per seine haul																						No. seine
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**	**S16**	**S17**	**S18**	**S19**	**S20**	**S21**	**S22**	**Total no.**	**hauls present**
Fundulus julisia																					2	2	4	2
Lampetra aepyptera																							0	0
Campostoma oligolepis																							0	0
Chrosomus erythrogaster																							0	0
Clinostomus funduloides																							0	0
Hemitremia flammea																							0	0
Luxilus chrysocephalus																							0	0
Lythrurus fasciolaris																							0	0
Notropis telescopus																							0	0
Pimephales notatus																							0	0
Pimephales promelas																							0	0
Rhinichthys obtusus																							0	0
Semotilus atromaculatus																							0	0
Catostomus commersonii																							0	0
Erimyzon oblongus																							0	0
Ameriurus natalis																							0	0
Forbesichthys agassizii																							0	0
Fundulus catenatus																							0	0
Gambusia affinis																							0	0
Cottus carolinae																							0	0
Cottus sp. cf. *bairdi*																							0	0
Lepomis auritus																							0	0
Lepomis cyanellus																							0	0
Lepomis macrochirus																							0	0
Lepomis megalotis																							0	0
Micropterus salmoides																							0	0
Etheostoma basilare																							0	0
Etheostoma crossopterum																							0	0
Etheostoma duryi																							0	0
Etheostoma forbesi																							0	0
Etheostoma luteovinctum																							0	0
Etheostoma sp. *spectabile*																							0	0
Number of specimens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	4	Total
Number of species	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	Total

Fundulus julisia (mm TL)	35	48	52	57

Site Name:	Pond Spring - Elk River drainage 35.4197 -85.9749																					
Date:	28 February 2013																					
Time:	11:15-12:20																					
Collectors:	B.R. Kuhajda, B.W. Bingham, T.B. Watkins, M.T. Hamilton, J. Bowyer, B. Maynard, P. Rakes, J.R. Shute, C. Ruble, R. Xiques																					
	Number per seine haul																					**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**	**S16**	**S17**	**S18**	**S19**	**S20**	**Total no.**	**hauls present**
Fundulus julisia																					0	0
Lampetra aepyptera																					0	0
Campostoma oligolepis																					0	0
Chrosomus erythrogaster																					0	0
Clinostomus funduloides																					0	0
Hemitremia flammea		1										1		2		1			1		6	5
Luxilus chrysocephalus																					0	0
Lythrurus fasciolaris																					0	0
Notropis telescopus																					0	0
Pimephales notatus																					0	0
Pimephales promelas																					0	0
Rhinichthys obtusus																					0	0
Semotilus atromaculatus																					0	0
Catostomus commersonii																					0	0
Erimyzon oblongus																					0	0
Ameriurus natalis																					0	0
Forbesichthys agassizii																					0	0
Fundulus catenatus																					0	0
Gambusia affinis	400	142		3	1		10		9	32		58	12		35	77	12	16	34	17	858	15
Cottus carolinae																					0	0
Cottus sp. cf. *bairdi*																					0	0
Lepomis auritus																					0	0
Lepomis cyanellus									2												2	1
Lepomis macrochirus																					0	0
Lepomis megalotis																					0	0
Micropterus salmoides																					0	0
Etheostoma basilare																					0	0
Etheostoma crossopterum			3						1												4	2
Etheostoma duryi																					0	0
Etheostoma forbesi																					0	0
Etheostoma luteovinctum																					0	0
Etheostoma sp. *spectabile*																					0	0
Number of specimens	400	143	3	3	1	0	10	0	12	32	0	59	12	2	35	78	12	16	35	17	870	Total
Number of species	1	2	1	1	1	0	1	0	3	1	0	2	1	1	1	2	1	1	2	1	4	Total

Site Name:	Pond Spring - Elk River drainage 35.4197 -85.9749													
Date:	16 May 2013													
Time:	11:05-12:00													
Collectors:	B.R. Kuhajda, B.W. Bingham, T.B. Watkins, M.T. Hamilton, S. Farnsley, H. Klug, et al.													
	Number per seine haul													**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Total no.**	**hauls present**
Fundulus julisia													0	0
Lampetra aepyptera													0	0
Campostoma oligolepis													0	0
Chrosomus erythrogaster													0	0
Clinostomus funduloides													0	0
Hemitremia flammea													0	0
Luxilus chrysocephalus													0	0
Lythrurus fasciolaris													0	0
Notropis telescopus													0	0
Pimephales notatus													0	0
Pimephales promelas													0	0
Rhinichthys obtusus													0	0
Semotilus atromaculatus													0	0
Catostomus commersonii													0	0
Erimyzon oblongus													0	0
Ameriurus natalis													0	0
Forbesichthys agassizii													0	0
Fundulus catenatus													0	0
Gambusia affinis	385	63	5	1	81	84	59	6	84	48	22	1	839	12
Cottus carolinae													0	0
Cottus sp. cf. *bairdi*													0	0
Ambloplites rupestris													0	0
Lepomis auritus													0	0
Lepomis cyanellus				2			1						3	2
Lepomis macrochirus	1	1	2	1	1	3	2						11	7
Lepomis megalotis													0	0
Micropterus salmoides				1									1	1
Etheostoma basilare													0	0
Etheostoma crossopterum													0	0
Etheostoma duryi													0	0
Etheostoma forbesi													0	0
Etheostoma luteovinctum													0	0
Etheostoma sp. *spectabile*													0	0
Number of specimens	386	64	7	5	82	87	62	6	84	48	22	1	854	Total
Number of species	2	2	2	4	2	2	3	1	1	1	1	1	4	Total

Site Name:	Merkle (Big) Spring - Elk River drainage 35.18322 -85.98313													
Date:	25 February 2013													
Time:	9:15-9:30													
Collectors:	B.R. Kuhajda, D.A. Neely, T.B. Watkins, G.J. Knothe													
	Number per seine haul													**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Total no.**	**hauls present**
Fundulus julisia						1	2						3	2
Lampetra aepyptera													0	0
Campostoma oligolepis													0	0
Chrosomus erythrogaster													0	0
Clinostomus funduloides													0	0
Hemitremia flammea													0	0
Luxilus chrysocephalus													0	0
Lythrurus fasciolaris													0	0
Notropis telescopus													0	0
Pimephales notatus													0	0
Pimephales promelas													0	0
Rhinichthys obtusus													0	0
Semotilus atromaculatus													0	0
Catostomus commersonii													0	0
Erimyzon oblongus													0	0
Ameriurus natalis													0	0
Forbesichthys agassizii													0	0
Fundulus catenatus													0	0
Gambusia affinis													0	0
Cottus carolinae													0	0
Cottus sp. cf. *bairdi*													0	0
Lepomis auritus													0	0
Lepomis cyanellus													0	0
Lepomis macrochirus													0	0
Lepomis megalotis													0	0
Micropterus salmoides													0	0
Etheostoma basilare													0	0
Etheostoma crossopterum													0	0
Etheostoma duryi			1	1					1		1	1	5	5
Etheostoma forbesi													0	0
Etheostoma luteovinctum													0	0
Etheostoma sp. *spectabile*													0	0
Number of specimens	0	0	1	1	0	1	2	0	1	0	1	1	8	Total
Number of species	0	0	1	1	0	1	1	0	1	0	1	1	2	Total
Fundulus julisia (mm TL)	46	45	32											

Site Name:	Farris Spring - Elk River drainage 35.1292 -86.13451													
Date:	25 February 2013													
Time:	10:50-11:20													
Collectors:	B.R. Kuhajda, D.A. Neely, T.B. Watkins, G.J. Knothe													
	Number per seine haul													**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Total no.**	**hauls present**
Fundulus julisia	1				1	2						3	7	4
Lampetra aepyptera													0	0
Campostoma oligolepis													0	0
Chrosomus erythrogaster													0	0
Clinostomus funduloides													0	0
Hemitremia flammea	16	10	9	8	11	5	8	3	1	2		14	87	11
Luxilus chrysocephalus													0	0
Lythrurus fasciolaris													0	0
Notropis telescopus													0	0
Pimephales notatus													0	0
Pimephales promelas													0	0
Rhinichthys obtusus													0	0
Semotilus atromaculatus													0	0
Catostomus commersonii													0	0
Erimyzon oblongus													0	0
Ameriurus natalis													0	0
Forbesichthys agassizii													0	0
Fundulus catenatus													0	0
Gambusia affinis													0	0
Cottus carolinae							1						1	1
Cottus sp cf. *bairdi*													0	0
Lepomis auritus													0	0
Lepomis cyanellus													0	0
Lepomis macrochirus													0	0
Lepomis megalotis													0	0
Micropterus salmoides													0	0
Etheostoma basilare													0	0
Etheostoma crossopterum													0	0
Etheostoma duryi													0	0
Etheostoma forbesi													0	0
Etheostoma luteovinctum													0	0
Etheostoma sp. *spectabile*													0	0
Number of specimens	17	10	9	8	12	7	9	3	1	2	0	17	95	Total
Number of species	2	1	1	1	2	2	2	1	1	1	0	2	3	Total
Fundulus julisia (mm TL)	59	46	53	55	53	48	55							

Site Name:	Hasty Site- Elk River drainage 35.16734 -86.24765
Date:	19 February 2013
Time:	14:10-14:40
Collectors:	2
Species collected	No number of specimens collected for each species per seine haul recorded for this site.
Campostoma oligolepis	
Clinostomus funduloides	
Chrosomus erythrogaster	
Notropis telescopus	
Rhinichthys atratulus	
Semotilus atromaculatus	
Catostomus commersonii	
Cottus carolinae	
Lepomis cyanellus	
Lepomis macrochirus	
Lepomis cyanellus x *L.* ?	

Site Name:	Rattlesnake Spring - Elk River drainage 35.07924 -86.23265
Date:	19 February 2013
Time:	11:10-12:20
Collectors:	B.R. Kuhajda, D.A. Neely, G.J. Knothe
Species collected	No number of specimens collected for each species per seine haul recorded for this site.
Campostoma oligolepis	
Hemitremia flammea	
Cottus carolinae	
Lepomis cyanellus	
Lepomis macrochirus	
Lepomis microlophus	
Micropterus salmoides	
Etheostoma nigripinne	
Etheostoma tennesseense	

Site Name:	Sherwood Spring & Hickory Creek - Caney Fork drainage 35.4768 -85.8462
Date:	28 February 2013
Time:	9:25-10:20
Collectors:	B.R. Kuhajda, B.W. Bingham, T.B. Watkins, M.T. Hamilton, J. Bowyer, B. Maynard

	Number per seine haul																					**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**	**S16**	**S17**	**S18**	**S19**	**S20**	**Total no.**	**hauls present**
Fundulus julisia																					0	0
Lampetra aepyptera											1										1	1
Campostoma oligolepis													1								1	1
Chrosomus erythrogaster																					0	0
Clinostomus funduloides		2			1	22				3	15	14	4		1		5		18	1	86	11
Hemitremia flammea							1												1		2	2
Luxilus chrysocephalus						1															1	1
Lythrurus fasciolaris		1																			1	1
Notropis telescopus		31	7		7	10	2		1		29	23	24	4	2		34		7	2	183	14
Pimephales notatus													2								2	1
Pimephales promelas																					0	0
Rhinichthys obtusus																					0	0
Semotilus atromaculatus						1					7	1	11						3		23	5
Catostomus commersonii																					0	0
Erimyzon oblongus																					0	0
Ameriurus natalis																					0	0
Forbesichthys agassizii																					0	0
Fundulus catenatus																					0	0
Gambusia affinis																					0	0
Cottus carolinae						1						2									3	2
Cottus sp. cf. *bairdi*																					0	0
Lepomis auritus																					0	0
Lepomis cyanellus																					0	0
Lepomis macrochirus																					0	0
Lepomis megalotis																					0	0
Micropterus salmoides																					0	0
Etheostoma basilare									1		1				2						4	3
Etheostoma crossopterum									1		1	1			2	1		2	1		9	7
Etheostoma duryi																					0	0
Etheostoma forbesi																					0	0
Etheostoma luteovinctum																					0	0
Etheostoma sp. *spectabile*																					0	0
Number of specimens	0	34	7	0	8	35	3	0	3	3	54	41	42	4	7	1	39	2	30	3	316	Total
Number of species	0	3	1	0	2	5	2	0	3	1	6	5	5	1	4	1	2	1	5	2	12	Total

Site Name:	Christian Spring & run upstream Sherwood Road - Caney Fork drainage 35.4803 -85.8613													
Date:	12 March 2013													
Time:	9:00-9:18													
Collectors:	B.R. Kuhajda, D.A. Neely, B.W. Bingham													
	Number per seine haul													**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Total no.**	**hauls present**
Fundulus julisia													0	0
Lampetra aepyptera													0	0
Campostoma oligolepis	2					2							4	2
Chrosomus erythrogaster													0	0
Clinostomus funduloides						2			1		1		4	3
Hemitremia flammea						2	1						3	2
Luxilus chrysocephalus													0	0
Lythrurus fasciolaris													0	0
Notropis telescopus													0	0
Pimephales notatus													0	0
Pimephales promelas													0	0
Rhinichthys obtusus													0	0
Semotilus atromaculatus						1							1	1
Catostomus commersonii													0	0
Erimyzon oblongus													0	0
Ameriurus natalis													0	0
Forbesichthys agassizii													0	0
Fundulus catenatus													0	0
Gambusia affinis													0	0
Cottus carolinae			1							1	1	3	6	4
Cottus sp. cf. *bairdi*													0	0
Lepomis auritus													0	0
Lepomis cyanellus													0	0
Lepomis macrochirus													0	0
Lepomis megalotis													0	0
Micropterus salmoides													0	0
Etheostoma basilare													0	0
Etheostoma crossopterum													0	0
Etheostoma duryi													0	0
Etheostoma forbesi													0	0
Etheostoma luteovinctum													0	0
Etheostoma sp. *spectabile*													0	0
Number of specimens	2	0	1	0	0	7	1	0	1	1	2	3	18	Total
Number of species	1	0	1	0	0	4	1	0	1	1	2	1	5	Total

Site Name:	Crooks site, Christian Spring run downstream Sherwood Road - Caney Fork drainage 35.4824 -85.8611													
Date:	12 March 2013													
Time:	9:23-9:55													
Collectors:	B.R. Kuhajda, D.A. Neely, B.W. Bingham													
	Number per seine haul													**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Total no.**	**hauls present**
Fundulus julisia													0	0
Lampetra aepyptera													0	0
Campostoma oligolepis		1		4				1				1	7	4
Chrosomus erythrogaster													0	0
Clinostomus funduloides		3		40	35	3	4	8		1		36	130	8
Hemitremia flammea		3	1	10			1		1	2		8	26	7
Luxilus chrysocephalus													0	0
Lythrurus fasciolaris													0	0
Notropis telescopus													0	0
Pimephales notatus													0	0
Pimephales promelas													0	0
Rhinichthys obtusus													0	0
Semotilus atromaculatus	2	1		5								2	10	4
Catostomus commersonii													0	0
Erimyzon oblongus													0	0
Ameriurus natalis													0	0
Forbesichthys agassizii													0	0
Fundulus catenatus													0	0
Gambusia affinis							3					1	4	2
Cottus carolinae	1	1			1		1				1	1	6	6
Cottus sp. cf. *bairdi*													0	0
Lepomis auritus													0	0
Lepomis cyanellus		1											1	1
Lepomis macrochirus													0	0
Lepomis megalotis													0	0
Micropterus salmoides													0	0
Etheostoma basilare		7						1					8	2
Etheostoma crossopterum	1	1					2		1		3		8	5
Etheostoma duryi													0	0
Etheostoma forbesi													0	0
Etheostoma luteovinctum													0	0
Etheostoma sp. *spectabile*													0	0
Number of specimens	4	18	1	59	36	3	11	10	2	3	4	49	200	Total
Number of species	3	8	1	4	2	1	5	3	2	2	2	6	9	Total

Site Name:	Hancock Spring - Caney Fork drainage 35.4988 -85.8684													
Date:	12 March 2013													
Time:	10:52-11:15													
Collectors:	B.R. Kuhajda, D.A. Neely, B.W. Bingham													
	Number per seine haul													**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Total no.**	**hauls present**
Fundulus julisia													0	0
Lampetra aepyptera													0	0
Campostoma oligolepis													0	0
Chrosomus erythrogaster													0	0
Clinostomus funduloides									2	1			3	2
Hemitremia flammea	3											2	5	2
Luxilus chrysocephalus													0	0
Lythrurus fasciolaris													0	0
Notropis telescopus									1				1	1
Pimephales notatus										1			1	1
Pimephales promelas													0	0
Rhinichthys obtusus													0	0
Semotilus atromaculatus													0	0
Catostomus commersonii													0	0
Erimyzon oblongus													0	0
Ameriurus natalis													0	0
Forbesichthys agassizii									1				1	1
Fundulus catenatus													0	0
Gambusia affinis	4	13		16	3	2		6		1	5	8	58	9
Cottus carolinae						1						3	4	2
Cottus sp. cf. *bairdi*													0	0
Ambloplites rupestris										1			1	1
Lepomis auritus													0	0
Lepomis cyanellus													0	0
Lepomis macrochirus													0	0
Lepomis megalotis													0	0
Micropterus salmoides													0	0
Etheostoma basilare	1						1						2	2
Etheostoma crossopterum						2							2	1
Etheostoma duryi													0	0
Etheostoma forbesi													0	0
Etheostoma luteovinctum													0	0
Etheostoma sp. *spectabile*													0	0
Number of specimens	8	13	0	16	3	5	1	6	4	4	5	13	78	Total
Number of species	3	1	0	1	1	3	1	1	3	4	1	3	10	Total

Site Name:	Cunningham Dairy Barn Spring - Caney Fork drainage 35.4926 -85.9222													
Date:	25 February 2013													
Time:	13:00-13:30													
Collectors:	B.R. Kuhajda, D.A. Neely, T.B. Watkins, G.J. Knothe													
	Number per seine haul													**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Total no.**	**hauls present**
Fundulus julisia	1		11	6	2	2	5	1	2	1		6	37	10
Lampetra aepyptera													0	0
Campostoma oligolepis													0	0
Chrosomus erythrogaster													0	0
Clinostomus funduloides													0	0
Hemitremia flammea													0	0
Luxilus chrysocephalus													0	0
Lythrurus fasciolaris													0	0
Notropis telescopus													0	0
Pimephales notatus													0	0
Pimephales promelas													0	0
Rhinichthys obtusus													0	0
Semotilus atromaculatus													0	0
Catostomus commersonii													0	0
Erimyzon oblongus													0	0
Ameriurus natalis													0	0
Forbesichthys agassizii													0	0
Fundulus catenatus													0	0
Gambusia affinis									2				2	1
Cottus carolinae													0	0
Cottus sp. cf. *bairdi*													0	0
Lepomis auritus													0	0
Lepomis cyanellus													0	0
Lepomis macrochirus													0	0
Lepomis megalotis													0	0
Micropterus salmoides													0	0
Etheostoma basilare													0	0
Etheostoma crossopterum													0	0
Etheostoma duryi													0	0
Etheostoma forbesi													0	0
Etheostoma luteovinctum													0	0
Etheostoma sp. *spectabile*													0	0
Number of specimens	1	0	11	6	2	2	5	1	4	1	0	6	39	Total
Number of species	1	0	1	1	1	1	1	1	2	1	0	1	2	Total
Fundulus julisia (mm TL)	53	50	55	60	54	55	60	53	49	52	53	47	56	65
	71	61	59	56	61	57	58	58	61	54	65	55	68	56
	63	61	46	55	57	63	52	60						

Site Name:	Clayborne Spring - Caney Fork drainage 35.5076 -85.91313													
Date:	25 February 2013													
Time:	14:00-14:50													
Collectors:	B.R. Kuhajda, D.A. Neely, T.B. Watkins, G.J. Knothe													
	Number per seine haul													**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Total no.**	**hauls present**
Fundulus julisia		6	3		1		10	3	4		2		29	7
Lampetra aepyptera													0	0
Campostoma oligolepis													0	0
Chrosomus erythrogaster													0	0
Clinostomus funduloides													0	0
Hemitremia flammea		1	1				11		1		11	3	28	6
Luxilus chrysocephalus													0	0
Lythrurus fasciolaris													0	0
Notropis telescopus													0	0
Pimephales notatus													0	0
Pimephales promelas													0	0
Rhinichthys obtusus													0	0
Semotilus atromaculatus							7	5	1		3		16	4
Catostomus commersonii													0	0
Erimyzon oblongus													0	0
Ameriurus natalis													0	0
Forbesichthys agassizii													0	0
Fundulus catenatus													0	0
Gambusia affinis	216	36	44	10	3	59	18	32	36	27	14	31	526	12
Cottus carolinae													0	0
Cottus sp. cf. *bairdi*													0	0
Lepomis auritus													0	0
Lepomis cyanellus													0	0
Lepomis macrochirus													0	0
Lepomis megalotis													0	0
Micropterus salmoides													0	0
Etheostoma basilare													0	0
Etheostoma crossopterum	3	4	3	3		1	9	7	9	2	6	4	51	11
Etheostoma duryi													0	0
Etheostoma forbesi													0	0
Etheostoma luteovinctum													0	0
Etheostoma sp. *spectabile*													0	0
Number of specimens	219	47	51	13	4	60	55	47	51	29	36	38	650	Total
Number of species	2	4	4	2	2	2	5	4	5	2	5	3	5	Total
Fundulus julisia (mm TL)	46	52	54	52	35	51	34	43	44	45	47	46		
	43	39	41	48	36	54	32	47	40	32	48	44		
	37	52	54	46	39									

Site Name:	Sain Spring - Caney Fork drainage 35.5062 -85.912													
Date:	12 March 2013													
Time:	14:23-15:10													
Collectors:	B.R. Kuhajda, D.A. Neely													
	Number per seine haul													**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Total no.**	**hauls present**
Fundulus julisia		1	1				1			1		2	6	5
Lampetra aepyptera													0	0
Campostoma oligolepis													0	0
Chrosomus erythrogaster													0	0
Clinostomus funduloides													0	0
Hemitremia flammea	1									2			3	2
Luxilus chrysocephalus													0	0
Lythrurus fasciolaris													0	0
Notropis telescopus													0	0
Pimephales notatus													0	0
Pimephales promelas													0	0
Rhinichthys obtusus													0	0
Semotilus atromaculatus													0	0
Catostomus commersonii													0	0
Erimyzon oblongus													0	0
Ameriurus natalis													0	0
Forbesichthys agassizii													0	0
Fundulus catenatus													0	0
Gambusia affinis	1	7	5	1	1	1	4	17	84	6	1	9	137	12
Cottus carolinae													0	0
Cottus sp. cf. *bairdi*													0	0
Ambloplites rupestris													0	0
Lepomis auritus													0	0
Lepomis cyanellus													0	0
Lepomis macrochirus													0	0
Lepomis megalotis													0	0
Micropterus salmoides													0	0
Etheostoma basilare													0	0
Etheostoma crossopterum	1	2	4	3	2	2	1	1		3	1	5	25	11
Etheostoma duryi													0	0
Etheostoma forbesi													0	0
Etheostoma luteovinctum													0	0
Etheostoma sp. *spectabile*													0	0
Number of specimens	3	10	10	4	3	3	6	18	84	12	2	16	171	Total
Number of species	3	3	3	2	2	2	3	2	1	4	2	3	4	Total
Fundulus julisia (mm TL)	44	55 M	50 F	48 F	49 M	48 M								

Site Name:	Upper Murphy Spring - Caney Fork drainage 35.515 -85.891													
Date:	12 March 2013													
Time:	13:10-13:45													
Collectors:	B.R. Kuhajda, D.A. Neely, B.W. Bingham													
	Number per seine haul													**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Total no.**	**hauls present**
Fundulus julisia													0	0
Lampetra aepyptera													0	0
Campostoma oligolepis									209	10			219	2
Chrosomus erythrogaster													0	0
Clinostomus funduloides													0	0
Hemitremia flammea					2	2			4		2		10	4
Luxilus chrysocephalus									8	2	2		12	3
Lythrurus fasciolaris													0	0
Notropis telescopus													0	0
Pimephales notatus													0	0
Pimephales promelas													0	0
Rhinichthys obtusus													0	0
Semotilus atromaculatus													0	0
Catostomus commersonii													0	0
Erimyzon oblongus													0	0
Ameriurus natalis													0	0
Forbesichthys agassizii													0	0
Fundulus catenatus													0	0
Gambusia affinis	3	9	4	11	35	94	1	9	7	416	1		590	11
Cottus carolinae													0	0
Cottus sp. cf. *bairdi*													0	0
Ambloplites rupestris													0	0
Lepomis auritus													0	0
Lepomis cyanellus							1						1	1
Lepomis macrochirus				2			1	2	39	31	2		77	6
Lepomis megalotis													0	0
Micropterus salmoides													0	0
Etheostoma basilare													0	0
Etheostoma crossopterum								2			1		3	2
Etheostoma duryi													0	0
Etheostoma forbesi													0	0
Etheostoma luteovinctum													0	0
Etheostoma sp. *spectabile*													0	0
Number of specimens	3	9	4	13	37	96	3	13	267	459	8	0	912	Total
Number of species	1	1	1	2	2	2	3	3	5	4	5	0	7	Total

Site Name:	Lower Murphy Spring - Caney Fork drainage 35.5162 -85.8889													
Date:	12 March 2013													
Time:	12:30-13:00													
Collectors:	B.R. Kuhajda, D.A. Neely, B.W. Bingham													
	Number per seine haul													**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Total no.**	**hauls present**
Fundulus julisia													0	0
Lampetra aepyptera													0	0
Campostoma oligolepis													0	0
Chrosomus erythrogaster													0	0
Clinostomus funduloides													0	0
Hemitremia flammea											1		1	1
Luxilus chrysocephalus													0	0
Lythrurus fasciolaris													0	0
Notropis telescopus													0	0
Pimephales notatus													0	0
Pimephales promelas													0	0
Rhinichthys obtusus													0	0
Semotilus atromaculatus			1										1	1
Catostomus commersonii													0	0
Erimyzon oblongus													0	0
Ameriurus natalis													0	0
Forbesichthys agassizii											1		1	1
Fundulus catenatus													0	0
Gambusia affinis	37	40	2	44	33	25		13	18			26	238	9
Cottus carolinae													0	0
Cottus sp. cf. *bairdi*													0	0
Ambloplites rupestris													0	0
Lepomis auritus													0	0
Lepomis cyanellus													0	0
Lepomis macrochirus	2			2	1	1							6	4
Lepomis megalotis													0	0
Micropterus salmoides													0	0
Etheostoma basilare													0	0
Etheostoma crossopterum													0	0
Etheostoma duryi													0	0
Etheostoma forbesi													0	0
Etheostoma luteovinctum													0	0
Etheostoma sp. *spectabile*													0	0
Number of specimens	39	40	3	46	34	26	0	13	18	0	2	26	247	Total
Number of species	2	1	2	2	2	2	0	1	1	0	2	1	5	Total

Site Name:	Ramsey Barn Spring - Caney Fork drainage 35.5416 -85.8585																				
Date:	26 February 2013																				
Time:	9:35-10:30																				
Collectors:	B.R. Kuhajda, D. A. Neely, T.B. Watkins, G.T. Knothe, B. Maynard																				
	Number per seine haul																				**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**	**S16**	**S17**	**S18**	**S19**	**S20**	**Total no.**	**hauls present**
Fundulus julisia																					0	0
Lampetra aepyptera																					0	0
Campostoma oligolepis								25	39	1		6	5	6		6				11	99	8
Chrosomus erythrogaster																					0	0
Clinostomus funduloides																					0	0
Hemitremia flammea				1				1		11			1	1				3		6	24	7
Luxilus chrysocephalus																		1			1	1
Lythrurus fasciolaris								1				1									2	2
Notropis telescopus																					0	0
Pimephales notatus								1				1		1				1			4	4
Pimephales promelas																					0	0
Rhinichthys obtusus																					0	0
Semotilus atromaculatus	1			3		1	1	1				6	2	3	3	1				5	27	11
Catostomus commersonii																					0	0
Erimyzon oblongus																					0	0
Ameriurus natalis																					0	0
Forbesichthys agassizii		1		1													1				3	3
Fundulus catenatus																					0	0
Gambusia affinis	1	95		5		2	5		102				60			58		5	32	2	270	11
Cottus carolinae								1		1				1	1	1		2	3		10	7
Cottus sp. cf. *bairdi*																					0	0
Lepomis auritus																					0	0
Lepomis cyanellus																					0	0
Lepomis macrochirus				2														3			5	2
Lepomis megalotis																					0	0
Micropterus salmoides																					0	0
Etheostoma basilare																					0	0
Etheostoma crossopterum				1												1	1			1	4	4
Etheostoma duryi																					0	0
Etheostoma forbesi																					0	0
Etheostoma luteovinctum								1											1		2	2
Etheostoma sp. *spectabile*																					0	0
Number of specimens	2	96	0	13	0	3	6	31	141	13	0	14	68	12	4	67	2	15	36	25	451	Total
Number of species	2	2	0	6	0	2	2	7	2	3	0	4	4	5	2	5	2	6	3	5	12	Total

Site Name:	Vervilla - Caney Fork drainage 35.5875 -85.8575																				
Date:	26 February 2013																				
Time:	11:52-12:52																				
Collectors:	B.R. Kuhajda, D. A. Neely, T.B. Watkins, G.T. Knothe, B. Maynard																				
	Number per seine haul																				**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**	**S16**	**S17**	**S18**	**S19**	**S20**	**Total no.**	**hauls present**
Fundulus julisia																					0	0
Lampetra aepyptera																					0	0
Campostoma oligolepis																					0	0
Chrosomus erythrogaster																					0	0
Clinostomus funduloides																					0	0
Hemitremia flammea														1							1	1
Luxilus chrysocephalus																					0	0
Lythrurus fasciolaris																					0	0
Notropis telescopus																					0	0
Pimephales notatus										1											1	1
Pimephales promelas																					0	0
Rhinichthys obtusus																					0	0
Semotilus atromaculatus																					0	0
Catostomus commersonii																					0	0
Erimyzon oblongus																					0	0
Ameriurus natalis																					0	0
Forbesichthys agassizii																					0	0
Fundulus catenatus																					0	0
Gambusia affinis	30	56	21	30	88	8	3	44	104	62	50	16	20	25	9	22	84	36	7	44	705	20
Cottus carolinae																					0	0
Cottus sp. cf. *bairdi*																					0	0
Lepomis auritus																					0	0
Lepomis cyanellus	8	10	4	1	12	1	6	9	1	18	4	11	4	2	3	2	5	4	8	6	119	20
Lepomis macrochirus																1		4			5	2
Lepomis megalotis																					0	0
Micropterus salmoides																					0	0
Etheostoma basilare																					0	0
Etheostoma crossopterum																					0	0
Etheostoma duryi																					0	0
Etheostoma forbesi																					0	0
Etheostoma luteovinctum																					0	0
Etheostoma sp. *spectabile*																					0	0
Number of specimens	38	66	25	31	100	9	9	53	105	81	54	27	24	28	12	25	89	44	15	50	831	Total
Number of species	2	2	2	2	2	2	2	2	2	3	2	2	2	3	2	3	2	3	2	2	5	Total

Site Name:	Type Locality (Benedict Spring) - Caney Fork drainage 35.5497 -85.9836
Date:	28 February 2013
Time:	13:30-13:45
Collectors:	B.R. Kuhajda, B.W. Bingham, T.B. Watkins, B. Maynard, P. Rakes, J.R. Shute, C. Ruble, R. Xiques, FWS intern

	Number per seine haul				No. seine
Species	**S1**	**S2**	**S3**	**Total #**	**hauls present**
Fundulus julisia	3	14	154	171	3
Lampetra aepyptera				0	0
Campostoma oligolepis				0	0
Chrosomus erythrogaster				0	0
Clinostomus funduloides				0	0
Hemitremia flammea				0	0
Luxilus chrysocephalus				0	0
Lythrurus fasciolaris				0	0
Notropis telescopus				0	0
Pimephales notatus				0	0
Pimephales promelas				0	0
Rhinichthys obtusus				0	0
Semotilus atromaculatus				0	0
Catostomus commersonii				0	0
Erimyzon oblongus				0	0
Ameriurus natalis				0	0
Forbesichthys agassizii				0	0
Fundulus catenatus				0	0
Gambusia affinis				0	0
Cottus carolinae				0	0
Cottus sp. cf. *bairdi*				0	0
Lepomis auritus	2		1	3	2
Lepomis cyanellus				0	0
Lepomis macrochirus				0	0
Lepomis megalotis				0	0
Micropterus salmoides				0	0
Etheostoma basilare				0	0
Etheostoma crossopterum				0	0
Etheostoma duryi				0	0
Etheostoma forbesi				0	0
Etheostoma luteovinctum				0	0
Etheostoma sp. *spectabile*				0	0
Number of specimens	5	14	155	174	Total
Number of species	2	1	2	2	Total

Fundulus julisia (mm TL)	60	25	28	35	32	26	28	F 56	36	23	33	F 56
	M 46	35	34	29	M 63	F 56	M 66	F 48	M 37	M 58	33	33
	M 64	M 70	F 63	F 55	F 65	F 92	M 58	F 60	32	M 60	F 80	M 55
	F 52	32	31	25	33	M 78	F 65	33	31	M 87	M 68	F 64
	F 59	F 57	F 49	F 46	25	34	M 60	M 69	36	M 65	F 50	M 60
	F 49	F 60	M 48	27	M 48	27	F 55	28	F 59	M 60	F 62	M 56
	F 67	F 56	F 62	M 58	M 60	M 51	F 56	F44	M 67	F 59	F 58	M 44

Site Name:	Jarrell Spring - Caney Fork drainage 35.5784 -86.0148													
Date:	21 March 2013													
Time:	12:40-13:06													
Collectors:	B.R. Kuhajda, B.W. Bingham, K.F. Alford, D.A. Neely													
	Number per seine haul													**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Total no.**	**hauls present**
Fundulus julisia													0	0
Lampetra aepyptera													0	0
Campostoma oligolepis													0	0
Chrosomus erythrogaster													0	0
Clinostomus funduloides													0	0
Hemitremia flammea													0	0
Luxilus chrysocephalus													0	0
Lythrurus fasciolaris													0	0
Notropis telescopus													0	0
Pimephales notatus													0	0
Pimephales promelas													0	0
Rhinichthys obtusus													0	0
Semotilus atromaculatus													0	0
Catostomus commersonii													0	0
Erimyzon oblongus													0	0
Ameriurus natalis													0	0
Forbesichthys agassizii	1	3	1	6	8	2	2	6	5	2	1	2	39	12
Fundulus catenatus													0	0
Gambusia affinis													0	0
Cottus carolinae													0	0
Cottus sp. cf. *bairdi*													0	0
Lepomis auritus													0	0
Lepomis cyanellus	1		1	4	1								7	4
Lepomis macrochirus													0	0
Lepomis megalotis													0	0
Micropterus salmoides													0	0
Etheostoma basilare													0	0
Etheostoma crossopterum													0	0
Etheostoma duryi													0	0
Etheostoma forbesi													0	0
Etheostoma luteovinctum													0	0
Etheostoma sp. *spectabile*													0	0
Number of specimens	2	3	2	10	9	2	2	6	5	2	1	2	46	Total
Number of species	2	1	2	2	2	1	1	1	1	1	1	1	2	Total

Site Name:	Pocahontas Spring - Caney Fork drainage 35.6353704 -86.04225													
Date:	8 March 2013													
Time:	9:40-10:15													
Collectors:	D.A. Neely, B.R. Kuhajda, A.L. George													
	Number per seine haul													**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Total no.**	**hauls present**
Fundulus julisia													0	0
Lampetra aepyptera													0	0
Campostoma oligolepis													0	0
Chrosomus erythrogaster												1	1	1
Clinostomus funduloides													0	0
Hemitremia flammea	1												1	1
Luxilus chrysocephalus													0	0
Lythrurus fasciolaris													0	0
Notropis telescopus													0	0
Pimephales notatus													0	0
Pimephales promelas													0	0
Rhinichthys obtusus													0	0
Semotilus atromaculatus												3	3	1
Catostomus commersonii													0	0
Erimyzon oblongus													0	0
Ameriurus natalis													0	0
Forbesichthys agassizii				4	2	2	2	5	2	4			21	7
Fundulus catenatus													0	0
Gambusia affinis										1			1	1
Cottus carolinae		1	1									1	3	3
Cottus sp. cf. *bairdi*													0	0
Lepomis auritus													0	0
Lepomis cyanellus	1									1			2	2
Lepomis macrochirus													0	0
Lepomis megalotis													0	0
Micropterus salmoides													0	0
Etheostoma basilare													0	0
Etheostoma crossopterum													0	0
Etheostoma duryi													0	0
Etheostoma forbesi		2		2		1			1				6	4
Etheostoma luteovinctum													0	0
Etheostoma sp. *spectabile*													0	0
Number of specimens	2	3	1	6	2	3	2	5	3	6	0	5	38	Total
Number of species	2	2	1	2	1	2	1	1	2	3	0	3	8	Total

Site Name:	Unnamed trib Lewis Creek 0.35 to 0.5 mi upstream TN Hwy 53 - Caney Fork drainage 35.70290 -86.06606							
Date:	21 March 2013							
Time:	9:47-10:04							
Collectors:	B.R. Kuhajda, B.W. Bingham, K.F. Alford, D.A. Neely							
	Number per seine haul							**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**Total no.**	**hauls present**
Fundulus julisia							0	0
Lampetra aepyptera							0	0
Campostoma oligolepis							0	0
Chrosomus erythrogaster							0	0
Clinostomus funduloides							0	0
Hemitremia flammea							0	0
Luxilus chrysocephalus							0	0
Lythrurus fasciolaris							0	0
Notropis telescopus							0	0
Pimephales notatus							0	0
Pimephales promelas							0	0
Rhinichthys obtusus							0	0
Semotilus atromaculatus							0	0
Catostomus commersonii							0	0
Erimyzon oblongus							0	0
Ameriurus natalis							0	0
Forbesichthys agassizii							0	0
Fundulus catenatus							0	0
Gambusia affinis							0	0
Cottus carolinae							0	0
Cottus sp. cf. *bairdi*								
Lepomis auritus							0	0
Lepomis cyanellus							0	0
Lepomis macrochirus							0	0
Lepomis megalotis							0	0
Micropterus salmoides							0	0
Etheostoma basilare							0	0
Etheostoma crossopterum							0	0
Etheostoma duryi							0	0
Etheostoma forbesi							0	0
Etheostoma luteovinctum							0	0
Etheostoma sp. *spectabile*							0	0
Number of specimens	0	0	0	0	0	0	0	Total
Number of species	0	0	0	0	0	0	0	Total

Site Name:	Unnamed trib Lewis Creek 0.13 to 0.17 mi upstream TN Hwy 53 - Caney Fork drainage 35.70380 -86.06217													
Date:	21 March 2013													
Time:	10:19-10:39													
Collectors:	B.R. Kuhajda, B.W. Bingham, K.F. Alford, D.A. Neely													
	Number per seine haul													**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Total no.**	**hauls present**
Fundulus julisia		2	1	4		1	2	3	3				16	7
Lampetra aepyptera													0	0
Campostoma oligolepis													0	0
Chrosomus erythrogaster													0	0
Clinostomus funduloides													0	0
Hemitremia flammea													0	0
Luxilus chrysocephalus													0	0
Lythrurus fasciolaris													0	0
Notropis telescopus													0	0
Pimephales notatus													0	0
Pimephales promelas													0	0
Rhinichthys obtusus													0	0
Semotilus atromaculatus													0	0
Catostomus commersonii													0	0
Erimyzon oblongus													0	0
Ameriurus natalis													0	0
Forbesichthys agassizii													0	0
Fundulus catenatus													0	0
Gambusia affinis													0	0
Cottus carolinae													0	0
Cottus sp. cf. *bairdi*													0	0
Lepomis auritus													0	0
Lepomis cyanellus													0	0
Lepomis macrochirus													0	0
Lepomis megalotis													0	0
Micropterus salmoides													0	0
Etheostoma basilare													0	0
Etheostoma crossopterum													0	0
Etheostoma duryi													0	0
Etheostoma forbesi													0	0
Etheostoma luteovinctum													0	0
Etheostoma sp. *spectabile*													0	0
Number of specimens	0	2	1	4	0	1	2	3	3	0	0	0	16	Total
Number of species	0	1	1	1	0	1	0	1	1	0	0	0	1	Total

Site Name:	Pedigo Spring Run at TN Hwy 53 - Caney Fork 35.703 -86.0594							
Date:	7 March 2013							
Time:	10:20-10:50							
Collectors:	B.R. Kuhajda, B.W. Bingham, T.B. Watkins, M.T. Hamilton, K.G. McPheeters							
	Number per seine haul							**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**Total no.**	**hauls present**
Fundulus julisia	8	7	3	3		80	101	5
Lampetra aepyptera							0	0
Campostoma oligolepis							0	0
Chrosomus erythrogaster							0	0
Clinostomus funduloides							0	0
Hemitremia flammea							0	0
Luxilus chrysocephalus							0	0
Lythrurus fasciolaris							0	0
Notropis telescopus							0	0
Pimephales notatus							0	0
Pimephales promelas							0	0
Rhinichthys obtusus							0	0
Semotilus atromaculatus							0	0
Catostomus commersonii							0	0
Erimyzon oblongus							0	0
Ameriurus natalis							0	0
Forbesichthys agassizii							0	0
Fundulus catenatus							0	0
Gambusia affinis							0	0
Cottus carolinae							0	0
Cottus sp. cf. *bairdi*							0	0
Lepomis auritus							0	0
Lepomis cyanellus				7	9	31	47	3
Lepomis macrochirus							0	0
Lepomis megalotis							0	0
Micropterus salmoides							0	0
Etheostoma basilare							0	0
Etheostoma crossopterum							0	0
Etheostoma duryi							0	0
Etheostoma forbesi							0	0
Etheostoma luteovinctum							0	0
Etheostoma sp. *spectabile*							0	0
Number of specimens	8	7	3	10	9	111	148	Total
Number of species	1	1	1	2	1	2	2	Total

Fundulus julisia (mm TL)								
	31	47	24	42	46	34	29	36
	34	25	54	33	45	40	37	42
	39	27	60	50	51	65 F	60 M	32
	58	50	47	50	82 F	34	30	35
	25	43	45	52	70	60	48	55
	42	40	40	49	34	45	52	45
	38	55	43	53	63	62	35	24
	50	58	27	22	45	44	55	45
	46	35	36	60	24	28	55	42
	59	42	60	27	45	24	54	32
	28	31	54	42	27	43	32	48
	40	32	34	28	31	54	28	28
	48							

Site Name:	Pedigo Farm site Lewis Creek - Caney Fork drainage 35.7027 -86.0488											
Date:	7 March 2013											
Time:	10:30-11:40											
Collectors:	B.R. Kuhajda, D.A. Neely, P.L. Rakes, D.J. Alexander, J.B. Stenger, S. Sorenson, J. Hendricks											
	Number per seine haul											**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**Total no.**	**hauls present**
Fundulus julisia		1				1	12	12	47	23	96	6
Lampetra aepyptera											0	0
Campostoma oligolepis			1			6				1	8	3
Chrosomus erythrogaster											0	0
Clinostomus funduloides						1					1	1
Hemitremia flammea						1	5	1	10	3	20	5
Luxilus chrysocephalus											0	0
Lythrurus fasciolaris											0	0
Notropis telescopus											0	0
Pimephales notatus		2		15	3		7	2	4	13	46	7
Pimephales promelas											0	0
Rhinichthys obtusus											0	0
Semotilus atromaculatus											0	0
Catostomus commersonii											0	0
Erimyzon oblongus											0	0
Ameriurus natalis										1	1	1
Forbesichthys agassizii											0	0
Fundulus catenatus											0	0
Gambusia affinis	7	5	4	147	100	2	2	2	19	11	299	10
Cottus carolinae											0	0
Cottus sp. cf. *bairdi*											0	0
Lepomis auritus											0	0
Lepomis cyanellus											0	0
Lepomis macrochirus											0	0
Lepomis megalotis											0	0
Micropterus salmoides											0	0
Etheostoma basilare											0	0
Etheostoma crossopterum											0	0
Etheostoma duryi											0	0
Etheostoma forbesi										1	1	1
Etheostoma luteovinctum				1	1						2	2
Etheostoma sp. *spectabile*											0	0
Number of specimens	7	8	5	163	104	11	26	17	80	36	474	Total
Number of species	1	3	2	3	3	5	4	4	4	7	9	Total
Fundulus julisia (mm TL)	30	64	38	48	42	31	43	40	39	38	26	40
	42	39	44	40	62	35	46	39	50	43	29	45
	37	41	57	41	40	50	42	44	45	50	35	35
	41	65	54	65	62	45	35	53	32	32	51	36
	60	41	43	38	32	37	45	68	40	65	61	62
	29	47	63	45	35	41	55	44	54	49	33	65
	33	43	41	44	42	48	40	45	40	50	42	45
	45	45	33	33	45	60	45	53	44	36	44	29

Site Name:	McMahan Creek at Woodland Estates subdividion - Caney Fork drainage 35.71496 -86.05357													
Date:	14 March 2013													
Time:	14:36-14:58													
Collectors:	B.R. Kuhajda, K.F. Alford, D.A. Neely, B.W. Bingham, G.J. Knothe, V. Caldwell, S. Silvey													
	Number per seine haul													**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Total no.**	**hauls present**
Fundulus julisia		9	6		3	2		2		2	1		25	7
Lampetra aepyptera													0	0
Campostoma oligolepis			1		13	2				8	6	11	41	6
Chrosomus erythrogaster								2					2	1
Clinostomus funduloides													0	0
Hemitremia flammea		3	11		3	1	1	9	4	21	1	4	58	10
Luxilus chrysocephalus													0	0
Lythrurus fasciolaris													0	0
Notropis telescopus													0	0
Pimephales notatus													0	0
Pimephales promelas													0	0
Rhinichthys obtusus													0	0
Semotilus atromaculatus													0	0
Catostomus commersonii													0	0
Erimyzon oblongud													0	0
Ameriurus natalis													0	0
Forbesichthys agassizii													0	0
Fundulus catenatus													0	0
Gambusia affinis													0	0
Cottus carolinae													0	0
Cottus sp. cf. *bairdi*													0	0
Lepomis auritus													0	0
Lepomis cyanellus					1			2					3	2
Lepomis macrochirus			1										1	1
Lepomis megalotis													0	0
Micropterus salmoides													0	0
Etheostoma basilare			2										2	1
Etheostoma crossopterum													0	0
Etheostoma duryi													0	0
Etheostoma forbesi			1				1		2				4	3
Etheostoma luteovinctum													0	0
Etheostoma sp. *spectabile*													0	0
Number of specimens	0	12	22	0	20	5	2	15	6	31	8	15	136	Total
Number of species	0	2	6	0	4	3	2	4	2	3	3	2	8	Total
Fundulus julisia (mm TL)	61	28	27	34	52	57	33	55	60	68	35	25		
	50	41	47	36	23	49	71	52	54	50	35	55		
	70	58												

Site Name:	Cooper Branch - Caney Fork drainage 35.674 -86.0335															
Date:	7 March 2013															
Time:	8:55-9:30															
Collectors:	B.R. Kuhajda, D.A. Neely, B.W. Bingham, T.B. Watkins, S. Sorenson															
	Number per seine haul															**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**S13**	**S14**	**Total no.**	**hauls present**
Fundulus julisia								5	2					1	8	3
Lampetra aepyptera															0	0
Campostoma oligolepis	1				1			1	1	4	3	1		33	45	8
Chrosomus erythrogaster	1		4								3			6	14	4
Clinostomus funduloides	3							1			2		3	55	64	5
Hemitremia flammea	2		1				1	5					1	9	19	6
Luxilus chrysocephalus														1	1	1
Lythrurus fasciolaris													1		1	1
Notropis telescopus															0	0
Pimephales notatus														2	2	1
Pimephales promelas															0	0
Rhinichthys obtusus											1		1	3	5	3
Semotilus atromaculatus											2				2	1
Catostomus commersonii															0	0
Erimyzon oblongus															0	0
Ameriurus natalis															0	0
Forbesichthys agassizii															0	0
Fundulus catenatus															0	0
Gambusia affinis															0	0
Cottus carolinae															0	0
Cottus sp. cf. *bairdi*															0	0
Lepomis auritus															0	0
Lepomis cyanellus															0	0
Lepomis macrochirus		1		1											2	2
Lepomis megalotis															0	0
Micropterus salmoides															0	0
Etheostoma basilare															0	0
Etheostoma crossopterum															0	0
Etheostoma duryi															0	0
Etheostoma forbesi															0	0
Etheostoma luteovinctum															0	0
Etheostoma sp. *spectabile*															0	0
Number of specimens	7	1	5	1	1	0	1	12	3	4	11	1	6	110	163	Total
Number of species	4	1	2	1	1	0	1	4	2	1	5	1	4	8	11	Total
Fundulus julisia (mm TL)	62 F	59 F	55 F	62 M	62 F	44 F	55 F	56 M								

Site Name:	Unnamed spring at Lewis Road - Caney Fork drainage 35.69005 -86.01314													
Date:	8 March 2013													
Time:	11:48-12:24													
Collectors:	B.R. Kuhajda, D.A. Neely, A.L. George													
	Number per seine haul													**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Total no.**	**hauls present**
Fundulus julisia													0	0
Lampetra aepyptera													0	0
Campostoma oligolepis													0	0
Chrosomus erythrogaster													0	0
Clinostomus funduloides													0	0
Hemitremia flammea				1							1	1	3	3
Luxilus chrysocephalus													0	0
Lythrurus fasciolaris													0	0
Notropis telescopus													0	0
Pimephales notatus													0	0
Pimephales promelas													0	0
Rhinichthys obtusus													0	0
Semotilus atromaculatus													0	0
Catostomus commersonii													0	0
Erimyzon oblongus													0	0
Ameriurus natalis													0	0
Forbesichthys agassizii					1								1	1
Fundulus catenatus													0	0
Gambusia affinis				2	5		81	181	9	56	69	17	420	8
Cottus carolinae													0	0
Cottus sp. cf. *bairdi*													0	0
Lepomis auritus													0	0
Lepomis cyanellus									5			1	6	2
Lepomis macrochirus							3	3	1				7	3
Lepomis cyanellus x *L. macrochirus*							1		3				4	2
Lepomis megalotis													0	0
Micropterus salmoides													0	0
Etheostoma basilare													0	0
Etheostoma crossopterum													0	0
Etheostoma duryi													0	12
Etheostoma forbesi													0	0
Etheostoma luteovinctum													0	0
Etheostoma sp. *spectabile*													0	0
Number of specimens	0	0	0	3	6	0	85	184	18	56	70	19	441	Total
Number of species	0	0	0	2	2	0	3	2	4	1	2	3	6	Total

Site Name:	Unnamed spring run and McMahan Creek near its mouth - Caney Fork drainage 35.6915 -86.0109													
Date:	8 March 2013													
Time:	13:10-13:40													
Collectors:	B.R. Kuhajda, D.A. Neely, A.L. George													
	Number per seine haul													**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Total no.**	**hauls present**
Fundulus julisia													0	0
Lampetra aepyptera													0	0
Campostoma oligolepis		4	1	7		1	1	6	1				21	7
Chrosomus erythrogaster		1					1	2					4	3
Clinostomus funduloides				9									9	1
Hemitremia flammea		3		4				2	1		1	7	18	6
Luxilus chrysocephalus		1	1	6				5					13	4
Lythrurus fasciolaris				21				2					23	2
Notropis telescopus													0	0
Pimephales notatus													0	0
Pimephales promelas													0	0
Rhinichthys obtusus				1									1	1
Semotilus atromaculatus		3		5				3					11	3
Catostomus commersonii													0	0
Erimyzon oblongus													0	0
Ameriurus natalis													0	0
Forbesichthys agassizii													0	0
Fundulus catenatus													0	0
Gambusia affinis													0	0
Cottus carolinae													0	0
Cottus sp. cf. *bairdi*													0	0
Lepomis auritus													0	0
Lepomis cyanellus									1				1	1
Lepomis macrochirus													0	0
Lepomis megalotis													0	0
Micropterus salmoides													0	0
Etheostoma basilare		1											1	1
Etheostoma crossopterum													0	0
Etheostoma duryi													0	0
Etheostoma forbesi													0	0
Etheostoma luteovinctum													0	0
Etheostoma spectabile													0	0
Number of specimens	0	13	2	53	0	1	2	20	3	0	1	7	102	Total
Number of species	0	6	2	7	0	1	2	6	3	0	1	1	10	Total

Site Name:	Lance Spring - Caney Fork drainage 35.6767 -85.9762																				
Date:	7 March 2013																				
Time:	12:50-14:00																				
Collectors:	B.R. Kuhajda, D.A. Neely, B.W. Bingham, T.B. Watkins, M.T. Hamilton, P.L. Rakes, J. Hendricks, J.B. Stenger, D.J. Alexander, K.G Mcpheeters, S. Sorenson																				
	Number per seine haul																				**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**	**S16**	**S17**	**S18**	**S19**	**S20**	**Total no.**	**hauls present**
Fundulus julisia		1					1	1	5	1											9	5
Lampetra aepyptera																					0	0
Campostoma oligolepis	38	3		1		120	52				18	5			7	29	2	129	100	7	511	12
Chrosomus erythrogaster	1	14													10	3		2			30	4
Clinostomus funduloides						8										5	1	7	51		72	5
Hemitremia flammea	25	115		4	1	46	75	13	65	4	47		1	15	19	25	18	11	4	10	498	17
Luxilus chrysocephalus						69	2								2	8	1	7	13		102	7
Lythrurus fasciolaris						111	49	2								2		33	21		218	6
Notropis telescopus							4														4	1
Pimephales notatus							2										1	2	1		6	4
Pimephales promelas																					0	0
Rhinichthys obtusus	6															2		1			9	2
Semotilus atromaculatus		13		1		8	1		6						5	2	1	2	3		42	10
Catostomus commersonii																		1			1	1
Erimyzon oblongus						14			4	4	20							2		2	46	21
Ameriurus natalis																					0	0
Forbesichthys agassizii			3	7	6						1	1							1		19	6
Fundulus catenatus							3														3	1
Gambusia affinis		71	2	3	18			7	6		5	9	4	16	3	3	2		1	12	162	15
Cottus carolinae	1			5		1		1		1	2		1	3	3	1	1		2	7	29	12
Cottus sp. cf. *bairdi*																					0	0
Lepomis auritus																					0	0
Lepomis cyanellus																					0	0
Lepomis macrochirus						1															1	1
Lepomis megalotis																					0	0
Micropterus salmoides						2											2				4	2
Etheostoma basilare																					0	0
Etheostoma crossopterum																					0	0
Etheostoma duryi																					0	0
Etheostoma forbesi		1			1	9		2	4		2		1		1	1		1	2	3	28	12
Etheostoma luteovinctum									2	2									1		5	3
Etheostoma spectabile																					0	0
Number of specimens	71	218	5	21	26	389	189	26	92	12	95	15	7	34	50	81	29	198	200	41	1799	Total
Number of species	5	7	2	6	4	11	9	6	7	5	7	3	4	3	8	11	9	12	12	6	21	Total
Fundulus julisia (mm TL)	25	60 F	51 M	45 F	48 F	43 M	44 F	44 F	48 F													

Site Name:	Charles Creek at TN Hwy 287 - Caney Fork drainage 35.7716 -85.9103													
Date:	21 March 2013													
Time:	14:14-14:28													
Collectors:	B.R. Kuhajda, D.A. Neely, K.F. Alford													
	Number per seine haul													**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**Total no.**	**hauls present**
Fundulus julisia													0	0
Lampetra aepyptera													0	0
Campostoma oligolepis		6						4	1			1	12	4
Chrosomus erythrogaster													0	0
Clinostomus funduloides												1	1	1
Hemitremia flammea							2		1				3	2
Luxilus chrysocephalus													0	0
Lythrurus fasciolaris													0	0
Notropis telescopus											3		3	1
Pimephales notatus													0	0
Pimephales promelas													0	0
Rhinichthys obtusus													0	0
Semotilus atromaculatus													0	0
Catostomus commersonii													0	0
Erimyzon oblongus													0	0
Ameriurus natalis													0	0
Forbesichthys agassizii													0	0
Fundulus catenatus													0	0
Gambusia affinis													0	0
Cottus carolinae													0	0
Cottus sp. cf. *bairdi*													0	0
Lepomis auritus													0	0
Lepomis cyanellus													0	0
Lepomis macrochirus													0	0
Lepomis megalotis													0	0
Micropterus salmoides													0	0
Etheostoma basilare													0	0
Etheostoma crossopterum													0	0
Etheostoma duryi													0	0
Etheostoma forbesi													0	0
Etheostoma luteovinctum													0	0
Etheostoma sp. *spectabile*													0	0
Number of specimens	0	6	0	0	0	0	2	4	2	0	3	2	19	Total
Number of species	0	1	0	0	0	0	1	1	2	0	1	2	4	Total

Site Name:	Blue (Herndon) Spring - Caney Fork drainage 35.871066 -85.846877
Date:	14 March 2013
Time:	11:39-12:45
Collectors:	B.R. Kuhajda, J.D. Steventon, G.J. Knoethe, E.T. Robinson, K.F Alford, D.A.Neely, M.T. Hamilton, R.L. Richardson, V. Caldwell, S. Silvey

	Number per seine haul																				No. seine
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**	**S16**	**S17**	**S18**	**S19**	**S20**	**Total no.**	**hauls present**
Fundulus julisia																1					1	1
Lampetra aepyptera																					0	0
Campostoma oligolepis	1	1		1						19						4	9	4	5	12	56	9
Chrosomus erythrogaster		9	4	2					1	48						10	18	7	22	21	142	10
Clinostomus funduloides																					0	0
Hemitremia flammea	6	16				7	1		4	23	2	2	4	16	10	8	6	4	5	18	132	16
Luxilus chrysocephalus																					0	0
Lythrurus fasciolaris																					0	0
Notropis telescopus																					0	0
Pimephales notatus																					0	0
Pimephales promelas																					0	0
Rhinichthys obtusus																					0	0
Semotilus atromaculatus	1	1				3				3				1		1	3			8	21	8
Catostomus commersonii																					0	0
Erimyzon oblongus																					0	0
Ameriurus natalis																					0	0
Forbesichthys agassizii			1	4	2	1	1	1	1				3	16	2	5	3	2			42	13
Fundulus catenatus																					0	0
Gambusia affinis	2	3	1	2		4		4	4	4	3	1		109	16	16	1		1		171	15
Cottus carolinae																					0	0
Cottus sp. cf. *bairdi*																1	4				5	2
Lepomis auritus																					0	0
Lepomis cyanellus										2		1		1		3		1			8	5
Lepomis macrochirus			1						4	2							1		1		9	5
Lepomis megalotis																					0	0
Micropterus salmoides																					0	0
Etheostoma basilare																					0	0
Etheostoma crossopterum																					0	0
Etheostoma duryi																					0	0
Etheostoma forbesi																					0	0
Etheostoma luteovinctum																					0	0
Etheostoma sp. *spectabile*									1	1	1	1					4				8	5
Number of specimens	10	30	7	9	2	15	2	5	15	102	6	5	7	143	28	49	49	18	34	59	595	Total
Number of species	4	5	4	4	1	4	2	2	6	8	3	4	2	5	3	9	9	5	5	4	11	Total

Fundulus julisia (mm TL)	65 F

Site Name:	Greenbrook Pond & run - Caney Fork drainage 35.949510 -85.818216
Date:	14 March 2013
Time:	8:45-9:20
Collectors:	B.R. Kuhajda, G.J. Knoethe, K.F. Alford, J.D. Steventon, E.T. Robinson, M.T. Hamilton, R.L. Richardson, B.W. Bingham, D.A. Neely, S. Silvey, V. Caldwell

	Number per seine haul																					**No. seine**
Species	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**	**S16**	**S17**	**S18**	**S19**	**S20**	**S21**	**Total no.**	**hauls present**
Fundulus julisia						3	1	3	1	5	1			35	40	9	28				48	174	11
Lampetra aepyptera																						0	0
Campostoma oligolepis																						0	0
Chrosomus erythrogaster									1	13	1											15	3
Clinostomus funduloides																						0	0
Hemitremia flammea			1	1					1	24	1		1	5	5							39	8
Luxilus chrysocephalus																						0	0
Lythrurus fasciolaris																						0	0
Notropis telescopus																						0	0
Pimephales notatus																						0	0
Pimephales promelas																						0	0
Rhinichthys obtusus																						0	0
Semotilus atromaculatus																						0	0
Catostomus commersonii																						0	0
Erimyzon oblongus																						0	0
Ameriurus natalis																						0	0
Forbesichthys agassizii																						0	0
Fundulus catenatus																						0	0
Gambusia affinis																						0	0
Cottus carolinae																						0	0
Cottus sp. cf. *bairdi*																						0	0
Lepomis auritus																						0	0
Lepomis cyanellus																						0	0
Lepomis macrochirus																						0	0
Lepomis megalotis																						0	0
Micropterus salmoides																						0	0
Etheostoma basilare																						0	0
Etheostoma crossopterum																						0	0
Etheostoma duryi																						0	0
Etheostoma forbesi																						0	0
Etheostoma luteovinctum																						0	0
Etheostoma sp. *spectabile*																						0	0
Number of specimens	0	0	1	1	0	3	1	3	3	42	3	0	1	40	45	9	28	0	0	0	48	228	Total
Number of species	0	0	1	1	0	1	1	1	3	3	3	0	1	2	2	1	1	0	0	0	1	3	Total

Fundulus julisia (mm TL)	46	31	45	43	35	37	35	42	34	39	41	47	31	26	52	38	38	35	40	32	69
	38	36	31	55	27	49	48	49	55	31	32	46	56	48	52	40	34	52	37	61	51
Spring run	43	37	42	50	54	47	28	45	45	47	48	41	44	31	46	50	51	42	47	50	38
	39	46	46	38	27	43	43	43	53	50	49	51	27	38	50	38	47	49	50	46	51
	54	53	59	65	66	60	33	60	55	62	52	60	62	65	50	52	70	62	67	67	72
Pond	42	40	72	45	48	31	55	60	57	57	54	72	65	59	67	38	43	62	68	50	55
	65	72	58	68	59	48	65	65	55	54	80	64	58	62	65	58	52	55	59	69	62
	28	34	48	66	62	42	55	62	61	58	61	50	66	56	72	64	55	68	60	63	