State of Arkansas
Department of Pollution Control and Ecology

Biotic and Abiotic Comparison of a Channelized and Unchannelized Stream in the Delta Area of Arkansas

January 1985

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INTRODUCTION

The Water Division of the Arkansas Department of Pollution Control and Ecology initiated a program in early 1983 to develop site-specific water quality standards for selected waters of the state to protect their existing uses. With a grant from the U.S. Environmental Protection Agency, 205(j), the project was designed to reclassify the streams of the state according to their existing physical, chemical and biological characteristics. The least disturbed streams within each physiographic region were established as reference streams and are being intensively sampled to establish baseline data.

Considerable difficulity was encountered in locating least-disturbed reference streams in the highly agriculturalized delta area of eastern Arkansas. However, the opportunity existed to compare one of the reference streams in the delta with a similar size and closely related stream of that area which has been channelized for agriculture drainage. Second Creek in St. Francis County and tributary to the L'Anguille River was selected as one of the least-disturbed reference streams. For comparison the channelized Brushy Creek in Cross and Poinsett Counties was selected. It is also a tributary to the L'Anguille River (Fig. 1). An added point of interest to this comparative project is the

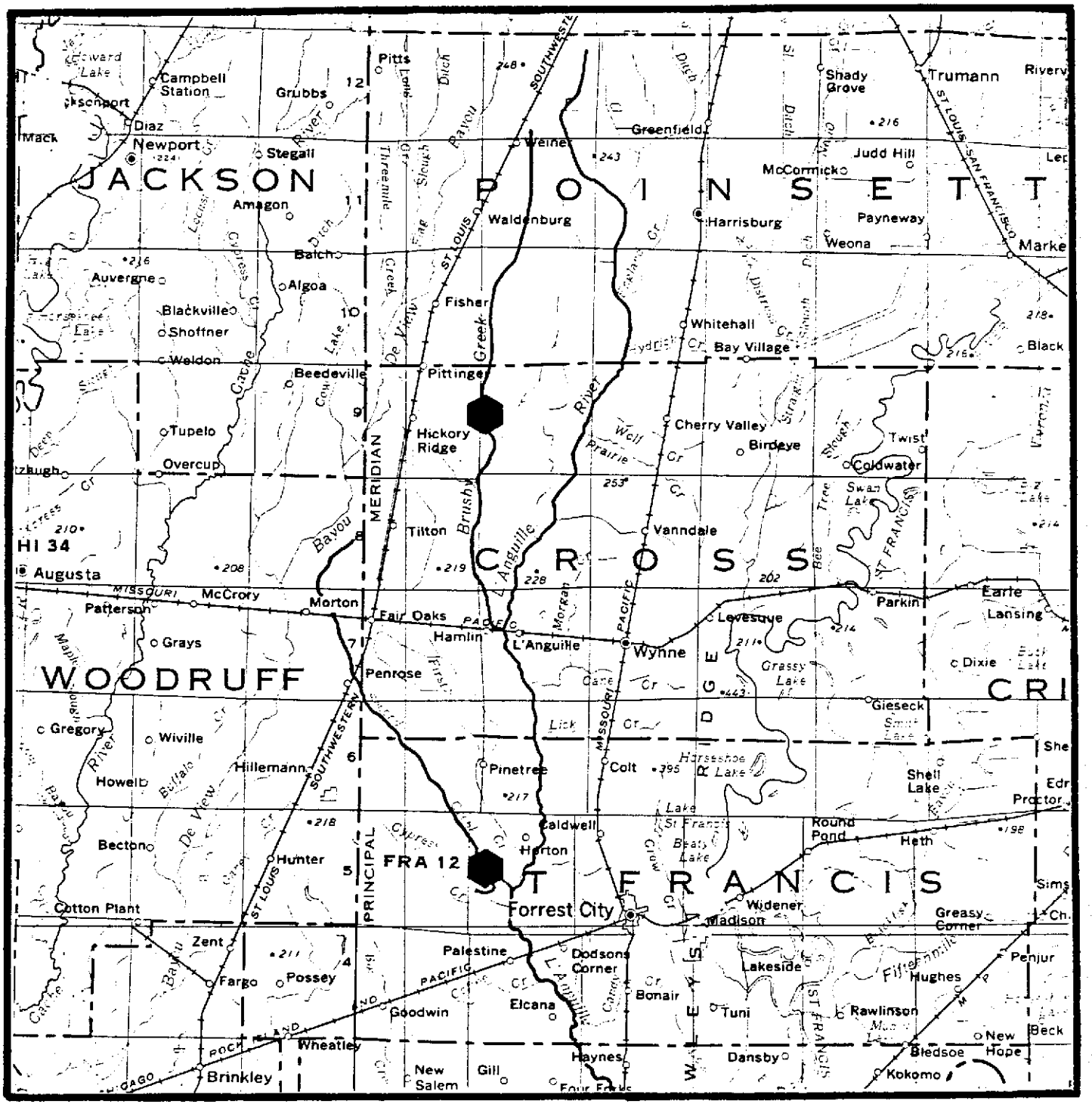


Figure 1. : Brushy Creek and Second Creek Area Map and Sample Sites

Sample Sites

possibility that a channelization project of the L'Anguille River may be initiated. At least one of the proposed alternatives would channelize the lower section of Second Creek.

Description of Study Area

Brushy Creek originates in Poinsett County near Weiner, Arkansas, flows southward through the highly agriculturalized sections of Poinsett and Cross Counties and enters the L'Anguille River west of Wynne, Arkansas. Watershed land uses are 95.8% agriculture and 4.2% forestland (ASWCC 1979). Most of the forestland is located below the sample site and near the confluence with L'Anguille River. Channel modification of the upper 90% of Brushy Creek was completed prior to 1974 and was probably accomplished on a segment by segment basis by local interest. Channel maintenance and clean-out is a local landowner responsibility and appears to be very active. The sample site was at Highway 42 bridge approximately 3 1/2 miles east of Hickory Ridge, Arkansas (Fig.1).

Second Creek begins near the Woodruff-Cross County line and meanders southwesterly then southeasterly across the western part of St. Francis County entering the L'Anguille River about 5 miles northwest of Forrest City, Arkansas. Land uses in the watershed are 64.5% agriculture and 35.5% forest,most of which is bottomland type forest. This stream was sampled at county road crossing

between Palestine and Horton in Section 17, Township 5 N, Range 2 E.

Materials and Methods

Standard sampling procedures have been established for each reference stream investigation. The investigation program requires sampling over a one week period (Monday through Friday) for each stream site. Two streams in close proximity were sampled concurrently. The established standard methodology was used to sample both Brushy Creek and Second Creek during the week of July 30 through August 3, 1984.

Physical characteristics of the stream site to be sampled were determined by establishing a stream reach which includes a length of the stream that was 15 times the stream width where stream flow measurements were taken. Stream flow measurements were made on a transect of the stream which was not widened by a pool or narrowed by a riffle. Ten transects were evenly spaced within the stream reach and taped measurements made along each transect for stream channel width, stream width, substrate type, instream cover and riparian cover. Stream depth and flow velocity were measured at 2-foot intervals across this transect. Velocity was measured with a Marsh-McBirney, Model 201, portable water current meter. Mean stream flow velocity was measured using tracer dye over a

representative reach of stream to determine time of travel.

Water quality was determined from the average of three grab samples. Samples were iced and returned to ADPC&E water lab for analysis. Analytical procedures followed were as described in Standard Methods, 14th Edition. Parameters measured include: pH, turbidity, total suspended solids, total dissolved solids, BOD_5, BOD_{20}, total phosphorus, PO_4-phosphorus, NO_2 + NO_3-nitrogen, NH_3-nitrogen, chlorides, sulfates, total iron, conductivity, alkalinity, total hardness, fecal coliform and total manganese.

Two continuous recording dissolved oxygen and temperature meters (YSI Model 56) were installed at each site on the first day of the sample period and were operated continuously until the end of the period. Meters were calibrated daily using the Winkler Azide method.

Benthic macroinvertebrates were collected using a Turtox Indestructible dip net and sampling all available microhabitats over a 30 minute time period. During sampling all collected material (stream debris and macroinvertebrates) were placed into a plastic container. After the 30 minute collecting period, the macroinvertebrates were sorted from stream debris at streamside using a #30 U.S. standard mesh sieve and fine pointed forceps and preserved in 70% ETOH. The samples were then transported to the lab where they were sorted, identified and enumerated. These

collections were taken in a qualitative manner and were analyzed to indicate relative abundance and community structure.

The Jaccard Coefficent (Jaccard, 1912), Dice Index (Czekanowski, 1913) and Ochiai Index (EPA, 1983), three qualitative similarity indices, were calculated to determine the similarity of benthic samples from Second and Brushy Creeks. These three indices are the most attractive qualitative similarity measures according to Boesch (1977) and have been widely used by stream pollution investigators (Carnis and Kaesler, 1969; Johnson and Brinkhurst, 1971; Kaesler and Cairns, 1972; and Foerster, 1974).

In addition, several indices which have been developed to evaluate benthic communities as indicators of water quality were calculated for both collections. These included Shannon-Weiner diversity index (Wihlm and Dorris, 1968); index of eveness, variety, and equitability (Weber, 1973); Biotic Conditions Index (Winget and Mangum, 1979); Chandler Biotic Score (Cook, 1976), and Biotic Index (Hilsenhoff, 1982).

Fish population sampling was accomplished by treating one-third to one-half acre of the stream with approximately 2 ppm powdered rotenone containing 7% active ingredient. Block nets were used at the lower end of the sample area to block movements of fish out of the sample area and to collect dead and dying fish drifting downstream. Rotenone was detoxified with potassium permanganate

immediately below the sample area. Fishes were dipped from the water by workers with hand held dip nets. All small fish were preserved in 10% formalin for laboratory indentification and large fishes were identified, counted and weighed in the field. Each species of fish was given a relative abundance value based on observations and subjective judgement of experienced fishery workers in the collecting crew and based on final enumeration of preserved specimens. Relative abundance values were assigned according to the following criteria.

4 - Abundant- species or age group collected easily in a variety of habitats where species expected; numerous individuals seen with consideration of sample gear limitations and expected abundance of such species; a dominant species of the species group.

3.5 - Common to Abundant

3 - Common - Species or age group collected in most areas where such species would exist; individuals frequently seen and apparently well established in population; one of the more frequent species of the species group.

2.5 - Present to Common

2 - Present - Species or age group collected with frequency to

indicate the likely presence of an established population but definitely a subordinate species in species group.

1.5 - Rare to Present

1 - Rare - Species or age group represented by only one or very few individuals in the population; more than likely a remnant, migrant or displaced species.

Values were also given for each age group for each species. Age groups included adult, intermediate and young; therefore the maximum relative abundance value for a species would be 12 with a minimum value of one. The Shannon-Wiener dominance diversity index and other comparative parameters such as percent primary feeders, secondary feeders, top carnivores, Percidae, etc. are calculated using relative abundance values instead of numbers of individuals.

It is felt that the relative abundance values more adequately reflect the abundance of a species than do actual numbers of individuals collected. In typical populations some fish species exist in very large numbers whereas other fishes, particularly predator species, exist in comparatively low numbers though they may be saturating their existing ecological niche.

RESULTS AND DISCUSSION

Brushy Creek and Second Creek offer an excellent opportunity to compare the physical, chemical and biological characteristics of two physiographically similar streams. One has been relatively undisturbed for a delta area stream and the other has had severe channel realignment and straightening, removal of riparian vegetation and cultivation to the edge of the stream channel.

Physical Characteristics

Brushy Creek drains 63 square miles above the sample site. Stream gradient was 1.85 ft/mi., channel width was 48.2 feet with a stream width on the sample date of 27 feet. Average depth was approximately 2 feet with a flow velocity of 0.5 feet/sec. and a calculated flow of 7.5 CFS. The flow noticably varied each day in response to drainage of irrigation water. The stream substrate was 90% mud and silt; some gravel and large rocks were present, but most likely were from road and bridge construction materials. Instream cover existed in only 2% of the area and was composed of brush, logs and debris which had collected beneath the highway bridge. There was no stream canopy and the riparian ground cover was predominantly grasses and bare ground, but the banks appeared to be moderately stable.

Sixty square miles of watershed exist above the sample site on

Second Creek. Stream gradient was 0.75 ft/mi. Channel width at the sample site was 62.5 feet and mean stream width was 42.2 feet. Estimated mean water depth was 2.5 feet with a stream velocity of 0.28 ft/sec. and a calculated flow volume of 7.5 CFS. Instream substrate types were predominantly mud and silt. Cover was measured as 0.4% undercut banks; 35% brush, logs and debris; 6.4% overhanging vegetation and 0.9% innundated vegetation. The sample reach was 70% moderate pools and 30% shallow pools. Stream canopy was 55% and was predominantly bottomland hardwood such as water oak, ash, sweetgum and some wetland type timber such as baldcypress. The bank was 80% stable. The water was relatively clear, but a shallow layer of fine silt covered much of the bottom and was easily dispersed into the water column by bottom disturbances. Resettling of silt and clearing of water could be observed over a short period of time. Flow fluctuations as a result of irrigation water drainage was apparent.

Water Quality

Table 1 compares selected water quality parameters from Brushy Creek and Second Creek. This data is the mean of the three grab samples taken at each site on the sample date, except the dissolved oxygen and D.O. saturation data are the extremes measured from a continuous 72 hour recording. Higher values of turbidity, total suspended solids, total dissolved solids, sulfates, alkalanity and total hardness in Brushy Creek are

Table 1. Comparison of Water Quality Parameters of Brushy Creek and Second Creek on July 31, 1984.*

Parameter	Brushy Creek	Second Creek
Flow - CFS	7.5	7.5
Temp - ^{o}C	25.5	24.7
pH	7.6	7.5
Turbidity - NTU	26.7	7.5
TSS - mg/l	36.3	11.3
TDS - mg/l	342.7	247.5
T.-Phos.-mg/l	0.11	0.10
NO_2-NO_3-N-mg/l	0.08	0.12
NH_3-N-mg/l	0.05	0.07
SO_4-mg/l	24.3	8.0
Alkalinity-mg/l	248	163
T. Hardness-mg/l	248.7	181.3
Dissolved Oxygen mg/l(min-max)**	4.5-12.1	3.4-8.2
D.O. saturation-% (min-max)**	53->100	39-100

* Average of three samples taken on same date.

** Taken from continuous recording meters at two stations over a 3-day period at each site.

reflective of greater levels of agriculture drainage. Stream flows during the sample period were predominantly from drainage of irrigation water and therefore are not indicative of moderate or heavy rainfall runoff. There is no doubt that significant increases in turbidity occurs in Brushy Creek following heavy rainfall. It is suspected that the higher TDS, sulfates, alkalinity and hardness in Brushy Creek may have resulted from crop fertilization and/or the use of ground water for irrigation.

Plots of a 72 hour continuous recording of dissolved oxygen, temperature and D.O. saturation at two stations on both streams are shown in Figures 2 through 5. Diurnal fluctuation of D.O. is apparent on both streams although Brushy Creek D.O. fluctuated approximately 7 mg/l daily while the D.O. on Second Creek varied about 4 mg/l per day. Dissolved Oxygen saturation levels approached 100% in the afternoon and dropped to near 15% just before daylight on Second Creek. In contrast D.O. saturation ranged from about 25% to highly supersaturated during the same time periods on Brushy Creek. Although not readily apparent, a short strand, brownish-green filamentous algae was attached to the stream bottom on Brushy Creek. Much of this was broken loose during fish sampling and was trapped in the block nets. Second Creek had a noticeable population of long-strand, green-filamentous algae; however the absence of a stream canopy on Brushy Creek may have increased D.O. production by photosynthesis thereby causing D.O. supersaturation during daylight hours.

Figure 2. : Dissolved Oxygen, Temperature, D.O. Saturation
Brushy Creek, Cross County, Arkansas

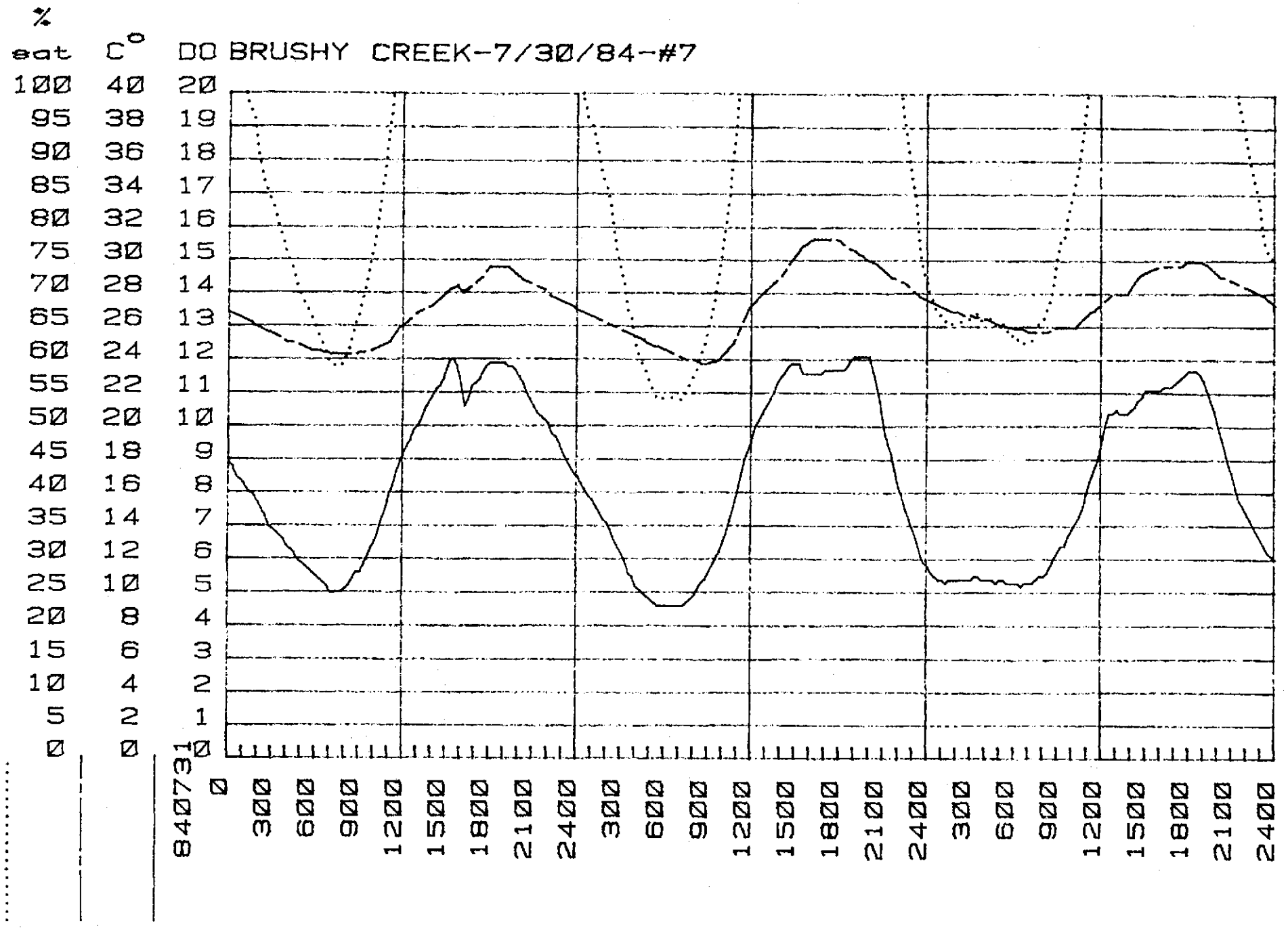


Figure 3. : Dissolved Oxygen, Temperature, D.O. Saturation
Brushy Creek, Cross County, Arkansas

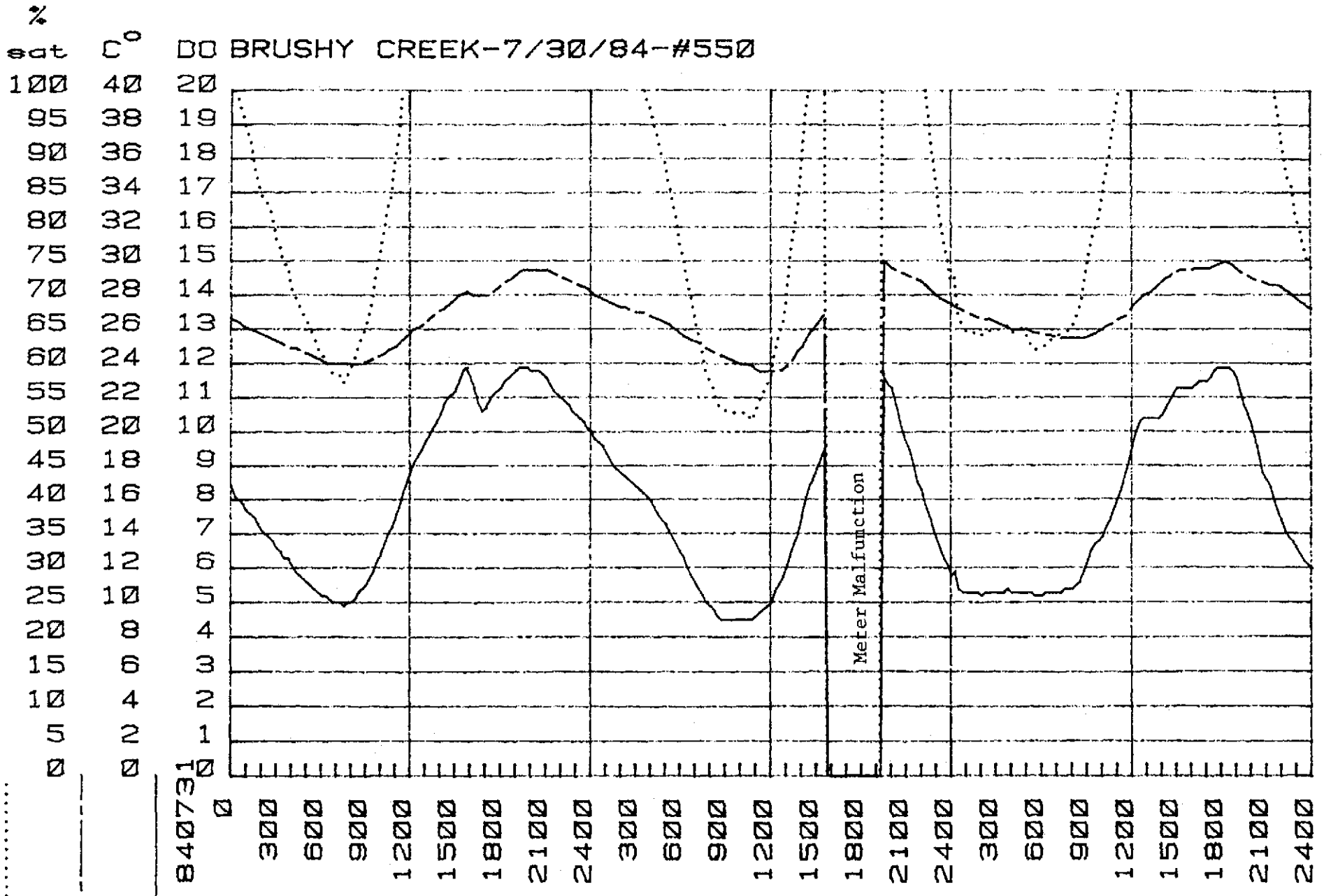


Figure 4. : Dissolved Oxygen, Temperature, D.O. Saturation
Second Creek, St. Francis County, Arkansas

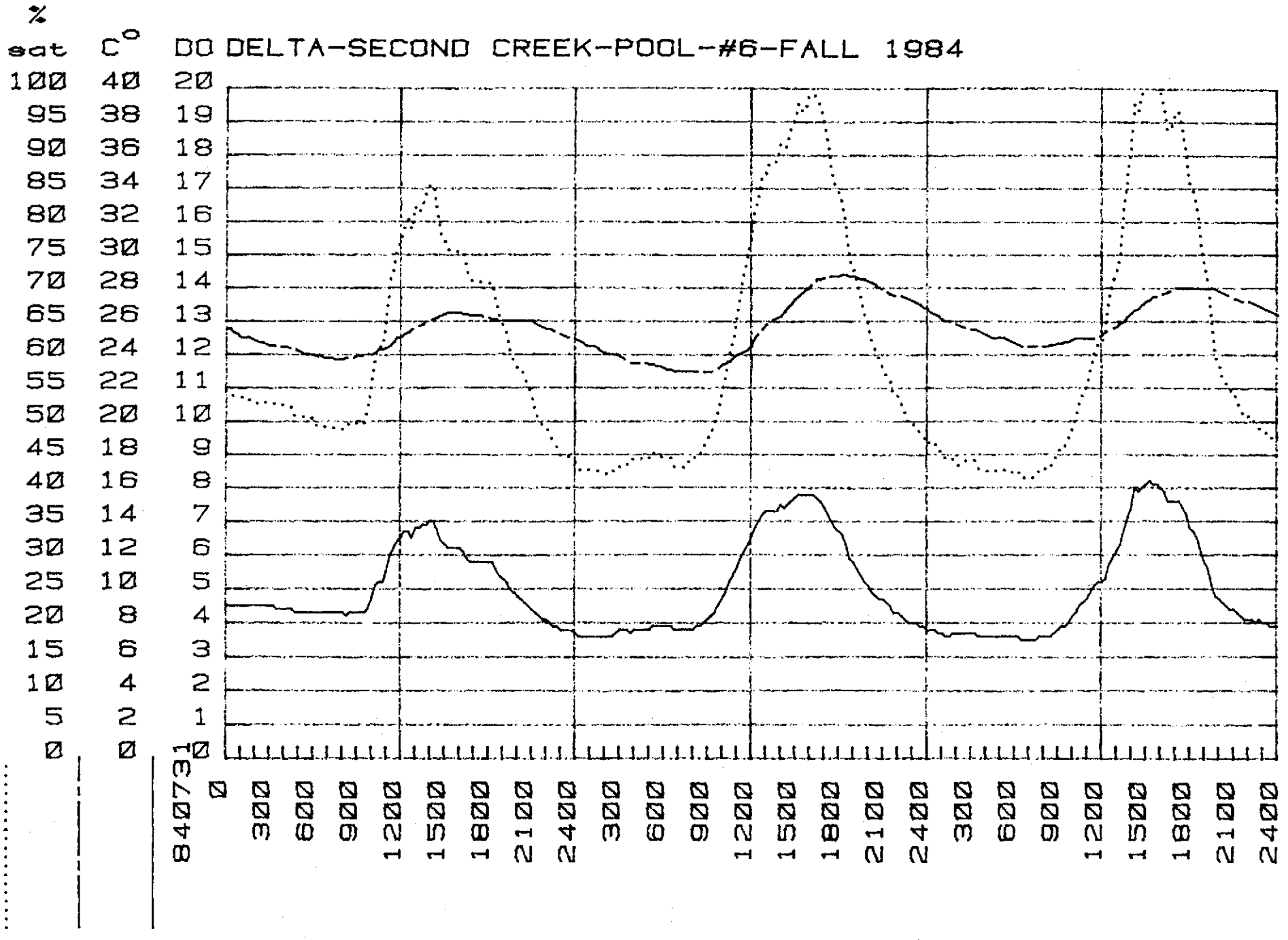
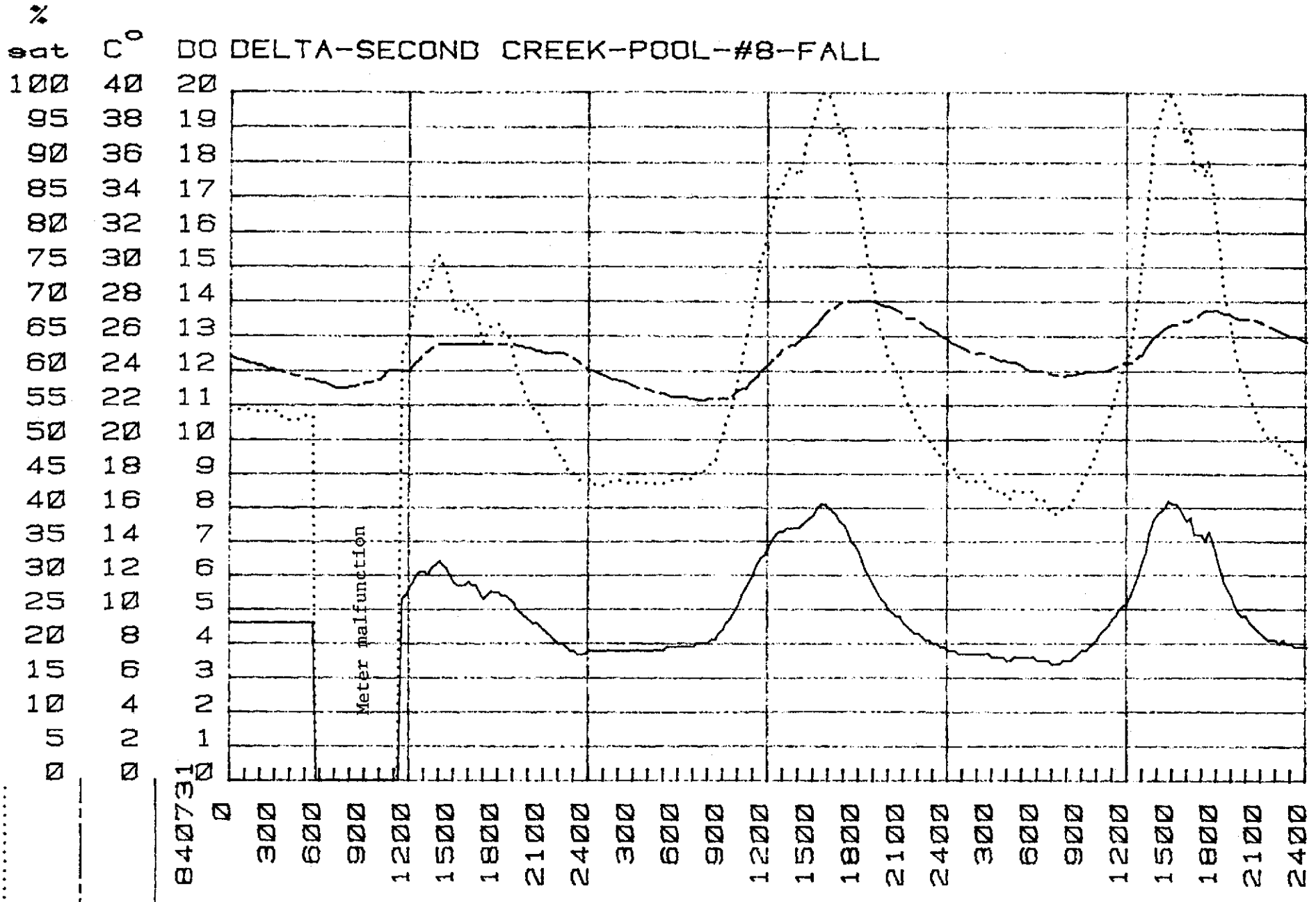


Figure 5. : Dissolved Oxygen, Temperature, D.O. Saturation
Second Creek, St. Francis County, Arkansas



Biological Characteristics

Macroinvertebrates - The low values of the Jaccard Coefficient, Dice Index and Ochiai Index (0.1867, 0.3146. and 0.445, respectively) indicated the benthic communities of Second and Brushy creeks were highly dissimilar. The values of these indicies range from 0-1, the minimum value(0) represents two collections which have nothing in common and the maximum value (1) indicates structurally identical communities. Although the total number of taxa collected were similar, 44 vs. 45, the total number of organisms collected from Second Creek was more than twice that in Brushy Creek (Table 2). Only 14 of the taxa were common to both sites, which accounted for 40% and 44% of the numerical totals from Second Creek and Brushy Creek, respectively. Other community indicies calculated for the macroinvertebrate communities (Table 2) indicated both streams possessed "fair" water quality and, as demonstrated by the water quality parameters measured, did not clearly indicate differences in water quality between the two streams.

Numerically, Amphipoda, Decapoda and Pelecypoda were the dominant orders of the Second Creek sample, comprising 36.9%, 16.6% and 12.9% respectively, or 66.4% of the total sample (Table 3). From Brushy Creek, these same groups comprised 0%,14.6% and 0.9% respectively, or 15.5% of the total sample (Table 4). The dominant orders collected from Brushy Creek were Coleoptera,

TABLE 2 . Comparision of indicies of benthic macroinvertebrates collected from Second Creek and Brushy Creek 205j study sites. 30 min. qualitative samples. 31 July 1984.

Community Paramenter	Second Creek	Brushy Creek
Total # Taxa	44	45
Total # Organisms	1380	629
Shannon-Weinner Diversity	3.3474	4.2128
Index of Richness	4.1275	4.7327
Index of Eveness	0.6131	0.7671
Index of Dominance	0.7045	0.4151
Index of Equitability	0.3182	0.6000
Biotic Condition Index (BCI)	64.70	63.65
Chandler Biotic Score (CBS)	46.34	48.23
Hilsenhoff Biotic index (BI)	2.24	2.91

Table 3. Macroinvertebrates of Second Creek 205j study site. 30 min. Qual. sample taken 31 July 1984.

TAXA	No. Org. INDV.	No. Org. CUML	% of Total INDV.	% of Total CUML.
AMPHIPODA		509		36.9
Gammarus faciatius	509		36.9	
DECAPODA		220		16.6
Palemonetes kadikensis	180		13.0	
Orconectes	36		2.6	
Orconectes b. brevis	4		0.3	
PELECYPODA		178		12.9
Corbicula	178		12.9	
EPHEMEROPTERA		136		9.9
Caenis	128		9.3	
Centroptilum rufostrigatum	4		0.3	
Stenacron interpunctatun	4		0.3	
ODONATA		75		5.5
Epitheca princeps	27		2.0	
Argia tibialis	19		1.4	
Gomphus vastus	9		0.7	
Perithemis tenera	8		0.6	
Macromia	6		0.4	
Boyeria vinosa	6		0.4	
DIPTERA		64		4.7
Coleotanypus	24		1.8	
Procladius	11		0.8	
Palpomyia	10		0.7	
Tribelos	8		0.6	
Cryptochironomus	6		0.4	
Polypedilum	4		0.3	
Haematopoda	1		0.1	
HEMIPTREA		46		3.3
Corixidae (female)	45		3.3	
Ranatra bueno	1		0.1	
COLEOPTERA		38		2.8
Peltodytes lengi	11		0.8	
Stenelmis (larvae)	8		0.6	
Peltodytes (larvae)	6		0.4	
Scirtes	6		0.4	
Stenelmis humerosus	3		0.2	
Dineutus ciliatus	3		0.2	
Berosus (larvae)	1		0.1	
ISOPODA		35		2.5
Lirceus hoppinae	35		2.5	
MEGALOPTERA		26		2.1
Sialis	26		2.1	
GASTRAPODA		14		1.0
Gyraulus	6		0.4	
Physa	4		0.3	
Ferrissia	3		0.2	
Lymnace	1		0.1	
TRICHOPTERA		11		0.9
Oecettis cinerascens	7		0.5	
Setodes	3		0.2	
Pycnopsyche subfaciatus	1		0.1	
ACARINA		10		0.7
Neumania	10		0.7	
ANNELIDA		9		0.6
Oligochaeta	4		0.3	
Moorbdella microstoma	3		0.2	
Helobdella fusca	1		0.1	
Helobdella stagnalis	1		0.1	

Total # org.= 1380 Total # Taxa= 44

Table 4 . Macroinvertebrates of Brushy Creek 205j study site. 30 min. Qual. sample taken 31 July 1984.

TAXA	No. Org. INDV.	No. Org. CUML.	% of Total INDV.	% of Total CLUM
COLEOPTERA		231		35.1
Berosus	78		12.4	
Stenelmis decorata	41		6.5	
Dubiraphia vittata	31		4.9	
Celina	17		2.7	
Uvarus	11		1.7	
Berosus (larvae)	8		1.3	
Gyrinus	8		1.3	
Listronothus	8		1.3	
Copelatus chevrolati renovatus	7		1.1	
Stenelmis (larvae)	7		1.1	
Scirtes	4		0.6	
Dineutus assimalis	2		0.3	
Hydrobius	2		0.3	
Hydrocanthus	2		0.3	
Trophisternus lateralis nimbatus	2		0.3	
Hydrochus	1		0.2	
Paracymus	1		0.2	
Phytobius	1		0.2	
EPHEMEROPTERA		135		21.5
Caenis	87		13.8	
Tricorythodes	43		6.8	
Stenacron interpunctatum	5		0.8	
DECAPODA		92		14.6
Palaemontes kadiakensis	92		14.6	
DIPTERA		70		11.1
Dicrotendipes	33		5.2	
Glyptotendipes	17		2.7	
Tanypus	6		0.9	
Cricotopus sylvestris	5		0.8	
Ablabesmyia philosphagnos	3		0.5	
Polypedilum	3		0.5	
Bezzia	2		0.3	
Cryptochironomus	1		0.2	
ODONATA		56		8.9
Argia tibialis	54		8.6	
Macromia	2		0.3	
TRICHOPTERA		18		2.8
Cheumatopsyche	15		2.4	
Hydropsyche simulians	1		0.2	
Nectopsyche	1		0.2	
Oecetis	1		0.2	
HEMIPTERA		11		1.7
Mesovelia mulsanti	4		0.6	
Rheumatobates	4		0.6	
Corixidae (female)	2		0.3	
Hydromerta martini	1		0.2	
PELECYPODA		6		0.9
Corbicula	6		0.9	
ANNELIDA		4		0.6
Oligochaeta	4		0.6	
GASTROPODA		3		0.5
Physa	3		0.5	
MEGALOPTERA		2		0.3
Corydalus cornutus	2		0.3	
MEMATOMORPHA		1		0.2
Paragordiua	1		0.2	
Total # org. = 629		Total # taxa = 45		

Ephemeroptera, Decapoda and Diptera, which comprised 35.1%, 21.5%, 14.6%, and 11.1%, respectively or 82% of the total. Conversely, from Second Creek these orders accounted for only 2.8%, 9.9%, 16.6% and 4.7% respectively or 34% of the total numbers.

The four dominant taxa of Second Creek, Gammarus fasciatus Say, Palaeomontes kadiakensis Rathbun, Corbicula and Caenis sp., comprised 36.9%, 13.0%, 12.9% and 9.3% respectively or 72.1% of the sample. The four dominant taxa of Brushy Creek, Palaeomontes kadiakensis Rathbun, Caenis sp., Berosus sp. and Argia, comprised 14.6%, 13.8%, 12.4% and 8.6% respectively, or 49.4% numerically.

Although the benthic community of Second Creek was dominated numerically by only a few taxa, the diversity was distributed among several groups. There were seven dipteran and coleopteran taxa, six odonate taxa, four taxa of both gastropods and annelids, and three taxa of decapods, mayflies and caddisflies. All but one taxa of the Second Creek sample was highly adapted to aquatic existance. Only the Corixidae possess the ability for quick dispersal,i.e.,flight. Gammarus fasciatus, 36.9% of the sample numerically, is described as being widely distributed and common in unpolluted waters, strongly thigmotactic, reacting negatively to light (Pennak, 1978). Due to their succeptibility to predation they remain hidden in vegetation or stream debris, sometimes in great quantities (McCafferty, 1981). Rarely are they present where adequate cover does not exist.

The Brushy Creek sample was dominated by Coleopterans, with 18 taxa which comprised 35% of the sample numerically. Of these 18 taxa, six are normally inhabitants of standing water environments, i.e. ponds, marshes, and littoral zones of lakes (Usinger, 1973). In addition, 14 taxa are capable of flight and can more easily disperse under adverse conditions. At the time of collection, rice fields upstream and adjacent to the study site were being drained. The proximity of these irrigated fields and the ease of dispersion of several taxa collected, could account for the presence of those species not normally present in flowing water environments. These additional taxa increased the diversity of the benthic community of Brushy Creek.

Despite the Brushy Creek benthic community being more evenly distributed among several taxa, the diversity of functional feeding groups was greatly reduced as indicated by the index of dominance (Table 2). The calculated value of the index of dominance ranges from 0-1 and the lower the value the greater the diversity of functional feeding groups. The reduction in the variety of taxa representing different groups at Brushy Creek reflects the reduction of instream cover and reduced microhabitat availability within the study area. The presence of a log jam at the Ar. Hwy. 42 bridge and concrete from bridge construction provided the only instream cover within the study area and were the only areas where caddisflies and mayflies were collected.

Fish Population- Distinctive fish population differences existed between Brushy Creek and Second Creek. These differences resulted primarily from the absence of instream fish habitat in Brushy Creek; however the dominant fish species in Brushy Creek were those more tolerant of high turbidity levels. Table 5 compares some general parameters and indicies (using relative abundance values) from the two populations. Total number of species, standing crop, total relative abundance value and diversity index were substantially higher in Second Creek than Brushy Creek. Although the difference in the diversity indicies from the two creeks was only 0.95 units, this difference is substantial. The use of relative abundance values instead of number of individuals produces diversity indicies which are higher and numerically more similar; however their comparisons are valid and the relation of the two populations is accurately reflected. The total fish biomass in Second Creek was 56% higher than in Brushy Creek. The Brushy Creek population was dominated by a species from five different families whereas the Second Creek population had seven species of Centrarchids totaling 22.4% of the total relative abundance value; six species of Cyprinids with 12.9% of the value and four species of Percids composing 15.3% of the total.

The trophic feeding structure of the two populations is also notably different. Primary feeders composed of detritivores, planktavores and omnivores which feed on a substantial amount of plant material comprised 12.9% of the Brushy Creek population, but

Table 5. Comparison of Fish Population Data from Brushy Creek and Second Creek August 1-2, 1984.

	Brushy Creek	Second Creek
Area sampled (acres)	0.31	0.47
Total wt. of fish (lbs)	47.6	112.7
Standing crop (lbs/acre)	153.5	239.8
Total species	21	35
Total Relative Abundance Value	89	209.5
Dominance Diversity Index (R.A. Value)	3.85	4.79
Primary feeders (% R.A. Value)	12.9	5.0
Secondary feeders (% R.A. Value)	84.8	80.4
Top Carnivors	2.2	14.6
Percidae	2.2	15.3
Cyprinidae *	21.9	12.9
Catostomidae	1.7	1.9
Centrarchidae **	13.5	22.4
Ictaluridae	19.7	8.4

* Excludes Carp

** Excludes Black Basses and Crappies

only 5% of the Second Creek fishes. In contrast, top carnivores (fish and crayfish feeders) comprised only 2.2% of the Brushy Creek population and 14.6% of the Second Creek population. High or notably increasing populations of primary feeders often indicate habitat and/or water quality deterioration while strong populations of top carnivores indicate a healthy diverse community (Karr 1981).

The Jaccard Index of qualitative similarity between the Brushy Creek & Second Creek population was calculated to be 0.51. This indicates approximately an equal level of similarity and dissimilarity among the species of both samples. (See discussion in Macroinvertebrates section above).

Of the 37 species of fish collected in the two samples only 19 species occurred in both samples. Table 6 list all species collected with the relative abundance value assigned to each species. The species are listed in numerical order of abundance from Second Creek. The most abundant species collected in Second Creek were pirate perch (Aphredoderus sayanus), bluegill (Lepomis macrochirus), largemouth bass (Micropterus salmoides) and bluntnose darter (Etheostoma chlorosomum). Other species common to this sample were several species of sunfishes (Centrarchidae), two additional species of darters (Percidae), topminnows (Fundulus spp.), yellow bullhead (Ictalurus natalis) and mosquitofish

Table 6. Comparison of Relative Abundance Values of Fish Species Collected in Brushy Creek and Second Creek.

Species	Brushy Creek	Second Creek
Aphredoderus sayanus	-	12
Lepomis macrochirus	2	12
Micropterus salmoides	2	12
Etheostoma chlorosomum	1	12
Lepomis megalotis	2	10.5
Gambusia affinis	12	10.5
Ictalurus natalis	5	9
Fundulus notatus	-	9
Fundulus olivaceous	-	9
Lepomis gulosus	-	9
Lepomis punctatus	1	9
Pomoxis nigromaculatus	-	9
Etheostoma asprigene	-	9
Etheostoma proeliare	-	9
Notropis fumeus	-	8
Notropis atherinoides	5.5	7.5
Notropis emiliae	-	7.5
Lepisosteus oculatus	-	7
Noturus gyrinus	6	6
Aplodinotus grunniens	8.5	4.5
Lepomis cyanellus	2	4
Dorosoma cepedianum	8	3
Ictalurus punctatus	11.5	2.5
Notropis venustus	12	2
Ictiobus bubalus	1.5	2
Ictiobus niger	-	2
Elassoma zonatum	-	2
Etheostoma gracile	1	2
Cyprinus carpio	1	1.5
Lepomis microlophus	-	1.5
Pomoxis annularis	3.5	1.5
Hybognathus hayi	-	1
Notemigonus crysoleucas	1	1
Lepomis symmetricus	-	1
Micropterus punctulatus	-	1
Centrarchus macropterus	1	-
Notropis sp.	1	-

(Gambusia affinis). In Brushy Creek the mosquitofish, blacktail shiner (Notropis venustus), channel catfish (Ictalurus punctatus), drum (Aplodinotus grunniens) and gizzard shad (Dorosoma cepedianum) were the dominant species. Of the ten most abundant species in both samples, only the mosquitofish was common to both sites (Table 7).

The fish population in Second Creek was a diverse, healthy and typical population of a lowland delta stream characterized by species of relatively fertile waters which associate with instream cover. In contrast, the Brushy Creek population had a comparatively low species diversity. Seven of the 21 species were represented by only one or two individuals and the dominant species were typical of turbid water habitats and sparce instream cover.

Table 7. Comparison of Dominant Species from Brushy Creek and Second Creek Fish Population Samples.

Species	Relative Abundance Value	
	Second Creek	Brushy Creek
A. sayanus	12	-
L. macrochirus	12	-
M. salmoides	12	-
E. chlorosomum	12	-
L. megalotis	10.5	-
G. affinis	10.5	12
N. venustus	-	12
I. punctatus	-	11.5
A. grunniens	-	8.5
D. cepedianum	-	8

SUMMARY AND CONCLUSIONS

1. The physical, chemical and biological characteristics of a channelized and an unchannelized stream in the delta area of eastern Arkansas were compared through intensive sampling during the week of July 30 through August 3, 1984.

2. Physiographic location,size of watershed and measured flows were similar in Brushy Creek and Second Creek; however Brushy Creek exhibits severe channelization, removal of instream and riparian vegetation and cultivation to the edge of the stream channel; whereas Second Creek demonstrates very little channel alteration or instream and riparian cover removal.

3. Over 95% of the drainage area of Brushy Creek is from intensive agriculture operations; however land uses in the Second Creek watershed is comprised of about 65% agriculture. Water quantities in both streams are influenced by removal and discharge of irrigation water.

4. Water quality measured during low flow did not exhibit great differences, although higher levels of turbidity, TDS, sulfates, alkalinity and hardness were noted in Brushy Creek and substantially higher daytime dissolved oxygen and dissolved oxygen percent saturation values were recorded in Brushy Creek.

5. The D.O. supersaturation in Brushy Creek was suspected to be a result of maximum exposure of this stream to sunlight causing high photosynthetic activity by submersed, attached algae.

6. It is strongly suspected and supported by observations of similar situations that substantial increases in turbidity occurrs in Brushy Creek during heavy rainfall runoff.

7. Macroinvertebrate populations in these streams were highly dissimilar although indicator species did not indicate the differences were due to major water quality variations.

8. The macroinvertebrate population of Second Creek was characterized by typical taxa of permanent, flowing waters of fair to good quality along with several taxa which typically associate with instream cover and debris. The Brushy Creek population was composed of several taxa more typical of standing water environments and taxa with a high degree of mobility from one waterbody to another. The absence of certain indicator taxa in Brushy Creek reflects the limited instream cover and microhabitats.

9. The fish populations in Brushy Creek and Second Creek were distinctively different as a result of the absence of instream habitat in Brushy Creek and the abundance of such habitat in Second Creek.

10. The measured total fish biomass in Second Creek was 86.3 pounds per acre (56%) higher than that measured in Brushy Creek.

11. Although excessive levels of turbidity were not measured in Brushy Creek during the sample period, the fish population structure is indicative of waters with frequent, high-turbidity conditions.

12. The obvious condition which produced the documented differences between Brushy Creek and Second Creek was the negative influence of habitat loss.

13. It was apparent in the physical characteristics as well as in the deteriorated macroinvertebrate and fish populations that channelization has adversely affected the biotic and abiotic character of Brushy Creek.

14. Second Creek, although showing some indications of agriculture runoff, has maintained its basic characteristics of a relatively undisturbed waterbody in the delta area of eastern Arkansas.

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