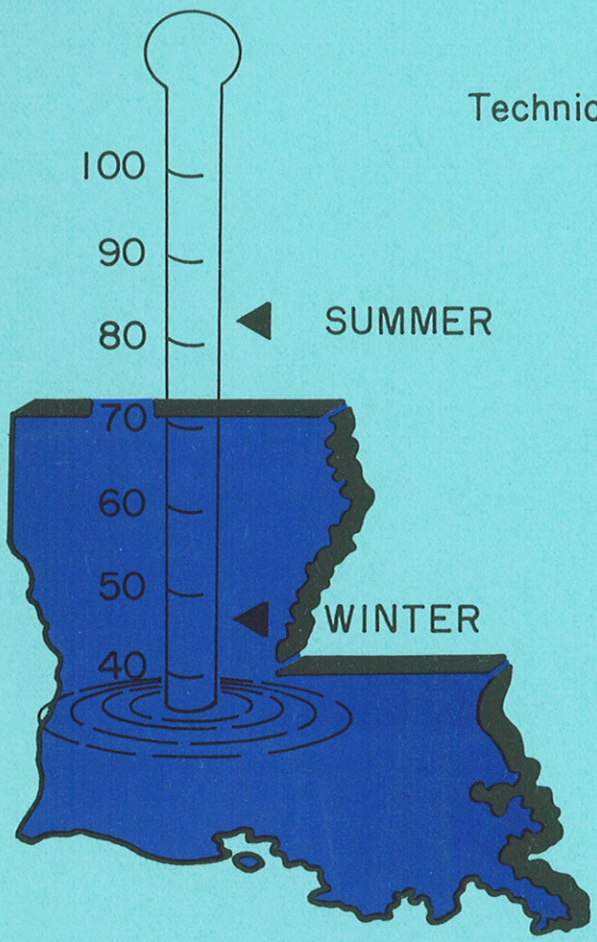
AN ANALYSIS OF STREAM TEMPERATURES IN LOUISIANA

Technical Report No. 6



Prepared by

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY, WATER RESOURCES DIVISION

Louisiana District

in cooperation with

LOUISIANA DEPARTMENT OF PUBLIC WORKS

1973

STATE OF LOUISIANA

DEPARTMENT OF PUBLIC WORKS

In cooperation with the

UNITED STATES GEOLOGICAL SURVEY

TECHNICAL REPORT NO. 6

AN ANALYSIS OF STREAM TEMPERATURES IN LOUISIANA

by

Anthony J. Calandro
U.S. Geological Survey

Published by

LOUISIANA DEPARTMENT OF PUBLIC WORKS

Baton Rouge, La.

1973

STATE OF LOUISIANA

EDWIN W. EDWARDS, Governor

DEPARTMENT OF PUBLIC WORKS

ROY AGUILLARD, Director

HU B. MYERS, Assistant Director

D. V. CRESAP, Chief Engineer

E. J. TAYLOR, Hydraulic Engineer

Cooperative projects with

UNITED STATES GEOLOGICAL SURVEY

V. E. McKELVEY, Director

E. L. HENDRICKS, Chief Hydrologist

E. A. MOULDER, Regional Hydrologist

A. N. CAMERON, District Chief

CONTENTS

ILLUSTRATIONS

TABLES

AN ANALYSIS OF STREAM TEMPERATURES IN LOUISIANA

By Anthony J. Calandro

ABSTRACT

Air temperatures during the summer months are approximately the same throughout the State; water temperatures, however, become progressively cooler from north to south. During the winter months air temperatures are cooler in the northern part of the State than in the central or southern parts, and water temperatures are about 5° Fahrenheit (3° Celsius) cooler.

A method of analysis developed by M. R. Collings was used to obtain midmonthly temperatures from miscellaneous water-temperature data from 71 sites. When compared to long-term daily temperature stations, the method works very well for Louisiana streams.

Monthly temperature duration, average monthly temperatures, and monthly extremes are shown for nine stations throughout the State. These stations are located on the larger streams and rivers.

INTRODUCTION

Stream-temperature information is vitally important to the proper utilization of the water resources in Louisiana. Temperature affects (1) the use of surface water for industrial, recreational, and other uses; (2) biochemical-reaction rates; (3) oxygen-saturation levels; (4) stream-reaeration rates; and (5) aquatic life.

The major natural factors affecting stream temperatures in Louisiana are solar radiation, shade, air temperature, and stream depth. The most important of these is solar radiation.

For the purposes of this report, the State has been divided into four regions: northern, central, southeastern, and southwestern Louisiana (fig. 1). Within each region similar hydrologic conditions occur.

The purpose of this report is to analyze miscellaneous water-temperature data and obtain midmonthly values; document areal differences; describe monthly variations in stream temperature; and relate air temperature to water temperature.

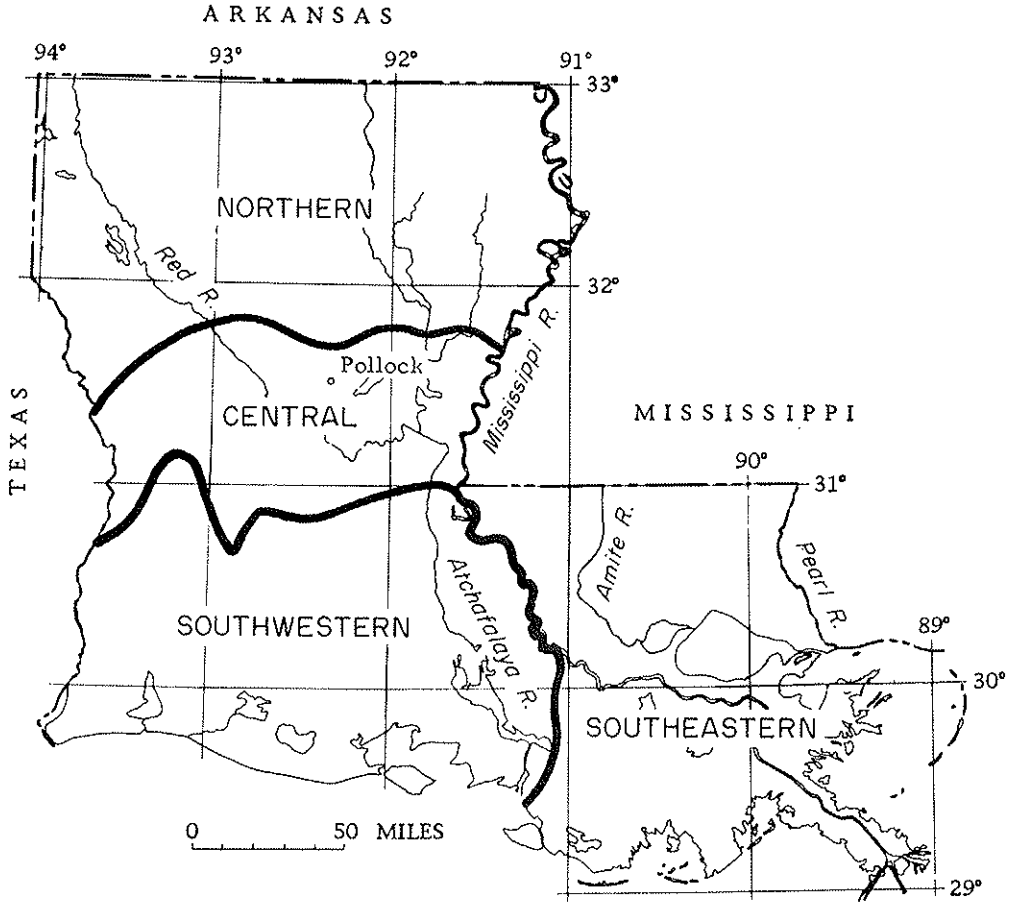


Figure 1.--Temperature regions in Louisiana.

Available Stream-Temperature Data

The U.S. Geological Survey has collected information on stream temperatures in Louisiana for many years. However, prior to 1956, the amount of stream-temperature data was negligible. From 1956 through 1968, miscellaneous temperature data amounting to eight to 12 measurements a year were collected at 71 sites, and once-daily temperature measurements were collected at nine sites. However, only the once-daily temperature measurements were published. In addition to the once-daily temperature measurements, data are presently being collected by continuous-recording temperature monitors at five locations. Although documented stream temperatures have been only as low as 33° F (0.5° C), ice has been observed along the edges of most Louisiana streams at times.

AIR TEMPERATURE VERSUS STREAM TEMPERATURE

Average monthly air temperature is a fairly good index of average monthly water temperature in most streams in Louisiana where no manmade effects occur. This close correlation is due to the fact that solar radiation affects both water and air temperatures similarly. Comparisons of mean midmonthly water temperatures to mean monthly air temperatures are shown in figure 2.

In northern Louisiana, mean monthly air temperature very closely approximates mean midmonthly stream temperature. The only significant difference occurs from January to March when air temperatures are about 3°F (1.5°C) warmer. In central, southeastern, and southwestern Louisiana, mean monthly air temperatures are generally 2° to 5°F (1° to 3°C) warmer than mean monthly stream temperatures.

Mean monthly air temperatures for the four regions are nearly the same during the summer months; however, summer water temperatures are cooler in the south than in the north (fig. 3). This is probably due to higher base flow in southern streams. Streamflow is generally above base flow during the winter months, and water temperature variations are caused mainly by variations in air temperature. Air temperatures are cooler in the north than they are in the central, southwest, or southeast regions; and water temperatures are subsequently as much as 5°F (3°C) lower.

Diurnal temperature fluctuations are shown for the Amite River near Denham Springs and Big Creek at Pollock (fig. 4). It is readily seen from this figure that large daily fluctuations in air temperature have only a 3° to 5°F (1.5° to 3°C) effect on daily water temperature. This is especially true for large streams and for periods of medium to high flow in smaller streams. Daily fluctuations in water temperature depend primarily on streamflow, shading, channel depth, and several other factors such as mixing and stream orientation. For these reasons it is difficult to relate hourly or even daily air temperature to water temperature.

SYNTHESIZED TEMPERATURE RECORD

Miscellaneous temperature information has been collected at 71 sites in Louisiana, usually at the time of stream discharge measurements. These data have been analyzed, and average midmonthly temperatures have been obtained using a method developed by Collings (1969). This method provides estimates of midmonthly temperatures from a minimum of eight miscellaneous temperature measurements taken throughout the year.

The method is very accurate when applied to Louisiana streams. Presented for comparison in table 1 is a list of average monthly temperatures computed from daily temperature records and average midmonthly temperatures obtained using the Collings method. Average midmonthly

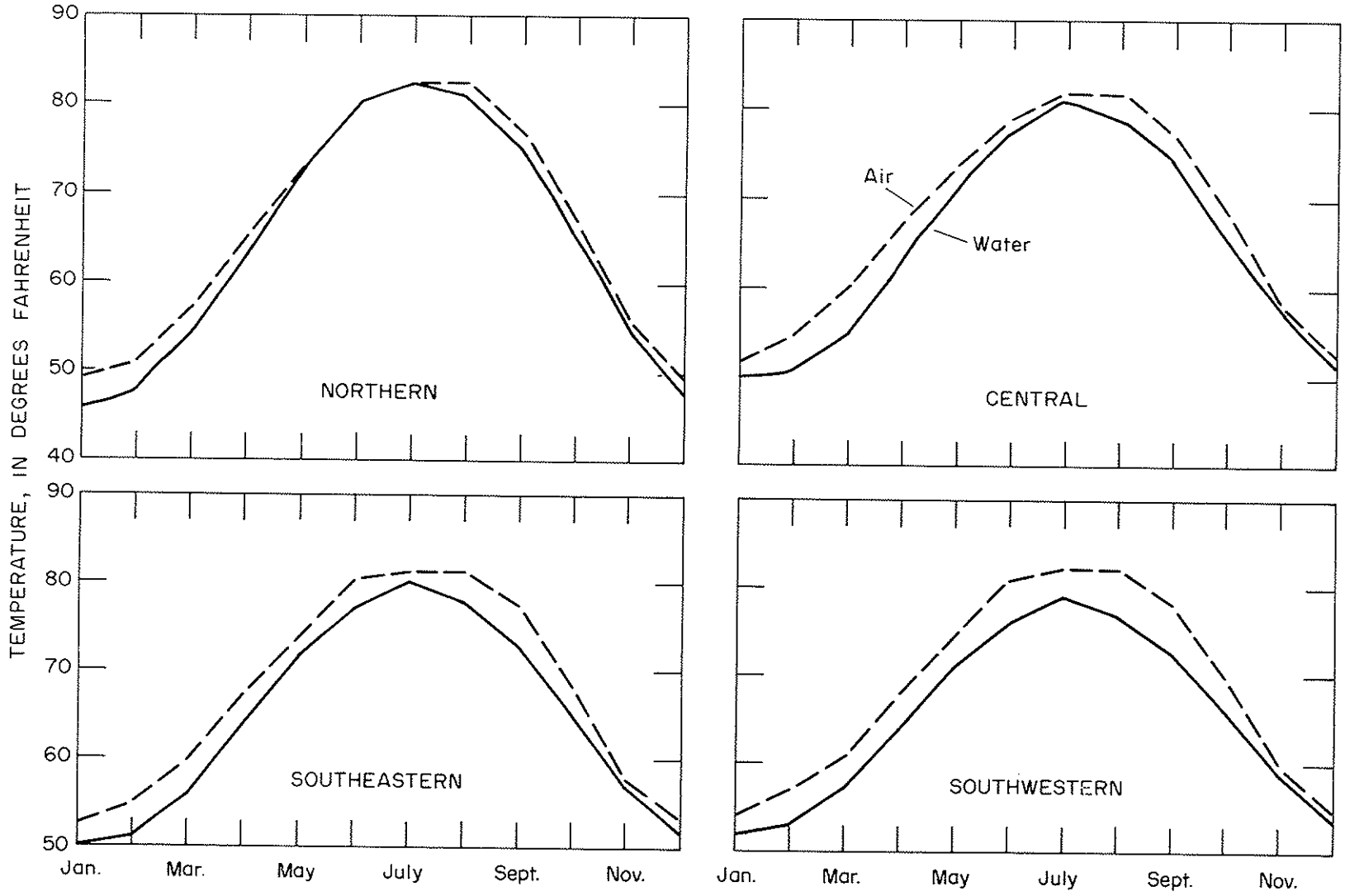


Figure 2. --Comparison of mean monthly air temperature to mean midmonthly water temperature for four temperature regions in Louisiana.

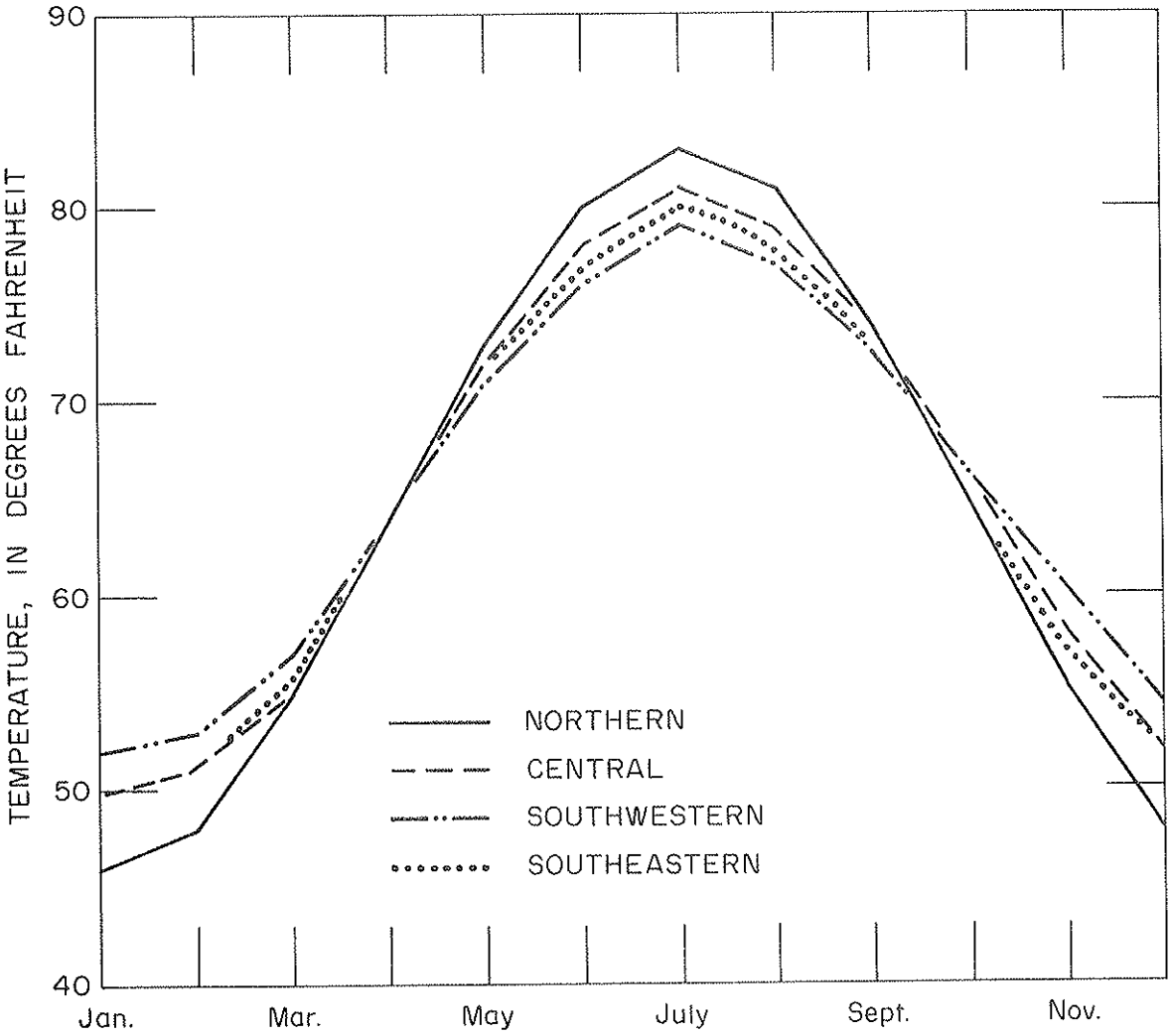


Figure 3.--Comparison of average midmonthly water temperatures for the four temperature regions in Louisiana.

temperatures were obtained by selecting, at random, eight to 12 daily temperature measurements a year. Difference between the average monthly and the obtained midmonthly temperatures never exceeds 2° F (1° C) for the sites selected for comparison.

Midmonthly temperatures obtained from miscellaneous temperature information are listed in table 2. Sites are in downstream order by region.

Although stream temperatures regionalize quite well, slight differences do occur from stream to stream in the same region. This is to be expected and is due primarily to natural factors such as stream orientation, shade, and depth.

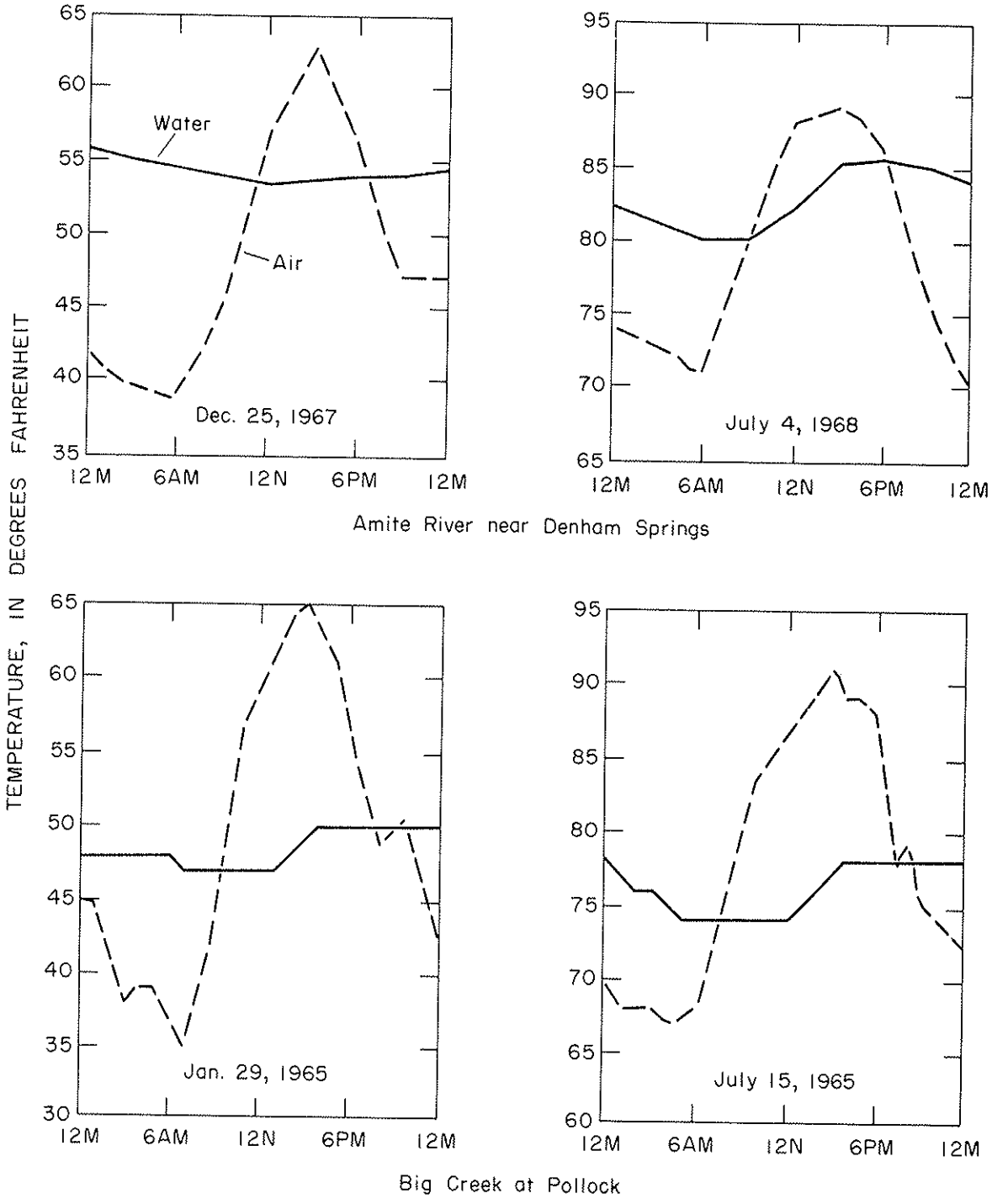


Figure 4. --Diurnal air- and water-temperature fluctuations for two streams in Louisiana.

DAILY TEMPERATURE STATIONS

Often it is necessary to know not only what the monthly stream temperature is but also what percent of time or duration this value will be available. Monthly temperature duration for nine daily temperature stations located throughout the State is shown in table 3. Included in the table are average monthly temperatures and monthly extremes. The stations used for these analyses are located on the larger streams and rivers that are important to water users.

Average monthly temperatures for the larger streams, excluding the Mississippi River, are somewhat higher than average monthly temperatures of the smaller streams within a region, especially during low-flow periods in the summer and fall. For example, the average monthly temperature of the Red River at Alexandria (table 3) from June through November is from 5° to 9°F (3° to 5°C) warmer than other streams in central Louisiana (fig. 3). This is due to solar radiation, which greatly affects water temperature in wide, relatively shallow, unshaded streams. For this reason the larger streams were not included in the regionalization by geographic area.

The Mississippi River is the only river in the State where the effects of man on water temperature have been studied. Water temperatures of the Mississippi River at St. Francisville and Luling Ferry have been measured daily since 1954 and 1957, respectively. From December to May the average monthly water temperature is approximately the same at the two sites. However, from June to November the average monthly water temperatures are from 1° to 3°F (0.5° to 1.5°C) warmer at Luling Ferry. This increase in water temperature at Luling Ferry is due primarily to industrial discharge of heated water into the river. Approximately 95 percent of the 5.0 billion gallons per day of water withdrawn from the river between St. Francisville and Luling Ferry is used for industrial cooling and is returned to the river with an increased thermal load (Everett, 1971). The effect of this heated water after complete mixing is not discernible during medium- or high-flow periods, but during low-flow periods, daily water temperatures are as much as 5°F (3°C) warmer at Luling Ferry than at St. Francisville.

SUMMARY

Average monthly stream temperature in the State of Louisiana can be determined quite accurately when the average monthly air temperature is known.

Excluding the larger streams, stream temperatures within regions are fairly uniform.

Temperature variations of the larger streams do not fit regional patterns and, with the exception of the Mississippi River, are warmer than streams in the same region.

Temperature variations of the Mississippi River between St. Francisville and Luling Ferry, La., indicate that man's influence may cause an increase in daily water temperatures by as much as 5°F (3°C) during low-flow periods.

SELECTED REFERENCES

Collings, M. R., 1969, Temperature analysis of a stream, in Geological Survey Research 1969, Chapter B: U.S. Geol. Survey Prof. Paper 650-B, p. B174-B179.

Duncan, A. C., [1967], Chemical quality of surface waters of Louisiana 1959-63: Louisiana Dept. Public Works Basic Recs. Rept. 2, 137 p.

Everett, D. E., 1971, Hydrologic and quality characteristics of the lower Mississippi River: Louisiana Dept. Public Works Tech. Rept. 5, 48 p.

Federal Water Pollution Control Administration, 1968, Water quality criteria, in Report of the National Technical Advisory Committee to the Secretary of the Interior: Washington, U.S. Govt. Printing Office, 234 p.

Kapustka, S. F., 1964, Chemical composition of surface waters of Louisiana, 1943-58: Louisiana Dept. Public Works, 212 p.

U.S. Geological Survey, [1965], Water quality records in Alabama, Louisiana, and Mississippi, 1964: Baton Rouge, La., U.S. Geol. Survey, Water Resources Div., 90 p.

_____ [1967a], Water resources data for Louisiana, 1965, pt. 2 Water quality records: Baton Rouge, La., U.S. Geol. Survey, Water Resources Div., 46 p.

_____ [1967b], Water resources data for Louisiana, 1966, pt. 2, Water quality records: Baton Rouge, La., U.S. Geol. Survey, Water Resources Div., 63 p.

_____ [1968], Water resources data for Louisiana, 1967, pt. 2, Water quality records: Baton Rouge, La., U.S. Geol. Survey, Water Resources Div., 245 p.

Table 1. --Average monthly water temperatures based on daily determinations and average midmonthly water temperatures obtained using the Collings method

[Temperature, in degrees Fahrenheit]

Month	Pearl River near Bogalusa		Red River at Alexandria		Red River near Hosston		Mermentau River near Lake Arthur		Vermilion River at Bancker Ferry	
	Average monthly	Average midmonthly	Average monthly	Average midmonthly	Average monthly	Average midmonthly	Average monthly	Average midmonthly	Average monthly	Average midmonthly
January	52	51	50	52	45	44	52	53	54	56
February	54	54	55	53	48	47	54	55	58	57
March	60	61	59	59	55	54	60	60	63	62
April	69	69	68	68	66	64	70	68	69	70
May	78	78	76	77	73	74	77	77	78	78
June	83	83	83	84	81	82	82	82	84	84
July	86	85	87	88	85	85	84	85	85	87
August	84	83	87	87	84	83	83	84	85	86
September	78	76	83	81	78	76	79	79	82	81
October	70	68	73	73	68	66	72	71	75	73
November	61	59	62	63	58	56	64	62	64	65
December	54	53	54	56	48	48	57	56	57	58

Table 2. --Midmonthly temperatures obtained using the Collings method

[Temperature, in degrees Fahrenheit]

Station No.	Station name	Drainage area (sq mi)	Months											
			Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
		Northern Louisiana												
7-3444.5	Paw Paw Bayou near Greenwood	78	46	49	55	64	72	78	80	77	71	62	54	48
7-3470	Kelly Bayou near Hosston	116	46	48	54	64	73	80	82	81	74	65	55	49
7-3480	Twelvemile Bayou near Dixie	3,137	47	48	55	64	73	81	83	82	75	66	56	50
7-3487	Bayou Dorcheat near Springhill	605	46	49	55	65	74	81	84	82	74	65	55	49
7-3488	Flat Lick Bayou near Leton	66.9	45	47	54	63	72	79	82	79	72	63	54	47
7-3490	Bayou Dorcheat near Minden	1,097	46	48	54	63	73	80	82	81	74	65	55	48
7-3495	Bodcau Bayou near Sarepta	546	46	48	54	64	73	81	83	81	74	65	55	48
7-3510	Boggy Bayou near Keithville	79	46	49	55	64	73	80	82	80	73	64	55	48
7-3520	Saline Bayou near Lucky	154	47	49	55	64	73	80	82	80	73	64	55	49
7-3528	Grand Bayou near Coushatta	93.9	46	48	55	64	73	80	82	81	74	65	55	49
7-3530	Saline Bayou near Clarence	1,386	47	49	54	63	72	79	82	81	75	66	57	50
7-3642	Bayou Bartholomew near Jones	1,187	46	47	54	64	73	81	83	82	75	65	55	48
7-3643	Chemin-a-Haut Bayou near Beekman	271	46	48	55	64	74	81	84	81	74	64	55	47
7-3645	Bayou Bartholomew near Beekman	1,645	45	47	54	63	73	80	83	81	74	65	55	48
7-3647	Bayou de Loutre near Laran	141	45	47	54	64	73	81	83	81	74	64	55	47
7-3650	Bayou D'Arbonne near Dubach	355	45	46	53	62	72	78	81	80	73	64	54	47
7-3677	Boeuf River near Arkansas-Louisiana State line	785	45	47	55	65	76	83	87	84	76	66	55	47
7-3680	Boeuf River near Girard	1,226	46	48	55	65	75	82	86	84	77	67	57	49
7-3685	Big Colewa Bayou near Oak Grove	42	45	48	55	64	75	82	84	82	74	64	55	47
7-3690	Bayou Lafourch near Crew Lake	361	46	47	53	63	73	81	85	84	78	68	58	49
7-3695	Tensas River at Tendal	309	45	47	54	64	74	81	84	82	75	65	55	48
7-3697	Bayou Macon near Kilbourne	504	45	46	54	63	73	81	84	82	76	66	56	48
7-3700	Bayou Macon near Delhi	782	45	47	54	63	73	81	85	83	76	67	56	48
7-3705	Castor Creek near Grayson	271	46	48	55	64	73	80	82	81	73	64	55	49
7-3710	Garrett Creek at Jonesboro	2.14	46	48	54	64	73	80	83	82	75	66	56	49

7-3720	Dugdemona River near Winnfield	654	47	49	55	64	74	81	84	82	75	65	56	49
8-0235	Bayou San Patricio near Noble	154	45	48	55	64	73	80	82	81	73	64	54	47
8-0240	Bayou San Miguel near Zwolle	111	48	51	56	64	73	78	80	77	71	63	55	50
8-0240.6	Blackwell Creek at Many	3.16	46	48	55	64	73	79	81	78	72	63	54	47
8-0242	Bayou La Nana near Zwolle	130	48	50	55	64	72	79	81	80	73	65	56	50
	Central Louisiana													
7-3519	Bayou Dupont near Robeline	35.1	49	50	55	63	71	77	80	79	73	66	57	51
7-3538	Youngs Bayou at Natchitoches	40.1	50	51	55	64	72	79	82	81	75	67	59	53
7-3540	Little Sandy Creek at Kisatchie	21.4	50	51	57	66	75	82	86	84	78	69	60	53
7-3545	Horsepen Creek near Provencal	5.27	49	50	55	63	72	78	82	81	75	68	59	52
7-3550	Hemphill Creek near Hot Wells	18.0	50	51	55	63	71	76	79	77	72	65	58	52
7-3730	Big Creek at Pollock	51.0	48	50	55	63	71	75	78	76	70	63	55	50
7-3835	Bayou des Glaises diversion channel at Moreauville	270	51	52	55	62	70	75	78	77	73	67	59	54
8-0130	Calcasieu River near Glenmora	499	52	53	57	64	72	77	80	79	74	67	60	54
8-0135	Calcasieu River near Oberlin	753	49	50	54	63	71	77	80	79	74	66	58	52
8-0140	Sixmile Creek near Sugartown	171	49	50	55	63	72	78	82	81	76	68	59	52
8-0142	Tenmile Creek near Elizabeth	94.2	49	50	55	63	71	76	79	78	73	65	57	52
8-0255	Bayou Toro near Toro	148	50	51	56	64	73	79	81	80	73	66	58	52
8-0280	Bayou Anacoco near Rosepine	365	50	52	57	66	74	80	82	81	75	67	58	52
	Southeastern Louisiana													
2-4900	Bogue Lusa Creek near Franklinton	12.1	49	50	54	62	69	74	78	77	72	64	57	52
2-4901.05	Bogue Lusa Creek at Bogalusa	72.7	48	49	55	63	72	78	81	80	73	65	56	50
2-4920	Bogue Chitto Creek near Bush	1,210	49	50	55	63	71	76	79	78	73	65	57	51
7-3735	West Fork Thompson Creek near Wakefield	35.3	49	50	55	63	72	79	82	81	75	67	58	52
7-3750	Tchefuncta River near Folsom	95.5	49	51	55	63	71	76	78	76	71	63	56	51
7-3755	Tangipahoa River at Robert	646	51	52	57	64	71	76	78	77	72	64	57	53
7-3758	Tickfaw River at Liverpool	89.7	50	52	56	63	71	75	77	75	71	64	57	52
7-3760	Tickfaw River at Holden	247	51	53	58	66	73	79	81	79	73	65	58	53
7-3765	Natalbany River at Baptist	79.5	52	53	58	65	73	79	81	80	74	67	59	54
7-3770	Amite River near Darlington	580	49	51	56	64	72	77	80	78	72	64	56	51
7-3775	Comite River near Olive Branch	145	50	51	56	64	72	78	81	79	73	66	58	52
7-3780	Comite River near Comite	284	50	52	57	64	72	78	81	79	73	65	58	52

Table 2.--Midmonthly temperatures obtained using the Collings method--Continued

Station No.	Station name	Drainage area (sq mi)	Months											
			Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
		Southeastern Louisiana--Continued												
7-3785	Amite River near Denham Springs	1,280	49	51	56	64	72	78	81	79	73	65	57	52
7-3790	Wards Creek at Government St., at Baton Rouge	4.10	51	52	56	63	71	76	79	78	73	66	59	54
		Southwestern Louisiana												
7-3819	Spring Creek near Glenmora	68.3	52	53	57	63	70	74	76	75	71	64	58	54
7-3820	Bayou Cocodrie near Clearwater	240	53	54	57	64	71	75	78	77	73	66	60	55
7-3825	Bayou Courtableau at Washington	715	53	53	56	63	69	74	77	77	73	67	61	55
7-3855	Bayou Teche at Arnaudville	1,531	54	54	58	64	72	77	80	79	75	69	62	55
7-3865	Bayou Bourbeau at Shuteston	19.0	54	55	59	64	71	75	77	76	72	66	60	55
8-0100	Bayou des Cannes near Eunice	131	53	53	57	64	71	76	79	78	73	67	60	55
8-0103	Long Point Gully near Crowley	25.7	53	54	58	64	72	76	79	77	73	66	60	55
8-0120	Bayou Nezpique near Basile	527	52	54	58	64	72	77	80	76	73	66	59	54
8-0145	Whiskey Chitto Creek near Oberlin	510	52	53	57	65	72	77	80	78	73	66	59	54
8-0148	Bundick Creek near De Ridder	120	51	52	56	63	71	76	79	77	72	65	58	53
8-0150	Bundick Creek near Dry Creek	238	51	53	57	64	72	78	81	80	74	67	59	54
8-0155	Calcasieu River near Kinder	1,700	53	55	59	66	73	79	81	80	75	68	61	55
8-0168	Bearhead Creek near Starks	177	50	52	57	65	73	79	81	80	73	66	58	52
8-0287	Hoosier Creek near Merryville	13.1	52	53	57	64	71	75	78	76	72	64	58	54

Table 3. --Monthly temperature duration for selected sites

[Temperature, in degrees Fahrenheit]

Month	Range in temperature	Average monthly temperature	Percent of time values equaled or exceeded those shown				
			90	70	50	30	10
Pearl River near Bogalusa, station No. 2-4895 (drainage area 6, 630 sq mi)							
January ----	38-65	52	45	48	51	55	61
February ---	44-64	53	47	50	52	55	59
March -----	48-75	60	52	55	59	64	68
April ------	61-79	71	65	68	70	74	77
May -------	67-85	76	70	74	77	79	82
June -------	75-90	82	78	81	83	84	87
July -------	76-89	84	80	83	84	86	88
August -----	77-88	85	80	84	86	87	87
September--	67-87	80	74	78	80	84	86
October ----	63-78	72	66	71	73	75	76
November --	45-79	63	56	60	62	65	75
December --	35-66	54	48	53	55	57	62
Red River near Hosston, station No. 7-3444 (drainage area 57, 041 sq mi)							
January ----	33-62	45	38	42	45	48	50
February ---	39-60	48	42	45	48	50	55
March -----	39-70	55	48	52	56	59	63
April ------	51-77	66	59	64	67	69	73
May -------	63-84	73	67	71	74	76	79
June -------	69-90	81	77	79	81	83	85
July -------	74-91	85	80	82	85	87	89
August -----	75-91	84	80	83	85	86	88
September--	63-89	78	70	76	79	82	85
October ----	49-79	68	62	66	68	71	74
November --	46-70	58	50	55	58	62	66
December --	33-61	48	41	45	49	52	55
Red River at Alexandria, station No. 7-3555 (drainage area 67, 500 sq mi)							
January ----	38-65	50	46	49	50	52	55
February ---	44-69	55	47	52	55	58	61
March -----	45-73	59	53	57	60	62	66
April ------	57-79	68	61	64	68	71	75
May -------	67-84	76	70	74	77	80	81
June -------	59-91	83	79	81	83	85	87
July -------	80-92	87	84	85	87	89	90
August -----	80-93	87	84	85	86	88	90
September--	70-89	83	78	82	84	85	86
October ----	62-85	73	67	70	74	76	80

Table 3. --Monthly temperature duration for selected sites--Continued

Month	Range in temperature	Average monthly temperature	Percent of time values equaled or exceeded those shown				
			90	70	50	30	10
Red River at Alexandria, station No. 7-3555 (drainage area 67, 500 sq mi)--Continued							
November--	52-75	62	55	59	61	64	69
December--	44-65	54	48	51	53	56	60
Atchafalaya River at Krotz Springs, station No. 7-3815 (drainage area 93, 300 sq mi including Red River)							
January ----	42-48	46	44	45	46	47	48
February ---	42-56	48	44	46	48	50	53
March -----	47-60	53	49	52	53	54	58
April ------	51-71	62	55	58	60	63	68
May -------	63-77	71	66	69	71	73	75
June -------	75-87	80	76	78	80	82	84
July -------	80-88	85	82	83	84	86	87
August -----	81-87	86	83	84	85	86	87
September--	77-86	82	80	81	82	83	85
October ----	60-79	71	63	68	73	75	78
November--	53-67	57	55	56	57	59	62
December--	44-55	49	45	47	49	51	54
Vermilion River at Bancker Ferry near Abbeville, station No. 7-3870 (drainage area 546 sq mi)							
January ----	36-65	54	48	51	55	57	60
February ---	44-71	58	50	54	58	61	66
March -----	48-74	63	57	60	62	65	69
April ------	55-78	69	62	67	70	72	76
May -------	65-86	78	72	75	78	80	83
June -------	75-96	84	79	82	84	85	88
July -------	76-95	85	82	84	85	87	89
August -----	75-95	85	82	84	85	87	89
September--	70-92	82	78	80	82	84	86
October ----	60-88	75	68	71	74	78	82
November--	52-85	64	59	61	64	66	71
December--	44-78	57	50	54	56	60	62
Mermentau River near Lake Arthur, station No. 8-0124 (drainage area 1, 730 sq mi)							
January ----	33-73	52	44	49	52	55	60
February ---	43-69	54	47	51	54	57	60
March -----	40-78	60	51	56	60	64	68
April ------	58-88	71	62	69	71	74	78
May -------	65-87	77	71	75	78	80	81

Table 3. --Monthly temperature duration for selected sites--Continued

Month	Range in temperature	Average monthly temperature	Percent of time values equaled or exceeded those shown				
			90	70	50	30	10
Mermentau River near Lake Arthur, station No. 8-0124 (drainage area 1, 730 sq mi)--Continued							
June -------	73-89	82	78	81	82	84	85
July -------	74-90	84	81	83	84	85	87
August -----	74-90	83	80	82	83	85	87
September--	62-90	79	73	79	81	83	89
October ----	61-82	72	64	69	73	75	79
November --	50-78	64	57	61	64	68	72
December --	38-79	57	48	53	56	60	67
Black River at Jonesville, station No. 7-3732.67 (drainage area 24, 158 sq mi)							
January ----	39-58	47	42	44	46	48	54
February ---	40-60	50	43	47	50	52	55
March -----	42-68	56	48	54	56	59	62
April ------	54-76	67	60	64	67	70	73
May -------	67-82	76	71	73	76	78	81
June -------	74-90	82	77	80	82	84	85
July -------	77-93	86	82	84	86	87	89
August -----	80-93	86	83	85	86	88	89
September--	70-88	82	78	80	83	85	86
October ----	62-82	73	67	70	73	75	79
November --	53-71	63	57	60	62	65	68
December --	42-64	52	45	50	53	55	58
Mississippi River near St. Francisville, station No. 7-3734.2 (drainage area 1, 243, 000 sq mi)							
January ----	37-55	44	40	42	44	46	48
February ---	37-56	45	40	43	45	47	50
March -----	43-60	50	46	48	50	53	56
April ------	48-70	60	54	58	60	62	66
May -------	60-80	70	65	68	70	73	75
June -------	63-83	77	74	76	77	79	81
July -------	73-87	82	80	81	83	84	85
August -----	78-87	83	81	82	83	84	85
September--	70-85	79	75	77	79	81	83
October ----	58-82	70	64	67	70	73	75
November --	47-69	60	55	58	60	62	64
December --	38-61	50	45	48	50	52	55
Mississippi River at Luling Ferry, station No. 7-3744 (drainage area 1, 243, 600 sq mi)							
January ----	37-54	45	42	43	44	46	48

Table 3. --Monthly temperature duration for selected sites--Continued

Month	Range in temperature	Average monthly temperature	Percent of time values equaled or exceeded those shown				
			90	70	50	30	10
Mississippi River at Luling Ferry, station No. 7-3744 (drainage area 1, 243, 600 sq mi)--Continued							
February ---	39-55	45	41	43	45	47	50
March -----	40-58	50	44	48	50	53	56
April ------	47-71	60	54	57	60	62	66
May -------	63-80	70	66	68	70	72	76
June -------	70-84	79	75	77	79	80	82
July -------	74-90	83	80	81	83	84	86
August -----	79-89	84	81	83	84	85	86
September--	73-88	82	78	79	81	83	86
October ----	60-82	72	66	69	72	74	78
November --	49-72	62	56	60	62	64	67
December --	42-62	50	46	48	50	53	56