Survey Report

Oklahoma Streams Management Program

Fish Management Survey and Recommendations

For

Spring Creek

2004 Performance Report

State: Oklahoma Grant No. F-44-19

Project Title: Oklahoma Stream Fisheries Management Program

Study Title: Surveys and Recommendations - Spring Creek

Period Covered: 1 January 2004 - 31 December 2004

SPRING CREEK

Abstract:

Spring Creek was sampled by fall electrofishing in 2004 to determine fish population trends. Survey results show smallmouth bass abundance was excellent while Largemouth abundance was moderate in 2004. All black bass populations exhibited good to excellent body conditions in 2004. No spotted bass were collected in 2004 however this is not unusual. Over the past four years spotted bass were only present in our samples in 2003. Sunfish collected in samples consisted of shadow bass (rock bass), bluegill, and longear sunfish, and warmouth in 2004. Shadow bass and longear sunfish abundance was excellent in 2004 while the numbers of other sunfish species were poor.

To date, no recommendations have been made for future regulations changes. However, electrofishing will continue on Spring Creek in 2005. We will also continue monitoring possible aquatic impacts associated with the introduction of rainbow trout in 2003.

Introduction:

Spring Creek is a clear-water, gravel-bottom stream that flows 64 kilometers through northeast Oklahoma. It's headwaters begin in southern Delaware County near Kansas, Oklahoma and flow through northern Cherokee County near Peggs, Oklahoma before entering Fort Gibson Reservoir in southeast Mayes County, Oklahoma. Agricultural uses and live stock grazing are the most common land use practices within the 302 sq. km. watershed with minimal timber harvest. Fish habitat consists primarily of root-wads, log-jams, under-cut banks, rock ledges, and boulders.

Ecological concerns: This diverse aquatic habitat in the stream supports several sport fisheries which include smallmouth bass, largemouth bass, spotted bass, shadow bass, bluegill sunfish, green sunfish, and longear sunfish. However, riparian disturbances caused by changing land use practices threaten to degrade the quality of habitat in this system by increasing the amount of stream bank erosion surroundings the impacted areas.

Increased streambank erosion degrades the in-stream habitat by increasing the streams sediment load and causing lateral migrations of the channel. When this happens the stream loses it's ability to transport the sediment load entering the stream and this causes the stream to become wider and more shallow. Once these morphological changes begin, the stream channel often becomes braided and quality habitat is lost.

ODWC personnel began to address these issues in 2002 by completing two streambank stabilization projects which used both hard and soft technologies. The first project Used a modified cedar tree revetment to stabilized a 350-ft stretch of bank. This method required the streambank be resloped to 1:2 grade to reduce the shear-stress at the toe of the bank. Once this was completed, an erosion control mat was installed over the exposed soil and anchored in place with wooden stakes. Large root-wads were then placed along the toe of the bank to reduce the shear-stress by deflecting the flow from the bank. Cedar trees were then anchored along the entire length of the bank to further slow the flow and catch sediment. The cedar trees extended from the water surface up to the bankfull elevation. Green ash, sycamore, and willow trees, and a variety of grasses were planted up the slope of the streambank to provide more stabilization.

The second project Used a series of five J-hook rock-vanes to stabilize a 500-ft stretch of streambank. These structures are designed to reduce the shear stress on the bank by shifting the

thalwag from the toe of the bank to the center of the stream channel. Each rock-vane was constructed using 32-36-in diameter rock. All rock-vanes were installed pointing upstream at a 20-30 degree angle from the streambank and extend to 2/3 of the bankfull width. Each vane has a slope of between two and seven percent from the top of the streambank to the end of the vanes. Both techniques provide excellent habitat for many species of fish including black bass and sunfish and can be used to show landowners two effective methods for reducing streambank erosion on their property.

A third project was recently completed by a private contractor using funds provided by a local landowner to restore a large section of stream. They used a series of J-hook rock-vanes coupled with a knowledge of natural channel design to accomplish their goals.

Social issues: Private anglers and angling groups have sought approval to introduce rainbow trout into Spring Creek for several years. Much concern from state conservation agencies, non-governmental organizations and private citizens about this issue was apparent including: 1) the potential of introduced trout to harm the biotic environment of these systems; 2) the possibility of rainbow trout to move from introduction (stocking) sites; and 3) the potential of rainbow trout to naturalize in these sensitive systems. In 1998, the ODWC began to address these concern after initiation of the Oklahoma Streams Management Program. During 1998 a moratorium was placed on all public trout stocking activities in NE OK until more information could be obtained to address the biological impacts of the trout introductions on the native fish communities. The Oklahoma Cooperative Fish and Wildlife Unit at Oklahoma State University completed a study entitled "Evaluation of trout stocking in northeastern Oklahoma streams" in the summer of 2003 that addressed these concerns. The study results indicated trout were unlikely to survive in Spring Creek due to elevated water temperatures during the summer months and it was unlikely that trout would affect the overall fish community structure of the system. Based on this information the ODWC granted an angling club a limited and localized one-year permit to stock trout in Spring Creek in 2004.

The decision to allow private anglers a permit to stock trout in Spring Creek was based on the best scientific information available at the time. However, there are still unresolved biological concerns regarding interactions between trout and the biotic environment. In August and September of 2004, ODWC personnel began assessing the impacts of trout by monitoring

water temperatures and using electrofishing gear and scuba diving techniques to determine if trout would be able to survive through the summer and to determine if the trout would feed on natural prey items. In October of 2004, the ODWC conducted our annual electrofishing surveys to assess the relative abundance, population size structure and condition of sportfish present in this system.

Methods:

Sportfish population assessments: These Electrofishing surveys were conducted from a boat using a pulsed direct current Smith-Root 2.5 GPP) and a boom-mounted anode array. Sport fish (Micropterus spp., Lepomis spp., rock bass Ambloplites rupestris and warmouth Chaenobryttus gulosus) were captured during multiple five-minute electrofishing runs to maximize the sample size. Electrofishing occured in all mesohabitat types available at each sampling site. Species name, lengths (mm) and weights (gm) were recorded for all sport fish as well as pedal time (seconds) from each sample site. All fish were released back into the stream below a natural barrier after processing.

In October of 2004 seven of eight possible sampling sites (Table 1.) were surveyed to determine the relative abundance and condition of the black bass populations and the relative abundance of the sunfish populations present in this system. Population assessments were made for individual species within the stream when sample sizes were sufficient. Total and specific length group relative abundances were calculated for individual electrofishing runs by dividing catch by pedal time. Mean relative abundances were determined by averaging results from individual electrofishing runs. Sport fish collected from all electrofishing runs were pooled by stream to calculate condition within specific length groups.

Rainbow trout assessment: To determine if the rainbow trout would survive through the summer months the ODWC placed five Tid-bit temperature loggers along the stream (Table 1) on July 31, 2004. Each temperature logger began recording hourly temperature readings at 12:00 PM and continued to record data until they were retrieved on October 1, 2004. The information collected during this time allowed us to determine if water temperatures remained low enough for the trout to survive through the summer months in 2004.

However, the data obtained by the temperature loggers only provide information for this year and they do not allow us to predict if trout will survive in following years if environmental

conditions are significantly different. We began to address this issue by obtaining historical hourly climatic data for variables that could affect water temperatures. Our data set contained information from January 1, 1994 through August 31, 2004 and was provided by the Oklahoma Climatological Survey's mesonet station which is located in Tahlequah, OK.

To determine if environmental conditions were significantly different in 2004 compared to the past ten years we compared the mean monthly air temperature, the mean soil temperature 30-cm below the surface, the amount of solar radiation, and the mean numbers of cooling degree days for each month in 2004 to the means from 1994-2003 using SYSTAT version 11 statistical software. The data sets for each variable were tested for normality using the Shapiro-Wilk test of normality and for equal variances. T-tests were used to compare data sets that were normally distributed and had equal variances while the Wilcoxon-Mann-Whitney test was used on data sets that did not meet the assumption of the T-tests.

We also electrofished two pools in August to locate trout that had survived late into the summer, to determine the relative abundance and condition of the trout populations and to determine if they were feeding on natural prey items. These Electrofishing surveys were conducted from a boat using a pulsed direct current Smith-Root 2.5 GPP) and a boom-mounted anode array. Electrofishing occured in all mesohabitat types available at each sampling site. Species name, lengths (mm) and weights (gm) were recorded for all trout as well as pedal time (seconds) from each sample site. Data collected from both sites were pooled together for analysis.

During these surveys we collected stomach samples from all trout that were collected. The stomach contents were then identified in the lab and prey items were categorized as fish, snails, crayfish, invertebrates, unidentifiable items and non-food items. These samples were then pooled by category and the volume of material present was measured by displacing a predetermined amount of water in a graduated cylinder. The total volume of all stomach contents were then divided into the amount for each category to determine the percent of prey items in the trouts diet.

Results - Sportfish population assessments:

Smallmouth Bass

1. Smallmouth bass abundance from 2004 electrofishing was 84 fish/hr which is the highest

catch rate recorded since sampling began in 2001 (Table 2). This indicates that a quality fishery exists in this system. However, low streams flows and sediment aggredation at some sampling sites during our sampling period may have concentrated fish and slightly inflated our estimated.

2. In 2004, body condition values (W_r) for smallmouth bass greater than 180-mm were excellent and those below 180-mm were good (Table 2).
3. Abundance and body condition of smallmouth bass were excellent in 2004 indicating a quality smallmouth bass fishery exists and .

Largemouth and Spotted Bass

1. Largemouth bass abundance from 2004 electrofishing was 19 fish/hr which is similar to estimates from the previous three years (Table 3). Spotted bass were not present in our samples from 2004 (Table 4) however, we have only collected spotted bass in one year of the four sample years.
2. Largemouth bass body condition values (W_r) were excellent for all size groups in 2004 (Table 3).
3. These data indicate that a moderate but stable population of largemouth bass exist in Spring Creek and they are in excellent condition. However, spotted bass populations may be limited.

Bluegill Sunfish

1. In 2004, the abundance of bluegill in all size groups was poor with only two bluegill present in our samples (Table 5). This is substantially lower than estimates from 2003 but similar to estimates in 2001 and 2002.
2. Body condition values (W_r) were excellent for all size groups collected in 2004 (Table 5).
3. These data suggest that a small and highly variable population exists in this system

Redear Sunfish

1. Redear sunfish were not collected in 2004 fall electrofishing (Table 6). However, this is not unusual. From 2001-2004 we only found four redear sunfish and all were collected in 2003.
2. Populations of redear sunfish are very small and may be confined to localized areas

Longear Sunfish

1. Longear sunfish abundances from 2004 was 19.39 fish/hr which is similar to estimates from 2003 and slightly higher than estimates from 2001 and 2002 (Table 7).
2. Body condition values (W_r) were not determined (Table 7).
3. Longear sunfish populations appear to be gradually increasing however, most fish are below 150-mm.

Green Sunfish

1. Total green sunfish abundances from 2004 fall electrofishing was 7.39 fish/hr which is similar to estimates from 2001-2003 (Table 8).
2. Body condition values (W_r) were not determined (Table 8).
3. Spring Creek supports a moderate but stabil population of green sunfish.

Warmouth Sunfish

1. Warmouth sunfish abundances from 2004 electrofishing was 1.85 fish/hr which is similar to 2003 abundances however, none were seen in 2001 and 2002 samples (Table 9).
2. Body condition values (W_r) were not determined (Table 9).
3. Warmouth sunfish populations are small and may be limited to localized areas of the stream.

Shadow Bass (Rock Bass)

1. Total shadow bass abundances from 2004 electrofishing were 57.23 fish/hr. These estimates are substantially higher than those of previous years (Table 10) and a large portion of the population are greater than 150-mm in length.
2. Body condition values (W_r) were not determined (Table 10).
3. Shadow bass populations are in excellent condition with high abundances and an excellent population structure.

Results - Monitoring of Trout Introductions:

Water temperature monitoring: Temperature logger data collected from all five sites indicated that water temperatures did not exceed lethal limits for trout in August or September. Figure 1 shows a plot of hourly temperature readings from the site where trout were stocked in 2004.

Environmental conditions:

1. Data collected from the Oklahoma Climatological Survey's indicated that the mean air temperatures were significantly lower in June ($P=0.034$), July ($P<0.001$), and August

(P<.001)of 2004 when compared to the 10 year historical averages for each month (Figure 2). Similarly, the average number of cooling degree days were significantly higher in July (P<0.001)and August (P<.001)when compared to the average for the past 10 years (Figure 3). The same was true for the mean soil temperature 30-cm below the surface and P-values were less than 0.001 for both July and August (Figure 4). The amount of solar radiation was significantly lower in June (P<0.001) and July (P<.001) but similar in August of 2004 (Figure 5). Precipitation amounts in July of 2004 were almost three times higher than the average for the past ten years however, amounts from other summer months were similar to the historical averages (Figure 6).

2. This data suggests that environmental factors during July and August may have played a role in maintaining water temperatures which were below lethal limits for rainbow trout in 2004. However, additional data is needed to determine the exact effects this may have had on stream water temperatures.

Electrofishing Assessment: We collected 14 rainbow trout during our August electrofishing surveys which equated to a catch rate of 17 fish/hr. The average length of the trout captured was 392-mm and the mean weight was 707-g. On average, these fish were in excellent condition with a mean Wr. Of 104 (Table 11).

Diet Analysis: In August of 2004, the ODWC collected stomach samples from 14 trout and found that 13 of the fish had prey items in their stomachs. Fish were the dominant prey items found and accounted for 67% (by volume) of the overall prey items. Other prey items found consisted of snails(13%), crayfish (4%), invertebrates (3%), unidentifiable items (3%) and non-food items (9%) (Figure 7).

Scuba diving assessment: In September ODWC staff searched seven pools and found five trout. All trout were located in one pool that was located near the original stocking site. This information coupled with our water temperature monitoring data indicate that summer water temperatures did not reach lethal limits for trout in 2004.

Recommendations:

Fishing Regulations: Maintain the current regulations on all black bass and sunfish.

Habitat: Identify a reference reach and conduct a level II geomorphic assessment so that data can be applied to other stream reaches in need of habitat improvements.

Ecological Concerns: Monitor the effects of trout introductions by placing temperature loggers in spring fed pools, annually assessing sportfish populations, coordinating with other state agecies to assess fish community and macroinvertebrate populations and complete a water quality model to determine if summer water temperatures will continue to be low enough to support rainbow trout.

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Table 1. Legal descriptions of possible sampling sites used on Spring Creek from 2001 through 2004.

SITE	DESCRIPTION
M & M A	Spring Creek: Cherokee Co., OK; T19N, R21E, NW 1/4 Section 36.
Cave Spring [A]	Spring Creek: Cherokee Co., OK; T19N, R21E, NW 1/4 Section 29 and SW 1/4 Section 20.
Treskwood	Spring Creek: Cherokee Co., OK; T19N, R21E, NE 1/4 Section 34.
Brookhill Farm [ABC*]	Spring Creek: Mayes Co., OK; T19N, R20E, NE 1/4 Section 12.
Galloway [ABC]	Spring Creek: Mayes Co., OK; T19N, R20E, NE 1/4 Section 9.
Cedar Crest	Spring Creek: Mayes Co., OK; T19N, R19E, NW 1/4 Section 24.
Rowland Ranch [ABC*]	Spring Creek: Mayes Co., OK; T20N, R20E, SE 1/4 Section 34.
Swimming Hole [B]	Spring Creek: Mayes Co., OK; T19N, R20E, NW 1/4 Section 17.
Mitch Fram B	Spring Creek: Cherokee Co., OK; T19N, R22E, SE 1/4 Section 15.
Chris Robb [B]	Spring Creek: Mayes Co., OK; T19N, R21E, NE 1/4 Section 34.

[A] Indicates 2004 electrofishing sites.

[B] Indicates 2004 temperature logger sites.

[C] Indicates 2004 scuba diving sites.

[D] Indicates sites where multiple scuba diving surveys were collected

* Indicates sites with two possible electrofishing pools.

Table 2. Total number (No.), catch rates (C/f), and relative weights (W_r) by size groups of smallmouth bass collected by fall electrofishing from Spring Creek. Acceptable W_r values are ≥90.

	Total		<180mm		180-279mm		280-349mm		≥305mm	
Year	No.	C/f	C/f	W_r	C/f	W_r	C/f	W_r	C/f	W_r
2001	64	42.5	15.5	96	21.25	101	7.75	118	5.25	119
2002	79	74.77	18.46	95	36.0	103	36.0	110	11.08	112
2003	73	33.7	8.77	93	18.46	101	5.54	110	4.15	108
2004	91	84.0	17.5	96	43.39	96	21.23	109	12.9	112

Table 3. Total number (No.), catch rates (C/f), and relative weights (W_r) by size groups of largemouth bass collected by fall electrofishing from Spring Creek. Acceptable W_r values are ≥ 90.

	Total		<200mm		200-299mm		300-379mm		380-509mm	
Year	No.	C/f	C/f	W_r	C/f	W_r	C/f	W_r	C/f	W_r
2001	4	2.5	.075	96	1.25	101	-	-	0.5	119
2002	20	19.39	7.38	110	4.61	102	6.46	100	0.92	99
2003	24	11.08	6.0	96	1.39	94	1.85	99	1.39	97
2004	21	19.39	11.8	97	6.46	102	2.77	100	-	-

Table 4. Total number (No.), catch rates (C/f), and relative weights (W_r) by size groups of spotted bass collected by fall electrofishing from Spring Creek. Acceptable W_r values are ≥90.

	Total		<180mm		180-279mm		280-349mm		≥305mm	
Year	No.	C/f	C/f	W_r	C/f	W_r	C/f	W_r	C/f	W_r
2001	-	-	-	-	-	-	-	-	-	-
2002	-	-	-	-	-	-	-	-	-	-
2003	11	5.08	4.15	87	0.46	85	0.46	99	-	-
2004	-	-	-	-	-	-	-	-	-	-

Table 5. Total number (No.), catch rates (C/f), and relative weights (W_r) by size groups of bluegill collected by fall electrofishing from Spring Creek. Acceptable W_r values are ≥90.

	Total		<75 mm		75-149 mm		≥150 mm	
Year	No.	C/f	C/f	W_r	C/f	W_r	C/f	W_r
2001	-	-	-	-	-	-	-	-
2002	2	1.85	-	-	1.85	94	-	-
2003	43	22.15	-	-	18.92	89	3.23	82
2004	2	1.84	-	-	0.92	105	0.92	95

Table 6. Total number (No.), catch rates (C/f), and relative weights (W_r) by size groups of redear collected by fall electrofishing from Spring Creek. Acceptable W_r values are ≥90.

	Total		<150 mm		≥150 mm	
Year	No.	C/f	C/f	W_r	C/f	W_r
2001	-	-	-	-	-	-
2002	-	-	-	-	-	-
2003	4	1.85	1.39	81	0.46	84
2004	-	-	-	-	-	-

Table 7. Total number (No.), catch rates (C/f), and relative weights (W_r) by size groups of longear collected by fall electrofishing from Spring Creek. Acceptable W_r values are ≥ 90.

	Total		<150 mm		>150 mm	
Year	No.	C/f	C/f	W_r	C/f	W_r
2001	8	5.25	5.25	-	-	-
2002	8	8.31	7.39	-	0.92	-
2003	32	14.77	14.77	-	7.0	-
2004	21	19.39	18.46	-	0.92	-

Table 8. Total number (No.), catch rates (C/f), and relative weights (W_r) by size groups of green sunfish collected by fall electrofishing from Spring Creek. Acceptable W_r values are ≥ 90.

	Total		<150 mm		>150 mm	
Year	No.	C/f	C/f	W_r	C/f	W_r
2001	19	10.5	3.5	-	7.0	-
2002	13	12.0	3.69	-	10.15	-
2003	16	7.38	1.85	-	7.85	-
2004	8	7.39	2.77	-	4.62	-

Table 9. Total number (No.), catch rates (C/f), and relative weights (W_r) by size groups of warmouth collected by fall electrofishing from Spring Creek. Acceptable W_r values are ≥ 90.

	Total		<150 mm		>150 mm	
Year	No.	C/f	C/f	W_r	C/f	W_r
2001	-	-	-	-	-	-
2002	-	-	-	-	-	-
2003	10	4.62	4.15	-	0.46	-
2004	2	1.85	1.85	-	-	-

Table 10. Total number (No.), catch rates (C/f), and relative weights (W_r) by size groups of shadow bass collected by fall electrofishing from Spring Creek. Acceptable W_r values are ≥90.

	Total		<150 mm		>150 mm	
Year	No.	C/f	C/f	W_r	C/f	W_r
2001	45	33.0	11.75	-	22.0	-
2002	32	31.39	7.38	-	24.92	-
2003	42	19.85	9.69	-	10.15	-
2004	62	57.23	27.7	-	29.54	-

Table 11. Rainbow trout population statistics from data collected in 2004.

N	14
Catch rate	17 fish/hr
Average length	N (sample size)
Average weight	1.6 pounds
Average Wr.	104
Maximum length	16.9
Minimum length	13.2

Figure 1. Hourly water temperature data from till at trout stocking site.

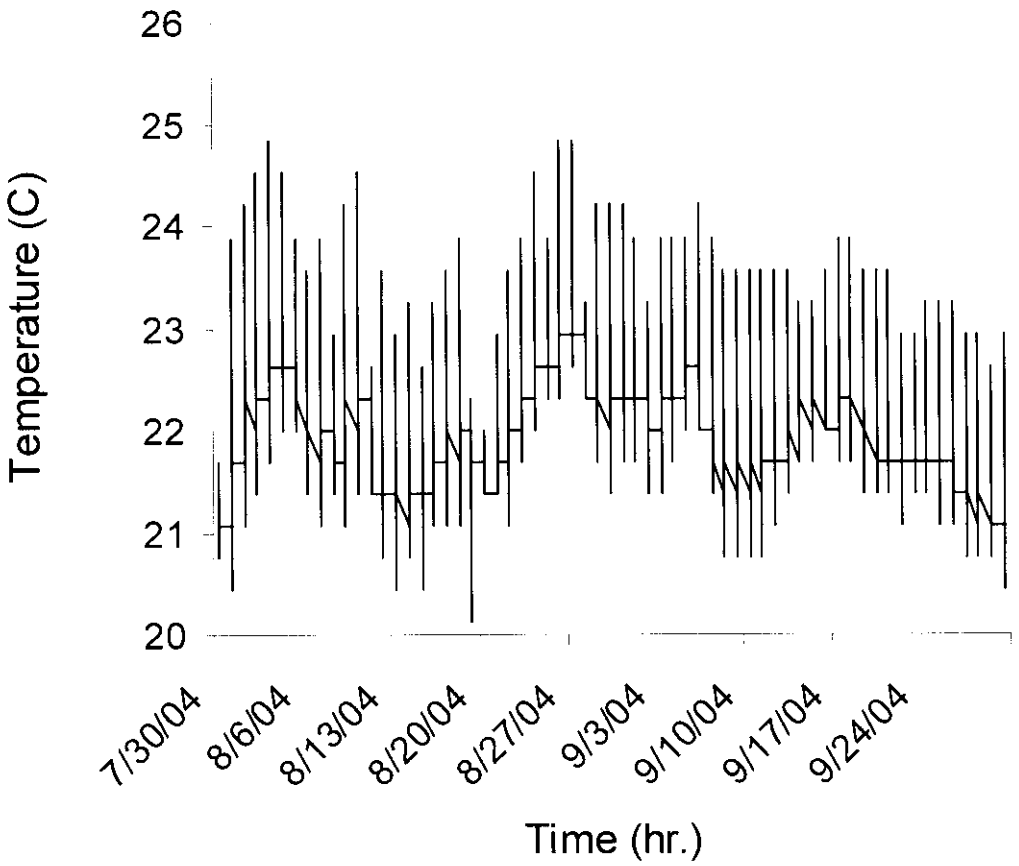
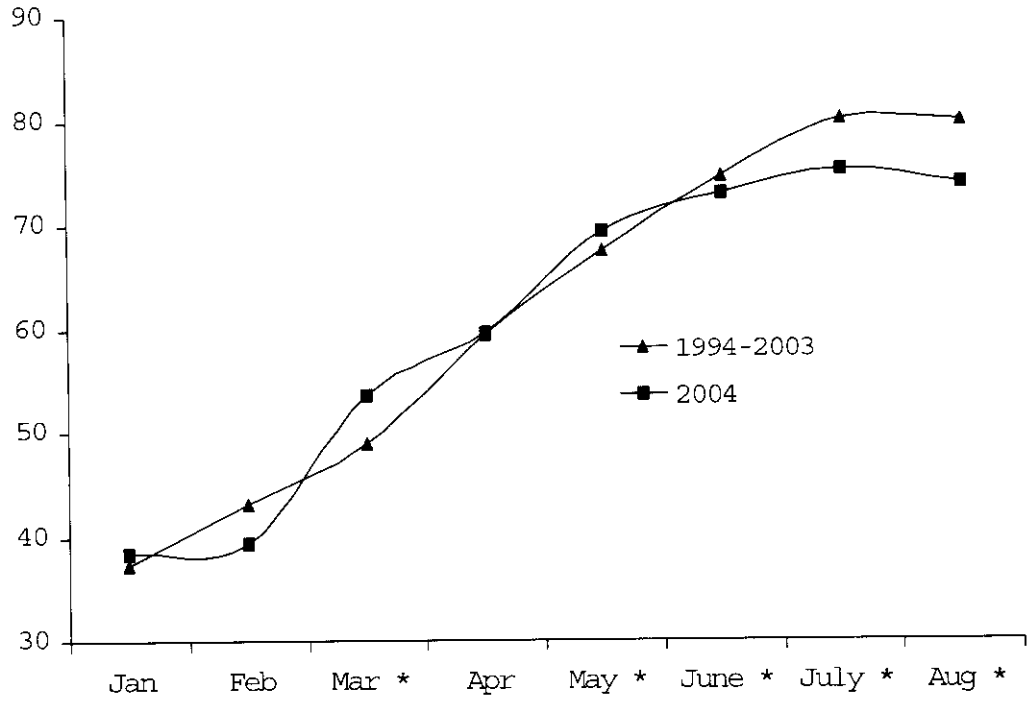
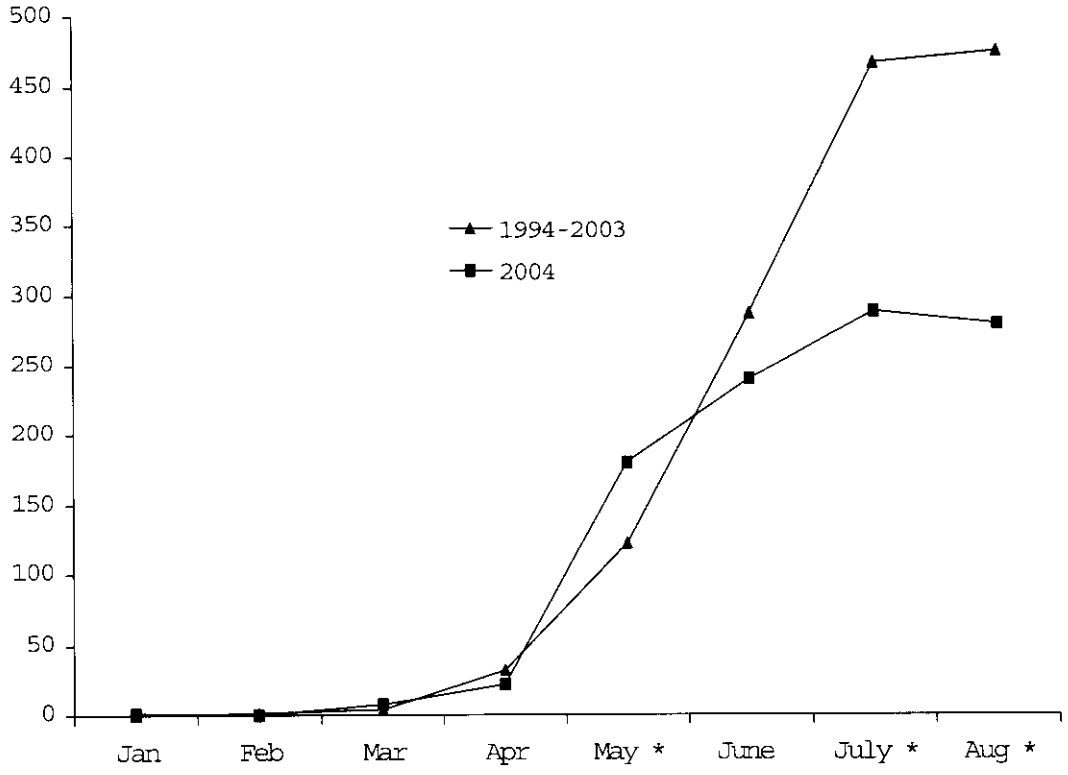


Figure 2. Average monthly air temperatures from 1994 through 2003 compared to 2004.



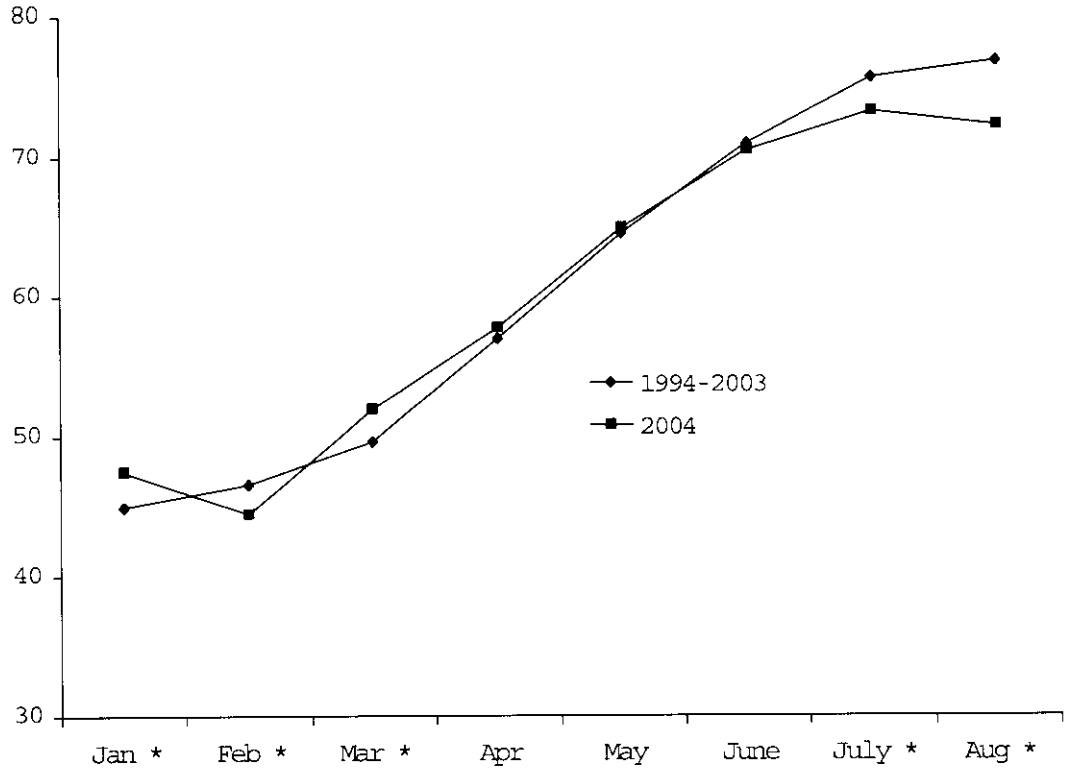
* is used to indicate significant differences between months($\underline{P} < 0.05$)

Figure 3. Average monthly cooling degree days from 1994 through 2003 compared to 2004.



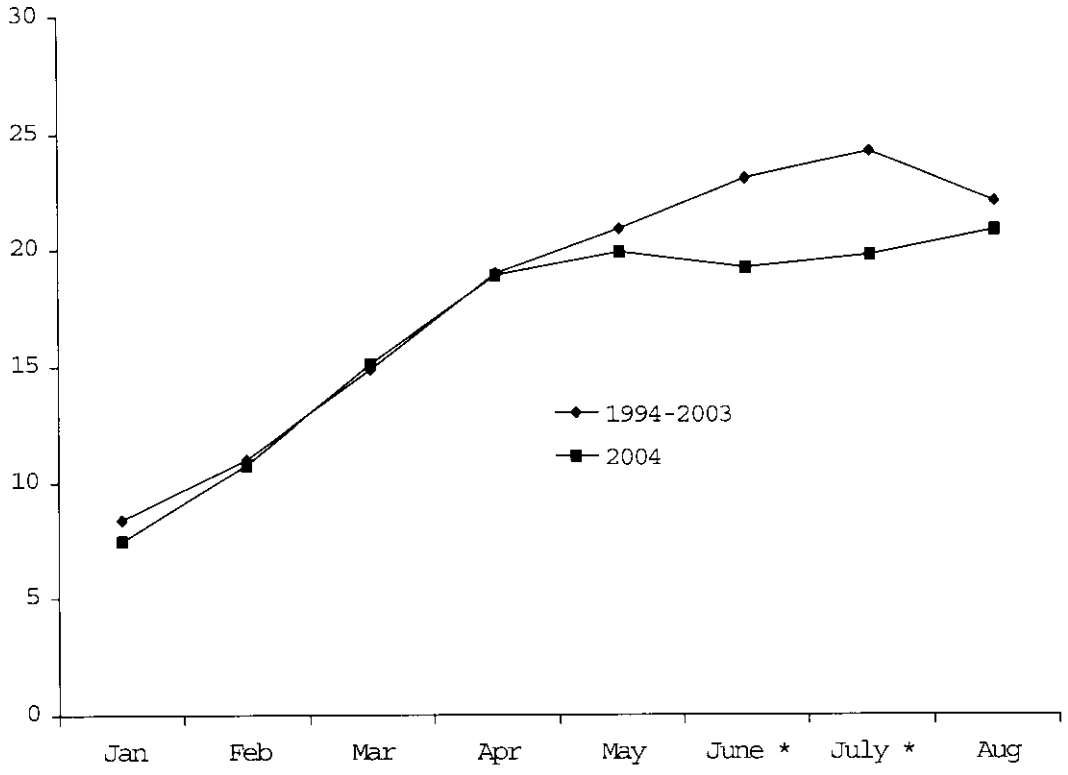
* indicates significant differences between months($\underline{P} < 0.05$)

Figure 4. Average monthly soil temperatures from 1994 through 2003 compared to 2004 at 30-cm below ground surface.



* indicates significant differences between months($\underline{P} < 0.05$)

Figure 5. Average monthly total solar radiation values from 1994 through 2003 compared to 2004.



* indicates significant differences between months($\underline{P} < 0.05$)

Figure 6. Average monthly precipitation from 1994 through 2003 compared to 2004.

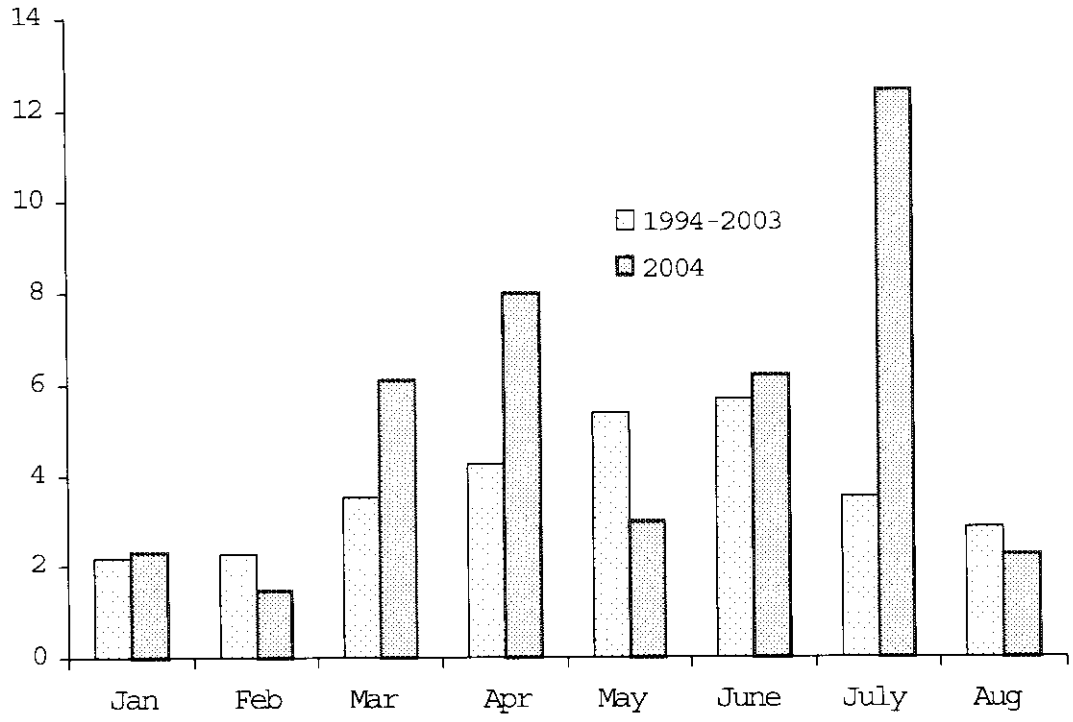
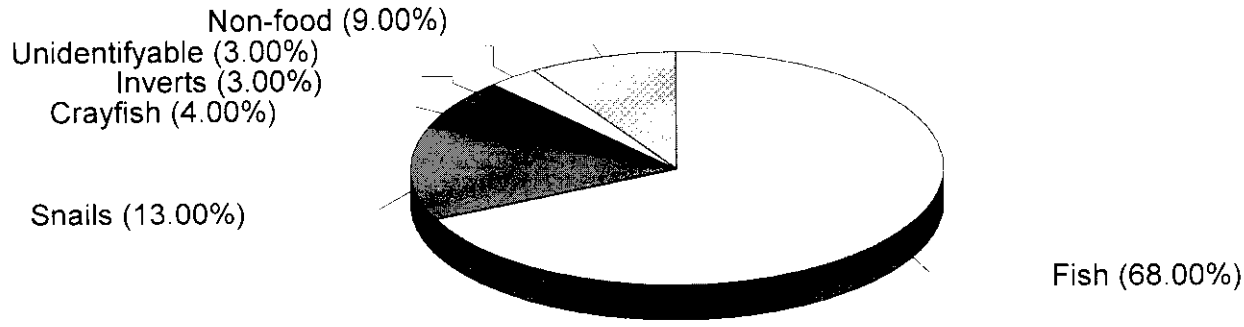


Figure 7. Percent of prey items found in trout stomach samples in 2004.



Oklahoma Stream Fact Sheet

Stream Name: Spring Creek **Year of Last Survey:** 2004 **Stream Length:** 64 km

Watershed Area: 302 sq. km **Location:** Kansas, Ok. SW to Fort Gibson Lake

Counties: Delaware, Cherokee, and Mayes **Phone:** (918) 683-1031 For Information

Primary Uses: Privately Owned: Livestock Grazing, Agricultural Uses.

Public Uses: Two access areas, both for user fees.

Notable Characteristics of Stream or Fishery: Very clear water and abundant habitat.

Special Regulations: Statewide Regulations.

Habitat Types and Improvements: Root-wads, log jams, boulders, rock ledges, under-cut banks, and aquatic vegetation. Two streambank stabilization projects were completed by ODWC in 2002 and one by private contractor in 2001. All three projects provide abundant fish habitat.

Management Strategy: Continue surveying in 2005.

Other Comments: In 2003, a local angling club was granted localized one year permit to stock rainbow trout and our data indicates some of the trout survived the summer months of 2004 and had begun to each natural prey items. ODWC will continue to monitor possible aquatic impacts associated with these introductions.

Status of Fishery for 2004: Spring Creek anglers will find the black bass populations at Spring Creek are in excellent condition. Electrofishing data indicates the abundance of smallmouth bass was higher in 2004 than in 2001-2003 and the body condition of fish greater than 180-mm were excellent. From 2001-2004, the relative abundance of smallmouth bass was consistently higher than other streams sampled in northeast Oklahoma. Largemouth bass numbers were moderate in 2004 and all size ranges of fish were in excellent condition. The largemouth bass populations were consistent with other regional streams sampled from 2001-2003

Sunfish are abundant in Spring Creek and anglers have the opportunity to catch six different species including shadow bass, green sunfish, longear sunfish, bluegill sunfish, warmouth and redear sunfish. Our survey indicate that shadow bass were the most abundant sunfish species and a large portion of the population is greater than 6-in. in length. Their relative abundances were

consistently higher than other regional streams sampled from 2001-2003. The abundance of bluegill, green sunfish, redear sunfish and warmouth were similar to other northeast Oklahoma streams in 2001-2003 however the relative abundance of longear sunfish was generally lower than other streams sampled. Large portions of the sunfish collected were greater than 6-in long except for longear sunfish which rarely grow much larger than 6-in.