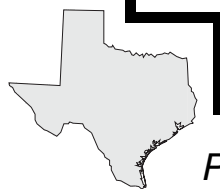


SUMMARY STATISTICS AND GRAPHICAL COMPARISONS OF SPECIFIC CONDUCTANCE, TEMPERATURE, AND DISSOLVED OXYGEN DATA, BUFFALO BAYOU, HOUSTON, TEXAS, APRIL 1986–MARCH 1991

U.S. GEOLOGICAL SURVEY
Open-File Report 95–706



Prepared in cooperation with the
CITY OF HOUSTON



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By D.W. Brown and E.M. Paul

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**In cooperation with the
CITY OF HOUSTON**

**Austin, Texas
1995**

U.S. DEPARTMENT OF THE INTERIOR

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U.S. GEOLOGICAL SURVEY

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CONTENTS

Abstract	1
Introduction	1
Summary Statistics	3
Graphical Comparisons	8
Reference	9

FIGURES

1. Map showing location of gaging stations, Buffalo Bayou, Houston, Texas	2
2. Hydrographs showing daily mean specific conductance, Buffalo Bayou, Houston, Texas	10
3–6. Boxplots showing daily mean specific conductance aggregated by:	
3. Station and season, Buffalo Bayou, Houston, Texas	11
4. Month, Buffalo Bayou at Houston, Texas (08074000), October 1987–March 1991	11
5. Month, Buffalo Bayou at Main Street, Houston, Texas (08074600), October 1986–March 1991	12
6. Month, Buffalo Bayou at Turning Basin, Houston, Texas (08074710), April 1986–March 1991	12
7. Hydrographs showing daily mean water temperature, Buffalo Bayou, Houston, Texas	13
8–11. Boxplots showing daily mean water temperature aggregated by:	
8. Station and season, Buffalo Bayou, Houston, Texas	14
9. Month, Buffalo Bayou at Houston, Texas (08074000), October 1987–March 1991	14
10. Month, Buffalo Bayou at Main Street, Houston, Texas (08074600), October 1986–March 1991	15
11. Month, Buffalo Bayou at Turning Basin, Houston, Texas (08074710), April 1986–March 1991	15
12. Hydrographs showing daily mean dissolved oxygen, Buffalo Bayou, Houston, Texas	16
13–16. Boxplots showing daily mean dissolved oxygen aggregated by:	
13. Station and season, Buffalo Bayou, Houston, Texas	17
14. Month, Buffalo Bayou at Houston, Texas (08074000), October 1987–March 1991	17
15. Month, Buffalo Bayou at Main Street, Houston, Texas (08074600), October 1986–March 1991	18
16. Month, Buffalo Bayou at Turning Basin, Houston, Texas (08074710), April 1986–March 1991	18

TABLES

1–3. Summary statistics by month for specific conductance, temperature, and dissolved oxygen, Buffalo Bayou at:	
1. Houston, Texas (08074000), October 1987–March 1991	3
2. Main Street, Houston, Texas (08074600), October 1986–March 1991	5
3. Turning Basin, Houston, Texas (08074710), April 1986–March 1991	6

Abbreviated Water-Property Units

°C, degrees Celsius

µS/cm, microsiemens per centimeter at 25 degrees Celsius

mg/L, milligrams per liter

Summary Statistics and Graphical Comparisons of Specific Conductance, Temperature, and Dissolved Oxygen Data, Buffalo Bayou, Houston, Texas, April 1986–March 1991

By D.W. Brown *and* E.M. Paul

Abstract

Buffalo Bayou is the major stream that drains the Houston, Texas, metropolitan area. The U.S. Geological Survey has provided specific conductance, temperature, and dissolved oxygen data to the City of Houston for three sites along a 7.7-mile reach of Buffalo Bayou since 1986. Summary statistics and graphical comparisons of the data show substantial variability in the properties during 1986–91. Specific conductance ranged from about 100 microsiemens per centimeter at 25 degrees Celsius at each of the three sites to 17,100 microsiemens per centimeter at 25 degrees Celsius at the most downstream site, at the headwaters of the Houston Ship Channel. Water temperatures ranged from 5 to 33 degrees Celsius. Temperatures were very similar at the two upstream sites and slightly warmer at the most downstream site. Dissolved oxygen ranged from zero at the most downstream site to 11.7 milligrams per liter at the most upstream site.

INTRODUCTION

Buffalo Bayou is the major stream that drains the Houston, Tex., metropolitan area (fig. 1). Flow in the bayou is regulated by flood-detention reservoirs near the western limits of the city. From there, Buffalo Bayou meanders eastward through downtown Houston to the Houston Ship Channel. The city wants to maintain the aesthetics of the bayou, including water quality, so that it is attractive and beneficial to the community and its visitors. The U.S. Geological Survey (USGS) has provided specific conductance, temperature, and dissolved oxygen data to the city for three sites along a 7.7-mile (mi) reach of Buffalo Bayou since 1986.

The purpose of this report, prepared in cooperation with the City of Houston, is to summarize the water-property data that the USGS has collected at the three Buffalo Bayou gaging stations during April 1986–May 1991. Summary statistics of the properties (maximum, minimum, mean, standard deviation, and selected percentiles) are aggregated by station and month for the periods of record. Hydrographs of daily mean properties for the periods of record and boxplots of the properties aggregated by station and season and by station and month are presented.

The three gaging stations on Buffalo Bayou at which water-property data were recorded (fig. 1) are Buffalo Bayou at Houston (08074000), Buffalo Bayou at Main Street, Houston (08074600), and Buffalo Bayou at Turning Basin, Houston (08074710). Buffalo Bayou at Houston is located at lat. 29°45'36", long. 95°24'30", on the right bank at the downstream side of a bridge across the bayou on Shepherd Drive 0.8 mi upstream from Waugh Drive. The drainage area upstream of the gage is 358 square miles (mi²). Buffalo Bayou at Main Street is located at lat. 29°45'54", long. 95°21'32", on the left bank at the mouth of Whiteoak Bayou at the upstream side of the Main Street viaduct 3.2 mi downstream from the Buffalo Bayou at Houston gage. The drainage area upstream of the gage (08074600) is 469 mi². The gage is affected by tides. Buffalo Bayou at Turning Basin is located at lat. 29°44'57", long. 95°17'27", on the left bank at Wharf No. 5 at the end of a private road 4.5 mi downstream from the Buffalo Bayou at Main Street gage. The drainage area is undetermined. The gage (08074710) is affected by tides.

Each of the gages is a three-parameter USGS mini-monitor with a Handar 570 Data Control Platform (DCP) that facilitates data transmission by way of satellite to a USGS computer every 4 hours. The instruments record data hourly. Each gage also is equipped to measure stage (water-surface elevation above a

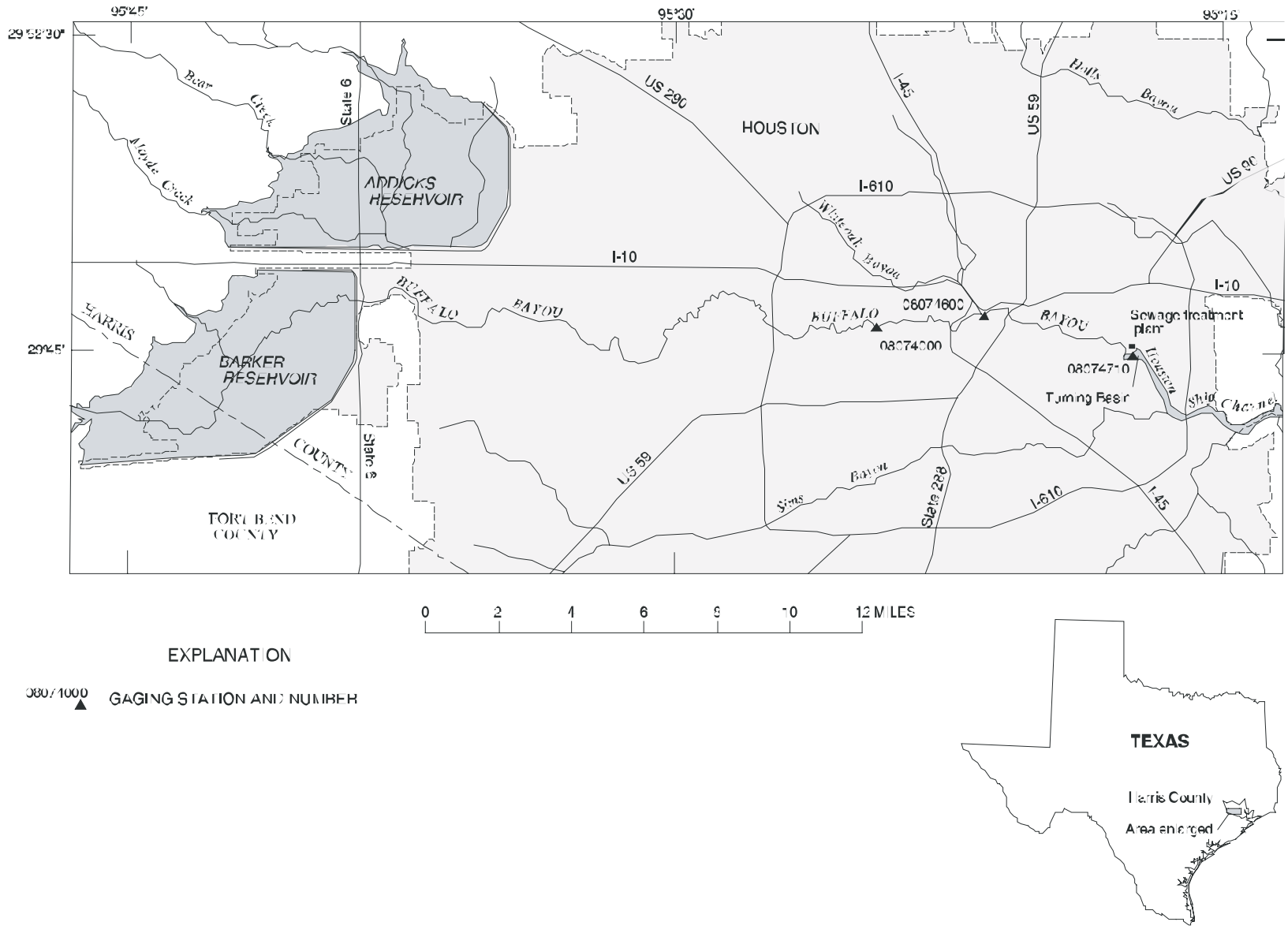


Figure 1. Location of gaging stations, Buffalo Bayou, Houston, Texas.

datum). Buffalo Bayou at Turning Basin is unique among the three sites in that a floating platform suspends the monitor probes at a constant depth of 2 feet (ft) below the water surface at any stage. The City of Houston, which monitors the data through the USGS computer, uses the data to assess the effectiveness of environmental controls on one of its largest sewage treatment plants a short distance upstream from the Turning Basin site (fig. 1).

Quality assurance of data collected from the Buffalo Bayou monitor network is accomplished by daily checks of the DCP data. The data are reviewed manually and by computerized data-analysis programs.

SUMMARY STATISTICS

Specific conductance, temperature, and dissolved oxygen varied substantially in Buffalo Bayou during 1986–91 (tables 1–3). The minimum daily mean specific conductance at all three sites was about 100 $\mu\text{S}/\text{cm}$; the minimum occurred in January at the most

upstream site and in June at the other two sites. Maximum daily mean specific conductance at each of the three sites (in downstream order) was 999, 2,680, and 17,100 $\mu\text{S}/\text{cm}$, and occurred in October, January, and December, respectively. Specific conductance at the sites typically increased with increasing proximity to the more saline Houston Ship Channel.

Daily mean water temperature in the bayou ranged from a minimum of 5 $^{\circ}\text{C}$ at the Main Street site in December to a maximum of 33 $^{\circ}\text{C}$ at the Turning Basin site in August. Minimum and maximum daily mean temperatures were very similar at the two upstream sites and were slightly warmer at the Turning Basin site.

Daily mean dissolved oxygen ranged from a minimum of zero at the Turning Basin site in November to a maximum of 11.7 mg/L at the most upstream site in December. Daily mean dissolved oxygen concentrations at the sites typically decreased with proximity to the ship channel and varied inversely with temperature.

Table 1. Summary statistics by month for specific conductance, temperature, and dissolved oxygen, Buffalo Bayou at Houston, Texas (08074000), October 1987–March 1991

[$\mu\text{S}/\text{cm}$, microsiemens per centimeter at 25 degrees Celsius; $^{\circ}\text{C}$, degrees Celsius; mg/L, milligrams per liter]

Period	Property	Maximum	Minimum	Mean	Standard deviation	Percentiles ¹				
						95	75	Median	25	5
Entire record										
	Specific conductance ($\mu\text{S}/\text{cm}$)	999	109	545	224.9	833	747	585	350	170
	Temperature ($^{\circ}\text{C}$)	30.0	6.0	22.1	5.5	29.0	27.0	22.0	18.0	12.0
	Dissolved oxygen (mg/L)	11.7	1.4	6.4	1.4	8.7	7.3	6.3	5.5	4.3
October										
	Specific conductance ($\mu\text{S}/\text{cm}$)	999	217	703	161.1	855	813	766	631	334
	Temperature ($^{\circ}\text{C}$)	28.0	17.0	22.8	2.2	26.0	24.0	23.0	21.0	18.0
	Dissolved oxygen (mg/L)	8.1	4.3	6.2	.9	7.9	6.9	6.0	5.4	4.8
November										
	Specific conductance ($\mu\text{S}/\text{cm}$)	907	203	615	171.2	820	745	687	492	256
	Temperature ($^{\circ}\text{C}$)	24.0	14.0	19.6	2.6	24.0	22.0	20.0	17.0	15.0
	Dissolved oxygen (mg/L)	9.2	4.0	6.8	1.0	8.3	7.5	6.7	6.1	5.2
December										
	Specific conductance ($\mu\text{S}/\text{cm}$)	996	146	652	188.7	842	787	724	529	231
	Temperature ($^{\circ}\text{C}$)	22.0	6.0	15.2	3.3	20.0	18.0	15.0	13.0	9.0
	Dissolved oxygen (mg/L)	11.7	3.6	7.7	1.5	10.4	8.5	7.9	6.8	5.4

Footnote at end of table.

Table 1. Summary statistics by month for specific conductance, temperature, and dissolved oxygen, Buffalo Bayou at Houston, Texas (08074000), October 1987–March 1991—Continued

Period	Property	Maximum	Minimum	Mean	Standard deviation	Percentiles ¹				
						95	75	Median	25	5
January										
	Specific conductance (µS/cm)	990	109	470	240.4	802	700	480	230	131
	Temperature (°C)	21.0	7.0	14.5	3.0	20.0	16.0	14.5	12.0	11.0
	Dissolved oxygen (mg/L)	11.4	3.4	7.6	1.6	10.5	8.4	7.8	6.6	4.9
February										
	Specific conductance (µS/cm)	833	116	497	238.1	812	716	558	251	135
	Temperature (°C)	21.0	7.0	16.0	2.8	20.0	18.0	16.0	14.0	11.0
	Dissolved oxygen (mg/L)	10.2	5.4	7.7	1.1	9.6	8.5	7.6	7.1	5.9
March										
	Specific conductance (µS/cm)	900	170	568	216.4	828	769	603	384	193
	Temperature (°C)	23.0	12.0	19.2	2.6	23.0	21.0	19.0	17.0	14.0
	Dissolved oxygen (mg/L)	9.7	3.4	6.9	1.1	8.5	7.7	6.9	6.3	5.3
April										
	Specific conductance (µS/cm)	979	123	471	251.4	842	718	446	231	142
	Temperature (°C)	26.0	17.0	22.2	2.1	25.0	24.0	22.0	20.0	18.0
	Dissolved oxygen (mg/L)	7.7	4.2	6.5	.7	7.5	7.0	6.4	6.0	5.3
May										
	Specific conductance (µS/cm)	850	127	426	236.6	832	624	387	201	149
	Temperature (°C)	28.0	21.0	25.1	1.8	28.0	26.0	25.0	23.0	22.0
	Dissolved oxygen (mg/L)	7.8	3.7	5.8	1.1	7.6	6.5	6.1	4.7	4.0
June										
	Specific conductance (µS/cm)	868	155	517	237.9	854	760	492	280	185
	Temperature (°C)	30.0	23.0	27.8	1.5	30.0	28.0	28.0	27.0	25.0
	Dissolved oxygen (mg/L)	7.3	2.6	5.5	1.0	6.9	6.2	5.7	4.9	3.6
July										
	Specific conductance (µS/cm)	997	128	518	158.9	778	632	525	399	247
	Temperature (°C)	30.0	25.0	28.3	1.1	30.0	29.0	28.0	27.0	26.0
	Dissolved oxygen (mg/L)	6.6	3.4	5.2	.7	6.1	5.7	5.3	4.7	3.9
August										
	Specific conductance (µS/cm)	830	156	531	183.6	771	680	571	387	183
	Temperature (°C)	30.0	25.0	28.5	1.0	30.0	29.0	28.0	28.0	26.0
	Dissolved oxygen (mg/L)	7.1	2.9	5.5	.8	6.7	6.0	5.5	5.0	4.0
September										
	Specific conductance (µS/cm)	920	167	567	219.5	836	759	612	358	212
	Temperature (°C)	30.0	22.0	26.4	2.1	29.0	28.0	26.0	25.0	22.0
	Dissolved oxygen (mg/L)	7.5	1.4	5.7	1.1	7.2	6.5	5.9	5.2	3.7

¹ The nth percentile is the value that exceeds no more than n percent of the data and is exceeded by no more than 100-n percent of the data.

Table 2. Summary statistics by month for specific conductance, temperature, and dissolved oxygen, Buffalo Bayou at Main Street, Houston, Texas (08074600), October 1986–March 1991

[$\mu\text{S}/\text{cm}$, microsiemens per centimeter at 25 degrees Celsius; $^{\circ}\text{C}$, degrees Celsius; mg/L , milligrams per liter]

Period	Property	Maximum	Minimum	Mean	Standard deviation	Percentiles ¹				
						95	75	Median	25	5
Entire record										
	Specific conductance ($\mu\text{S}/\text{cm}$)	2,680	111	583	332.9	1,180	776	560	310	165
	Temperature ($^{\circ}\text{C}$)	31.0	5.0	22.1	5.6	29.0	27.0	22.0	17.0	12.0
	Dissolved oxygen (mg/L)	11.4	.5	5.4	1.9	8.8	6.6	5.2	4.1	2.3
October										
	Specific conductance ($\mu\text{S}/\text{cm}$)	2,080	167	741	384.8	1,570	922	700	475	212
	Temperature ($^{\circ}\text{C}$)	29.0	17.0	22.8	2.6	28.0	24.0	22.0	21.0	19.0
	Dissolved oxygen (mg/L)	7.8	.7	5.0	1.6	7.3	6.3	5.1	4.1	1.9
November										
	Specific conductance ($\mu\text{S}/\text{cm}$)	1,780	197	676	319.7	1,320	841	641	451	234
	Temperature ($^{\circ}\text{C}$)	24.0	13.0	19.4	2.7	23.0	22.0	20.0	17.0	15.0
	Dissolved oxygen (mg/L)	9.7	1.7	5.5	1.6	8.2	6.7	5.5	4.6	2.6
December										
	Specific conductance ($\mu\text{S}/\text{cm}$)	1,800	159	742	390.4	1,440	1,030	715	393	207
	Temperature ($^{\circ}\text{C}$)	21.0	5.0	14.7	3.1	19.0	17.0	15.0	13.0	9.0
	Dissolved oxygen (mg/L)	10.5	2.7	6.7	1.6	9.8	7.7	6.7	5.7	3.9
January										
	Specific conductance ($\mu\text{S}/\text{cm}$)	2,680	117	517	479.9	1,720	651	366	206	141
	Temperature ($^{\circ}\text{C}$)	20.0	6.0	13.9	2.7	19.0	15.0	13.0	12.0	10.0
	Dissolved oxygen (mg/L)	11.4	.8	7.3	2.0	10.1	8.6	7.7	5.8	3.7
February										
	Specific conductance ($\mu\text{S}/\text{cm}$)	1,040	114	484	240.0	800	709	509	240	129
	Temperature ($^{\circ}\text{C}$)	20.0	6.0	15.5	2.7	19.0	17.0	15.0	14.0	10.0
	Dissolved oxygen (mg/L)	10.4	3.6	7.2	1.6	9.8	8.3	7.4	6.1	4.4
March										
	Specific conductance ($\mu\text{S}/\text{cm}$)	1,590	159	596	277.4	1,030	767	612	376	178
	Temperature ($^{\circ}\text{C}$)	23.0	12.0	18.7	2.6	22.0	20.0	19.0	17.0	13.0
	Dissolved oxygen (mg/L)	9.1	2.3	6.0	1.5	8.7	7.1	6.0	4.8	3.2
April										
	Specific conductance ($\mu\text{S}/\text{cm}$)	1,090	123	548	269.0	905	806	554	303	146
	Temperature ($^{\circ}\text{C}$)	26.0	16.0	21.8	2.4	25.0	24.0	22.0	20.0	17.0
	Dissolved oxygen (mg/L)	7.2	1.6	5.3	1.4	7.0	6.3	5.5	4.4	2.5
May										
	Specific conductance ($\mu\text{S}/\text{cm}$)	914	114	411	237.4	870	616	332	202	142
	Temperature ($^{\circ}\text{C}$)	28.0	21.0	24.9	1.7	27.0	26.0	25.0	23.0	22.0
	Dissolved oxygen (mg/L)	9.0	1.1	4.7	1.5	7.2	5.6	4.9	3.9	1.7

Footnote at end of table.

Table 2. Summary statistics by month for specific conductance, temperature, and dissolved oxygen, Buffalo Bayou at Main Street, Houston, Texas (08074600), October 1986–March 1991—Continued

Period	Property	Maximum	Minimum	Mean	Standard deviation	Percentiles ¹				
						95	75	Median	25	5
June										
	Specific conductance (µS/cm)	890	111	444	252.2	867	721	366	218	167
	Temperature (°C)	30.0	23.0	27.4	1.7	30.0	28.0	27.0	26.0	24.0
	Dissolved oxygen (mg/L)	10.7	.7	4.4	1.6	7.8	5.3	4.6	3.3	1.9
July										
	Specific conductance (µS/cm)	906	155	487	187.7	792	633	480	319	216
	Temperature (°C)	30.0	24.0	28.2	1.2	30.0	29.0	28.0	27.0	26.0
	Dissolved oxygen (mg/L)	10.5	1.2	4.4	1.5	8.5	4.8	4.3	3.3	2.5
August										
	Specific conductance (µS/cm)	1,860	137	676	322.6	1,280	845	660	438	193
	Temperature (°C)	31.0	24.0	28.9	1.2	30.0	30.0	29.0	28.0	26.0
	Dissolved oxygen (mg/L)	6.2	2.0	4.3	1.0	6.0	5.1	4.4	3.5	2.6
September										
	Specific conductance (µS/cm)	2,270	200	671	305.6	1,220	842	657	445	226
	Temperature (°C)	30.0	22.0	26.6	1.9	29.0	28.0	27.0	25.0	23.0
	Dissolved oxygen (mg/L)	6.2	.5	3.8	1.5	5.9	5.0	4.0	2.7	1.2

¹ The nth percentile is the value that exceeds no more than n percent of the data and is exceeded by no more than 100-n percent of the data.

Table 3. Summary statistics by month for specific conductance, temperature, and dissolved oxygen, Buffalo Bayou at Turning Basin, Houston, Texas (08074710), April 1986–March 1991

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter]

Period	Property	Maximum	Minimum	Mean	Standard deviation	Percentiles ¹				
						95	75	Median	25	5
Entire record										
	Specific conductance (µS/cm)	17,100	97.0	5,370	4,284.9	13,500	8,420	4,610	1,490	282
	Temperature (°C)	33.0	9.0	23.6	5.8	31.0	29.0	24.0	18.0	13.0
	Dissolved oxygen (mg/L)	10.0	.0	4.1	2.0	8.1	5.3	3.8	2.5	1.2
October										
	Specific conductance (µS/cm)	16,800	502	8,480	4,241.3	15,600	11,800	8,330	5,270	1,420
	Temperature (°C)	30.0	19.0	25.3	2.2	29.0	26.0	25.0	24.0	21.0
	Dissolved oxygen (mg/L)	6.7	.9	3.5	1.2	5.6	4.3	3.6	2.6	1.7
November										
	Specific conductance (µS/cm)	15,400	520	7,710	4,081.6	14,500	11,400	7,480	4,470	1,080
	Temperature (°C)	25.0	16.0	21.4	2.2	24.0	23.0	21.0	20.0	16.0
	Dissolved oxygen (mg/L)	7.2	.0	3.9	1.5	6.4	4.8	4.1	3.3	.5

Footnote at end of table.

Table 3. Summary statistics by month for specific conductance, temperature, and dissolved oxygen, Buffalo Bayou at Turning Basin, Houston, Texas (08074710), April 1986–March 1991—Continued

Period	Property	Maximum	Minimum	Mean	Standard deviation	Percentiles ¹				
						95	75	Median	25	5
December										
	Specific conductance (µS/cm)	17,100	235	7,840	4,603.7	15,600	11,100	8,240	4,040	438
	Temperature (°C)	22.0	10.0	16.6	2.6	20.0	18.0	17.0	15.0	12.0
	Dissolved oxygen (mg/L)	9.6	1.7	5.9	1.8	9.1	7.5	5.6	4.4	3.1
January										
	Specific conductance (µS/cm)	15,900	141	4,540	3,882.6	11,400	7,520	3,300	834	272
	Temperature (°C)	21.0	9.0	14.6	2.2	18.0	16.0	14.0	13.0	11.0
	Dissolved oxygen (mg/L)	10.0	3.7	7.4	1.4	9.6	8.4	7.5	6.3	5.1
February										
	Specific conductance (µS/cm)	11,100	197	5,230	3,611.7	10,800	8,570	5,320	1,470	282
	Temperature (°C)	21.0	12.0	16.3	1.8	19.0	17.0	16.0	15.0	13.0
	Dissolved oxygen (mg/L)	9.4	1.0	5.8	1.7	8.6	7.0	6.0	5.1	2.1
March										
	Specific conductance (µS/cm)	11,700	404	4,040	2,945.1	9,470	6,350	3,120	1,620	465
	Temperature (°C)	23.0	14.0	19.1	2.1	22.0	21.0	19.0	17.0	15.0
	Dissolved oxygen (mg/L)	9.6	.8	4.9	1.9	7.8	6.2	5.2	3.6	1.3
April										
	Specific conductance (µS/cm)	14,600	154	4,800	4,350.7	12,800	8,810	3,920	717	226
	Temperature (°C)	26.0	18.0	22.3	1.8	25.0	23.0	22.0	21.0	19.0
	Dissolved oxygen (mg/L)	8.3	.3	4.1	1.6	6.6	5.2	4.3	2.8	1.2
May										
	Specific conductance (µS/cm)	14,400	137	3,140	3,341.9	10,700	4,670	2,450	347	226
	Temperature (°C)	29.0	21.0	25.9	1.7	28.0	27.0	26.0	25.0	23.0
	Dissolved oxygen (mg/L)	7.3	.3	2.9	1.3	5.0	3.8	2.9	1.9	1.0
June										
	Specific conductance (µS/cm)	10,600	97.0	2,070	2,843.2	9,330	1,850	755	304	226
	Temperature (°C)	32.0	24.0	28.7	1.7	31.0	29.0	29.0	27.0	25.0
	Dissolved oxygen (mg/L)	6.1	.4	3.2	1.2	5.3	4.0	3.2	2.4	1.5
July										
	Specific conductance (µS/cm)	13,500	167	3,440	2,821.3	9,070	4,700	3,030	831	301
	Temperature (°C)	32.0	25.0	29.8	1.1	31.0	30.0	30.0	29.0	27.0
	Dissolved oxygen (mg/L)	5.5	.4	2.6	1.0	4.7	3.3	2.5	1.9	.9
August										
	Specific conductance (µS/cm)	16,500	160	7,010	4,108.8	14,400	9,500	6,930	3,460	414
	Temperature (°C)	33.0	25.0	30.4	1.1	32.0	31.0	30.0	29.0	28.0
	Dissolved oxygen (mg/L)	6.6	.1	2.6	1.3	5.0	3.7	2.3	1.5	1.0
September										
	Specific conductance (µS/cm)	17,000	389	6,680	4,276.8	15,000	8,890	5,940	3,450	1,060
	Temperature (°C)	32.0	25.0	28.9	1.3	30.0	30.0	29.0	28.0	26.0
	Dissolved oxygen (mg/L)	6.1	.3	2.9	1.2	4.9	3.6	3.0	2.0	.5

¹ The nth percentile is the value that exceeds no more than n percent of the data and is exceeded by no more than 100-n percent of the data.

GRAPHICAL COMPARISONS

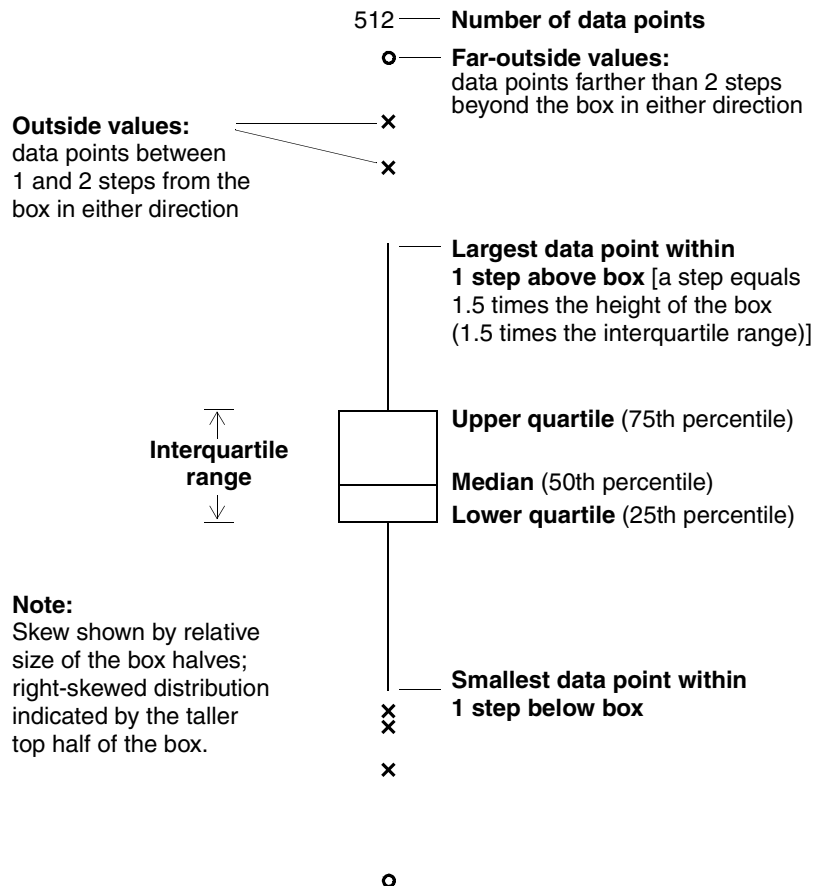
In addition to hydrographs of daily mean properties for the periods of record, boxplots (Helsel and Hirsch, 1992) of the properties aggregated by station and season and by station and month are presented. The boxplots facilitate comparison of ranges of properties by season and by month at the three gaging stations. As explained below, the boxplots also show the center of the data (median), the variation (interquartile range), the skew (relative size of the box halves), and the presence or absence of unusual values (outside and far-outside values).

The hydrographs of daily mean specific conductance (fig. 2) and the boxplots of daily mean specific conductance aggregated by station and season (fig. 3) show that specific conductance varied over a much wider range at the Turning Basin site than at the two upstream sites. The seasonal boxplots also show that specific conductance was appreciably higher in the

winter than in the summer at the Turning Basin site and slightly higher in the winter than in the summer at the two upstream sites.

The boxplots of daily mean specific conductance aggregated by month at each station (figs. 4–6) show that the smallest median specific conductance was in May or June, and the largest was in October or December. Variability in specific conductance, as indicated by the interquartile range, was smallest (182 $\mu\text{S}/\text{cm}$) at the most upstream site in October and largest (8,090 $\mu\text{S}/\text{cm}$) at the Turning Basin site in April. No consistent pattern of variability is evident.

The hydrographs of daily mean water temperature (fig. 7) and the boxplots of daily mean water temperature aggregated by station and season (fig. 8) show very similar patterns at each of the three sites. The seasonal boxplots also show that variability in temperature, as indicated by the interquartile range, was larger in the winter than in the summer.



The smallest median of daily mean water temperature¹ aggregated by month at the three sites was in January and the highest was in August (figs. 9–11). Variability in temperature, as indicated by the interquartile range, was lowest (1 °C) at the most upstream site in June and August and at the Turning Basin site in July; variability was largest (5 °C) at the most upstream site in November and December and at the Main Street site in November.

The hydrographs of daily mean dissolved oxygen (fig. 12) show that concentrations were cyclic, typically higher in the colder months and lower in the warmer months. The boxplots of daily mean dissolved oxygen aggregated by station and season (fig. 13) show that concentrations typically decreased with proximity of the sites to the ship channel and that seasonal variability, as indicated by the interquartile range, was smallest

¹ Slight differences between the temperature percentiles indicated on the boxplots (figs. 9–11) and the corresponding percentiles in tables 1–3 are because the boxplots reflect actual values, and the tables report values rounded to the nearest 0.5 °C.

at the most upstream site in the summer and largest at the Turning Basin site in the winter.

The smallest median of daily mean dissolved oxygen concentration² aggregated by month at the three sites was in July, August, or September and the largest was in December or January (figs. 14–16). Variability in dissolved oxygen, as indicated by the interquartile range, was smallest (1.0 mg/L) at the most upstream site in April, July, and August and largest (3.1 mg/L) at the Turning Basin site in December.

REFERENCE

Helsel, D.R., and Hirsch, R.M., 1992, *Statistical methods in water resources*: New York, Elsevier, 522 p.

² Slight differences between the dissolved oxygen percentiles indicated on the boxplots (figs. 14–16) and the corresponding percentiles in tables 1–3 are because the boxplots reflect actual values, and the tables report values rounded to the nearest 0.1 mg/L.

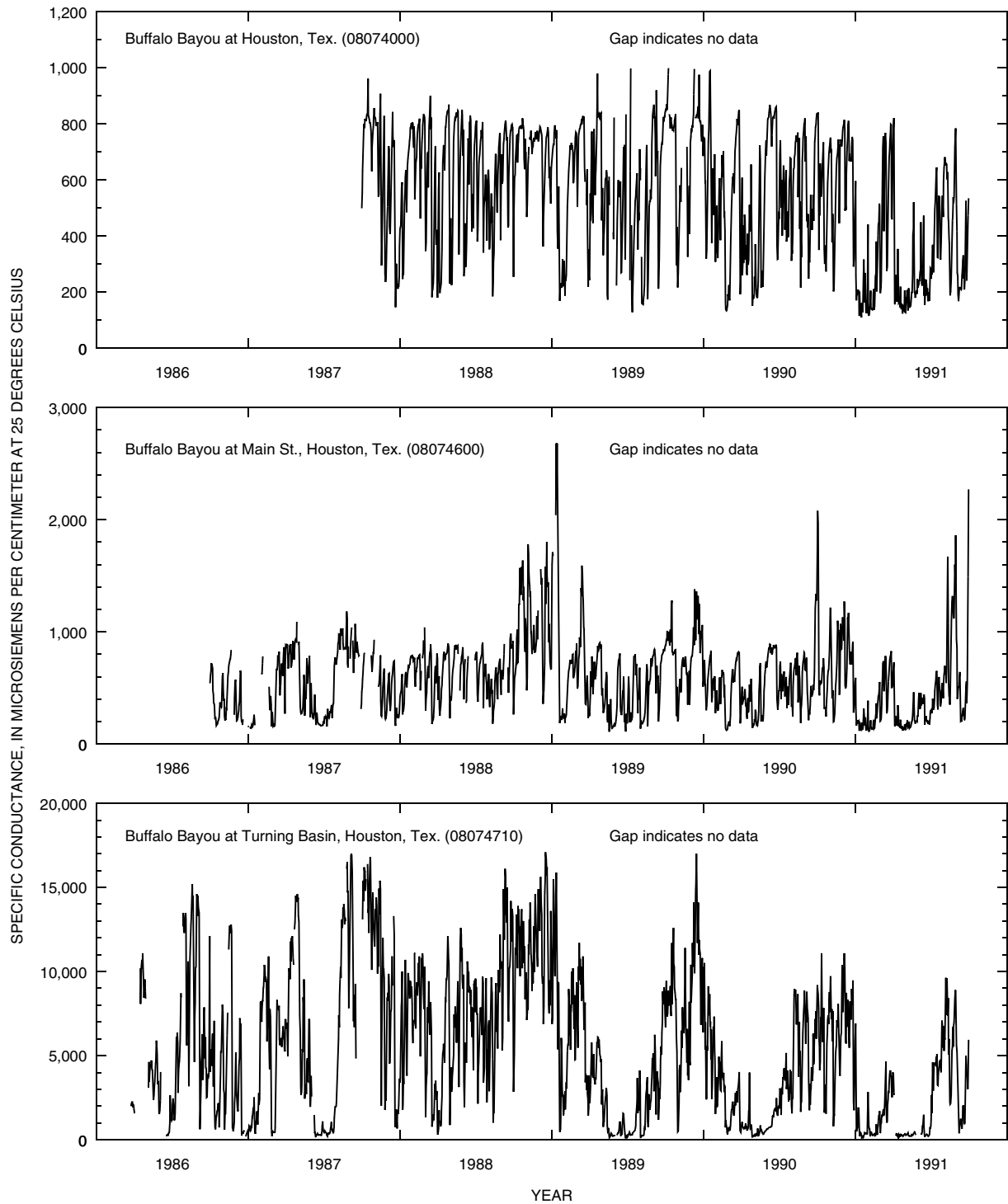


Figure 2. Hydrographs showing daily mean specific conductance, Buffalo Bayou, Houston, Texas.

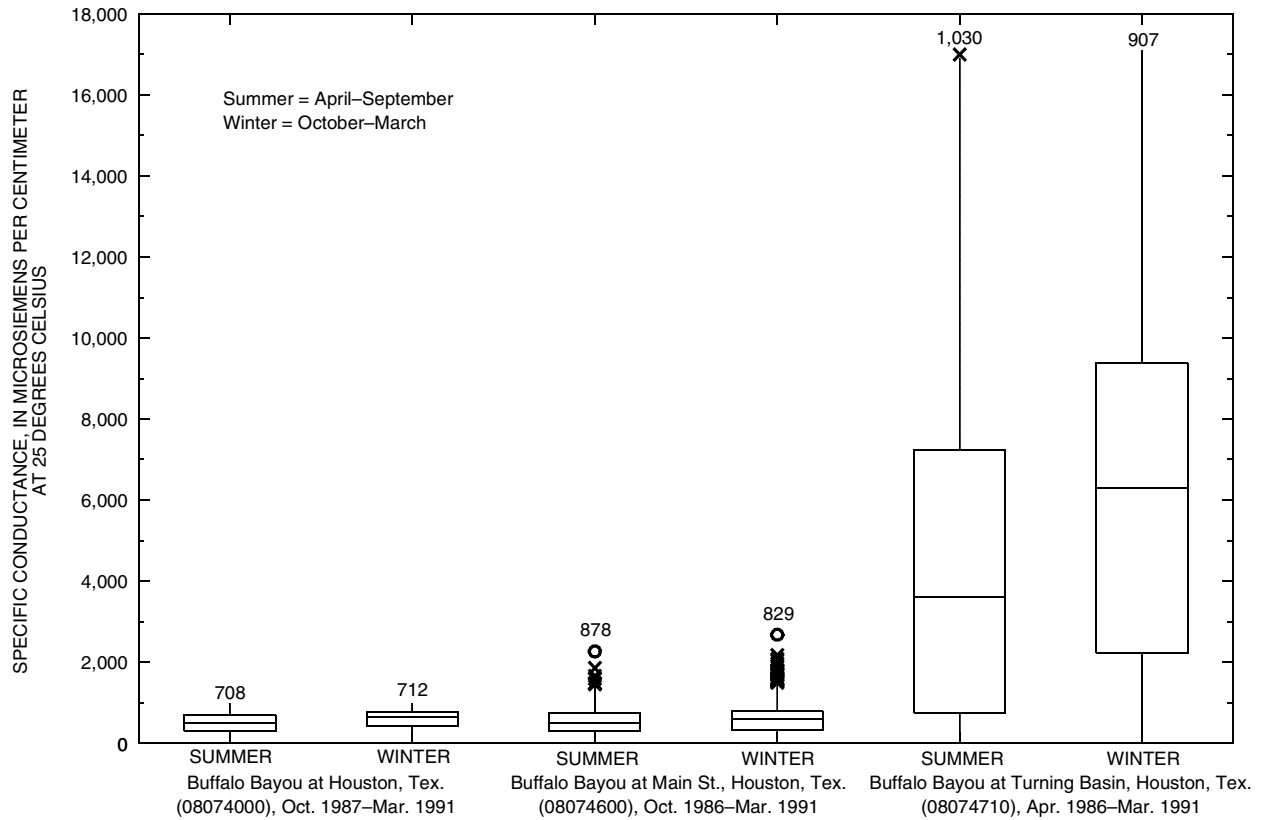


Figure 3. Daily mean specific conductance aggregated by station and season, Buffalo Bayou, Houston, Texas.

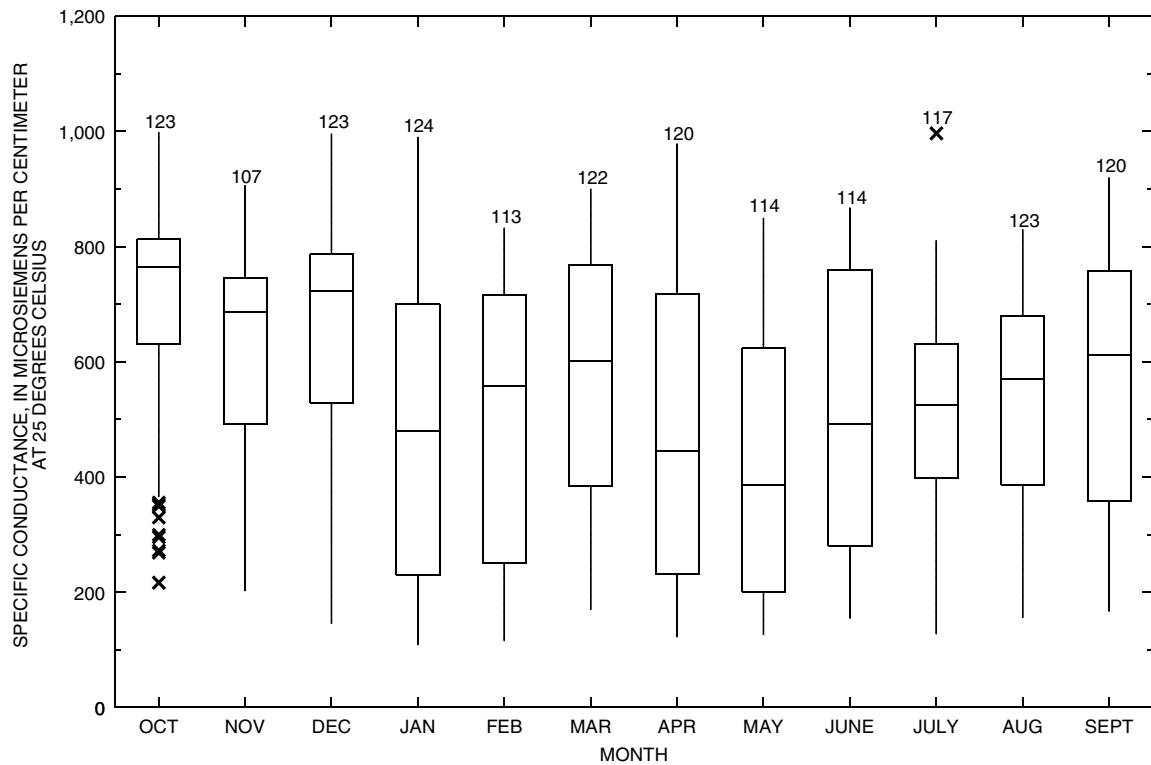


Figure 4. Daily mean specific conductance aggregated by month, Buffalo Bayou at Houston, Texas (08074000), October 1987–March 1991.

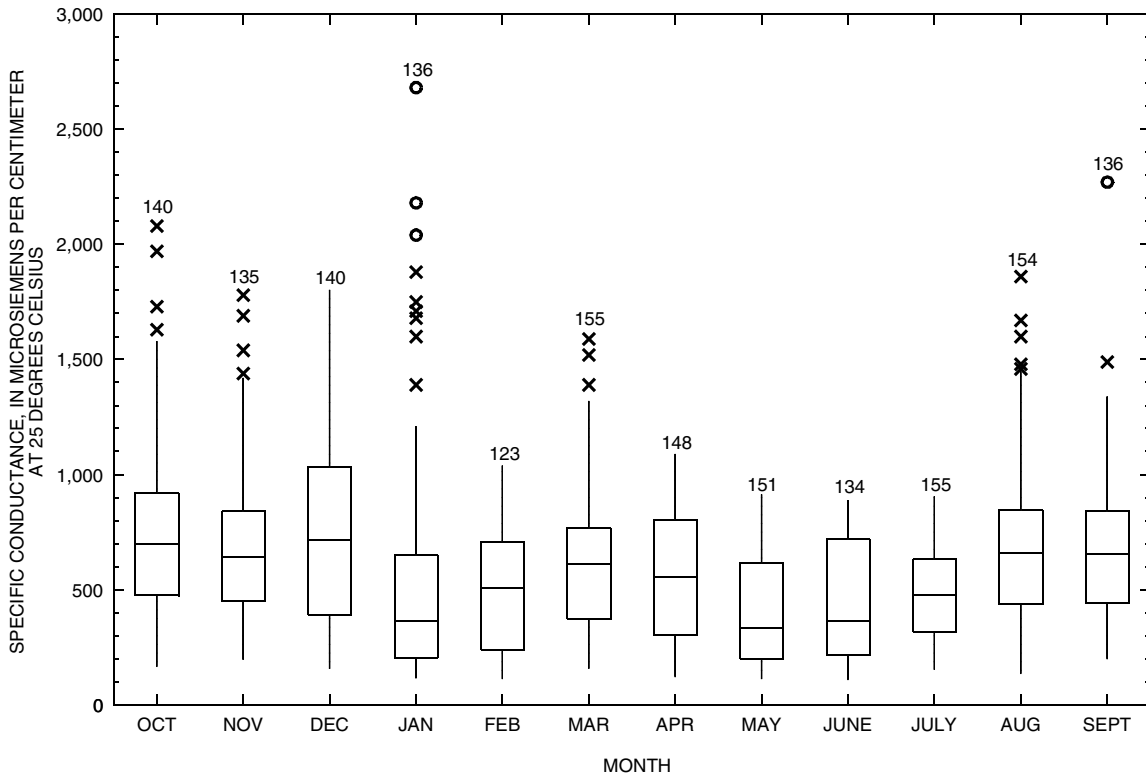


Figure 5. Daily mean specific conductance aggregated by month, Buffalo Bayou at Main Street, Houston, Texas (08074600), October 1986–March 1991.

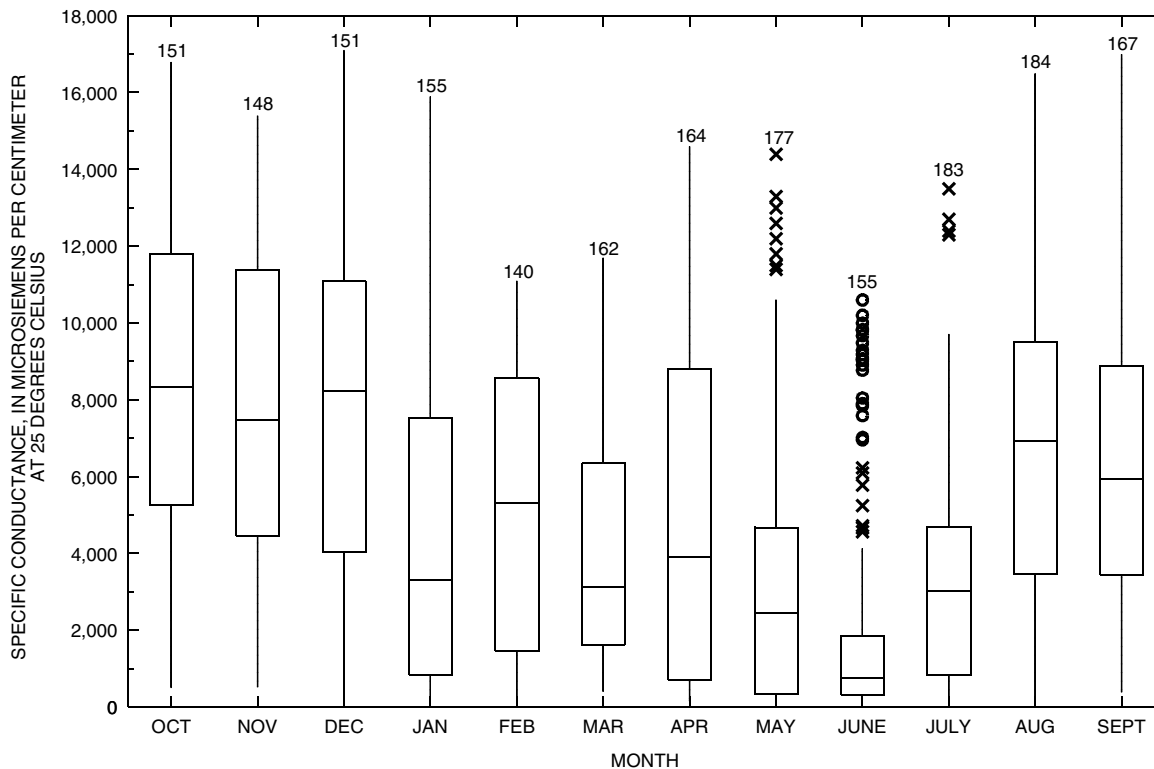


Figure 6. Daily mean specific conductance aggregated by month, Buffalo Bayou at Turning Basin, Houston, Texas (08074710), April 1986–March 1991.

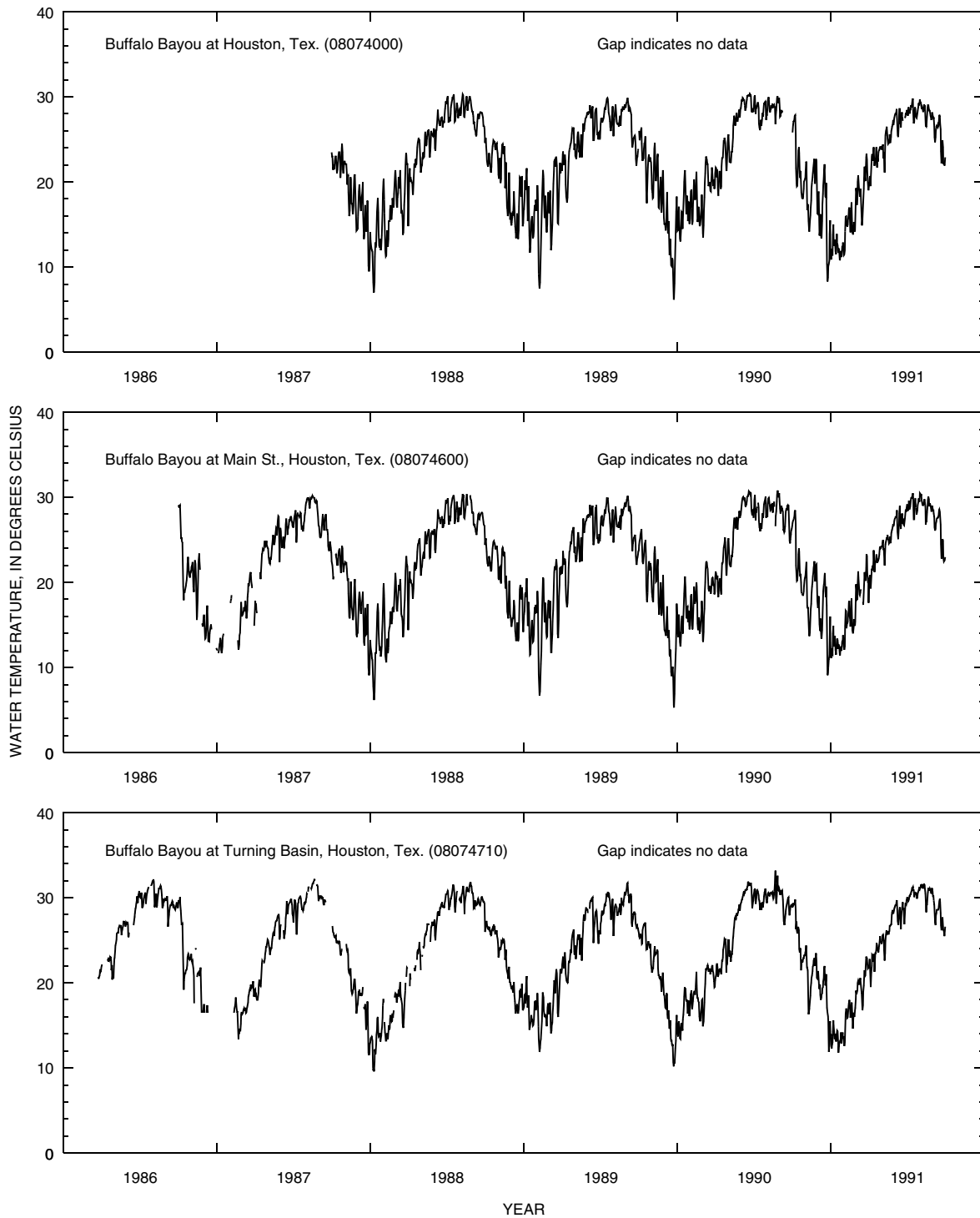


Figure 7. Hydrographs showing daily mean water temperature, Buffalo Bayou, Houston, Texas.

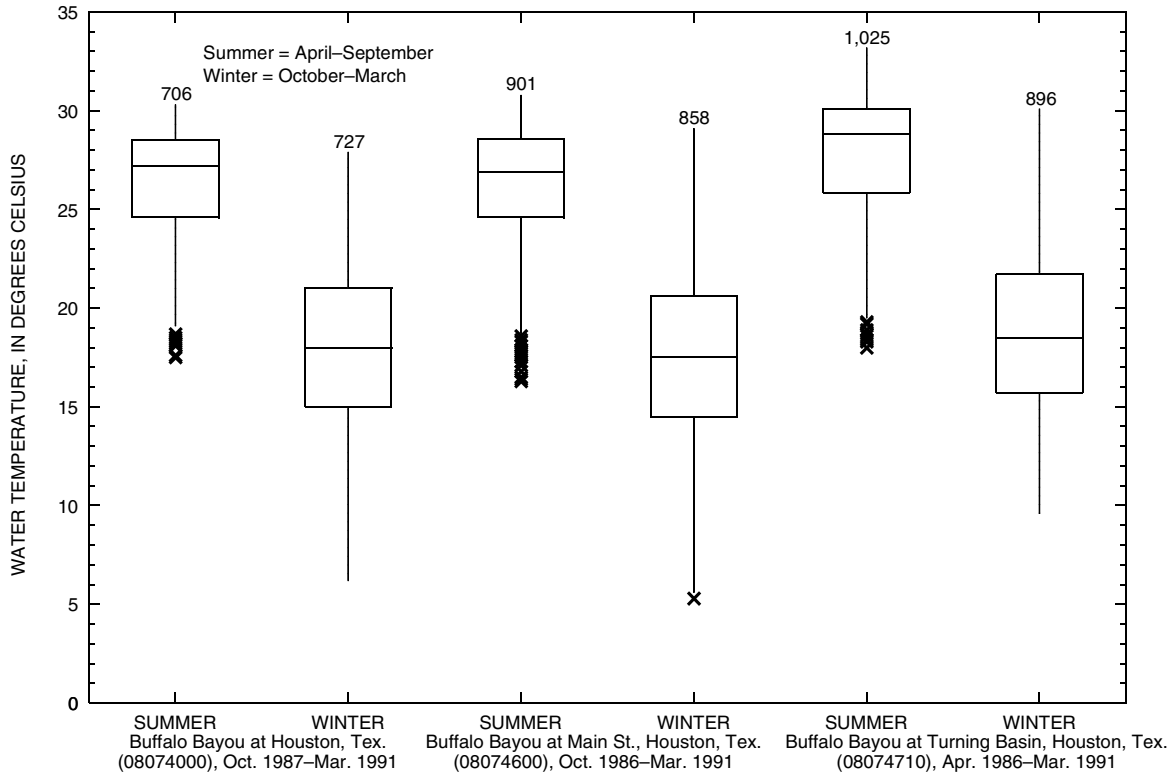


Figure 8. Daily mean water temperature aggregated by station and season, Buffalo Bayou, Houston, Texas.

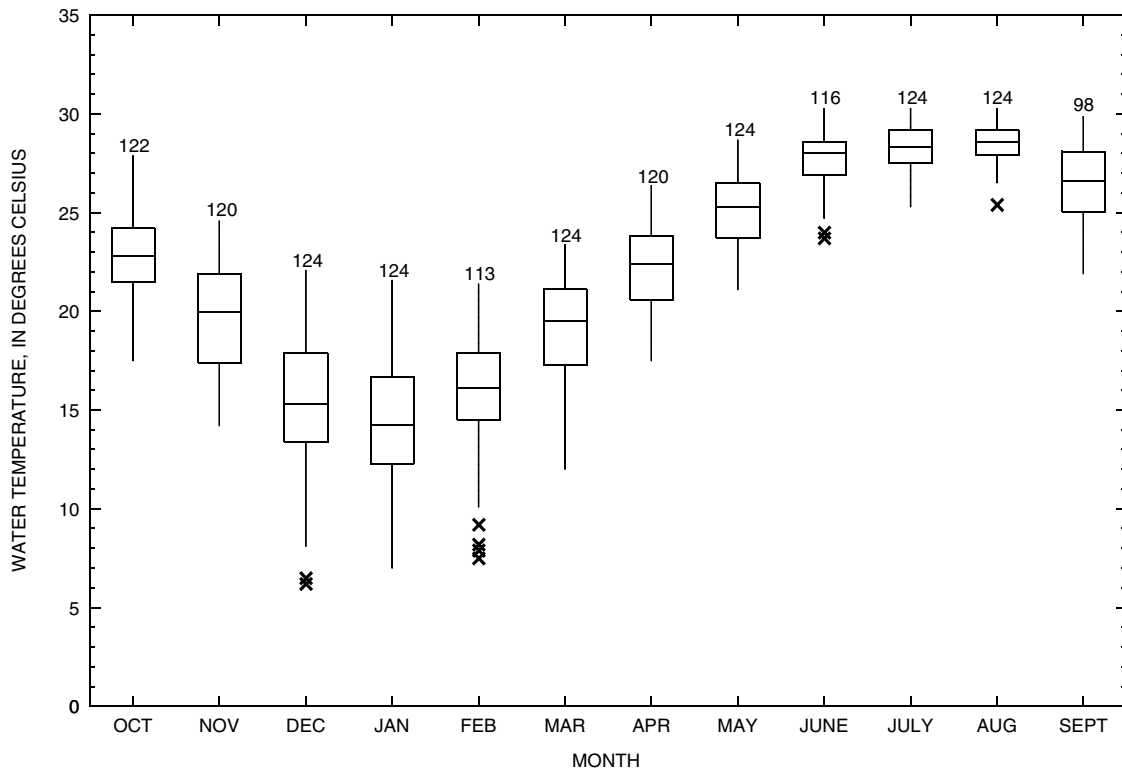


Figure 9. Daily mean water temperature aggregated by month, Buffalo Bayou at Houston, Texas (08074000), October 1987–March 1991.

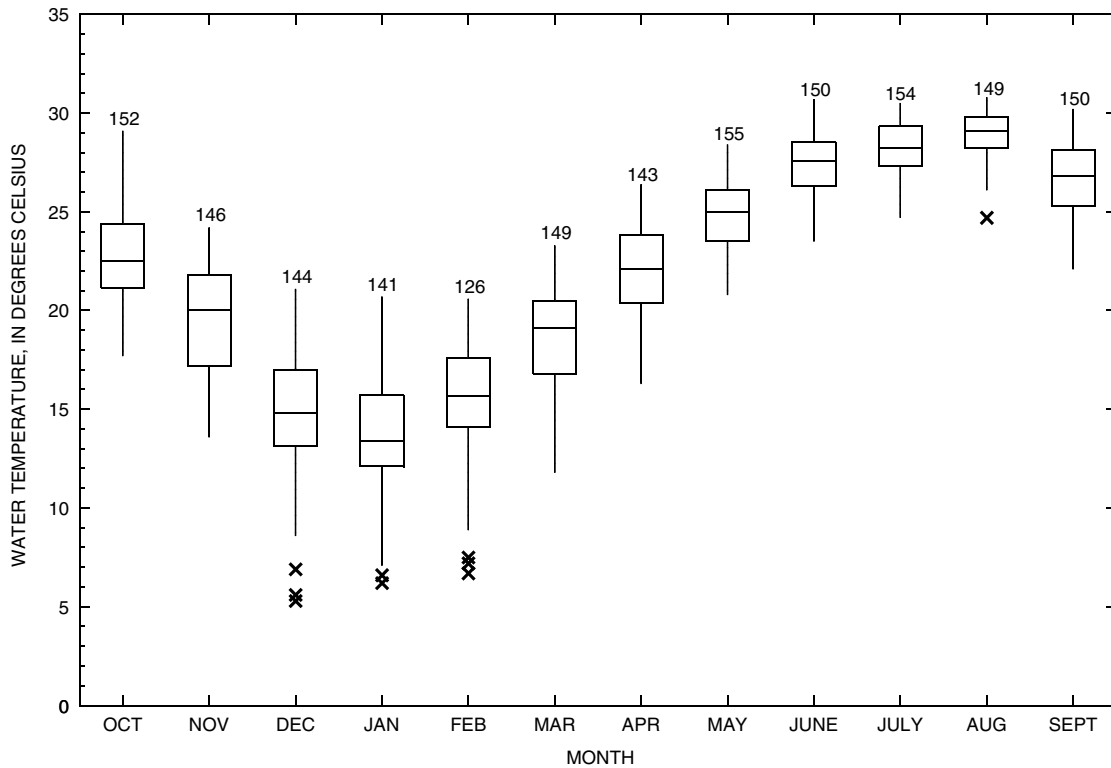


Figure 10. Daily mean water temperature aggregated by month, Buffalo Bayou at Main Street, Houston, Texas (08074600), October 1986–March 1991.

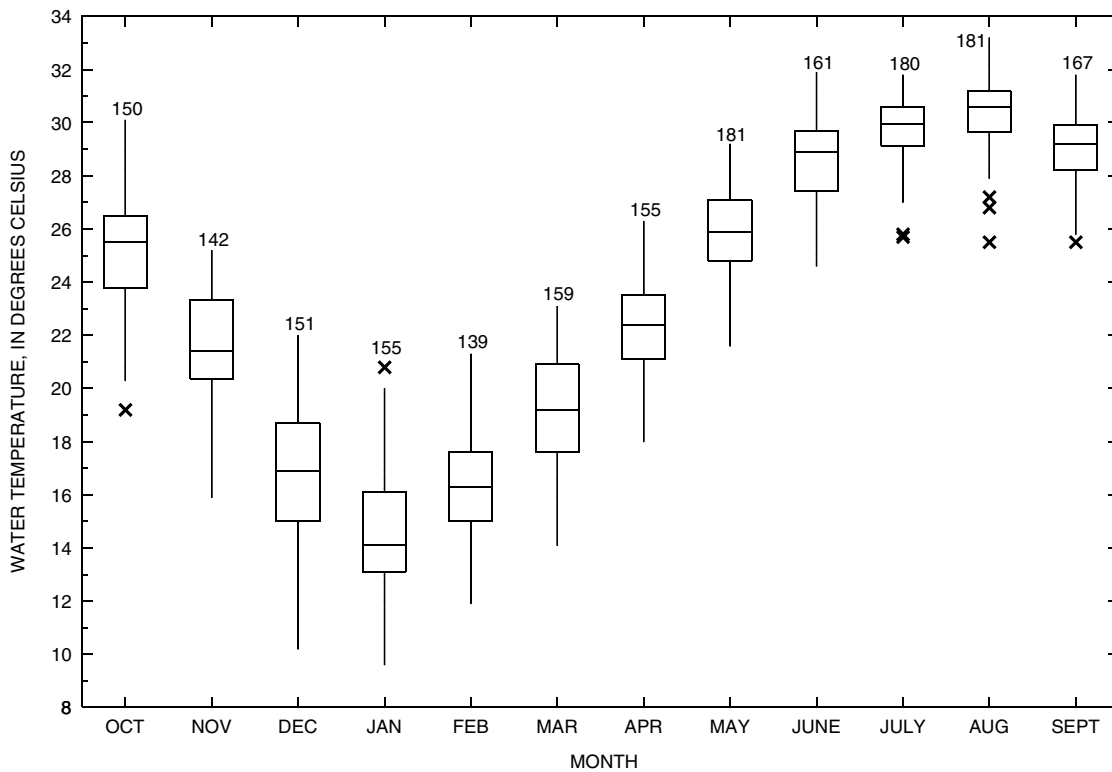


Figure 11. Daily mean water temperature aggregated by month, Buffalo Bayou at Turning Basin, Houston, Texas (08074710), April 1986–March 1991.

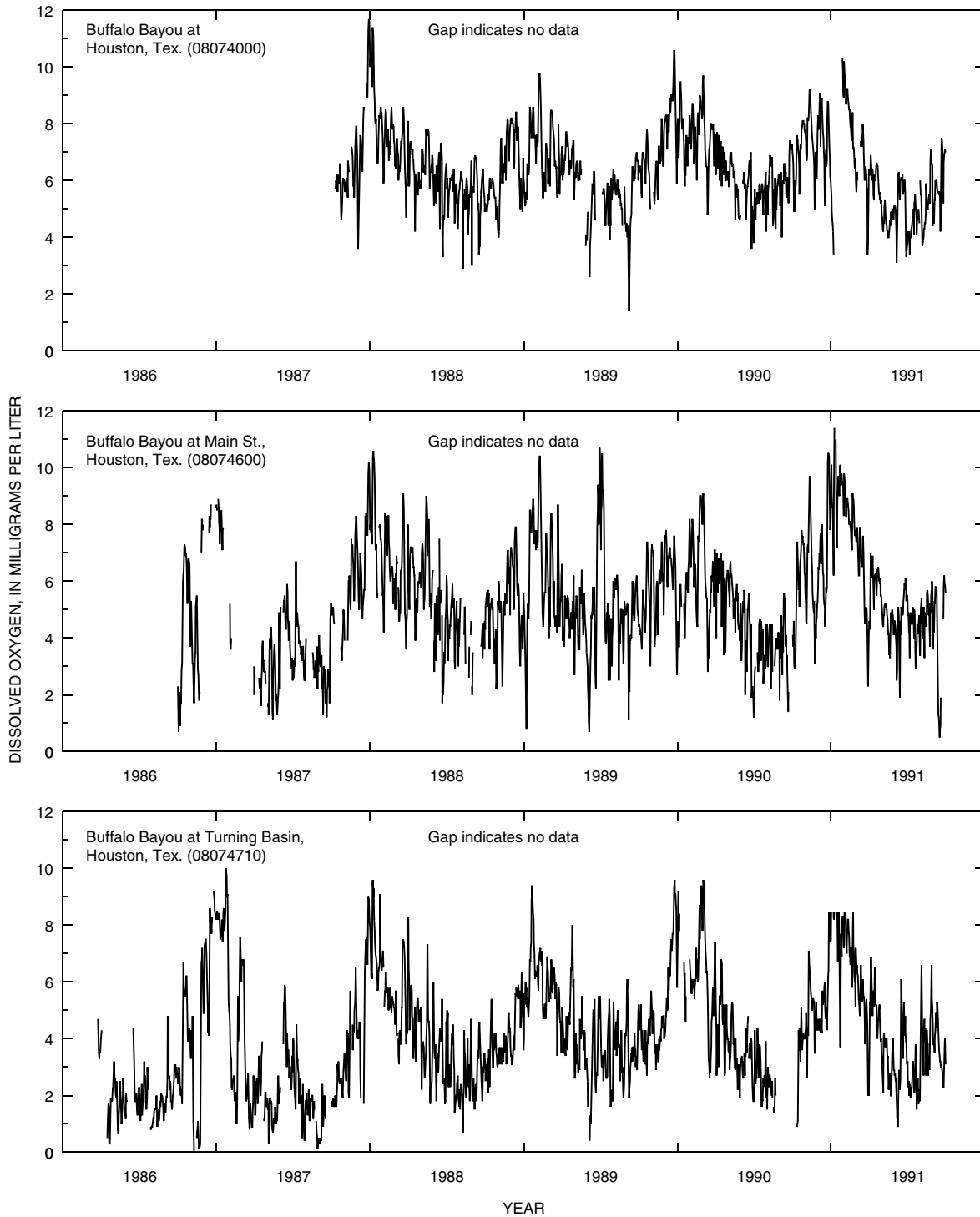


Figure 12. Hydrographs showing daily mean dissolved oxygen, Buffalo Bayou, Houston, Texas.

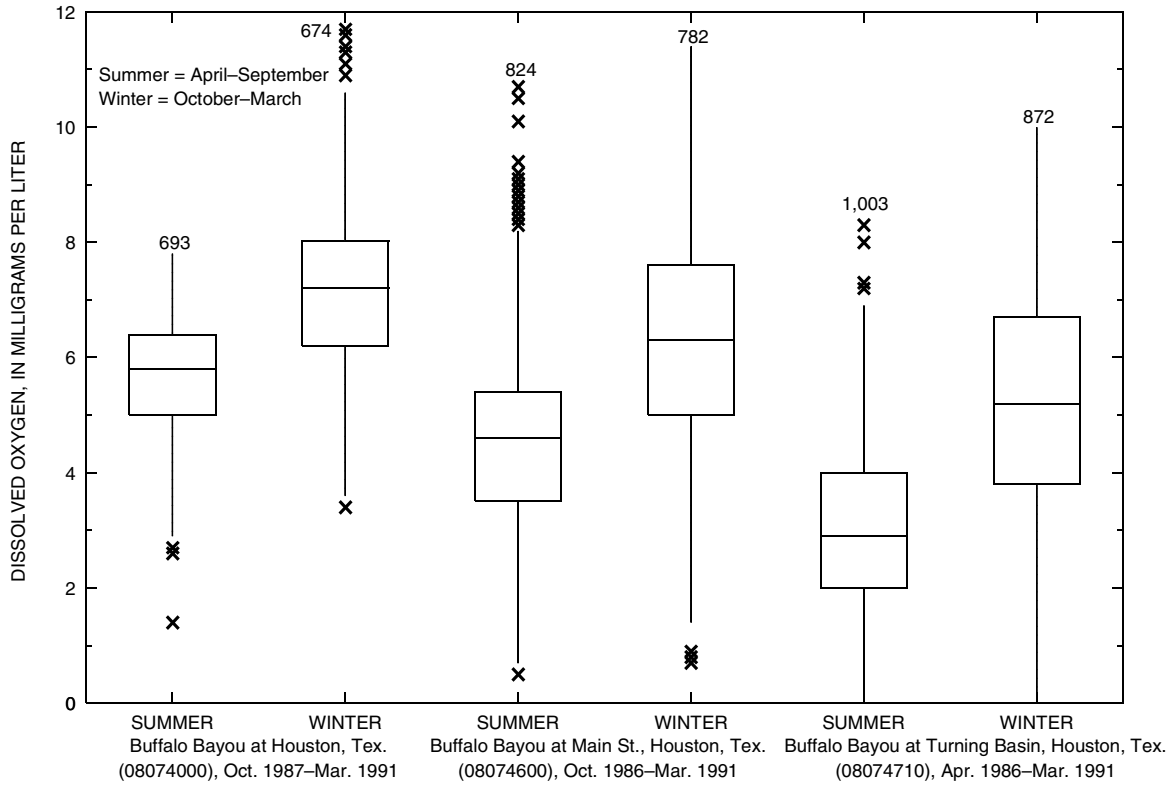


Figure 13. Daily mean dissolved oxygen aggregated by station and season, Buffalo Bayou, Houston, Texas.

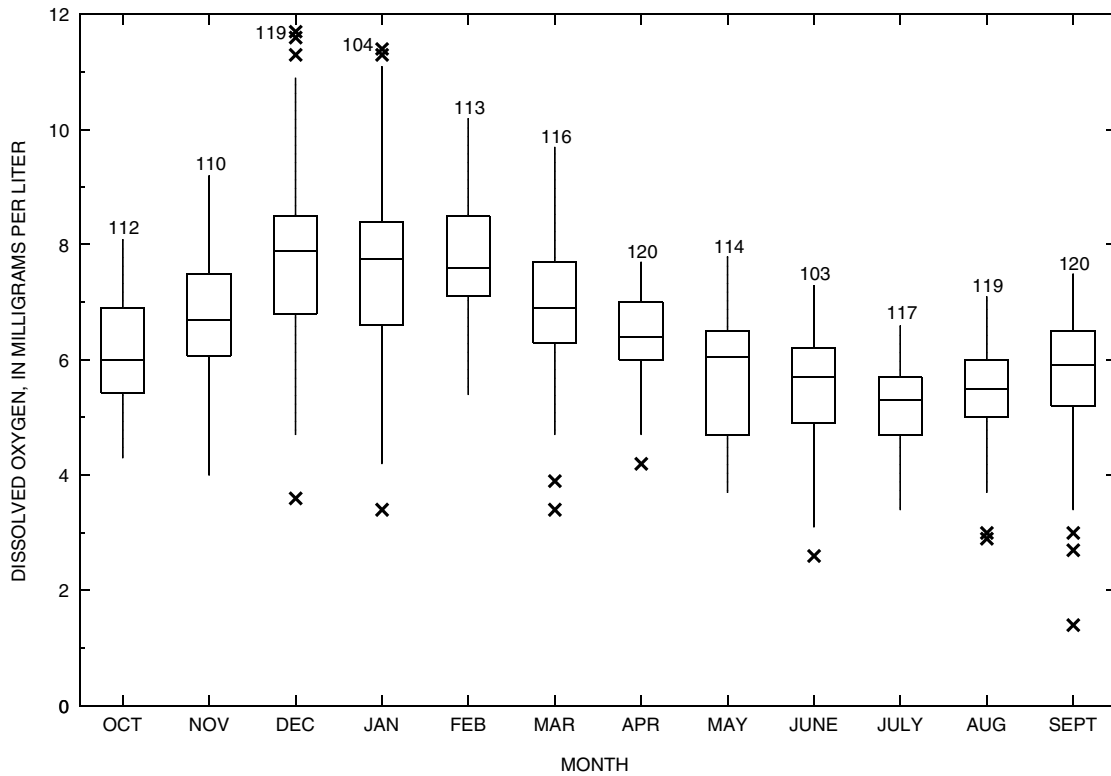


Figure 14. Daily mean dissolved oxygen aggregated by month, Buffalo Bayou at Houston, Texas (08074000), October 1987–March 1991.

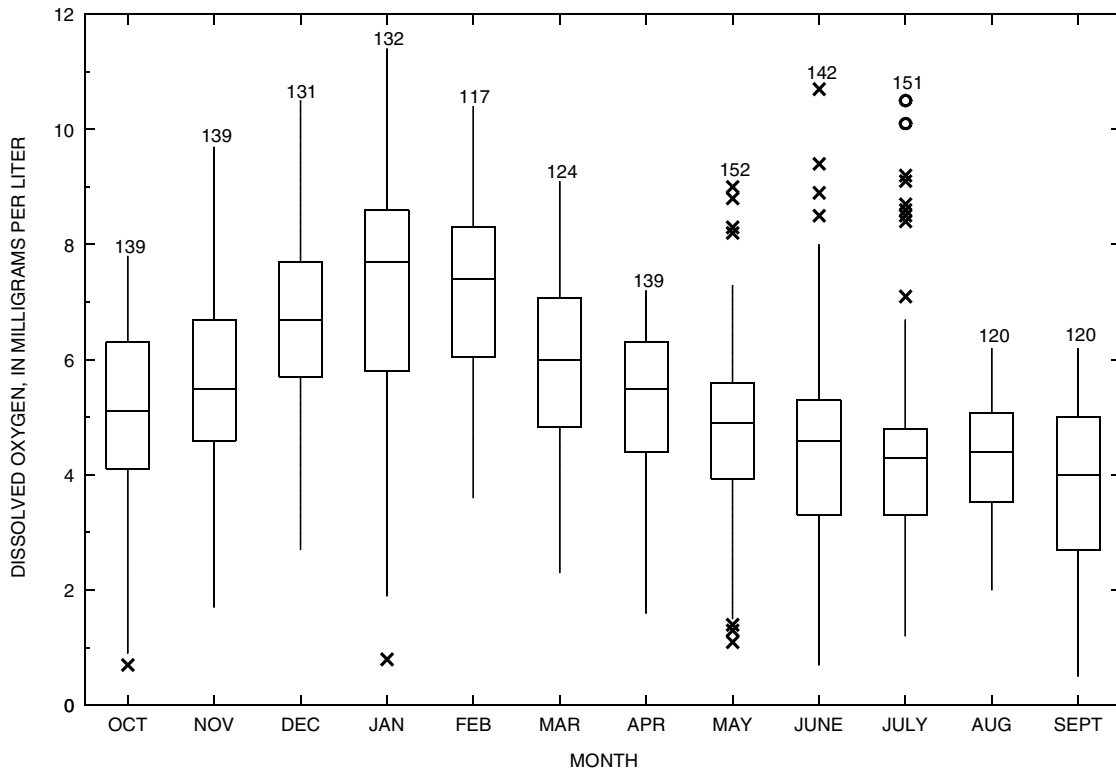


Figure 15. Daily mean dissolved oxygen aggregated by month, Buffalo Bayou at Main Street, Houston, Texas (08074600), October 1986–March 1991.

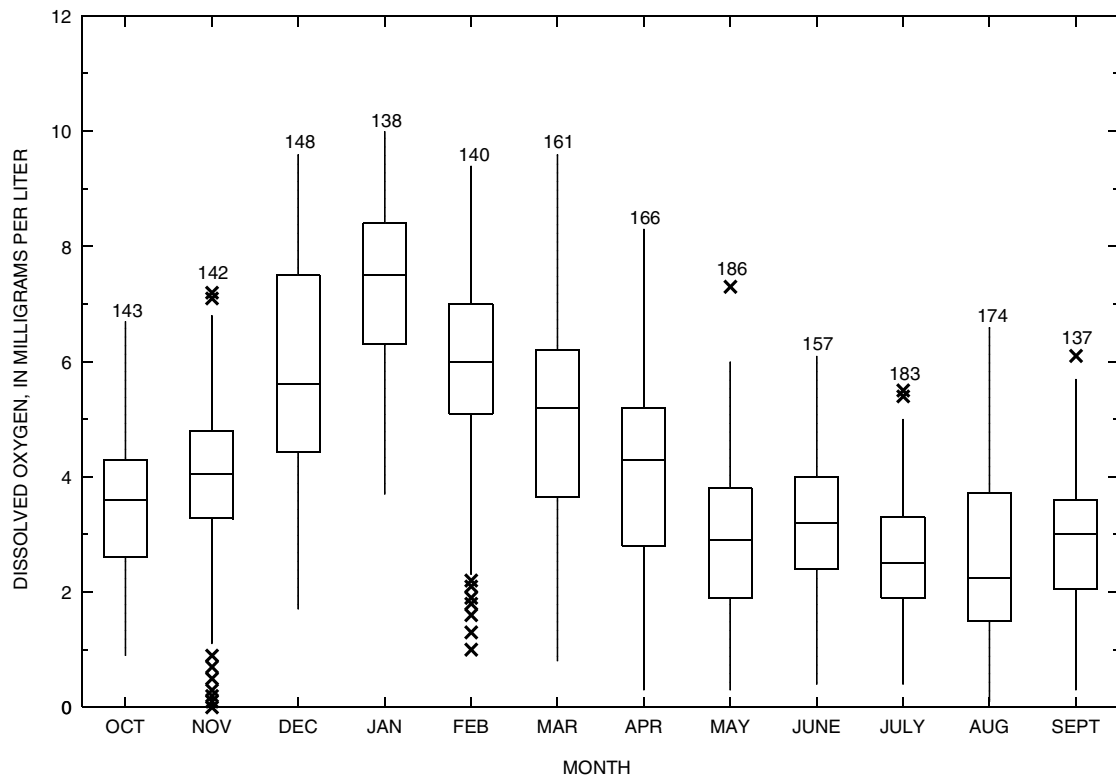


Figure 16. Daily mean dissolved oxygen aggregated by month, Buffalo Bayou at Turning Basin, Houston, Texas (08074710), April 1986–March 1991.