THE EFFECT OF URBANIZATION ON HIGHEST MAXIMUM AND HIGHEST MEAN SUMMER STREAM TEMPERATURES: TRINITY AND SAN ANTONIO RIVER BASINS, TEXAS

THESIS

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in Partial Fulfillment of

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Master of Applied Geography

By

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To my parents, Victor and Beverley Michalk, for infinite patience and encouragement

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CHAPTER I

INTRODUCTION TO THE STUDY

Problem Statement

Recent concern about water quality of streams passing through major cities raises the issue of if and how much summer stream temperatures in urban areas have been increased. Many researchers have studied the effects of temperature on fish and other aquatic life. Water temperature governs such processes as migration, breeding, hatching, development, behavior, distribution, and the metabolic rate of fish species (Gunter 1957; Macan 1958; Hesser et al 1975; Reynolds 1977; Shingleton, Hocutt, and Stauffer 1981; Scott and Poynter 1991). Scott and Poynter (1991) also reported that temperature alteration has the greatest impact in areas where conditions are already marginal. Research by Matthews (1987) and Matthews and Zimmerman (1990) found that streams of the southern Great Plains and the Southwest, including Texas, contain some of the warmest free-flowing water on Earth. The authors reported that fish in these streams at times live near their lethal thermal limits under natural conditions, suggesting that an additional increase of 3-4°C (5-7°F) would be enough to cause a number of these species to die off if they did not migrate away from the area of elevated temperature. Macan (1958) discussed the significance of sustained increases and decreases in water temperature to aquatic life. According to his research, exceptionally hot or cold events are not the key factor as they are for land habitats, but rather how long the high or low temperature has lasted. As urbanization generally represents a lasting change to the environment, any increases or decreases in the temperature of aquatic habitats due to urbanization would likely be long-term, unless adequately mitigated. Clark (1969) stated that concern should not be paid as much to lethal temperatures as to temperatures that may simply be unfavorable to the fish. In the long run, the effect of such temperatures on metabolism, feeding, growth, reproduction, and other vital functions could be just as harmful to fish populations as outright exposure to lethally high temperatures.

Increases in temperature also lessen the dissolved oxygen (DO) content of water (O'Connor 1967; Frankel and Hansen 1968; O'Connor and DiToro 1968). At one atmosphere pressure, the solubility of oxygen in freshwater systems can range from 14.6 mg/L at 0°C (32°F) to 6.4 mg/L at 40°C (104° F) (Maidment 1993). Oxygen solubility strongly influences the productivity and composition of aquatic ecosystems (Sharpe and DeWalle 1980). Increased temperature additionally affects such water quality characteristics as taste, odor, and color; high temperatures reduce pollution assimilation and self-purification capacities, and increase algal productivity (LeClerc 1963; Delay and Seaders 1966; Brown and Krygier 1967; Corbett, Lynch, and Sopper 1978; Feller 1981; Lam 1981; Ahtiainen 1988; Holopainen and Huttunen 1992).

Few studies have analyzed the effects of urbanization on stream temperature (Pluhowski 1970; Pluhowski 1972; Jones and Clark 1987; Webb and Walling 1992). However, considerable research has been done relating forest clearcutting to stream temperature alteration (Greene 1950; Larkin et al. 1959; Fritts 1961; Eschner and Larmoyeux 1963; Edington 1966; Brown and Krygier 1967; Gray and Edington 1969; Brown 1970; Brown and Krygier 1970; Likens et al. 1970; Brown, Swank, and Rothacher 1971; Swift and Messer 1971; Bengeyfield 1973; Brazier and Brown 1973; Burton and Likens 1973; Corbett, Lynch, and Sopper 1975; Hesser et al. 1975; Hornbeck et al. 1975; Smith and Lavis 1975; Lee and Samuel 1976; Erman, Newbold, and Roby 1977; Corbett, Lynch, and Sopper 1978; Lee 1978; Graynoth 1979; Lynch, Corbett, and Hoopes 1979; Brown 1980; Patton 1980; Feller 1981; Crisp and Howson 1982; Hewlett and Fortson 1982; Rishel, Lynch, and Corbett 1982; Jeppesen and Iversen 1987; Ahtiainen 1988; Beschta and Taylor 1988; Harr and Fredriksen 1988; Brown 1989; Garman and Moring 1991; Hostetler 1991; Ahtiainen 1992; Holopainen and Huttunen 1992; Binkley and Brown 1993; Rowe and Taylor 1994). According to Pluhowski (1970, 1972), one of the most significant ways in which urbanization modifies water temperatures is by clearcutting the stream environs. A number of summary works reviewing literature pertinent to this subject are available for further study, including Anderson (1973), Gibbons and Salo (1973), Patton (1973), and Morgan and Graynoth (1978).

Purpose of Study

The purpose of this thesis is to determine if and to what extent urbanization is increasing the highest mean and maximum annual water temperatures in waterways flowing through the Dallas-Fort Worth and San Antonio metropolitan areas of Texas.

Study Area

This study focuses on a number of rivers and streams in the Dallas, Fort Worth, and San Antonio metropolitan areas and nearby rural areas. The specific U.S. Geological Survey (U.S.G.S.) gaging stations studied are summarized in Tables 1 and 2. Their locations are shown in Figure 1 (Trinity River Basin) and Figure 2 (San Antonio River Basin).

TABLE 1

GAGING STATIONS AND PERIODS OF RECORD FOR WATER TEMPERATURE OBSERVATIONS
Trinity River Basin, Dallas and Fort Worth Metropolitan Areas and Vicinity

Station Name	Period of Record[a]	U.S.G.S. Gage Number
West Fork Trinity River at Beach Street at Fort Worth	Oct 1976 - current	08048543
West Fork Trinity River at Grand Prairie	Oct 1976 - Sep 1992, Aug 1993 - current	08049500
Trinity River at Cedar Crest Boulevard at Dallas	Feb 1984 - current	08057055
Trinity River below Dallas	Jan 1977 - Sep 1992, Apr 1993 - current	08057410
East Fork Trinity River at Seagoville	Mar 1987 - current	08061980
East Fork Trinity River near Crandall	Mar 1977 - Sep 1977, Mar 1987 - current	08062000
Trinity River near Rosser	Mar 1977 - current	08062500
Trinity River at Trinidad	Apr 1986 - current	08062700

[a] Note: Period with maximum and mean temperature data. Data available through Water Year 1996 (September 1996).

TABLE 2

GAGING STATIONS AND PERIODS OF RECORD FOR WATER TEMPERATURE OBSERVATIONS
San Antonio River Basin, San Antonio Metropolitan Area and Vicinity

Station Name	Period of Record[a]	U.S.G.S. Gage Number
San Antonio River at Loop 410 at San Antonio	Dec 1986 - Aug 1988, Mar 1993 - current	08178565
Salado Creek (lower station) at San Antonio	Jan 1987 - current	08178800
Medina River at La Coste	Jan 1987 - Sep 1995 (discontinued)	08180640
Medio Creek at Pearsall Road at San Antonio	Mar 1987 - Sep 1995	08180750
Leon Creek at IH-35 at San Antonio	Oct 1985 - current	08181480
Medina River at San Antonio	Jan 1987 - current	08181500
San Antonio River near Elmendorf	Jun 1984 - Jul 1986, Dec 1986 - current	08181800
San Antonio River near Falls City	Jan 1987 - current	08183500
Cibolo Creek near Falls City	Mar 1981 - May 1987, July 1987 - Sep 1991 (discontinued)	08186000

[a] Note: Period with maximum and mean temperature data. Data available through Water Year 1996 (September 1996).

Time of Study

The precision of this study depends on water temperature data availability. Only gaging stations that record daily maximum, minimum, and mean water temperature data have been used. The earliest summer for which maximum, minimum, and mean water temperatures were recorded is 1977. Prior to that year, some stations have once-daily temperature records, but time of collection is inconsistent and primarily in the morning when maximum temperatures are unlikely to occur. Some of the stations have temperature data available only back to 1987. The study uses water years (October - September) rather than calendar years (January - December).

Figure 1. Water Temperature Gaging Stations: Trinity River Basin, Texas

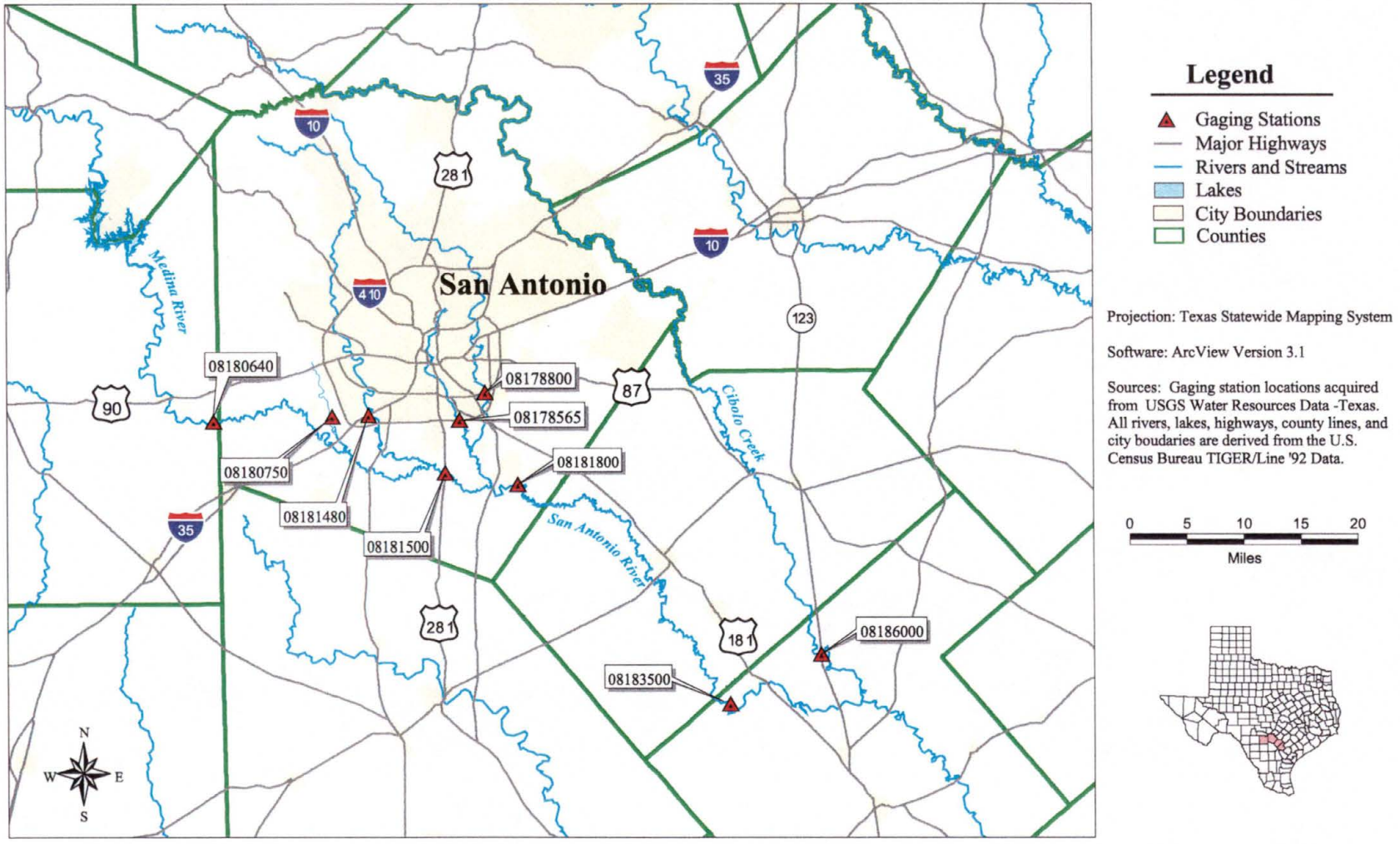

Figure 2. Water Temperature Gaging Stations: San Antonio River Basin, Texas

Research Questions

- Have the twenty warmest annual maximum daily and mean daily stream/river temperatures risen in the Dallas, Fort Worth, and San Antonio metropolitan areas during the period studied?
- Have stream/river temperatures also risen in surrounding and nearby rural areas?
- Do these rises in temperature correspond to increases in population density in the surrounding area (upstream census tracts)?
- Controlling for such factors as streamflow, air temperature, and other meteorological conditions, do urbanized areas tend to have warmer maximum and mean stream temperatures than rural areas?
- Does water temperature in urbanizing areas tend to increase through the period of study while water temperature in already urbanized areas tends not to exhibit a defined increase?
- Are there higher percentages of days (annually) above certain threshold water temperatures in the latter years of the study period? Do these higher temperatures occur in areas that are presently undergoing urbanization, already urbanized areas, rural areas, or in all three of these settings?
- If high water temperatures do occur more frequently in the latter part of the study, do these higher temperatures correspond with higher air temperatures? If so, do higher air temperatures occur in all areas (possibly due to global warming) or only in the more urbanized areas (urban heat island effect)?
- Is there a significant difference between observations from the Dallas-Fort Worth area and the San Antonio area? Why?

CHAPTER II

LITERATURE REVIEW

Overview

The world is rapidly urbanizing. Urbanization is a process of landscape modification, which alters the local environment from its natural state to conditions of increasing population and increasing impervious cover (Savini and Kammerer 1961; Stankowski 1972). Many environmental problems have arisen as a result of the urbanization process. One of the natural systems most severely affected is the waterway. Urbanization, and the many activities that urbanization entails, can put great stress on aquatic systems. Urban growth can adversely affect both water quality and quantity.

Effects on Fish

One of the most important water quality parameters for aquatic life is water temperature. The temperature of an aquatic ecosystem governs the metabolic rate, hatching, development, behavior, and distribution of fish (Gunter 1957; Hesser et al. 1975; Shingleton, Hocutt, and Stauffer 1981) . It acts as a directive factor which causes fish to congregate in certain thermal ranges or to move to areas with different environmental conditions (Brett 1956; Hesser et al. 1975). Seasonal, thermoperiodic, diel (daily), and spawning migration patterns are highly dependent on temperature (Reynolds 1977). Water temperature affects when and where breeding and hatching can and do occur, influencing species range limits (Macan 1958; Scott and Poynter 1991). Temperature can indirectly affect habitat selection, intraspecific size segregation, interspecific niche differentiation, isolating mechanisms, predator avoidance, prey location, and escape reactions (Reynolds 1977). Many biochemical reactions, including enzyme activity and absorption of dissolved minerals, are also temperature dependent (Eschner and Larmoyeux 1963; Brown and Krygier 1967).

As water temperature rises, dissolved oxygen in the water decreases (an increase of 10-15°C (18-27°F) reduces oxygen solubility almost twenty percent (Golterman, Clymo, and Ohnstad 1978)). Feeding and reproduction are also inhibited (Brett 1956). Fish experience reduced growth, vigor, and resistance to predation and disease, while populations of most fish pathogens rise with increasing temperature (Brett 1956; Hesser et al. 1975; Rickard and Watson 1985). Additionally, higher temperatures mean faster rates of organic decomposition, resulting in less time during which nutrients are available for aquatic organisms (Brown and Krygier 1967).

Brett (1956) states that lethal temperature limits for fish are set by the most sensitive essential tissue, usually the nervous system (for upper temperature limits), but possibly the respiratory or other systems. Lethal temperatures, preferred temperatures, and temperatures for optimum activity are all subject to change through acclimation (Brett 1956). In 1973, the Environmental Protection Agency proposed criteria for "important species" on which thermal standards would be based. These standards included ultimate upper incipient lethal temperatures, temperatures which would result in cold shock, optimum temperatures for growth and reproduction, and maximum temperatures for short-term exposures. "Important species" consisted of important sport or commercial species, important forage species, and rare or endangered species (Stauffer et al. 1976).

Sustained temperature increases caused by urbanization or clearcutting of forests may not be at levels lethal to fish, but they represent a consistent and lasting change to the habitat (Swift and Messer 1971). Burton and Likens (1973) suggest that greater daily fluctuations in stream temperature, such as from urbanization or clearcutting, can change the community structure of aquatic systems. Increased temperature fluctuation could result in changes in the temporal succession of organisms and in replacement of stenothermal by eurythermal organisms. (Eurytherms are able to tolerate a wide range of temperatures; stenotherms can tolerate only slight temperature changes.)

Other Effects of Increased Temperatures

Water temperature affects a variety of environmental factors that have an impact on human beings. A rise in temperature makes water less palatable to humans (Brown and Krygier 1967; Corbett, Lynch, and

Sopper 1978). Increased water temperature reduces the capacity of streams to assimilate pollution and affects their self-purification capacity, decreasing sanitary quality and making them less esthetically pleasing (LeClerc 1963; Delay and Seaders 1966; Feller 1981). Activities which raise stream temperature can also increase algal productivity, consequently degrading water supplies, decreasing oxygen levels, and lowering esthetic value (Corbett, Lynch, and Sopper 1978; Lam 1981; Ahtiainen 1988; Holopainen and Huttunen 1992).

Effects of Urbanization On Stream Temperature

Many human activities can alter the temperature of an aquatic environment. Direct sources of temperature manipulation include the discharge of thermal effluents from industrial sources and electricity generating facilities into waterways, and the release of cold water into rivers from impounded reservoirs. Other sources of water temperature change include the discharge of municipal wastewater into rivers (which raises temperatures slightly (Dunne and Leopold 1978, 716)), indirect effects of forestry practices and urbanization, and the potential effects of global warming. Temperature degradation from activities such as forestry and urbanization (except that of direct thermal pollution) is considered a nonpoint source of pollution (Brown, Brown, and Binkley 1993).

Highly urbanized areas have a considerable percentage of land area cleared and overlaid by buildings and pavement relative to the amount of land that is covered by trees and other natural groundcover. Such areas compound the effects of clearcutting with a high percentage of impervious cover. Clearcutting and other land-clearing measures can raise a stream's temperature by removing shade over the stream itself, over the contributing watershed, or over areas that provide baseflow (groundwater) to the stream (Eschner and Larmoyeux 1963; Patton 1980; Hewlett and Fortson 1982). Clearcut watersheds may also lose the cooling effect of contact with cooler substrate present under shade (Burton and Likens 1973). Clearcut lands tend to experience decreased infiltration and increased runoff, as do areas with a high degree of impervious cover. Decreased infiltration and increased runoff cause decreased groundwater flows, which are apt to raise summer stream temperatures and increase daily temperature fluctuations (Pluhowski 1961; Jones and Clark 1987).

Pluhowski studied the effects of clearing vegetation from streambanks in urban areas (Pluhowski 1970; Pluhowski 1972). His 1972 article documented the effects on stream temperature related to the removal of bank vegetation associated with a channel alignment project in a Virginia stream basin undergoing rapid urbanization. The streambanks were lined by trees and brush, except for an 1,100-foot (290-meter) reach marked by a complete absence of trees (although low-profile brush covered both banks). On sunny summer days, the lower end of the cleared stretch was 3.4°C (6.1°F) higher than the upper end. On cloudy summer days, the difference was only 0.5°C (0.9°F). His 1970 study focused on the impact to stream temperature by varying degrees of urbanization on Long Island, New York. He studied five streams which were similar except for differing degrees of urban buildup. The basins ranged from almost completely undeveloped to nearly totally urbanized. Modifications to the streams from urbanization which affected water temperature included clearcutting of vegetation from streambanks, introduction of ponds and lakes, increased storm runoff to streams, and reduction of groundwater inflow. Pluhowski found that these modifications increased average stream temperatures by as much as 5-8°C (9-14°F). Different sites along the same streams had temperatures varying by as much as 8-10°C (14-18°F) during summer months due to differing amounts of solar radiation reaching the stream surfaces. Pluhowski states that shading in urbanized areas, provided by trees, shrubs, or man-made structures, may reduce incoming solar radiation by as much as seventy percent.

Groundwater inflows can have a significant effect on the temperature of streams (Patton 1980; Hewlett and Fortson 1982). Ferguson and Suckling (1990) state that urban impervious surfaces reduce groundwater levels by reducing infiltration and increasing direct runoff. Stream temperature is most severely altered in streams where the surface flow volume is small (Brown and Krygier 1967; Moore 1968; Brown 1969; Brown and Krygier 1970). Jones and Clark (1987) demonstrated that decreases in low flow volume associated with urbanization may increase diurnal temperature fluctuations. Pluhowski (1961) found that a high rate of groundwater inflow decreased stream temperatures in summer and increased them in winter. Low groundwater inflow had an opposite effect. He also noted that influx of groundwater tended to minimize temperature fluctuation. Simmons and Reynolds (1982) reported reduced baseflow to streams due to urbanization. They associated their findings with increased impervious surface area, storm water

sewerage, and sanitary sewerage. Groundwater beneath wooded areas tends to have temperatures lower than those below cleared areas (Pluhowski and Kantrowitz 1963). Pluhowski and Kantrowitz studied a residential deforested area (a park) and a nearby wooded location, in which they found that groundwater temperatures could be 3-5°F (2-3°C) warmer under the cleared area. Interestingly, Riggs (1965) observed that in a basin cleared of trees and brush (but without impervious cover), low flows in summer and fall were actually better sustained than in a comparable basin with a lower proportion of land cleared.

Jones and Clark (1987) compared stream temperatures in watersheds with population densities between ten to twenty persons per hectare (highly urbanized) and two to ten persons per hectare (less highly urbanized). They did not find a significant correlation between observed stream temperature ranges and population density, although they did find that tree canopy cover negatively correlated with urbanization.

Pluhowski's (1970) study of Long Island streams noted the effect of "urban heat islands" on water temperature. Air temperatures in the more urbanized area were warmer than those in the less developed parts, contributing to increased stream temperatures. Webb and Walling (1992) also reported rising long-term mean stream temperatures within their study area in the United Kingdom, partly due to land use effects.

Effects of Air Temperature, Meteorological Conditions, and Streamflow On Stream Temperature

In addition to increased water temperatures indirectly due to "urban heat islands," observed increases in water temperature may be due to regional increases in air temperatures (Webb and Walling 1992; Webb and Walling 1993). Some studies predict that the greenhouse effect may cause surface water temperatures in parts of the southern United States to rise by up to 7°C (13°F) (Cooter and Cooter 1990). Most researchers contend that air temperature is a strong determinant in stream temperature variation. Some research considers it to be the primary factor in determining the temperature of small streams (Smith and Lavis 1975; Crisp and Howson 1982; Jeppesen and Iversen 1987). Beschta and Taylor (1988) and Hostetler (1991) specify using maximum daily air temperature to calculate water temperature.

Burton and Likens (1973) observed that on days of comparable air temperature, there was less variation in stream temperature on cloudy than on sunny days. Cloudcover was suggested as a significant

factor in a number of other studies (Delay and Seaders 1966; Pluhowski 1972; Sinokrot and Stefan 1993; Sinokrot and Stefan 1994). Relative humidity was also included in some stream temperature prediction models (Sinokrot and Stefan 1994).

Brown (1970) stated that solar radiation is much more important than air temperature and the cooling effect of evaporation in determining the temperature of small, unshaded streams. He explained that the heat received by a stream depends on solar angle, determined by season, time of day, and latitude.

For a given level of solar radiation or heat input, stream temperature is inversely proportional to streamflow volume (Brown and Krygier 1970). Brown and Krygier (1967) specified that "streams with small flow volumes react to changes in microclimate more rapidly and to a greater magnitude than do larger rivers." Thus, daily temperatures of small streams fluctuate more than do those of larger rivers (Brown 1969). Moore (1968) analyzed the relationship of observed changes in water temperature over time to rate of flow and air temperature.

Measuring Urbanization

Lazaro's (1979) definition of the urbanizing period held that "the time period of the change in land use may be determined by observing data on population shifts, or residential or other construction," and that "in many cases, the majority of land use change accompanying urban development is caused by residential construction." Stankowski (1972) suggested using population density as an indicator of urbanization, correlating percentage of impervious area to the respective population densities of different land use categories. Craig (1979) used population density to measure urbanization in a flood frequency study. He discussed a method to determine population density from census tract maps when the land area of the tracts is not otherwise provided, using a transparent mylar grid.

CHAPTER III

METHOD OF ANALYSIS

In order to assess the significance of urbanization on water temperatures, four separate multiple regression analysis procedures are used in this study. Following the collection and organization of water temperature, discharge, climatological, and population density data, the information is analyzed using forward stepwise multiple regression. For all procedures, separate analyses are done for maximum and for mean daily water temperatures (five days each, randomly selected from the twenty warmest water days annually). The variables are described in detail in the "Research Variables" section of this paper.

The first regression includes all of the independent variables, *including* population density, for the years 1980 and 1990 (census years) only. The year of observation variable and the "urbanization status" variables (discussed later) are not included. Only five of the seventeen water temperature sites have data as far back as 1980 (and only four have sufficient 1980 observations for inclusion in this analysis), so this data is looked at only cross-sectionally, not temporally, with the sites that *do* have 1980 and 1990 data contributing two sets of data points.

The second analysis looks at the data temporally, using all of the variables *except* population density (and urbanization status) for *all* of the years available at each station. To see if urbanization has an effect on water temperatures, each station is regressed separately. The sites are then grouped into "urbanization status" categories, as "actively urbanizing," "previously urbanized," "semi-urbanized," or "non-urban," as defined in the "Research Variables" section. Tables 3 and 4 list the observation sites according to their urbanization status designations. These classifications are analyzed to see if there is a correlation between sites with water temperatures that have increased (or decreased) over time and any of the urbanization categories. Significant water temperature changes over time appear as positive or negative (and statistically significant) correlations between the "water temperature" variable and the "year" variable

in these equations. In addition, these correlations must be persistent from one observation site to the next within a certain urbanization status category to show a relationship with any specific urbanization status classification. Population densities for the years between and after available census tract data are not interpolated or extrapolated, for reasons discussed in the next chapter.

TABLE 3

URBANIZATION STATUS DESIGNATIONS FOR WATER TEMPERATURE OBSERVATION SITES
Trinity River Basin

Station Name	Urbanization Status Designation
West Fork Trinity River at Beach Street at Fort Worth	Previously Urbanized (PREVURB)
West Fork Trinity River at Grand Prairie	Actively Urbanizing (ACTIVURB)
Trinity River at Cedar Crest Boulevard at Dallas	Previously Urbanized (PREVURB)
Trinity River below Dallas	Previously Urbanized (PREVURB)
East Fork Trinity River at Seagoville	Actively Urbanizing (ACTIVURB)
East Fork Trinity River near Crandall	Actively Urbanizing (ACTIVURB)
Trinity River near Rosser	Non-urban (NONURB)
Trinity River at Trinidad	Non-urban (NONURB)

TABLE 4

URBANIZATION STATUS DESIGNATIONS FOR WATER TEMPERATURE OBSERVATION SITES
San Antonio River Basin

Station Name	Urbanization Status Designation
San Antonio River at Loop 410 at San Antonio	Previously Urbanized (PREVURB)
Salado Creek (lower station) at San Antonio	Previously Urbanized (PREVURB)
Medina River at La Coste	Semi-urbanized (SEMIURB)
Medio Creek at Pearsall Road at San Antonio	Actively Urbanizing (ACTIVURB)
Leon Creek at IH-35 at San Antonio	Previously Urbanized (PREVURB)
Medina River at San Antonio	Semi-urbanized (SEMIURB)
San Antonio River near Elmendorf	Actively Urbanizing (ACTIVURB)
San Antonio River near Falls City	Non-urban (NONURB)
Cibolo Creek near Falls City	Non-urban (NONURB)

The two river basins (separately) are also analyzed through this same method with *all* sites included to test if there is discernible evidence that the latter years of the study show a tendency towards either higher or lower water temperatures independent of the other variables. Hypothetically, there should not be any evidence of such an effect unless a major influencing variable has been omitted or is being masked by the presence of another confounding variable as both "urban heat island" and possible global warming influences should also be noticeable through effects on the air temperature and three-day air temperature variables.

Additionally, a fourth multiple regression analysis is included to incorporate population density into an analysis of the entire study period. The four urbanization status designations are used as a surrogate measure of population density for all the years of the study. The observation sites are classified according to their respective urbanization status categories, as previously described. Four dichotomous variables are

thereby created for use in the regression analysis. For each of these dichotomous variables, a designation of "one" means a particular observation is of that urbanization status category and a designation of "zero" means it is not. For example, if a water temperature observation is from a site determined to be in an "actively urbanizing" area, the four dichotomous variables will read as follows: PREVURB (previously urbanized) = 0; ACTIVURB (actively urbanizing) = 1; SEMIURB (semi-urbanized) = 0; NONURB (non-urban) = 0. As the value (0 or 1) assigned to any three of these variables completely determines the value of the fourth, only three are included in the analysis. SEMIURB, which is something of an "other" category anyway, is excluded. (The Trinity River Basin has no sites that fit the SEMIURB definition, so even though the other three dichotomous variables are analyzed, only two can end up in the final regression equations; the value of the third variable becomes completely dependent on the other two.) The variable YEAR is excluded from this analysis as well. So, obviously, is population density (POPDENS) for the years it is available (1980 and/or 1990). This analysis tests whether any of the urbanization status categories shows a marked effect on water temperature independent of the other variables. This method was devised because of concern that the sample sizes of the "population density" (1980 and 1990 only) analysis and several of the individual site "by year" analyses may be too small to ensure sample normality and/or validity.

The analyses are carried out using the Statistical Package for the Social Sciences (SPSS) (Norusis and SPSS Inc. 1990). SPSS reports which variables significantly affect the water temperatures, which variables are most and least important (and the order of importance/strength of all those in between), how much variability is explained and unexplained, and how interrelated each of the variables is with each of the others. The order in which the variables enter the regression equation depends on the extent to which variation in an independent variable accounts for the variation in the dependent variable. Probability of *F*-to-enter (or "PIN") limits were set at .400 (Appendix E; Table 5). PIN limits stipulate the maximum probabilities of statistical significance needed for entry and removal of independent variables, so that only variables whose variation contributes above a specified significance level to the variation of the dependent variable will be included in the analyses.

TABLE 5

SAMPLE ENTRY FROM APPENDIX E
Multiple Regression Analysis Results

PROCEDURE	**STATISTICS**	**REGRESSION EQUATION**	**ORDER OF VARIABLES ENTRY INTO REGRESSION EQUATION**	**VARIABLES NOT IN THE EQUATION**	**VARIABLES WITH SIG *T* < OR = .0500**	**VARIABLES WITH SIG *T* = .0000**
Trinity River Basin maximum water temperature vs. year	total cases: 540 cases used: 529 Adjusted R^2: .59 standard error: 1.11 F = 109.12 Sig F = .0000	H2O TEMP = 27.4648 - .0205 (YEAR) - .0060 (DATERANK) - .7056 (DISCHLN) + .0561 (AIRTEMP) + .0563 (AIR3TEMP) - .0038 (WIND) - .2831 (CLOUDS)	1. DISCHLN 2. AIRTEMP 3. AIR3TEMP 4. DATERANK 5. WIND 6. YEAR 7. CLOUDS	PRECIP DEWPT	Constant DISCHLN AIRTEMP AIR3TEMP DATERANK WIND YEAR CLOUDS	Constant DISCHLN
	EXPLAINED AND UNEXPLAINED SUM OF SQUARES	**INTER-CORRELATIONS > OR = (+/-) .500**	**INTER-CORRELATIONS: (+/-) .400 TO .499**	**PREDICTED MEAN WATER TEMPERATURE**	**OUTLIERS > OR = (+/-) 3.0 STANDARD DEVIATIONS**	**MEAN OF DISCHLN VARIABLE**
	explained: 947.28 unexplained: 646.13 <u>Degrees of Freedom</u> Regression: 7 Residual: 521	H20TEMP / DISCHLN = (-) .726 AIRTEMP / AIR3TEMP = (+) .744	H20TEMP / AIRTEMP (+) AIRTEMP / DEWPT(-) AIR3TEMP / PRECIP (-) AIR3TEMP / DEWPT (-)	32.05 °C standard deviation: 1.34	3.04 SD 3.10 3.68 4.29	5.34 standard deviation: 1.63

An additional statistical test, the Student's *t*-test, is also used to determine if there are statistically significant differences among the water temperature means of the four urbanization status categories (Trinity and San Antonio River Basins, annual maximum and annual mean water temperatures analyzed separately). The *t*-test determines if differences between urbanization status categories are significant based on the means, standard deviations, and number of samples. Student's *t*-test results are located in Appendix F (Tables 44-47). Table 6 provides an example. This examination may indicate if there are any patterns to the data that are not discernible through the multiple regression analyses. This method allows independent comparison of each of the four urbanization status categories with each of the others. However, the Student's *t*-test does not compensate or account for the influence of other independent variables.

TABLE 6

SAMPLE ENTRY FROM APPENDIX F
Student's *t*-test Results

Test Variables	**Mean water temperatures (°C)**	**Standard deviation of mean water temperatures**	**Levene's test for equality of variances**	**Separate-variance *t*-test or pooled-variance *t*-test**	***t*-value**	**Two-tailed significance**
Previously Urbanized vs. Actively Urbanizing (Trinity River Basin - maximum water temp. analysis)	Previously Urbanized 32.75 Actively Urbanizing 31.07	1.92 1.04	F = 76.55 P = .000	separate	8.68 degrees of freedom 189.84	.000

A number of graphs are used to demonstrate any patterns or major alterations in stream and river temperatures. The first series of graphs (see Appendix A) displays highest maximum and highest mean water temperatures versus year for each site using the mean of the twenty warmest water temperatures for each water year. Figure 3 provides an example of these graphs. Also noted on these graphs are the 1970, 1980, and 1990 population densities in the areas from the gaging stations to eight miles upstream of the

sites. A second set of graphs (Appendix B) shows the number of days annually at each station during which maximum daily water temperatures exceeded the maximum preferred range (30.0°C, 86°F), the upper limit for satisfactory growth as recommended by the Federal Water Pollution Control Administration (33.5°C, 92°F), and the upper lethal limit (35.5°C, 96°F) for *Micropterus salmoides* (largemouth bass). An example is presented in Figure 4. A third series notes the number of days annually at each site during which maximum daily water temperatures are in excess of the maximum recommended temperatures designated by the Texas Natural Resource Conservation Commission (TNRCC) for the river segment containing that site (Appendix C). Figure 5 shows the Fort Worth site as an example. Appendix D is comprised of graphs directly comparing maximum and mean daily water temperatures with the maximum air temperatures on those days for each observation site (example in Figure 6).

A final collection of graphs (included in the data analysis section) compare water and air temperatures within and between the two river basins in several ways. The first group shows a direct comparison of the water temperatures (maximum and mean) between the San Antonio River Basin and Trinity River Basin sites, and of the maximum air temperatures between basins on the days those water temperature observations were made. This section also includes graphs that indicate maximum air temperatures within each basin on the aforementioned dates, comparing the observation site maximum air temperatures of the different urbanization status categories and a similar graphic comparison of maximum and of mean water temperatures among the various urbanization categories. These water and air temperature graphs all use the five observation dates used in the regression analyses. The five water temperature values are averaged, and this mean is then used as a data point on the graphs. The same procedure is followed for the air temperature data, using the dates corresponding to the maximum *and* the mean water temperature data. Thus, in comparing the Trinity and San Antonio Basin air temperatures directly, there are two data points per site per available year. This method should increase the validity of such a comparison, as it increases the effective number of observation dates from five to ten.

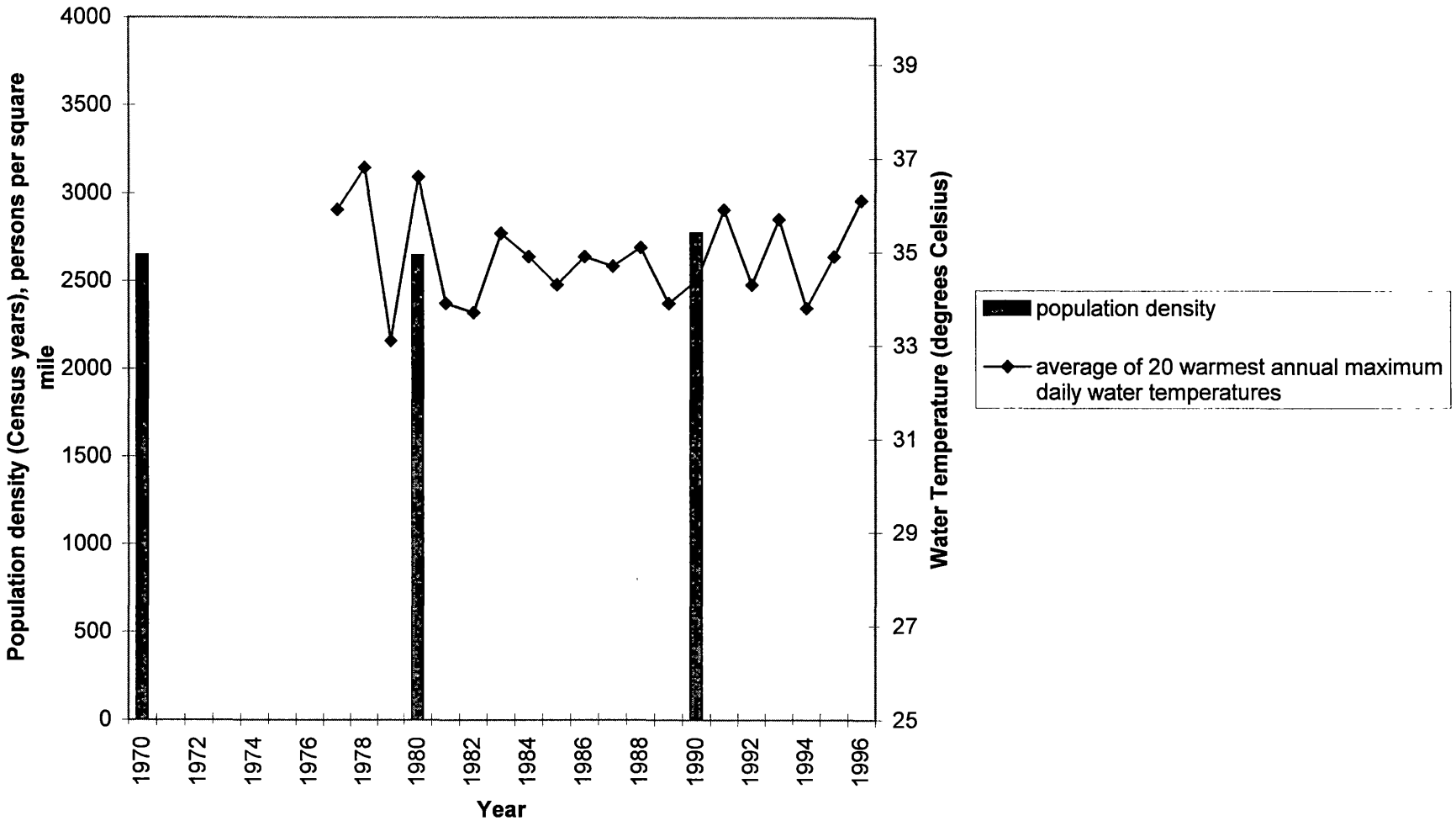

Figure 3. Population density vs. average of twenty warmest annual daily maximum water temperatures: West Fork Trinity River at Beach Street at Fort Worth, TX - 1970-1996 (Appendix A example)

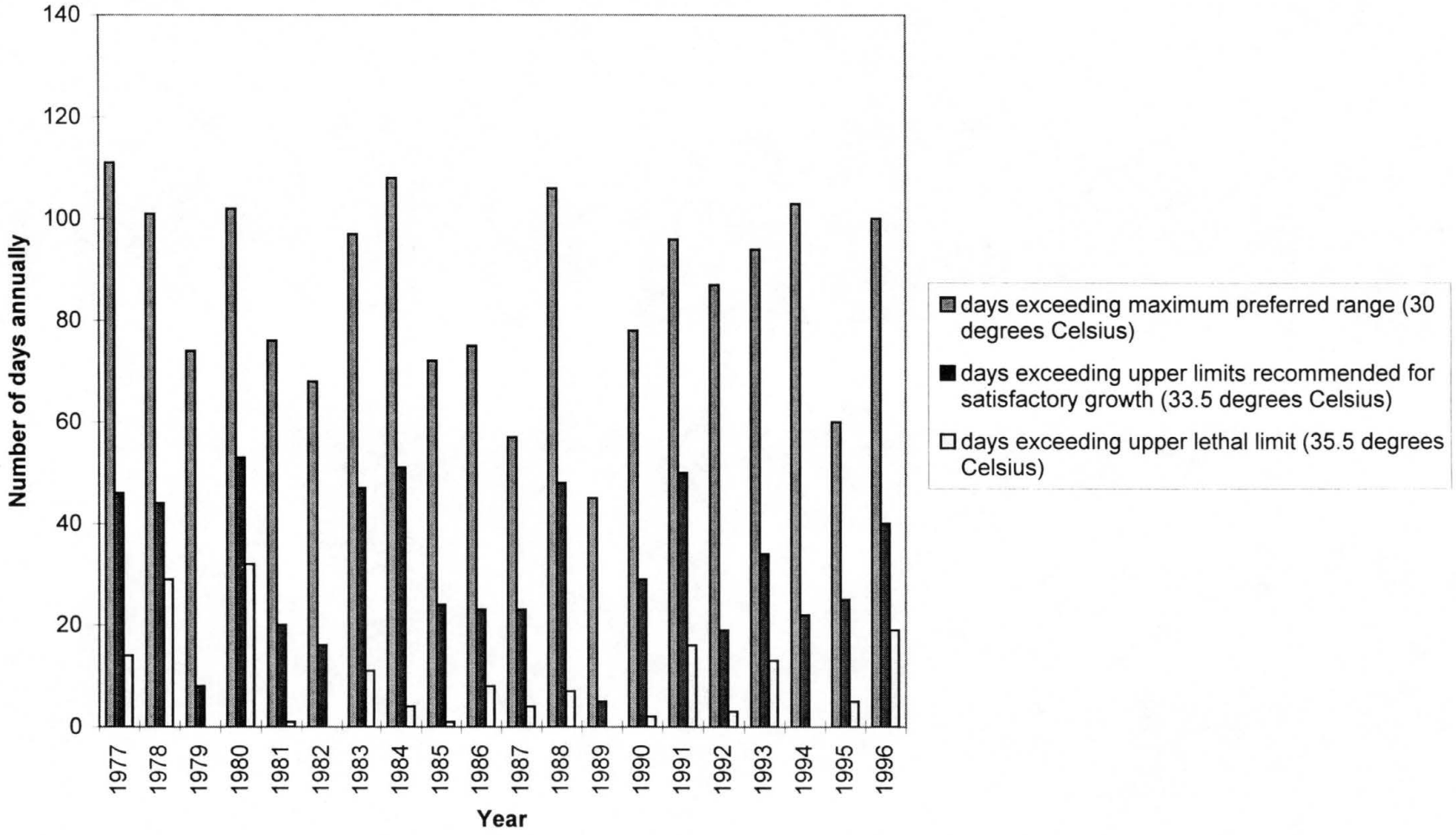

Figure 4. Number of days per year with daily maximum water temperatures at or exceeding critical temperatures for largemouth bass (Micropterus salmoides): West Fork Trinity River at Beach Street at Fort Worth, TX - 1977-1996 (Appendix B example)

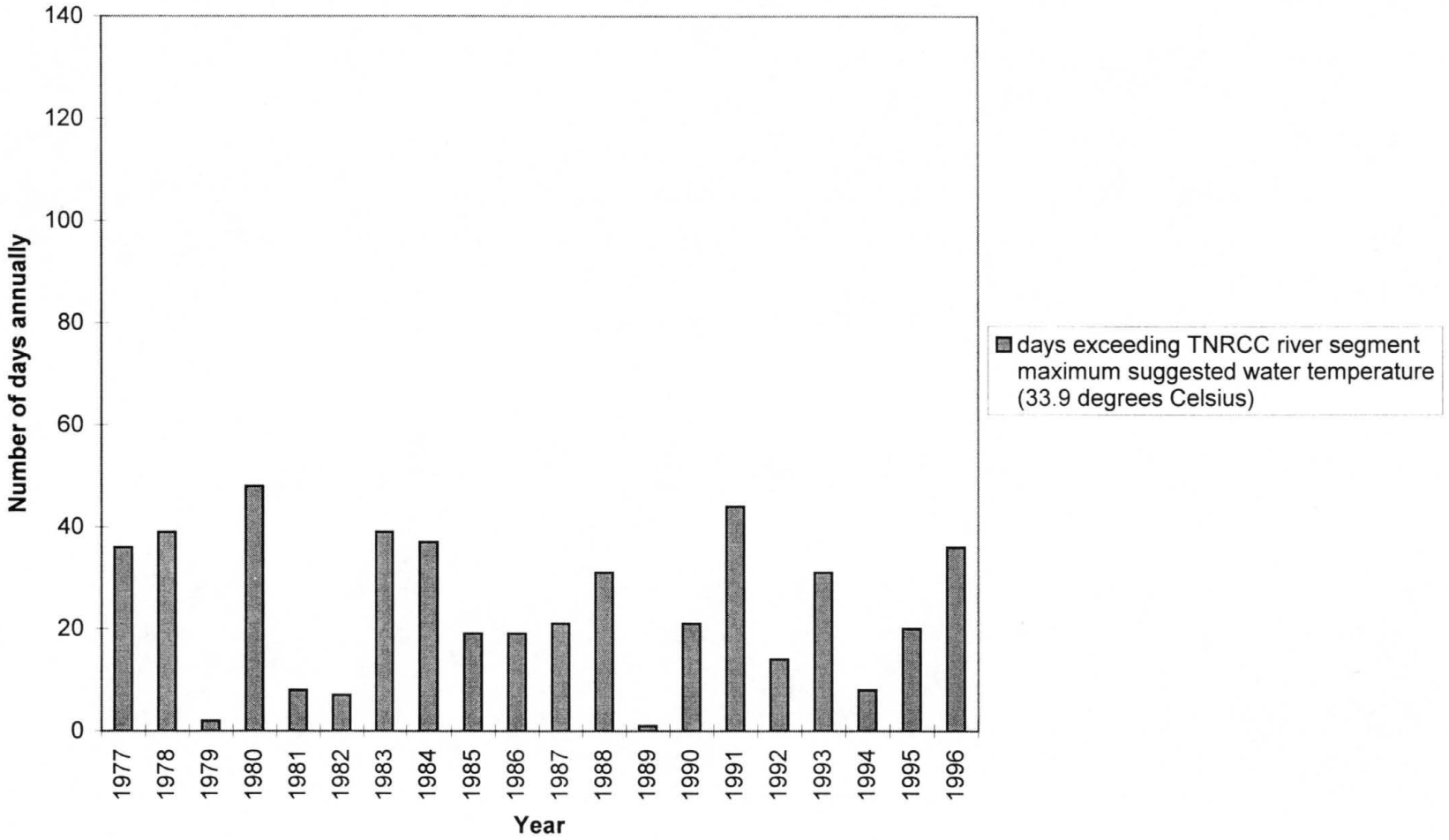

Figure 5. Number of days per year with daily maximum water temperatures at or exceeding TNRCC suggested maximum water temperatures, by river segment: West Fork Trinity River at Beach Street at Fort Worth, TX - 1977-1996 (Appendix C example)

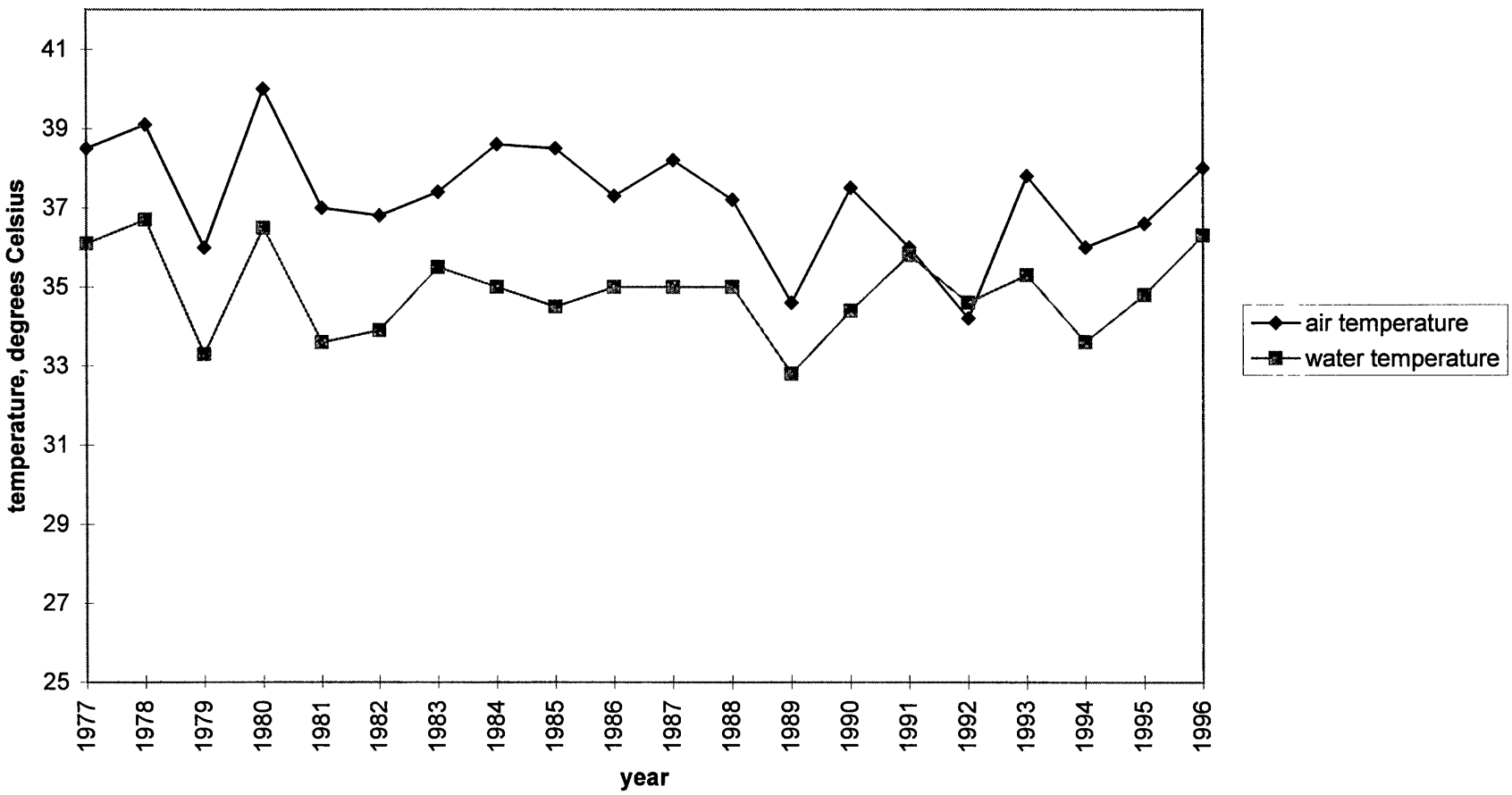

Figure 6. Daily maximum water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, West Fork Trinity River at Beach Street, Fort Worth, TX: 1977-1996 (Appendix D example)

CHAPTER IV

RESEARCH VARIABLES

Overview

This paper compares water temperature conditions in rural areas, urbanized areas, and areas currently undergoing urbanization to determine if any observed changes in water temperature can be attributed to the process of urbanization. To identify any such trend, other factors must be taken into account. Conditions such as air temperature and other meteorological phenomena, the stream's flow rate, location, time of year, and time of day can all influence stream temperature and must be accounted for. This study intends to determine if observed changes in stream/river temperatures in the Trinity and San Antonio River Basins of Texas are attributable to observed increases in urbanization.

Stream Temperature

This investigation focuses on the "twenty"[1] warmest water days (twenty highest maximum temperature and twenty highest mean temperature days) of each study year (water year) at each of the gaging stations used in the study. This method is similar to the one used by Beschta and Taylor in their 1988 study of the effects of timber harvesting and peak flow events on stream temperature in an Oregon watershed. Due to the quantity of data involved in calculating the multiple variables analyzed for each

[1] In most cases, there are not exactly twenty days during which the twenty highest temperatures are measured. Where additional days record the same water temperature as the twentieth warmest day, all of the days at this temperature are recorded, but only enough of these days to round the total observation dates to twenty are used, via random selection. All observations at the higher temperatures are retained in the data set (e.g. if there are two days at 31.0°C, ten days at 30.5°C, and fifteen days at 30.0°C, all of the 31.0°C and 30.5°C days are included, and eight of the 30.0°C days are randomly selected to bring the total to twenty days). Also, where an *average* of the twenty warmest temperatures are calculated, only twenty temperatures are used.

observation date, five of these twenty warmest water days were randomly selected to be used in the statistical analysis for each site for each year.

Also noted are the number of days each year during which daily maximum water temperatures exceeded 30.0°C (86°F), 33.5°C (92°F), and 35.5°C (96°F). These three temperatures represent the maximum preferred temperature, the upper temperature range for satisfactory growth, and the upper lethal limit, respectively, for largemouth bass (*Micropterus salmoides*). This subject is discussed in more detail later in this paper. Similarly, the number of days each year during which daily maximum water temperatures surpassed the maximum temperatures suggested by the Texas Natural Resource Conservation Commission (TNRCC) for the particular river segment containing that gaging station are shown.

My study uses a modified version of Beschta and Taylor's (1988) method. One difference is that my research intends to determine the effect of urbanization on stream temperature, rather than the effect of timber harvesting and peak flows. Instead of data relating to those factors, this paper analyzes how stream temperature correlates with urbanization, using population density as a measure of urbanization. Second, I use the "twenty" warmest water days of each water year rather than the ten warmest days as Beschta and Taylor did. At some of my study sites, the ten highest annual stream temperatures may all be within one-half of a degree Celsius. Beschta and Taylor's ten highest yearly temperatures had a much wider range. In order for a site to be included in a particular year's analysis, at least seventy-five percent of its water temperature readings for June 1st through September 30th of that year must be available.

Although use of the twenty warmest water days of each year (for maximum and mean temperatures) provides a better dispersion of temperature observations, it also creates the problem of requiring an impracticable amount of data collection for several of the other (independent) variables. The meteorological variables in the analysis are not recorded on-site and must be calculated using data from multiple nearby sites for each day of analysis. For this reason, five days were randomly selected from each of the twenty warmest maximum and twenty warmest mean temperature days of each year at each observation site, as previously stated. (Where there were multiple days with the same temperature as the twentieth warmest day, those days were first randomly selected to round the total number to twenty (see footnote, previous page).)

Urbanization

Population density changes affecting the gaging stations are based upon census tract data (Lazaro 1979). I have used census data as far back as the 1970 Census to show population increases in the census tracts and, for non-tracted areas, within census county divisions. For the segments with temperature data dating back only to the 1980's, I have only been able to use more recent census data. Decreases in population density are not included, because decreases mean depopulation (of neighborhoods) and not destruction of buildings, roads, and other structures that increase temperatures. In these cases I use the highest population density figures from the 1970, 1980, or 1990 censuses. However, some population density figures are recorded as decreased nonetheless due to significant changes in census tract boundaries from one decade to the next. In most cases, census tract boundaries decrease in size as older tracts are subdivided. However, in subdividing some large, less highly populated tracts, this situation poses a problem in that the river segment may now only flow through a more (or less) densely populated "sub-tract" which may be significantly different in population density from the earlier census value for the larger tract as a whole. Also, in one case when a new highway was constructed, the north-south border between two large census tracts was drastically altered. Moving census borders in such a way not only changes tract population density directly, but also significantly affects how much of the eight-mile river segment used to determine effective population density (see next page) is within each census tract. Population density is used directly in the analysis only for the census years (i.e., 1980 and 1990). Interpolation of population density data for non-census years from census year data would cause the figures for the intervening years to be directly dependent on the 1970, 1980, and 1990 population densities. Multiple regression analysis requires that all data points be independent of each other. Extrapolation of figures beyond 1990 was not done either.

In order to observe the effects of urbanization on stream and river temperatures, the degree of urbanization must be determined for each study site. For the purposes of this study, urbanization is measured by population density and by increases in population density. Four categories are used to define the "urbanization status":

- "Actively urbanizing" areas are defined as areas (census tracts or census county divisions) undergoing significant population growth as measured by population density. Population density must be greater than or equal to fifty persons per square mile in the 1990 census, and population density must have increased by at least twenty-five percent since the 1970 census. Tracts with population densities that already exceeded one thousand persons per square mile in 1970 are not included in this category.
- "Previously urbanized" areas are defined as census tracts or census county divisions having population densities greater than or equal to one thousand persons per square mile in 1970, whether these population densities increased, decreased, or remained stable through the period of study.
- "Semi-urbanized" areas are defined as census tracts or census county divisions with 1990 population densities of at least fifty persons per square mile but less than one thousand persons per square mile in which population density decreased, remained stable, or increased by less than twenty-five percent from 1970 to 1990.
- "Non-urban" areas are defined as census tracts or census county divisions with population densities of less than fifty persons per square mile in the 1990 census, whether population densities have increased, decreased, or remained stable.

To operationalize the population density variable, the land area that can be reasonably expected to influence the river/stream temperature must be quantified. Assuming a low flow stream velocity of one cubic foot per second, a parcel of water would travel approximately eight miles in a twelve hour period. To measure the population density of the area that influences daily maximum (and mean) water temperatures, all census tracts along the main streambed and major tributaries up to eight miles upstream are included in that site's population density variable.

Population density for the stream segment from each gaging station to eight miles upstream of that station is simulated by the following method to reflect the relative contribution of each census tract to the overall population density affecting the stream segment. The population density of each census tract

through which the river/stream passes up to eight miles upstream is multiplied by the proportion of that eight miles that is within each of the census tracts. For example, if this eight mile segment passes through two census tracts, one for five miles and the other for three miles, the effective population density will be 5/8 times (population density of tract 1) plus 3/8 times (population density of tract 2). For purposes of analysis, the gaging stations are then classified as being in zones "previously urbanized," "actively urbanizing," "semi-urbanized," or "non-urban," applying the previous definitions to these overall population density figures. In cases of depopulating census tracts, *only* the highest preceding census population figures (1970, 1980, or 1990) are used to determine overall population density, since depopulation does not decrease the number of buildings, roads, and other structures already in place. This method should provide an acceptable strategy to deal with changes in census tract boundaries from one census to the next, especially where the boundaries have changed only slightly and/or where several tracts are included within this eight-mile definition. Where major boundary changes have occurred within or between exceptionally large tracts of significantly different population densities, this method should at least minimize the overall effect of such boundary shifts on the population density variable. Many of the census tracts in the Dallas/Fort Worth and San Antonio metropolitan statistical areas have been subdivided, combined with other census tracts, or have had their boundaries moved to conform to newly constructed roads or developments during this time period.

Additional Variables

Water temperature is highly dependent on air temperature. Observed increases in water temperature may be due to regional increases in air temperature rather than urbanization. Air temperature must be included in this analysis to determine if any observed changes in water temperature are due to urbanization or to other confounding factors.

Daily solar radiation data (Fort Worth and San Antonio) is available only through August 1972 (in the U.S. Weather Bureau's *Climatological Data: National Summary*), and is therefore not included in this analysis. To account for monthly differences in solar angle (which affects solar radiation levels (Brown 1970)), the study incorporates "date rankings" as did the Beschta and Taylor study. "Date rankings" is a

term used as "an index of available solar radiation over the four-month period for clear days, when stream temperatures would be highest" (Beschta and Taylor 1988, 20). The date ranking system Beschta and Taylor used assigns the numbers 1 through 122 corresponding to the dates June 1st through September 30th. Texas temperature variations are not always as seasonally distinct as those in Oregon. In my study, May and October occasionally contribute some of the twenty warmest water temperature days. Thus, my date rankings use May 1st (day 1) through October 31st (day 184). (It should be noted that any included October temperatures from a certain water year are from the previous *calendar* year. However, only one October temperature observation made it into the final analysis.) It appears that the occurrence of twenty-highest-water-temperature days outside of this period (e.g., in April) results only when a large percentage of water temperature data is missing. Such misrepresentation is controlled by the elimination of study sites in a particular year's analysis when less than seventy-five percent of the water temperature readings for June 1st through September 30th at that site are available. To account for any water temperature variations that may be affected by latitude or regional geologic differences, all analyses are done separately within the Trinity River Basin and within the San Antonio River Basin to differentiate between the northern (Dallas/Fort Worth vicinity) sites and the southern (San Antonio vicinity) sites.

Another variable is daily average streamflow in cubic feet per second (c.f.s.). This variable had to be logged (natural log) for inclusion in the multiple regression analyses, as preliminary scatterplots of the independent variables with water temperature indicated the relationship with discharge had a right skew. Intuitively, it seems obvious that there would be less water temperature variation between observations with discharge rates of, for example, 101 c.f.s. and 110 c.f.s. than there would be between observations of one c.f.s. and ten c.f.s., and even less temperature variation from 1001 c.f.s. to 1010 c.f.s. Thus, the necessity to log the discharge variable seems logical. A daily wind variable is included (measured in total daily wind movement over the recording site, in miles). Daily cloudcover and dew point temperatures for Fort Worth and San Antonio are used to approximate conditions at all sites except for Gage 08062700 (Trinity River at Trinidad), which incorporates data from the Fort Worth and Waco stations, and Gages 08183500 (San Antonio River near Falls City) and 08186000 (Cibolo Creek near Falls City), which use data from the San Antonio and Corpus Christi stations. Total cloudcover is recorded ranging from clear (0.0) to completely

overcast (1.0), by approximately 1/10th increments (0.0 (clear), 0.1, 0.25, 0.4, 0.5, 0.6, 0.75, 0.9, 1.0 (completely overcast)). Dew point temperature (°F) is used instead of relative humidity, which is temperature dependent. Water's ability to retain heat more efficiently than the air and land around it may have a noticeable effect on maximum daily water temperatures, in that the river or stream will likely retain enough heat from previous warm days to contribute significantly to its current temperature. To account for this effect, the average of the three previous days' maximum air temperatures serves as another variable.

Sinokrot and Stefan (1993) included streambed composition, groundwater inflows, reservoir releases, and wastewater discharges in their equations to estimate stream temperature. There should be no significant variations in temperature at specific sites over time due to the streambed unless the stream or river has been physically modified during the period of study. *Water Resources Data, Texas* notes such changes, and none are indicated during the study period. It should be noted that the gaging station for Cibolo Creek near Falls City was moved fifty feet downstream in March 1990 (the station's water temperature records were discontinued in September 1991). This move may prove to be significant, as the prior location was in the immediate vicinity of the State Highway 123 bridge. The major geologic site to site variations should be minimized by the separate analyses of the Dallas/Fort Worth and the San Antonio regions. I have attempted to minimize the effect of reservoir releases by choosing gaging stations that are not immediately downstream of major reservoirs. Similarly, all sites are ostensibly located a minimum of three miles downstream from any wastewater discharge sites. However, it should be noted that low flows at some sites are sustained by sewage effluents. I also have attempted to ensure a minimum three-mile upstream distance between the gage sites and any industrial sources or electricity generating facilities that discharge thermal effluents. As groundwater temperatures are heavily influenced by urbanization through decreased infiltration rates and increased runoff, and resultant decreases in low flow volume, groundwater temperature is not independent of urbanization, and therefore cannot be used as an independent variable in this analysis. However, recent precipitation does affect the inflow of groundwater. Therefore, precipitation totals for the preceding seven day period (including the date of observation) are included as an independent variable.

List of Variables

Dependent Variables (used in separate analyses of each urban area, and independent of each other):

- Five (randomly selected) of the twenty highest daily maximum water temperatures of each study (water) year
- Five (randomly selected) of the twenty highest daily mean water temperatures of each study (water) year
- Number of days (annually) with water temperatures greater than or equal to 30.0°C (86°F), 33.5°C (92°F), and 35.5°C (96°F) (This variable is studied separately, not as part of a multiple regression analysis.)
- Number of days (annually) exceeding maximum suggested water temperatures, by river segment, as specified by the Texas Natural Resource Conservation Commission (TNRCC). (This variable is also analyzed separately, not as part of a regression analysis.)

Independent Variables:

- Population density of census tracts up to eight miles upstream (main stem and major tributaries) of gaging station study sites (included only for 1980 and 1990 - a separate analysis)
- Urbanization status: categorization of each observation site as "previously urbanized," "actively urbanizing," "semi-urbanized," or "non-urban" as per previously defined parameters for all years of study - also a separate analysis
- Year of observation (Water Year)
- Maximum air temperature (estimated) on the five specified days (see above) selected from the twenty highest maximum (or mean) water temperature days of each year
- Average daily discharge at gaging stations on the five specified days of each year (this variable is logged)
- "Date rankings" of the five specified days of each year:

  May 1st = 1 through October 31st = 184
- Total wind movement (estimated) at each study site on the five specified days of each year

- Cloudcover (estimated) at each study site on the five specified days of each year
- Dew point temperature (estimated) at each study site on the five specified days of each year
- Average of maximum air temperatures (estimated) for three days previous to each of the five specified days of each year (to account for heat retained by water)
- Total precipitation at each study site over previous seven day period, including observation date, for each of the five specified days of each year

These variables, their units of measurement, and the abbreviations used in the multiple regression analysis procedures are provided in Table 7.

Two separate analyses are conducted for each method of analysis to differentiate between sites in the Dallas-Fort Worth vicinity and those in the San Antonio vicinity. For each gaging station, population density is based on overall population density for all census tracts or census county divisions up to eight miles upstream, based on the proportion of that eight miles that is within each tract or county division. Decreases in population density are disregarded, as discussed previously, unless census boundary changes make doing so an invalid representation of conditions. Summer water temperature data (June 1st through September 30th) must be at least seventy-five percent complete at any site for any given year for that sample to be included in the study.

TABLE 7

VARIABLE ABBREVIATIONS AND UNITS OF MEASUREMENT

Variable Abbreviation	Variable	Units of Measure
H2OTEMP	Daily maximum or daily mean water temperature (as appropriate)	°C
YEAR	Water Year	2-digit year designation
DATERANK	Date rank	May 1st = 1 through October 31st = 184
DISCHLN	Natural log of average daily discharge	(Discharge measured in cubic feet per second)
AIRTEMP	Daily maximum air temperature	°F
AIR3TEMP	Average daily maximum air temperature over previous 3 days	°F
PRECIP	Precipitation over previous 7 day period (including observation date)	Inches
WIND	Daily wind	Miles per day
CLOUDS	Cloud cover	0.0 = completely clear to 1.0 = total overcast
DEWPT	Dew point temperature	°F
PREVURB	Previously urbanized, as defined	1 = previously urbanized, 0 = other urbanization status
ACTIVURB	Actively urbanizing, as defined	1 = actively urbanizing, 0 = other urbanization status
SEMIURB	Semi-urbanized, as defined	1 = semi-urbanized, 0 = other urbanization status
NONURB	Non-urban, as defined	1 = non-urban, 0 = other urbanization status
POPDENS	Population density, as defined	Persons per square mile

An additional analysis shows the number of days each year at each site where the maximum water temperature is at or in excess of 30.0°C (86°F), 33.5°C (92°F), and 35.5°C (96°F). These temperatures represent the maximum preferred range, the upper limits formerly recommended by the Federal Water Pollution Control Administration for satisfactory growth, and the upper lethal limit, respectively, for the largemouth bass (*Micropterus salmoides*) (Clark 1969, 24). The largemouth bass was chosen as a representative species because its native range includes the Trinity and San Antonio River systems. It is also the major recreational game fish of the area. The data on number of days during which these temperatures were exceeded is presented in graphic form but is not incorporated into the regression equations. This analysis shows the persistence and frequency of excessive water temperatures and is included to take into account Macan's (1958) assertion that the duration of extreme temperatures is as important as the actual temperatures reached in measuring the effects of temperature stress on aquatic organisms. The temperatures relating to preferred range and upper limits for satisfactory growth are included per Clark's (1969) statement that temperatures unfavorable to fish may be just as harmful in the long run as lethally high temperatures. Similarly, this paper notes the frequency (number of days annually) that maximum suggested water temperatures are exceeded at each gaging station based on Texas Natural Resource Conservation Commission (TNRCC) specifications for that particular river segment (Tables 8 and 9). TNRCC designates specific water quality parameters, including water temperature, by river segment throughout Texas.

TABLE 8

TNRCC WATER TEMPERATURE CRITERIA
Trinity River Basin, Dallas and Fort Worth Metropolitan Areas and Vicinity (TNRCC 1997)

Station Name	U.S.G.S. Gage Number	TNRCC River Segment	Maximum Temperature
West Fork Trinity River at Beach Street at Fort Worth	08048543	0806	93°F (33.9°C)
West Fork Trinity River at Grand Prairie	08049500	0841	95°F (35.0°C)
Trinity River at Cedar Crest Boulevard at Dallas	08057055	0805	95°F (35.0°C)
Trinity River below Dallas	08057410	0805	95°F (35.0°C)
East Fork Trinity River at Seagoville	08061980	0819	91°F (32.8°C)
East Fork Trinity River near Crandall	08062000	0819	91°F (32.8°C)
Trinity River near Rosser	08062500	0805	95°F (35.0°C)
Trinity River at Trinidad	08062700	0804	93°F (33.9°C)

TABLE 9

TNRCC WATER TEMPERATURE CRITERIA
San Antonio River Basin, San Antonio Metropolitan Area and Vicinity (TNRCC 1997)

Station Name	U.S.G.S. Gage Number	TNRCC River Segment	Maximum Temperature
San Antonio River at Loop 410 at San Antonio	08178565	1911	90°F (32.2°C)
Salado Creek (lower station) at San Antonio	08178800	1910	90°F (32.2°C)
Medina River at La Coste	08180640	1903	90°F (32.2°C)
Medio Creek at Pearsall Road at San Antonio	08180750	1912	95°F (35.0°C)
Leon Creek at IH-35 at San Antonio	08181480	1906	95°F (35.0°C)
Medina River at San Antonio	08181500	1903	90°F (32.2°C)
San Antonio River near Elmendorf	08181800	1911	90°F (32.2°C)
San Antonio River near Falls City	08183500	1911	90°F (32.2°C)
Cibolo Creek near Falls City	08186000	1902	90°F (32.2°C)

Data Sources

Population data comes from the U.S. Bureau of the Census. The land area of census tracts is provided only for the 1990 Census. Some tracts have been either combined with other tracts or divided into additional tracts over the years 1970 to 1990. To determine population densities for tracts whose land area is not given, a dotted grid transparency was placed over census tract maps to determine the area of the census tracts. This information was then combined with population figures to determine population density. Census tracts that changed in area with successive censuses underwent this process again as needed. Census tracts and county divisions used in the population density calculations are listed for each site as part of Appendix G.

Information on water temperature and discharge is from the U.S. Geological Survey's (U.S.G.S.) *Water Resources Data, Texas*. All of the gaging stations used provide information on daily maximum, minimum, and mean water temperatures throughout the year. Daily average discharge records (cubic feet per second) are available for most of the gaging stations. Two stations provide water temperature information but not discharge data. For Gage 08057055 (Trinity River at Cedar Crest Boulevard at Dallas), discharge data is from Gage 08057000 (Trinity River at Dallas), 2.7 miles upstream. *Water Resources Data, Texas* uses the discharge data from Gage 08057000 in its water quality calculations for Gage 08057055, remarking that there is no appreciable inflow between the two stations. For Gage 08061980 (East Fork Trinity River at Seagoville), discharge data is from Gage 08062000 (East Fork Trinity River near Crandall), four miles downstream. After inspection of the 1:100,000-scale metric topographic map of the area, there appears to be no appreciable inflow between the two stations. *Water Resources Data, Texas* uses the same monthly discharge amounts for chemical and biochemical analyses at both stations.

Data on air temperature, precipitation, and wind is from the National Oceanic and Atmospheric Administration's (NOAA) *Climatological Data for Texas*. A detailed list of the stations used for each variable is provided in Appendix G, including which weather stations are used with each gaging station, by year, and what substitute stations have been used, when applicable. A sample entry from Appendix G is shown in Table 10. To estimate air temperatures, precipitation amounts, and wind conditions at each water temperature gaging station, data from all weather stations up to three times the distance of the station nearest the gage site are used. Stations lying within this perimeter are not included if another weather station is located nearer to the gaging station in the same general direction. The relative contribution of data from each station is based on the total number of stations used and their relative distance to the gaging station. Stations used for the calculations vary depending on which stations are available. Over the period of the study, many stations are added, discontinued, or have intermittent data. Data on cloudcover and dew point temperatures are the 7:00 a.m. conditions provided in the *Daily Weather Maps: Weekly Series*, also published by NOAA. Local estimates are made using the same method as just described. These stations and their use in the variable calculations are also listed in Appendix G. The final calculated figures for all the variables on all the observation dates used in the analyses comprise Appendix H. Table 11 provides an example of the information contained in this appendix.

TABLE 10

SAMPLE ENTRY FROM APPENDIX G

Water Temperature Gaging Stations: Observation Dates, Census Tracts/County Divisions, Discharge and Meteorological Data Observation Sites

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1990	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max: 8/31 7/1 8/28 6/27 7/9 Mean: 8/28 8/26 9/1 7/11 9/5	Fort Worth PMSA, tracts: 1001.02 1002.02 1003 1005.01 1009 1010 1011 1012.02 1015 1016 1017 1019 1020 1035 1038 1045.01 1046.04 1046.05 1059	same as water temp gaging station	-Benbrook Dam -Burleson 3SSE -Dallas-Ft. Worth Reg. WSCMO AP -Dallas Arboretum White Lake (when available) -Waxahachie (when available)	-Arlington -Benbrook Dam -Burleson 3SSE -Aledo 4SE -Dallas-Ft. Worth Reg. WSCMO AP -Roanoke -Lillian 3W -Joe Pool Lake	-Benbrook Dam -Joe Pool Lake (when available) -Grapevine Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

TABLE 11

SAMPLE ENTRY FROM APPENDIX H
Water Temperature Gaging Stations: Dependent and Independent Variable Values

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1990	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max:			2774							
		8/31	123	35.0		19	104	101.6	0	27.2	.1	66
		7/1	62	34.5		43	96.5	96	.09	73.8	.1	70
		8/28	120	34.5		21	101.3	101	.09	26.1	0	68
		6/27	58	34.0		115	98.1	95.1	.26	86.4	.9	72
		7/9	70	34.0		59	97.8	96.5	.21	87.1	.4	64
		Mean:										
		8/28	120	32.5		21	101.3	101	.09	26.1	0	68
		8/26	118	32.0		22	101.2	98.6	.09	53.8	0	67
		9/1	124	31.5		17	102.3	102.5	.02	31.6	.25	66
		7/11	72	31.0		8.8	98.3	97.1	.21	84.1	.75	69
		9/5	128	31.0		22	99.9	96.4	.02	29.3	.1	65

CHAPTER V

DATA ANALYSIS

Overview

A total of forty-six multiple regression procedures were performed to analyze the data gathered for this study. Two regressions were done for each of the seventeen individual study sites, one for the maximum water temperature observations and one for the mean water temperature observations at each site. YEAR was included as a variable in this analysis. YEAR was also the variable of chief interest in four regressions looking at all of the sites in the Trinity River Basin as a whole, and then similarly all of the sites in the San Antonio River Basin. Again, these analyses were further divided into maximum and mean water temperature studies (see Appendix E, Tables 32-35). The same four groupings were also used in multiple regression analyses incorporating population density to eight miles upstream from each site (census years only) (Appendix E, Tables 36-39) and analyses substituting "urbanization status" categories for actual population density so that all years of data (from other variables) could be included, not just data from census years (Appendix E, Tables 40-43). Appendix E provides summarized figures from the twelve SPSS analyses that include year, population density, and urbanization status for the entire basins. The thirty-four *individual* site analyses have not been reproduced for inclusion in this paper. Additionally, some of the key information provided by the multiple regression analyses is summarized in Tables 12-17 and 20-28.

One observation that stands out when looking at all of this information together is a lack of consistently definitive results from one procedure to the next. This situation itself reveals a number of insights, one being that there appears to be a major difference in the amount of influence various factors have over stream temperatures in the San Antonio River Basin as opposed to the Trinity River Basin. Another finding involves the adjusted R^2 values of the regression results. Adjusted R^2 is a measure indicating the ratio of variation in the dependent variable that is explained by variation in the independent

variables (explained sum of squares) to the variation that is *not* explained by variation in the independent variables (unexplained sum of squares). The multiple regressions that looked at large sample groups tended to have relatively low adjusted R^2 values, indicating that the proportion of explained variance was often not particularly high. The multiple regressions that had small sample sizes, conversely, tended to have high adjusted R^2 values, suggesting more actual correlation between the dependent and independent variables. Typically, larger sample groups should show an *increased* amount of explanation in the variablility of the dependent variable by the independent variables, *if* a relationship truly exists. However, the different analyses look at the population data in different ways, and effectively from different viewpoints. Most of the analyses with comparatively low observation numbers (as few as twenty-seven, but as many as one hundred) were used to look for changes in water temperature values over time, which indeed *should* show clearer, more accurate, patterns at the individual stations than for the basin as a whole. Thus, although some of the results may be viewed with skepticism due to their sample sizes, the analyses from smaller data sets should not necessarily be discounted.

In fact, in looking at these multiple regression analyses, the *F* values are the true indicators as to whether the relationships between the dependent variables and the independent variables are statistically significant. An *F* value of approximately 4.0, or higher, indicates a statistically significant relationship between the dependent and independent variables. A value at or above 4.0 signifies that there is a less than five percent chance that the observed relationship could have been a chance occurrence of sampling from a population in which there was no linear relationship between the dependent and independent variables. Tables 12, 13, and 14 show the *F* values, the calculated significance values associated with each *F* value, and the corresponding adjusted R^2 values of the various multiple regression analyses.

TABLE 12

F VALUES OF MULTIPLE REGRESSION ANALYSES
Trinity River Basin - Individual Sites

Specific Analysis	*F* Value	Signif *F* Value	Adjusted R^2 Value
Fort Worth			
- maximum	12.4	.0000	.48
- mean	13.7	.0000	.51
Grand Prairie			
- maximum	15.9	.0000	.55
- mean	9.9	.0000	.34
Cedar Crest Blvd., Dallas			
- maximum	25.4	.0000	.73
- mean	15.6	.0000	.67
Below Dallas			
- maximum	2.9	.0278	.09
- mean	6.0	.0000	.28
Seagoville			
- maximum	32.4	.0000	.72
- mean	20.1	.0000	.71
Crandall			
- maximum	39.2	.0000	.85
- mean	17.2	.0000	.61
Rosser			
- maximum	56.4	.0000	.80
- mean	44.7	.0000	.79
Trinidad			
- maximum	13.1	.0000	.69
- mean	20.6	.0000	.83

TABLE 13

F VALUES OF MULTIPLE REGRESSION ANALYSES
San Antonio River Basin - Individual Sites

Specific Analysis	*F* Value	Signif *F* Value	Adjusted R^2 Value
San Antonio River, Loop 410, San Antonio			
- maximum	25.0	.0000	.86
- mean	19.2	.0000	.83
Salado Creek			
- maximum	2.6	.0518	.12
- mean	7.3	.0004	.29
Medina River, La Coste			
- maximum	24.7	.0000	.82
- mean	25.7	.0000	.74
Medio Creek			
- maximum	2.2	.0925	.10
- mean	2.0	.1149	.09
Leon Creek			
- maximum	8.6	.0000	.55
- mean	12.8	.0000	.62
Medina River, San Antonio			
- maximum	22.9	.0000	.74
- mean	36.6	.0000	.84
San Antonio River, Elmendorf			
- maximum	29.3	.0000	.77
- mean	23.1	.0000	.61
San Antonio River, Falls City			
- maximum	15.2	.0000	.71
- mean	17.4	.0000	.68
Cibolo Creek			
- maximum	13.9	.0000	.61
- mean	13.6	.0000	.63

TABLE 14

F VALUES OF MULTIPLE REGRESSION ANALYSES
Trinity and San Antonio River Basins - Water Year, Urbanization Status, and Population Density Analyses

Specific Analysis	*F* Value	Signif *F* Value	Adjusted R^2 Value
WATER YEAR			
Trinity River Basin			
- maximum	109.1	.0000	.59
- mean	45.4	.0000	.37
San Antonio River Basin			
- maximum	17.4	.0000	.20
- mean	39.6	.0000	.44
URBANIZATION STATUS			
Trinity River Basin			
- maximum	195.5	.0000	.75
- mean	45.8	.0000	.43
San Antonio River Basin			
- maximum	29.8	.0000	.33
- mean	43.9	.0000	.52
POPULATION DENSITY			
Trinity River Basin			
- maximum	31.7	.0000	.76
- mean	20.8	.0000	.67
San Antonio River Basin			
- maximum	27.6	.0000	.80
- mean	21.8	.0000	.75

The *F* values in these tables indicate that at a significance level of .05, the only analyses that did not show a significant relationship between water temperature and the other variables were the individual site analyses at Salado Creek (maximum temperatures) and Medio Creek (maximum and mean temperatures), both in the San Antonio River Basin. The Trinity River below Dallas individual site analysis (maximum temperatures) also had an *F* value below 4.0 ($F = 2.9$), but the significance level indicated was only .0278. These four analyses also had the lowest adjusted R^2 values.

Adjusted R^2 Values

As mentioned, adjusted R^2 values in the regression analyses that included year to identify patterns of temperature change over time at the individual Trinity Basin stations were often fairly high. This finding suggests that the independent variables explained a lot of the variation in the dependent variable. Of the total of sixteen maximum and mean water temperature analyses, only four had adjusted R^2 values under .50. However, these four, and the two others with values under .60, were the maximum and mean analyses for two of the three previously urbanized sites (West Fork Trinity River at Beach Street at Fort Worth and Trinity River below Dallas) and the rapidly urbanizing Grand Prairie site. Perhaps more telling though is the fact that these three stations, along with the Rosser site (which contrastingly had high adjusted R^2 values for both the maximum and mean analyses), have the longest periods of usable data in the study. These analyses each had a good number of total cases from which observation data were taken, the number of cases actually used after eliminating samples with missing data in one category or another ranging from seventy-four to one hundred. In comparison, the eight analyses from the other four stations included as few as thirty-three cases to as many as forty-nine. The adjusted R^2 values of the regression analyses for the individual Trinity River Basin sites, as well as the explained and unexplained sum of squares values for each regression, are summarized in Table 15. The sum of squares values assist in showing how much confidence can be placed in the regression findings by indicating the ratio of variability in the dependent variable explained by the independent variables to that not explained, and additionally giving an indication of the relative quantity of obsevations analyzed (compare Tables 15 and 16 to Table 17).

TABLE 15

ADJUSTED R^2 VALUES / EXPLAINED AND UNEXPLAINED SUM OF SQUARES / PREDICTED WATER TEMPERATURE MEANS
Summary: Trinity River Basin - Individual Sites

Specific Analysis	Adjusted R^2	Sum of Squares		# of Cases		Predicted
		Explained	Unexplained	Total	Used	Mean
Fort Worth						
- maximum	.48	75.6	68.5	100	99	34.9
- mean	.51	34.2	28.0	100	99	31.5
Grand Prairie						
- maximum	.55	38.6	27.1	90	86	32.1
- mean	.34	15.9	26.2	90	88	31.1
Cedar Crest Blvd., Dallas						
- maximum	.73	13.9	4.3	45	45	31.6
- mean	.67	16.0	6.3	45	44	30.5
Below Dallas						
- maximum	.09	8.7	51.7	75	74	31.3
- mean	.30	21.9	43.5	80	79	30.7
Seagoville						
- maximum	.72	24.8	8.4	50	49	30.7
- mean	.71	12.3	4.2	50	48	29.5
Crandall						
- maximum	.85	41.6	6.4	45	43	31.0
- mean	.61	24.6	13.2	45	42	30.0
Rosser						
- maximum	.80	78.1	18.2	100	100	31.2
- mean	.79	73.1	17.8	100	96	30.7
Trinidad						
- maximum	.69	43.5	14.4	35	33	31.6
- mean	.83	23.1	3.4	35	33	30.4

The San Antonio River Basin sites had adjusted R^2 values under .50 only for the two Salado Creek analyses (previously urbanized) and the two Medio Creek analyses (actively urbanizing). One of the Leon Creek analyses (also previously urbanized) was the only additional adjusted R^2 under .60. All of the San Antonio Basin sites had a relatively low number of observation cases, as only the Cibolo Creek and San Antonio River at Elmendorf sites had any data prior to 1987 and the Cibolo Creek station's water

temperature readings were discontinued in 1991. The basin sites' analyses had as few as twenty-seven cases (San Antonio River at Loop 410) to as many as fifty-nine (San Antonio River at Elmendorf). So, perhaps the most significant thing about the three stations with adjusted R^2 values under .60 is that these stations also had the lowest discharge rates (incidentally also less than any of the Trinity Basin sites). In the San Antonio Basin, such low flow volumes are often maintined by springflow and artesian wells, and in some cases municipal wastewater effluent from farther upstream. These unaccounted-for variables may have been the most significant temperature modifiers in these cases. The Trinity Basin sites are not influenced significantly by springflow, instead maintaining low flows with sewage effluents and occasional reservoir releases. Table 16 summarizes adjusted R^2 and sum of squares figures for the San Antonio River Basin. One can see from the size of the explained and unexplained sum of squares values for the Loop 410 site compared to the other sites that widely varying temperature values from one year to the next can cause the sum of squares values to be large despite a low number of total observations.

The multiple regressions that used YEAR in analyzing changes in maximum and mean water temperatures over time for all of the San Antonio sites *combined* had a very low adjusted R^2 value in the maximum temperature study and a fairly low value (under .50) for the mean analysis (see Table 17). The combined Trinity sites had a low adjusted R^2 value for the mean water temperature analysis and an adjusted R^2 value of .59 for the maximum temperature analysis. These analyses had almost 530 cases for the two Trinity analyses and around four hundred for both San Antonio studies. These findings suggest that the more cases there are included in the analyses, the less correlation there is to be found between the dependent variable and the independent variables. However, I believe there is a problem with this type of analysis in that it *does* look at all of the sites together. Such an analysis attempts to find an overall pattern of temperature change over time throughout the basin instead of looking for dissimilarities between areas with different populations and population growth rates. One valuable aspect of this analysis, however, is that it would indicate if there is some anomalous increase throughout the area of river and stream temperatures unrelated to any of the other included independent variables. The generally low adjusted R^2 values suggest there is not. Another implication is that it is considerably more difficult to explain water temperature variation between sites than it is to explain variation over time at a specific site.

TABLE 16

ADJUSTED R^2 VALUES / EXPLAINED AND UNEXPLAINED SUM OF SQUARES / PREDICTED WATER TEMPERATURE MEANS
Summary: San Antonio River Basin - Individual Sites

Specific Analysis	Adjusted R^2	Sum of Squares		# of Cases		Predicted
		Explained	Unexplained	Total	Used	Mean
San Antonio River, Loop 410, San Antonio						
- maximum	.86	101.1	11.5	30	28	33.4
- mean	.83	30.8	4.4	30	27	30.5
Salado Creek						
- maximum	.12	6.8	28.6	50	48	28.9
- mean	.29	8.2	16.4	50	48	28.2
Medina River, La Coste						
- maximum	.82	14.0	2.4	40	37	28.9
- mean	.74	9.7	2.9	40	36	28.1
Medio Creek						
- maximum	.10	1.9	8.0	45	41	29.8
- mean	.09	1.4	6.1	45	41	28.7
Leon Creek						
- maximum	.55	31.6	18.9	45	44	29.1
- mean	.62	23.3	11.2	45	44	27.9
Medina River, San Antonio						
- maximum	.74	33.7	10.0	50	48	29.7
- mean	.84	21.4	3.4	50	49	28.8
San Antonio River, Elmendorf						
- maximum	.77	53.9	13.4	60	59	31.3
- mean	.61	26.2	15.0	60	58	30.1
San Antonio River, Falls City						
- maximum	.71	40.4	12.9	50	48	31.6
- mean	.68	15.1	5.9	50	48	30.7
Cibolo Creek						
- maximum	.61	75.9	39.2	50	50	30.7
- mean	.63	51.0	24.3	50	46	29.1

TABLE 17

ADJUSTED R^2 VALUES / EXPLAINED AND UNEXPLAINED SUM OF SQUARES / PREDICTED WATER TEMPERATURE MEANS
Summary: Trinity and San Antonio River Basins - Water Year, Urbanization Status, and Population Density Analyses

Specific Analysis	Adjusted R^2	Sum of Squares		# of Cases		Predicted
		Explained	Unexplained	Total	Used	Mean
WATER YEAR						
Trinity River Basin						
- maximum	.59	947.3	646.1	540	529	32.0
- mean	.37	200.3	327.8	545	528	30.7
San Antonio River Basin						
- maximum	.20	244.2	923.5	420	403	30.3
- mean	.44	292.6	358.6	420	397	29.1
URBANIZATION STATUS						
Trinity River Basin						
- maximum	.75	1195.8	397.6	540	529	32.0
- mean	.43	234.5	295.2	545	529	30.7
San Antonio River Basin						
- maximum	.33	403.8	763.8	420	403	30.3
- mean	.52	346.4	304.8	420	397	29.1
POPULATION DENSITY						
Trinity River Basin						
- maximum	.76	135.2	37.6	50	50	32.2
- mean	.67	37.2	15.7	50	50	30.8
San Antonio River Basin						
- maximum	.80	51.1	10.4	35	34	30.2
- mean	.75	35.5	9.5	35	35	29.2

When these same sites are regressed with the various urbanization status categories as variables, again with high numbers of observation cases, adjusted R^2 values are similar to those of the "by year" analyses, although slightly higher (i.e., the Trinity maximum temperature analysis had the highest adjusted R^2 values, followed by the San Antonio mean, Trinity mean, and San Antonio maximum analyses, respectively). The Trinity maximum temperature study had an adjusted R^2 of .75, a fairly high value, while its mean temperature study had a relatively low Adjusted R^2 value. In the San Antonio Basin, the mean

temperature analysis also had adjusted R^2 over .50, although barely, while the maximum temperature analysis had a low adjusted R^2. I am not sure why both methods' maximum temperature analyses in the Trinity basin would have had the higher adjusted R^2, while both mean analyses in the San Antonio Basin had the higher adjusted R^2 values, unless this finding is related to springflow as well.

The multiple regression analyses that included population density directly as a variable again had fairly low quantities of observations for both basins, thirty-four and thirty-five for the two San Antonio analyses and fifty for both of the Trinity Basin procedures. All of these studies had high adjusted R^2 values, ranging from .67 for the Trinity Basin's mean water temperature analysis up to .80 in the San Antonio Basin maximum temperature study. The significance of this correlation becomes muddled by the fact that both Trinity studies found a strong positive relationship between population density and water temperatures and both San Antonio analyses found a strong inverse relation between the two variables.

Possible explanations for the opposite direction of the findings for the two basins involve combined effects of springflow, discharge rates, and groundcover characteristics. A number of studies (Brown and Krygier 1967; Moore 1968; Brown 1969; Brown and Krygier 1970) reported maximum water temperatures to typically be highest in small streams, but this was generally not the case in the San Antonio River Basin. (The San Antonio River itself was hottest at the most upstream site, although the other two San Antonio River sites were also downstream of the confluence with the Medina River.) The highly urbanized sites (by population density) vary considerably in their groundcover characteristics. This factor helps to explain why the *average* water temperature observations were so low for the "previously urbanized" category despite the San Antonio River at Loop 410 site's consistently high temperatures. This subject is discussed in more detail later in this paper.

The contribution of springflow is also important in understanding water temperature conditions in this basin. Aside from the San Antonio River sites, the more highly urbanized gage sites are smaller creeks originating a relatively short distance upstream from the gages. The less urbanized sites are mostly downstream San Antonio River main stem or Medina River sites, with larger drainage basins and higher discharge rates. Cibolo Creek (classified non-urban) also has a large drainage basin upstream of the gage site, in contrast to the Leon Creek, Medio Creek, and Salado Creek sites (all previously urbanized or

actively urbanizing). So, the more highly urbanized sites have lower rates of flow, much of which comes from springflow and artesian wells. The creeks are also narrow enough to receive significant shading from trees along the banks, where present. The larger streamflow at the Medina River and downstream San Antonio River sites contains a larger proportion of water that has been flowing above ground for a considerable distance. The water has had more time to be warmed by solar radiation, the streambed, and high air temperatures (sewage effluent from various upstream water treatment facilities may also contribute a slight warming effect). Furthermore, the wider river channels cause more surface area to be exposed to the warming effect of solar radiation, even if there are trees along the banks. Some of the tributary water in these larger watersheds comes from urbanized or urbanizing areas. Similarly, these larger drainage basins include more *land* area over which vegetative groundcover has been either thinned out or replaced by impervious cover. Pluhowski and Kantrowitz (1963) demonstrated that groundwater under areas where trees and other vegetation have been cleared, even when the area is not covered by impervious surfaces, tends to be warmer than groundwater under wooded areas. Thus, the springflow modifying the water temperatures at the sites with the larger drainage basins may itself be warmer than the springflow contributing to the smaller drainage basin sites. Table 18 compares the San Antonio River Basin gaging stations average June through September daily discharge rates for each station's period of record and drainage basin areas upstream of each gage site.

The positive correlation indicated between population density and water temperature in the Trinity River Basin may be more directly valid than the San Antonio Basin's suggested inverse relationship. In the Trinity River Basin, low flows are not sustained by springflow, but by wastewater effluent and occasional reservoir releases. The Trinity River Basin sites are also all along the main stem or major forks of the Trinity River and, as such, have considerably higher flow rates and wider channels than the San Antonio River Basin sites. The lack of significant springflow to modify temperatures during periods of low flow, as well as the fact that there are no sites with small drainage basins, means that the stations follow the basic premise that higher water temperatures correspond with lower discharge volumes. The multiple regression analyses took the discharge rates into account and still found that the more heavily populated sites generally had the higher water temperatures. Although the drainage basins of the Trinity sites are very large in

comparison to the San Antonio River Basin sites, the lack of significant springflow to sustain low flows means there should be much less effect on summer river temperatures related directly to cleared or heavily urbanized drainage basin *land* surface area and associated higher groundwater inflow temperatures, as was suggested for the San Antonio Basin. If this study had included more days when significant rainfall occurred, the landcover of the surrounding basin would have presumably had more effect on water temperatures. Water draining off of warm urban surfaces into creeks, both as direct runoff and as baseflow, after a summer rain may have raised temperatures considerably. However, as the study included only dates among the hottest days of the year, there were few observation dates with rain conditions. Table 19 shows the Trinity River Basin gaging stations average June through September daily discharge rates for each station's period of record and drainage basin areas upstream of each gage site.

Other possible explanations for the contrasting relationships indicated between population density and water temperature in the two basins include stream orientation and modification of temperatures by sewage effluent and reservoir releases. Moore (1967) found east-west oriented streams in Oregon to be 2 to 4°C (3.6 to 7.2°F) warmer during summer months than were comparable north-south oriented streams due to differences in absorbed solar radiation. Geiger (1965) reported that east-west oriented streams received seven to nineteen percent more sunshine than did north-south oriented streams. The West Fork of the Trinity River and the Trinity River main stem both flow generally west to east through the most heavily urbanized portion of the Trinity basin. The San Antonio River, Leon Creek, Salado Creek, and Medio Creek all flow generally north to south through the most densely populated part of the San Antonio Basin study area. The EastFork of the Trinity River and downstream Trinity River main stem sites (less urbanized) are oriented more north-south or northwest-southeast. In the San Antonio River Basin, the less highly urbanized Medina River and San Antonio River near Elmendorf are oriented basically west-east. The San Antonio River near Falls City runs northwest to southeast. The section of Cibolo Creek above the gage site flows more north-south, although the actual gage site appears to be on a short west to east stretch of the creek.

Table 18

GAGING STATION AVERAGE DAILY SUMMER DISCHARGE AND DRAINAGE BASIN AREA
San Antonio River Basin

Gage Site	Urbanization Status Designation	Period of Record	Jun-Sep Average Daily Discharge (c.f.s.)	Drainage Basin Area (mi^2)
San Antonio River at Loop 410 at San Antonio	PREVURB	1987-96	137	125
Salado Creek (lower station) at San Antonio	PREVURB	1960-96	42.8	189
Medina River at La Coste	SEMIURB	1987-96	237	805[a]
Medio Creek at Pearsall Road at San Antonio	ACTIVURB	1987-95	11.4	47.9
Leon Creek at IH-35 at San Antonio	PREVURB	1985-96	45.2	219
Medina River at San Antonio	SEMIURB	1939-96	230	1317[a]
San Antonio River near Elmendorf	ACTIVURB	1962-96	589	1743
San Antonio River near Falls City	NONURB	1925-96	482	2113
Cibolo Creek near Falls City	NONURB	1931-96	139	827

[a] Note: Medina River gage sites drainage basin areas include 634 mi^2 above dam forming Medina Lake.

Table 19

GAGING STATION AVERAGE DAILY SUMMER DISCHARGE AND DRAINAGE BASIN AREA
Trinity River Basin

Gage Site	Urbanization Status Designation	Period of Record	Jun-Sep Average Daily Discharge (c.f.s.)	Drainage Basin Area (mi^2)
West Fork Trinity River at Beach Street at Fort Worth	PREVURB	1977-96	441	2685
West Fork Trinity River at Grand Prairie	ACTIVURB	1925-96	513	3065
Trinity River at Cedar Crest Blvd. at Dallas	PREVURB	1934-96[a]	1486[a]	6106[a]
Trinity River below Dallas	PREVURB	1957-96	1939	6278
East Fork Trinity River at Seagoville	ACTIVURB	1954-96[b]	472[b]	1224
East Fork Trinity River near Crandall	ACTIVURB	1954-96	472	1256
Trinity River near Rosser	NONURB	1925-96[c]	2396	8147
Trinity River at Trinidad	NONURB	1965-96	2952	8538[d]

[a] Note: No discharge data at station. Period of record, discharge, and drainage basin area data are from Gage 08057000 (Trinity River at Dallas), 2.7 miles upstream.

[b] Note: No discharge data at station. Period of record and discharge data are from Gage 08062000 (East Fork Trinity River near Crandall), four miles downstream.

[c] Note: No discharge data 1926-38.

[d] Note: 8538 mi^2 area does not include 1007 mi^2 upstream from Cedar Creek Reservoir. Main lake discharge joins Trinity River below gage site. Secondary dam approximately 14.3 miles above gage site intermittently releases into stream which joins river approximately 12.4 miles above gage site.

In the Trinity River Basin, more inflow of wastewater effluent in heavily urbanized areas than in less urbanized areas downstream may contribute to elevated temperatures in the more populous areas. Similar conditions in San Antonio may be masked by significant springflow. Also, there is a greater continuous expanse of urban area along the Trinity River, as the West Fork and main stem flow directly through downtown Fort Worth and Dallas without substantial relief from urban land in between. The river picks up wastewater effluent from many sources along the way. Additionally, the farther down the Trinity River Basin one goes, the more reservoirs there are that eventually feed into the river system. The outflow from Lake Ray Hubbard (a fairly large lake) into the East Fork Trinity River may still exhibit a significant cooling effect as far down as the Seagoville and Crandall gage sites. The Seagoville site is 14.5 miles downstream, and the Crandall site is 18.5 miles downstream. The East Fork Trinity River later converges with the main stem of the Trinity River above the Rosser and Trinidad sites, as well. Williams (1968) reported significant drops in water temperature as far as 71.0 miles downstream following *significant* reservoir releases. The mean discharge for the Seagoville and Crandall analyses (both used discharge data from the Crandall station) ranged from 84 c.f.s. (Crandall mean temperature analysis) to 106 c.f.s. (Seagoville maximum temperature analysis), which included effluent from three discharge sites into tributaries above the gage sites (but below the lake). Discharge rates in Williams' study tended to be much higher during significant release periods, with some observations approaching 1200 c.f.s.

Intercorrelation of Variables

One matter that needs to be addressed in this analysis is the problem of multi-collinearity and what effect it may have on the relationships between the dependent and the independent variables. Most of the multiple regression analyses had several cases of intercorrelation between independent variables. Correlation between individual variables is measured on a scale in which 0.000 indicates there is absolutely no correlation between two variables. Positive correlations are denoted by a positive number, which increases as the degree of correlation increases to a maximum value of 1.000, indicating a perfect positive correlation. Similarly, negative correlations approach -1.000 as they near perfect inverse correlation. This correlation coefficient is also known as Pearson's Product-Moment Correlation Coefficient. When

discussing intercorrelation of variables, this summary breaks cases down into three categories. The first classification is those variable pairs with correlations greater than or equal to .500 (or less than or equal to -.500). The actual figure amounts are noted for these correlations. A second distinction is made for those variables whose correlations are in the .400 to .499 (or -.400 to -.499) range. In most cases, these values are referred to simply as "above .400." Cases in which variables have a correlation value less than .400 are assumed to have too little intercorrelation to merit discussion. The correlation figure is not a linear measure. Squaring these correlation values gives R^2 values that show a more linear representation of how closely related the two variables are, but in squaring the value, the positive or negative sign is lost and the indication of whether the relation is a direct or inverse one is lost with it. *Adjusted* R^2, as used throughout the regression analysis and referred to frequently within this paper, is a modification of the R^2 value measuring the correlation between the dependent variable and the independent variables. Adjusted R^2 seems to provide a better measure of the relationship between the dependent and independent variables in multiple regression analyses. Adjusted R^2 indicates the proportion of the variability in the dependent variable that is explained by variation in the independent variables that are included in the final regression equation at the specified PIN limits (eliminating variables that do not contribute significantly to the dependent variable's variability).

One example of intercorrelation was especially prevalent in this study, occurring in all forty-six cases. The variable for daily maximum air temperature on the water temperature observation date (AIRTEMP) was consistently very highly correlated with the variable for the average daily maximum air temperature over the previous three-day period (AIR3TEMP). This relationship was always positive and had correlation values ranging from .619 to .882. This relationship seems intuitively obvious, but it raises a concern that one or both of these variables as a result are not accorded their proper degree of influence on the dependent variable. (Variable abbreviations and units of measurement are provided in Table 7.)

In the majority of cases, both of these variables were included in the final regression equation calculated by the SPSS program. However, either both would be included towards the end of the stepwise multiple regression procedure (generally indicating they did not make up a large proportion of the explained variance of the dependent variable), or one would enter very early and the other very late. Likewise, if one

of these two variables accounted for too little of the explained variation in the dependent variable to be included in the equation at all, the other typically would be one of the first variables to enter the equation. Interestingly, this final situation is more the case when AIRTEMP is included and AIR3TEMP is not, especially in the regressions that concentrated on specific sites for the duration of the study rather than the basin-wide studies. Twenty-six of the thirty-four multiple regression analyses involving the individual sites had adjusted R^2 values greater than .50. Of these, nine included AIRTEMP in the regression equation and not AIR3TEMP (both were included in thirteen, only AIR3TEMP in three, and neither in one). In all of these nine cases, AIRTEMP was one of the first three variables to be included. In all but one of these nine cases, AIRTEMP's "sig *t*" value was less than or equal to .0500 (but usually more than .0000), meaning that the ascribed values of *t* (a test statistic) are statistically significant at P = .05. In other words, the probability of the actual *t* values being greater than the given *t* values are less than or equal to .05 (5%), but not zero. The *t* value indicates the number of standard errors that a sample statistic is distant from its mean. (Actually, seven of the nine cases had sig *t* values of .0017 or lower. The other two cases also had the lowest adjusted R^2 values.) Table 20 shows the sig *t* values of both the AIRTEMP and AIR3TEMP variables for the final regression equations in which only one of the two variables was included. Note that when only AIRTEMP is included, the sig *t* values are typically low and the adjusted R^2 values are high. Conversely, when only AIR3TEMP is included, if sig *t* is low, then adjusted R^2 is also typically low. When adjusted R^2 is high (implying an increased liklihood that change in the dependent variable *is* related to change in the independent variables), the sig *t* values are also usually high. In several cases where only AIR3TEMP is included, sig *t* is high *and* adjusted R^2 is low.

The intercorrelation of AIRTEMP and AIR3TEMP was the only example that occured not only in every possible case, but also always with a correlation coefficient value above .500. However, a number of other cases of intercorrelation were prevalent. AIR3TEMP and PRECIP (precipitation over the seven previous days, including the observation date) had a correlation level of at least .400 (always negative) in over half the cases in both river basins for the individual site analyses and in both basins for the three other analyses (all sites by year; all sites by population density; and all sites by urbanization status). This relation makes intuitive sense, in that conditions may have included rain, and therefore overcast skies, on one or

more of the three previous days of the AIR3TEMP variable, cooling the air somewhat. In the individual site analyses, DISCHLN (the natural logarithm of the daily average discharge) and both AIRTEMP and AIR3TEMP had correlation levels above .400 in over half the cases (always negative). However, this correlation never exceeded .400 in any of the analyses looking at all of the sites as a whole, suggesting to me that this relationship is site specific and has more to do with air temperature being related to *changing* streamflow levels at the site itself rather than to any generalized discharge amounts. The AIRTEMP and AIR3TEMP variables also correlated at levels above .400 with DEWPT (dewpoint temperature), also always negative, in at least half the cases for both the individual site analyses and the combined site analyses, but for the Trinity River Basin only. I cannot explain this difference between river basins; perhaps there is interference in one basin or the other from the intercorrelation of AIRTEMP and AIR3TEMP, producing a false relationship or lack thereof. The San Antonio Basin (individual site analyses only) curiously showed an intercorrelation above .400 in well over half of its eighteen cases between WIND and CLOUDS (positive relationship). There were no cases of this correlation above .400 in the Trinity River Basin.

Aside from the previously mentioned examples, the multiple regression analyses incorporating all of the sites together show some interesting similarities and differences between the Trinity and San Antonio River Basins through correlations of their differing primary independent variables. The variable YEAR showed no correlation above .400 with any variable other than water temperature (discussed later) in either basin for the combined sites analyses except for one occurrence with DEWPT (positive correlation) in the Trinity Basin. This oddity is most likely the result of some other intercorrelation or problem within the analysis, although there were a number of YEAR/DEWPT correlations that occurred in the individual site analyses as well (only in eight of the thirty-four cases though, all of the Trinity Basin cases showing a positive relationship, like the above case, and all of the San Antonio cases with inverse relations). (A YEAR/DISCHLN relationship also appeared in eleven of the individual site cases, all six of the San Antonio cases negative, four out of five of the Trinity cases positive.) Most of the other independent variable intercorrelations that appeared only infrequently were either positive in both basins or negative in both basins, or they did not occur at all in one of the basins.

TABLE 20

SIG *T* VALUES OF AIR TEMPERATURE VARIABLES WHEN ONE IS INCLUDED AND OTHER IS EXCLUDED FROM FINAL REGRESSION EQUATION
Trinity and San Antonio River Basins

Site	Sig *t* of AIRTEMP (if included in equation)	Sig *t* of AIR3TEMP (if included in equation)	Adjusted R^2
Cedar Crest Blvd., Dallas - maximum	.0001		.73
Cedar Crest Blvd., Dallas - mean	.0000		.67
Below Dallas - mean		.0008	.30
Seagoville - maximum	.0017		.72
Seagoville - mean	.0002		.71
Crandall - maximum	.0004		.85
Trinidad - maximum		.1646	.69
Trinidad - mean		.0060	.83
Salado Creek - maximum		.1053	.12
Salado Creek - mean		.0017	.29
Medio Creek - maximum	.1021		.10
Medio Creek - mean		.2592	.09
Leon Creek - maximum	.1899		.55
Medina River, San Antonio - mean	.0004		.84
San Antonio River, Elmendorf - mean	.0402		.61
San Antonio River, Falls City - mean		.2364	.68
Cibolo Creek - mean	.0009		.63

Population density (POPDENS) exhibited a strong inverse relationship (ranging from .659 to .732) with DISCHLN in all four of the regression analyses it was included in (Trinity maximum and mean; San Antonio maximum and mean). Although increased urbanization, through decreased groundcover and increased impervious cover, does tend to lead to increased runoff and therefore increased rates of flow

during significant rain events, this study analyzed the hottest days of the year, and therefore almost none of the observation dates were on days with any significant rainfall. Increased urbanization also tends to *decrease* inflow to streams from groundwater during periods of low flow for the same reasons as mentioned above, and it is this relationship that shows up in the POPDENS/DISCHLN intercorrelation. An intercorrelation between POPDENS and AIR at or above .400 occurred in only one case (a positive correlation of exactly .400 in the Trinity Basin mean water temperature analysis). A POPDENS/ AIR3TEMP relation appeared only in the San Antonio Basin, in both the maximum and mean water temperature analyses, but both indicated an inverse relationship. The inconsistency of these observed relationships (and their absence in the remaining cases) between population density and the air temperature variables suggests there is little evidence of an "urban heat island" effect that can be clearly recognized through this data and method of analysis. The heavily urbanized parts of the Trinity River Basin study area have considerably higher population densities and are more heavily built-up than the heavily urbanized parts of San Antonio included in the analyses, which may explain why the Trinity Basin showed more of a positive correlation between population density and maximum daily air temperatures. Additionally, the three "previously urbanized" San Antonio gage sites are out toward the fringes of the city, whereas the Fort Worth and Dallas (Cedar Crest Boulevard) gages are both very near the core of their respective downtowns. POPDENS also had cases (Trinity Basin only) in which it appeared to correlate with the daily amount of wind. More likely, some of the more heavily urbanized sites happen to be closer to wind measurement stations with generally greater average wind velocity. POPDENS and DATERANK also had a positive correlation (.503) for the San Antonio mean water temperature analysis. Presumably, this incidence was due to some other interrelationship rather than an actual relation between these variables.

The urbanization status variables had some predictable correlations, but the oddities and exceptions are of special interest. In the Trinity River Basin, the PREVURB (previously urbanized), ACTIVURB (actively urbanizing), and NONURB (non-urban) variables all intercorellated at levels exceeding .400. PREVURB and ACTIVURB had a correlation of around .600 for both the mean and maximum water temperture analyses. The San Antonio River Basin, on the other hand, had no intercorrelations among these variables above the .400 level. This apparent disparity actually does make

sense, as the San Antonio Basin had semi-urbanized sites as well as sites fitting these three classifications, while the Trinity Basin had no semi-urbanized sites. As a result, there was more interdependence among the three Trinity Basin urbanization variables. (As mentioned previously, SEMIURB (semi-urbanized) was intentionally not included as a variable in the multiple regression procedures. The urbanization status variables were constructed as dichotomous variables, so the value of any three (with a value of 1 or 0 indicating they were or were not, respectively, classified as that urbanization status category) would exactly determine the value of the fourth. Such would be the case even if there were no cases in which the fourth category did occur, as was the case in the Trinity Basin. Variables in the multiple regression analyses should not be exactly determined by the other variables.)

NONURB also had a fairly strong positive relationship with DISCHLN in both of the Trinity Basin analyses (correlation values of .569 and .576). This relationship is actually most likely due to the fact that both of the non-urban sites are located farthest downstream, where the discharge rate is significantly higher than the other sites. This and other possible explanations are discussed later. Both of the San Antonio Basin analyses indicated an inverse relationship (correlation value between -.400 and -.499) between PREVURB and DISCHLN, which seems to correlate with the inverse relationship between POPDENS and DISCHLN mentioned previously.

Summary of Multiple Regression Analysis Results

The multiple regression analyses show little conclusive evidence of a consistent relationship between water temperature and increasing urbanization, as measured by population density attributes, but they do suggest a number of interesting patterns. First, the individual site regressions for the San Antonio Basin revealed that water temperature (H2OTEMP) was inversely related to the YEAR variable at all three of the previously urbanized sites. This statement implies that the water temperature at these sites has actually decreased over time during the period of study. Such a suggestion must be viewed skeptically though, as of the three sites designated as previously urbanized, both Salado Creek analyses had low adjusted R^2 values and the two San Antonio River at Loop 410 at San Antonio analyses included only twenty-seven and twenty-eight observations. This pattern is interesting though, because YEAR had a

positive relationship with all of the non-urban sites, and all of the actively urbanizing and semi-urbanized sites that included YEAR as a variable in their final regression equations. Both Medio Creek (actively urbanizing) analyses omitted YEAR, but they also had low adjusted R^2 values. Medina River at La Coste (semi-urbanized) also omitted YEAR, although YEAR and H2OTEMP did initially have a correlation value above .400 (inverse) in the maximum temperature analysis. Increasing tree height over time *could* have produced an increased shading/cooling effect at the Leon Creek and Salado Creek sites, as these streams are narrow enough to benefit significantly from streamside tree cover. Medio Creek may have experienced a similar effect, but omission of the YEAR variable suggests it would have been minimal. The San Antonio River at Loop 410 site would not have experienced such conditions. The wider riverbeds of the Medina River and downstream sections of the San Antonio River would lessen any similar effect at those sites. The individual site characteristics of the three "previously urbanized" gage locations are discussed in more detail later in the paper, as very disparate results between these sites necessitated closer inspection.

The La Coste analyses were also the only non-"previously urbanized" site analyses to have intercorrelations between the YEAR variable and other variables. La Coste's results indicated intercorrelations between YEAR and AIRTEMP and between YEAR and AIR3TEMP (both inverse correlations). (The previously urbanized sites, in comparison, all indicated inverse relationships between YEAR and DISCHLN. Additionally, some of the previously urbanized sites also showed YEAR as having inverse relations with DEWPOINT (several cases) and with WIND and DATERANK (one case each).)

The final regression equations (to calculate summer daily maximum or mean water temperatures given the other variable values) are given in Tables 21, 22, and 23. (Variable abbreviations and units of measure are provided in Table 7.) As YEAR acts as something of a surrogate variable for changing population densities in the individual site analyses, its sig *t* values, as well as those of the equation constants, are noted in Tables 24 and 25.

TABLE 21

FINAL REGRESSION EQUATIONS FROM MULTIPLE REGRESSION ANALYSES
Trinity River Basin - Individual Sites

Specific Analysis	Final Regression Equation
Fort Worth	
- maximum	24.8814 + .0190(YEAR) - .0107(DATERANK) - .4012(DISCHLN) + .0452(AIRTEMP) + .0678(AIR3TEMP) - .1934(PRECIP) - .0058(WIND) - .4148(CLOUDS)
- mean	15.0919 - .0068(DATERANK) - .2484(DISCHLN) + .0783(AIRTEMP) + .0579(AIR3TEMP) + .2273(PRECIP) - .0140(WIND) - .5249(CLOUDS) + .0798(DEWPT)
Grand Prairie	
- maximum	17.3864 - .0215(YEAR) - .4315(DISCHLN) + .0456(AIRTEMP) + .1159(AIR3TEMP) - .0046(WIND) - .3003(CLOUDS) + .0451(DEWPT)
- mean	21.0498 - .0217(YEAR) - .0037(DATERANK) + .0809(AIRTEMP) + .0412(AIR3TEMP) + .2291(PRECIP)
Cedar Crest Blvd., Dallas	
- maximum	26.8597 - .7375(DISCHLN) + .0854(AIRTEMP) - .0068(WIND) - .4545(CLOUDS) + .0180(DEWPT)
- mean	18.2263 - .0422(YEAR) - .9358(DISCHLN) + .1480(AIRTEMP) - .1007(PRECIP) - .0048(WIND) + .1059(DEWPT)
Below Dallas	
- maximum	34.7473 - .0097(DATERANK) - .7160(DISCHLN) - .3277(PRECIP) + .0317(DEWPT)
- mean	22.3750 - .0290(YEAR) - .0131(DATERANK) + .3972(DISCHLN) + .1004(AIR3TEMP) - .0069(WIND) + .6121(CLOUDS)

TABLE 21---Continued

Specific Analysis	Final Regression Equation
Seagoville	
- maximum	12.2264 + .1362(YEAR) - .4315(DISCHLN) + .0822(AIRTEMP) + .0784(PRECIP)
- mean	15.9641 + .0398(YEAR) - .0037(DATERANK) - .4506(DISCHLN) + .0750(AIRTEMP) + .3106(CLOUDS) + .0692(DEWPT)
Crandall	
- maximum	29.6077 - .0446(YEAR) - .0076(DATERANK) - .6221(DISCHLN) + .0937(AIRTEMP) + .1108(PRECIP) - .6094(CLOUDS)
- mean	24.4606 - .0363(YEAR) - .4958(DISCHLN) + .0644(AIRTEMP) + .0499(AIR3TEMP)
Rosser	
- maximum	27.3222 - .0167(YEAR) - .0077(DATERANK) - .8421(DISCHLN) + .0536(AIRTEMP) + .0624(AIR3TEMP) - .0063(WIND) + .0124(DEWPT)
- mean	25.7736 - .0208(YEAR) - .0075(DATE) - .8869(DISCHLN) + .0686(AIRTEMP) + .0412(AIR3TEMP) - .0024(WIND) - .2031(CLOUDS) + .0421(DEWPT)
Trinidad	
- maximum	51.9533 - .1521(YEAR) - .0333(DATERANK) - 1.5160(DISCHLN) + .0887(AIR3TEMP) - .0113(WIND) - .9488(CLOUDS)
- mean	15.0614 + .1335(YEAR) - .0081(DATERANK) - .5600(DISCHLN) + .1245(AIR3TEMP) + .1751(PRECIP) - .0057(WIND) - .4604(CLOUDS) - .0538(DEWPT)

TABLE 22

FINAL REGRESSION EQUATIONS FROM MULTIPLE REGRESSION ANALYSES
San Antonio River Basin - Individual Sites

Specific Analysis	Final Regression Equation
San Antonio River, Loop 410, San Antonio	
- maximum	20.3922 - .0943(YEAR) - .0359(DATERANK) - 1.0289(DISCHLN) + .4727(AIRTEMP) - .1698(AIR3TEMP) + .4441(PRECIP) - .0256(WIND)
- mean	24.6848 - .0920(YEAR) - .0054(DATERANK) - .8849(DISCHLN) + .2879(AIRTEMP) - .1024(AIR3TEMP) + 1.0195(PRECIP) - .0098(WIND)
Salado Creek	
- maximum	27.8174 - .0473(YEAR) - .0108(DATERANK) + .0701(AIR3TEMP) - .7134(CLOUDS)
- mean	16.9737 - .0986(YEAR) + .1345(AIR3TEMP) + .0978(DEWPT)
Medina River, La Coste	
- maximum	6.9180 - .0143(DATERANK) - .1545(DISCHLN) + .0471(AIRTEMP) + .0994(AIR3TEMP) - .1770(PRECIP) - .3200(CLOUDS) + .1339(DEWPT)
- mean	15.4596 - .0091(DATERANK) - .2211(DISCHLN) + .0549(AIRTEMP) + .0921(AIR3TEMP)
Medio Creek	
- maximum	20.9714 - .0043(DATERANK) + .0497(AIRTEMP) + .0055(WIND) + .0549(DEWPT)
- mean	21.1646 + .0332(AIR3TEMP) + .0038(WIND) - .5427(CLOUDS) + .0612(DEWPT)
Leon Creek	
- maximum	36.1938 - .1329(YEAR) - .0152(DATERANK) - .8092(DISCHLN) + .0774(AIRTEMP) + .7577(PRECIP) - .0097(WIND) + .9006(CLOUDS)
- mean	28.1825 - .1199(YEAR) - .0152(DATERANK) - .4815(DISCHLN) + .0728(AIRTEMP) + .0595(AIR3TEMP) + .7413(PRECIP)

TABLE 22---Continued

Specific Analysis	Final Regression Equation
Medina River, San Antonio	
- maximum	35.0880 + .1026(YEAR) - .9522(DISCHLN) + .3413(PRECIP) + .0185(WIND) - .2563(CLOUDS) - .1535(DEWPT)
- mean	10.5319 + .0792(YEAR) - .7637(DISCHLN) + .1028(AIRTEMP) + .4463(PRECIP) - .0031(WIND) + .2871(CLOUDS) + .0619(DEWPT)
San Antonio River, Elmendorf	
- maximum	33.1940 + .0256(YEAR) - .0061(DATERANK) - 1.1750(DISCHLN) + .1458(AIRTEMP) - .1138(AIR3TEMP) - .0056(WIND) - .2953(CLOUDS)
- mean	21.3098 + .0363(YEAR) - .8561(DISCHLN) + .1033(AIRTEMP) - .2205(CLOUDS)
San Antonio River, Falls City	
- maximum	26.9566 + .1632(YEAR) - .5193(DISCHLN) + .1089(AIRTEMP) - .1414(AIR3TEMP) + .5088(PRECIP) + .0130(WIND) - .5134(CLOUDS) - .0676(DEWPT)
- mean	10.8195 + .1709(YEAR) - .3294(DISCHLN) + .0450(AIR3TEMP) - .2260(PRECIP) - .0065(WIND) + .0292(DEWPT)
Cibolo Creek	
- maximum	- 26.6871 + .1864(YEAR) + .2633(AIRTEMP) - .1004(AIR3TEMP) - .6713(PRECIP) - 1.1557(CLOUDS) + .3631(DEWPT)
- mean	- 17.1671 + .0530(YEAR) + .0084(DATERANK) + .1885(AIRTEMP) + .3643(PRECIP) - 1.2315(CLOUDS) + .3183(DEWPT)

TABLE 23

FINAL REGRESSION EQUATIONS FROM MULTIPLE REGRESSION ANALYSES
Trinity and San Antonio River Basins - Water Year, Urbanization Status, and Population Density Analyses

Specific Analysis	Final Regression Equation
WATER YEAR	
Trinity River Basin	
- maximum	27.4648 - .0205(YEAR) - .0060(DATERANK) - .7056(DISCHLN) + .0561(AIRTEMP) + .0563(AIR3TEMP) - .0038(WIND) - .2831(CLOUDS)
- mean	22.1076 - .0349(YEAR) - .0078(DATERANK) - .1883(DISCHLN) + .0585(AIRTEMP) + .0638(AIR3TEMP) - .0055(WIND) + .0252(DEWPT)
San Antonio River Basin	
- maximum	3.2741 + .0656(YEAR) - .0089(DATERANK) + .2289(DISCHLN) + .1598(AIRTEMP) + .0612(AIR3TEMP) - .9523(CLOUDS)
- mean	- 6.7731 + .0472(YEAR) - .0091(DATERANK) + .2974(DISCHLN) + .1941(AIRTEMP) + .0713(AIR3TEMP) - .0047(WIND) - .8475(CLOUDS) + .0858(DEWPT)
URBANIZATION STATUS	
Trinity River Basin	
- maximum	27.8386 - .0083(DATERANK) - 1.4659(ACTIVURB) + .1729(NONURB) - .8401(DISCHLN) + .0549(AIRTEMP) +.0391(AIR3TEMP) - .0043(WIND) - .1357(CLOUDS)
- mean	19.2985 - .0084(DATERANK) - .1784(PREVURB) - .7950(ACTIVURB) - .2756(DISCHLN) + .0536(AIRTEMP) + .0807(AIR3TEMP) + .0982(PRECIP) - .0050(WIND) + .0162(DEWPT)
San Antonio River Basin	
- maximum	8.4041 - .0107(DATERANK) + 1.4956(PREVURB) + 1.5217(ACTIVURB) + 1.9129(NONURB) + .3000(DISCHLN) + .2149(AIRTEMP) - 1.0045(CLOUDS)
- mean	- 2.0291 - .0087(DATERANK) + .7372(PREVURB) + .9895(ACTIVURB) + 1.1193(NONURB) + .3035(DISCHLN) + .1620(AIRTEMP) + .0863(AIR3TEMP) - .0044(WIND) - .7743(CLOUDS) + .0908(DEWPT)

TABLE 23---Continued

Specific Analysis	Final Regression Equation
POPULATION DENSITY	
Trinity River Basin	
- maximum	27.8409 - .0128(DATERANK) + 6.2376×10^{-4}(POPDENS) - .4864(DISCHLN) + .0741(AIRTEMP) - .5817(PRECIP)
- mean	20.2300 - .0077(DATERANK) + 3.8142×10^{-4}(POPDENS) + .1124(AIR3TEMP) - .0037(WIND) - .7220(CLOUDS)
San Antonio River Basin	
- maximum	16.6251 - 7.9076×10^{-4}(POPDENS) + .3729(DISCHLN) + .1281(AIRTEMP) + 1.7012(PRECIP) + .7230(CLOUDS)
- mean	29.8626 - .0075(DATERANK) - 4.8899×10^{-4}(POPDENS) + .3648(DISCHLN) - .0079(WIND) - .6168(CLOUDS)

TABLE 24

SIG *T* OF 'YEAR' VARIABLE AND CONSTANT IN FINAL MULTIPLE REGRESSION ANALYSIS EQUATIONS
Trinity River Basin - Individual Site Analyses

Specific Analysis	Coefficient Sign of YEAR Variable (+/-)	Sig *t* Value of YEAR Variable	Sig *t* Value of Constant	Adjusted R^2 Value
Fort Worth				
- maximum	+	.3036	.0000	.48
- mean	N/A[a]	.7887	.0000	.51
Grand Prairie				
- maximum	-	.0990	.0000	.55
- mean	-	.0554	.0000	.34
Cedar Crest Blvd., Dallas				
- maximum	N/A[a]	.7431	.0000	.73
- mean	-	.0429	.0000	.67
Below Dallas				
- maximum	N/A[a]	.7703	.0000	.09
- mean	-	.0802	.0000	.28
Seagoville				
- maximum	+	.0000	.0023	.72
- mean	+	.0253	.0000	.71
Crandall				
- maximum	-	.0032	.0000	.85
- mean	-	.0515	.0000	.61
Rosser				
- maximum	-	.0732	.0000	.80
- mean	-	.0349	.0000	.79
Trinidad				
- maximum	-	.0045	.0000	.69
- mean	+	.0001	.0153	.83

[a] Note: N/A denotes regression equations in which the YEAR variable was excluded, as it was not found to be significant at the specified .400 PIN limits.

TABLE 25

SIG *T* OF 'YEAR' VARIABLE AND CONSTANT IN FINAL MULTIPLE REGRESSION ANALYSIS EQUATIONS
San Antonio River Basin - Individual Site Analyses

Specific Analysis	Coefficient sign of YEAR variable (+/-)	Sig *t* value of YEAR variable	Sig *t* value of Constant	Adjusted R^2 value
San Antonio River, Loop 410, San Antonio				
- maximum	-	.2443	.1787	.86
- mean	-	.0999	.0361	.83
Salado Creek				
- maximum	-	.2876	.0000	.12
- mean	-	.0070	.0521	.29
Medina River, La Coste				
- maximum	N/A[a]	.7392	.0907	.82
- mean	N/A[a]	.7782	.0000	.74
Medio Creek				
- maximum	N/A[a]	.6044	.0000	.10
- mean	N/A[a]	.8026	.0000	.09
Leon Creek				
- maximum	-	.0077	.0001	.55
- mean	-	.0059	.0004	.62
Medina River, San Antonio				
- maximum	+	.0005	.0000	.74
- mean	+	.0000	.0323	.84
San Antonio River, Elmendorf				
- maximum	+	.2016	.0000	.77
- mean	+	.0842	.0013	.61
San Antonio River, Falls City				
- maximum	+	.0000	.0024	.71
- mean	+	.0000	.0349	.68
Cibolo Creek				
- maximum	+	.0003	.0025	.61
- mean	+	.2162	.0140	.63

[a] Note: N/A denotes regression equations in which the YEAR variable was excluded, as it was not found to be significant at the specified .400 PIN limits.

The two multiple regression analyses incorporating YEAR in studies of all the San Antonio Basin sites combined (Appendix E, Tables 34 and 35) indicated a positive relationship between year and water temperature, as did most of the non-"previously urbanized" sites as mentioned above, with no variables interfering with the relationship via significant intercorrelations with YEAR. Both of these analyses had relatively low adjusted R^2 values though, so it would be inappropriate to infer much about relationships between the variables based on these two analyses. Table 26 indicates the sig *t* values of both YEAR and the regression equation constant. The sig *t* values of the constant appear to reflect the low adjusted R^2 values of the San Antonio analyses. The San Antonio maximum temperature analysis had the lowest adjusted R^2 score (.20) as well as a high sig *t* value. However, the Trinity Basin mean temperature analysis also had a relatively low adjusted R^2 value (.37), which is not evident from the sig *t* values.

TABLE 26

SIG *T* OF 'YEAR' VARIABLE AND CONSTANT IN FINAL MULTIPLE REGRESSION ANALYSIS EQUATIONS
Trinity and San Antonio River Basins - Basin-wide Water Year Analyses

Specific Analysis	Coefficient sign of YEAR variable (+/-)	Sig *t* value of YEAR variable	Sig *t* value of Constant	Adjusted R^2 value
Trinity River Basin				
- maximum	-	.0269	.0000	.59
- mean	-	.0000	.0000	.37
San Antonio River Basin				
- maximum	+	.0032	.4092	.20
- mean	+	.0010	.0461	.44

The Trinity River Basin sites showed no clear correlation patterns between year and water temperature for previously urbanized, actively urbanizing, or non-urban sites, regardless of whether they had high or low adjusted R^2 values. All three categories had some cases with positive relationships between the two variables and others with inverse relationships between the variables. However, YEAR and DISCHLN were positively correlated for the three previously urbanized site analyses with adjusted R^2 values above .50, as well as for the one Grand Prairie (actively urbanizing) analysis with an adjusted R^2

value exceeding .50. This indication is opposite from the observations obtained from the six previously urbanized San Antonio River Basin analyses. None of the other actively urbanizing site analyses in the Trinity Basin indicated a YEAR/DISCHLN relationship, despite also having high adjusted R^2 values. The only other Trinity River Basin analysis in which YEAR and DISCHLN were intercorrelated was an *inverse* relationship at the Trinidad site.

The maximum and mean water temperature analyses including year for all of the Trinity sites combined (as shown in Table 26; see also Appendix E, Tables 32 and 33) both indicated an inverse relationship between year and water temperature, again opposite from what both of the combined San Antonio sites analyses showed. As with the San Antonio analyses, the Trinity River Basin's mean water temperature regression had a low adjusted R^2, but in this case, the adjusted R^2 value from the maximum water temperature analysis was relatively high, at .59. However, as mentioned already, the individual Trinity Basin sites showed no patterns concerning year and water temperature relationships with which the combined sites analysis could be compared.

Both of the Trinity River Basin analyses that included population density showed a *positive* relationship between population density and water temperature (Table 27). Both of the San Antonio River Basin studies indicated an *inverse* relationship between population density and water temperature. In all four cases, population density was either the first or second variable to enter the regression equations (first in three of the analyses). All four of these regressions had high adjusted R^2 values as well, but the low number of observations in each calls into question their validity. As previously stated, all four analyses also indicated a high (inverse) correlation between population density and the natural log of the average daily streamflow rate (DISCHLN). A more detailed summary of these analyses is provided in Appendix E, Tables 36-39.

TABLE 27

SIG *T* OF 'POPDENS' VARIABLE AND CONSTANT IN FINAL MULTIPLE REGRESSION ANALYSIS EQUATIONS
Trinity and San Antonio River Basins - Basin-wide Population Density Analyses

Specific Analysis	Coefficient sign of POPDENS variable	Sig *t* value of POPDENS variable	Sig *t* value of Constant	Adjusted R^2 value
Trinity River Basin				
- maximum	+	.0023	.0000	.76
- mean	+	.0003	.0000	.67
San Antonio River Basin				
- maximum	-	.0001	.0044	.80
- mean	-	.0137	.0000	.75

As discussed earlier, the opposite observed relationships between population density and water temperature in the two river basins may be closely tied to the presence of significant springflow at times of low flow in the San Antonio Basin and the lack of similar conditions in the Trinity Basin. Another contributing factor may be related to warmer groundwater inflow in the larger urbanized drainage basins where springflow *is* a significant factor (i.e. in the San Antonio River Basin). The more highly urbanized San Antonio River Basin sites have relatively small drainage basins and discharge rates when compared to the *less* urban San Antonio Basin sites, but considerable portions of the contributing watershed areas of these latter sites are either heavily urbanized or have at least had their tree cover significantly thinned. These conditions could contribute to warmer groundwater temperatures, in turn lessening the effect of groundwater inflow as a stream temperature modifier. In the Trinity Basin, a similar effect would be less significant, as low flows are sustained primarily by surface flow (wastewater effluent and reservoir releases) discharged directly into the river and its tributaries. Differing vegetation coverage around streams and throughout watersheds, as well as channel width, also contribute significantly to the interbasin differences. The Trinity River Basin sites generally have wider channels, especially in the more populous areas. Thus tree cover, where present, is not as effective at shading the waterways from solar radiation. The cooling effect of shade directly on the stream surfaces is also not as big a factor in determining water temperature on these larger rivers.

The Trinity River basin-wide analyses found water temperature to be positively correlated with population density but inversely related to year of observation, while the San Antonio River basin-wide analyses found water temperature to inversely correlate with population density and to have a positive correlation with year of observation. Although the regressions' *F* values indicate all of the analyses to be valid, comparing the adjusted R^2 values shows a greater correlation between water temperature and the independent variables in the population density analyses. Such a finding makes intuitive sense as YEAR would generally have more relevance in the individual site analyses than in basin-wide analyses. Water temperatures may have on *average* decreased over time in the Trinity Basin and increased in the San Antonio Basin, but by looking at the individual site analyses, one can see that such a generalization is invalid (Tables 24 and 25). Water temperatures seem to have decreased over time in San Antonio's "previously urbanized" areas and increased in most of the other areas, with some areas not showing any significant change in either direction. The Trinity River Basin analyses indicate some sites with *increasing* temperatures and others with *decreasing* temperatures over time in *all* urbanization status categories.

The regression analyses that included urbanization status classificiations also differ significantly between the Trinity and San Antonio River Basin examples. A summary of urbanization status variables coefficient values and sig *t* values, including sig *t* values of the equation constant and adjusted R^2 values, is shown in Table 28. A more extensive summary of the regression results is provided in Appendix E, Tables 40-43. In both of the San Antonio River Basin equations, all three urbanization status variables were present and were given positive signs, indicating a positive correlation between each and water temperature. The coefficient values of the three urbanization status classifications (SEMIURB was excluded) are directly comparable, as they have the same "units of measurement". In both cases (the maximum and mean water temperature analyses), NONURB had the largest coefficient value, followed by ACTIVURB, and finally PREVURB. This sequence was also the order in which they entered the regression equations. Therefore, non-urban areas are suggested to have the most influence on elevating water temperature levels, followed by actively urbanizing areas, and lastly, by previously urbanized areas. However, the adjusted R^2 for the maximum temperature analysis was fairly low (.33) and that of the mean temperature analysis is not particularly high either (.52), so the previous statement may or may not be true, even though the "sig *t*"

values for NONURB, ACTIVURB, and PREVURB for both analyses were all equal to .0000. Another possible complication stems from the intercorrelation (between .400 and .499) of PREVURB with DISCHLN in both of these analyses.

TABLE 28

SIG *T* AND PARTIAL ADJUSTED R^2 VALUES OF 'URBANIZATION STATUS' VARIABLES AND CONSTANT IN FINAL MULTIPLE REGRESSION ANALYSIS EQUATIONS
Trinity and San Antonio River Basins - Basin-wide Urbanization Status Analyses

Specific Analysis	Variable/ Constant	Coefficient Sign and Value of Variable	Sig *t* Value of Variable/ Constant	Partial Adjusted R^2	Final Adjusted R^2
Trinity River Basin					
- maximum	PREVURB	N/A[a]	N/A[a]	N/A[a]	.75
	ACTIVURB	- 1.47	.0000	.1724	
	NONURB	+ .17	.1329	.0006	
	Constant		.0000		
- mean	PREVURB	- .18	.0773	.0017	.43
	ACTIVURB	- .80	.0000	.0819	
	NONURB	N/A[a]	N/A[a]	N/A[a]	
	Constant		.0000		
San Antonio River Basin					
- maximum	PREVURB	+ 1.50	.0000	.0266	.33
	ACTIVURB	+ 1.52	.0000	.0405	
	NONURB	+ 1.91	.0000	.0728	
	Constant		.0035		
- mean	PREVURB	+ .74	.0000	.0269	.52
	ACTIVURB	+ .99	.0000	.0338	
	NONURB	+ 1.12	.0000	.0505	
	Constant		.4771		

[a] Notes: N/A denotes regression equations in which the specific variable was excluded, as it was not found to be significant at the specified .400 PIN limits. Furthermore, in the two Trinity River Basin cases, only two of the three Urbanization Status variables could be allowed into the regression equations, as the lack of any "semi-urbanized" sites meant that the value (1 = yes, 0 = no) of any two of the other three variables completely determined the value (1 or 0) of the third.

With the Trinity Basin studies that included urbanization status variables, the adjusted R^2 value for the mean temperature analysis was moderate (.43) and that of the maximum temperature analysis was high (.75). Both cases included only two of the urbanization status variables though, as the lack of any

SEMIURB sites caused the multiple regression analysis program to allow only two of the remaining three variables to enter into the final regression equation. The maximum water temperature analysis included ACTIVURB with a large negative coefficient and NONURB with a small positive coefficient. ACTIVURB also entered the regression equation much earlier than NONURB, indicating a stronger relation between ACTIVURB and water temperature. However, in all four Trinity River Basin cases NONURB also had a strong positive correlation (above .500) with DISCHLN. NONURB was not included in the mean water temperature analysis. PREVURB was included instead, displaying a weak inverse relation with water temperature. ACTIVURB again showed a considerably stronger (still inverse) correlation with the water temperature variable. In this case, ACTIVURB also entered the regression equation several steps prior to PREVURB's entry. In all four of these Trinity basin cases, ACTIVURB's "sig *t*" value finished at .0000 while NONURB and PREVURB all ended with "sig *t*" values in excess of .05 (meaning there is a much better chance that the relative significance ascribed to NONURB and PREVURB is not truly representative).

Table 28 also notes the "partial adjusted R^2" values of the urbanization status variables. These numbers represent how much the adjusted R^2 values for the analyses changed with the addition of each of these variables. The larger the partial adjusted R^2 value, the more variation in the dependent variable (water temperature) is explained by variation in that particular independent variable. These numbers provide additional information about the relative importance of each independent variable in determining the value of the dependent variable. The partial adjusted R^2 values of the urbanization status variables agree with the order of importance indicated by the variable coefficients. (The partial adjusted R^2 values do not indicate the direction of the relationships.) Partial adjusted R^2 does allow comparison of the relative strengths of the variable relationships. In the San Antonio River Basin, NONURB exhibits the most influence over water temperature and PREVURB the least, but the three variables are all of similar magnitude. In the Trinity River Basin, however, ACTIVURB increases the overall adjusted R^2 value by almost fifty times what PREVURB does in the mean temperature analysis and by well over 250 times what NONURB does in the maximum temperature analysis.

The evidence presented by the two Trinity River Basin analyses suggests that an area that is actively urbanizing may have a more significant correlation with local water temperature levels than either previously urbanized or non-urban sites. I don't believe these results indicate that active urbanization actually causes stream temperatures to decrease. Rather, the trend would be for summer river temperatures in actively urbanizing areas to *more consistently be lower* (compared to temperatures at previously urbanized and non-urban sites) than river temperatures are either *higher or lower* at either previously urbanized or non-urban locations. The reasons for such a tendency are not clear. Similarly, the non-urban sites tend to most often have the warmest water temperatures, for whatever reason. If it *is* true that non-urban conditions tend to raise water temperatures, then this observation could be due to the clearing of tree cover in the studied non-urban areas for farmland. Aerial photography or direct on-site analysis could aid in the explanation of these findings. Another possibility, of course, is that there is not enough evidence to note any significant changes in water temperature due to the urbanization status, as defined, of these particular sites, and that conclusions based on the results of the regression equations are false.

Student's *t*-test Results

The Student's *t*-test is used to analyze if there is a significant difference between the mean values of the same variable in two different sample groups. In this study, the variable is maximum (or mean) daily water temperatures and the sample groups are the different urbanization status categories. This section analyzes if there are significant differences between the means of any or all of the urbanization status categories. In the San Antonio River Basin, the means of the maximum and mean daily water temperatures of the previously urbanized, actively urbanizing, non-urban, and semi-urbanized sites were analyzed against each of the other urbanization status categories. For the Trinity River Basin, the procedure was the same, except for the exclusion of the semi-urbanized category, as there were no sites in the basin that qualified as semi-urbanized under the definition provided.

As this study is interested in the occurrence of temperatures both above and below the means in determining if the means are equal or not, a two-tailed test is used. To test the equality of the means, either a separate-variance *t*-test or a pooled-variance *t*-test must be implemented. Determination of which test to

use is important, as use of the pooled-variance *t*-test with population variances that are not equal can result in the probability level associated with the statistic being in error. The amount of this error depends on the inequality of the sample sizes and of the variances. Similarly, using the separate-variance test when the population values are equal will usually result in too large of an observed significance level. While the different values produced by the two methods may be small in large samples, the separate-variance *t*-test should generally be used when the variances are suspected to not be equal. To test whether the two population variances are equal, one needs to look at the *F* value (the ratio of the larger sample variance to the smaller sample variance). If the observed significance level (P) for the *F* test is small, the hypothesis that the population variances are equal can be rejected, and the separate-variance *t*-test should be used. If the significance level for the *F* test is large, the pooled-variance *t*-test should be used. The *F* test itself is more dependent on the sample populations being normal than the *t*-test is, so the *F* test should only be used here as a tool to test for the equality of the two variances to determine which type of *t*-test to use (Norusis and SPSS Inc. 1990, 155-56). Using the correct variance test, along with the *t*-statistic (the ratio of the difference of the means divided by their standard deviation) and the appropriate degrees of freedom, a two-tailed significance value of the difference between the two means can be calculated. SPSS can also provide these results, although it leaves the decision of which variance test (separate or pooled) to use to the researcher's discretion.

The figures and results of the *t*-tests are detailed in Appendix F (Tables 44-47). The two-tailed significance test results are summarized in Tables 29 and 30. The *t*-test results showed a high level of significance for all possible pairings of the urbanization status categories with the exception of actively urbanizing/non-urban for Trinity Basin maximum temperatures (two-tailed significance level of .619) and previously urbanized/semi-urbanized for San Antonio Basin mean temperatures (two-tailed significance level of .412).

TABLE 29

STUDENT'S *T*-TEST RESULTS: TWO-TAILED SIGNIFICANCE TESTS
Trinity River Basin

Specific Analysis	Test Variable 1	Mean Water Temp. (°C)	Test Variable 2	Mean Water Temp. (°C)	Two-tailed Significance
Trinity River Basin - maximum					
	PREVURB	32.75	ACTIVURB	31.07	.000
	PREVURB	32.75	NONURB	30.99	.000
	ACTIVURB	31.07	NONURB	30.99	.619
Trinity River Basin - mean					
	PREVURB	30.97	ACTIVURB	30.02	.000
	PREVURB	30.97	NONURB	30.36	.000
	ACTIVURB	30.02	NONURB	30.36	.010

Of the remaining pairings, the Trinity Basin mean temperatures pair of actively urbanizing/non-urban had a two-tailed significance level of .010; the San Antonio Basin maximum temperatures' previously urbanized/actively urbanizing pairing had a two-tailed significance level of .018; and the San Antonio Basin maximum temperatures pairing of previously urbanized and semi-urbanized had a two-tailed significance level of .005. All three of these values are well below the .05 and .025 significance levels. The other thirteen pairs of urbanization status categories all indicated two-tailed significance levels of .000, indicating definite significant differences between the variable means, according to this test method.

TABLE 30

STUDENT'S *T*-TEST RESULTS: TWO-TAILED SIGNIFICANCE TESTS
San Antonio River Basin

Specific Analysis	Test Variable 1	Mean Water Temp. (°C)	Test Variable 2	Mean Water Temp. (°C)	Two-tailed Significance
San Antonio River Basin - maximum					
	PREVURB	30.03	ACTIVURB	30.60	.018
	PREVURB	30.03	NONURB	31.58	.000
	PREVURB	30.03	SEMIURB	29.38	.005
	ACTIVURB	30.60	NONURB	31.58	.000
	ACTIVURB	30.60	SEMIURB	29.38	.000
	NONURB	31.58	SEMIURB	29.38	.000
San Antonio River Basin - mean					
	PREVURB	28.65	ACTIVURB	29.42	.000
	PREVURB	28.65	NONURB	30.73	.000
	PREVURB	28.65	SEMIURB	28.53	.412
	ACTIVURB	29.42	NONURB	30.73	.000
	ACTIVURB	29.42	SEMIURB	28.53	.000
	NONURB	30.73	SEMIURB	28.53	.000

One drawback of the Student's *t*-test is that it does not take into account the influence of any other factors on the dependent variable. As a result, it shows only whether there is or is not a significant difference between the means of the water temperatures between the different urbanization status categories. For example, this test shows that for some reason the non-urban San Antonio River Basin sites have a significantly higher mean value than any of the other San Antonio River Basin site classifications, but it is not clear why that might be. It should be noted that this finding is based on observations from one non-urban site only, the San Antonio River near Falls City station. The Cibolo Creek site was not included in

the *t*-test analysis as it did not have observations in the same time frame as the other stations (1981-1991 instead of 1987-1996). (The Trinity River Basin sites were also analyzed only for the years 1987-1996.)

The *t*-test results showed that in the San Antonio Basin, non-urban sites had the highest means of both maximum and mean water temperatures, followed by the actively urbanizing sites, the previously urbanized sites, and the semi-urbanized sites, in that order. The means of the previously urbanized and semi-urbanized sites had a large two-tailed significance value for the mean water temperature observations, indicating there was not a significant difference between the mean values of the mean daily water temperatures of these two categories. In the Trinity River Basin, the previously urbanized sites typically had the highest mean values for both maximum and mean water temperatures. The mean water temperature analysis found non-urban sites to have the next highest mean value, followed by actively urbanizing sites (there were no "semi-urbanized" sites in the Trinity Basin). The maximum water temperature study switched the two categories, finding actively urbanizing sites to have a slightly higher mean value than the non-urban sites, but the very high two-tailed significance level shows there was probably not a significant difference between the mean values of the actively urbanizing and non-urban sites' maximum water temperatures.

Several possible explanations occur to me to why the non-urban sites would not have the lowest mean values for maximum and mean water temperatures in the two basins. One possibility is that there is no true correlation between the urbanization variables and water temperature levels. Another stems from the fact that the non-urbanized sites in both basins are downstream from the major urban centers. (At the inception of the study, it seemed that the Medina River at La Coste site in the San Antonio Basin, upstream from the City of San Antonio, would be a non-urban site. The method for determining the urbanization status of the sites defined it as semi-urbanized though, as measuring population density to eight miles upstream included a large portion of the river within the city limits of the City of Castroville and a comparatively short stretch that flowed through rural Medina County.) The downstream sites of the Trinity River near Rosser and at Trinidad and of the San Antonio River near Falls City (but not of Cibolo Creek) all have higher average flow rates than their upstream "urbanized" counterparts. Larger discharge typically implies wider rivers, with more surface area exposed to the warming effects of the sun. The rural areas may

also have significant land areas within the watershed cleared for farming, further decreasing the cooling effect of shade on tributary streams and areas contributing groundwater inflow.

Graph Analyses

The various graph analyses tend to identify persistently high water temperature problem areas rather than to implicate any specific stage of urbanization as being culpable for elevated temperatures. The graphs displaying the mean value of the five maximum (and mean) daily water temperature observations for each year of record against a backdrop of 1970, 1980, and 1990 population density figures calculated for each site show no visibly noticeable relationship between the two variables (see Appendix A). Obviously, there is much variation in the water temperature variables due to other factors such as air temperature and flow rates, but the only site with consistently different (and considerably higher) water temperatures perceptible in these graphs was the West Fork Trinity River station in Fort Worth at Beach Street (Appendix A, Figure A-1). The San Antonio River gage at Loop 410 in San Antonio was also generally quite a bit warmer than the other stations in its basin, but its minimal number of observations makes it difficult to qualify these results as consistent (Appendix A, Figure A-17). None of the other high population density sites in either basin had water temperatures obviously higher (or lower) than those of median or low population density areas.

The observation site in Fort Worth (Appendix B, Figure B-1) consistently had river temperatures in excess of not only the maximum preferred range of *Micropterus salmoides*, but also of the upper temperature limits recommended for its satisfactory growth. Almost every summer also there were a number of days when water temperatures exceeded the fish's upper lethal limit. No other Trinity River sites exhibited such frequent extreme temperatures. Only the San Antonio River at Loop 410 in San Antonio observation site (Appendix B, Figure B-9) shared this distinction, having a comparable number of, or even more, days in excess of all three measures in four of the six years for which data was available at the station. The remainder of the Trinity sites only occasionally had years with a few summer days over the satisfactory growth limits. Only the Grand Prairie site (Appendix B, Figure B-2) had days in excess of this temperature in more than two of its observation years. The only site with any occurrence of lethal temperature levels

other than the Fort Worth station was the Trinity River below Dallas station in the summer of 1987 (Appendix B, Figure B-4). No additional San Antonio Basin stations had any days over the lethal level, and the occurrence of days exceeding the recommended satisfactory growth temperature limits were even less frequent than was the case in the Trinity River Basin. Only the San Antonio River stations near Elmendorf (Appendix B, Figure B-15) (1996 only) and near Falls City (Appendix B, Figure B-16) (1990, 1993, and 1996) had any occurrence of days over the satisfactory growth limits.

The occurrence of days exceeding these temperatures did not appear to appreciably increase over time at any of the observation sites in either basin. A tendency for the frequency of days above maximum preferred temperature range thresholds to seemingly decrease could be seen at the West Fork Trinity River at Grand Prairie and Trinity River below Dallas and near Rosser sites (Appendix B, Figures B-2, B-4, and B-7). The observations at all other Trinity River locations fluctuated and no distinct pattern of increase or decrease could be visually detected. The general lack of observation dates exceeding the threshold temperatures at the San Antonio Basin sites precluded any visual identification of patterns suggesting increases or decreases over time. The San Antonio River at Loop 410 site had too few years of data to reveal whether or not there was an actual pattern of increasing frequency of days over these temperatures.

The analysis of days exceeding maximum water temperatures suggested by the Texas Natural Resource Conservation Commission (TNRCC) by river segment yielded very similar results. Only the Fort Worth site (Appendix C, Figure C-1) surpassed these recommended temperatures on a regular basis. Twice, in 1980 and 1991, this temperature was exceeded on more than forty days. The other Trinity stations rarely, if ever, exceeded the suggested temperature limits. It should be mentioned that the Fort Worth site's designated river segment had a lower suggested maximum temperature than the other two "previously urbanized" sites as well as the Grand Prairie ("actively urbanizing") site. Likewise in San Antonio, only the San Antonio River at Loop 410 station (Appendix C, Figure C-9) had a considerable number of days over the TNRCC temperature threshold specified for its river segment. In fact, it far surpassed even the Fort Worth station as far as the quantity of days above its recommended maximum temperature, with anywhere from fifty to nearly eighty days above the TNRCC temperatures in 1988, 1994, 1995, and 1996. In fact, 1987 and 1993 were the only years with available data that were not excessive in

this regard, with less than ten days above the suggested temperatures for both years. The San Antonio River at Loop 410 site's recommended maximum temperature is, however, several degrees lower than that of the Fort Worth site. These two sites were analyzed more closely using digital orthophoto quarter quads (DOQQs) to see if their unusually warm temperatures could be explained through visual inspection. The results of these analyses are discussed in the next section of this paper.

No pattern of increase or decrease in number of days exceeding the TNRCC standards over time was particularly discernible at any of the Trinity Basin sites from the graphs, and no real pattern was in evidence at the San Antonio Basin sites other than that 1996 water temperatures were considerably above the norm at both the San Antonio River near Elmendorf (Appendix C, Figure C-15) and San Antonio River near Falls City (Appendix C, Figure C-16) locations. Had the Cibolo Creek station (Appendix C, Figure C-17) continued to record water temperature data, it may have revealed a pattern of increasing temperatures. There were no dates exceeding TNRCC's recommended temperatures at the site from 1981 through 1987, then there were four occurrences in 1988, six in 1989, and six again in 1991. In 1990, when there were too few observation dates available for inclusion in the study, there were eleven days above the TNRCC threshold temperature. This number is even more anomalous in that there were no observation dates in 1990 from July 1st through the middle of September. This year of extremes, however, coincides with the relocation of the gage site in March of 1990. Prior to that time, the readings were taken in the immediate vicinity of a highway bridge spanning the creek. The new location was fifty feet downstream.

The annual maximum and mean daily water temperatures were compared graphically between basins (Figures 7 and 8). The San Antonio Basin observations were on average noticeably lower, presumably due to the influence of springflow and increased shade coverage of the narrower urban streams.

The maximum air temperatures on the dates for which both maximum and mean water temperature observations were made were also graphed to compare summer air temperatures between the two basins (shown in Figure 9). Maximum air temperatures in the Trinity Basin fluctuated considerably more than did their counterparts in the San Antonio Basin. San Antonio's air temperatures did not vary much from year to year, but the Trinity Basin had some years with exceptionally low air temperatures, and others with extremely high readings. In fact, there were numerous summers during which air temperatures in the

Trinity River Basin exceeded 110°F (43.3°C), while no such extreme temperatures were recorded in the San Antonio Basin on any of the dates observed.

The maximum air temperature observations were then categorized according to the urbanization status classification of the various sites, with the two basins again analyzed separately (Figures 10 and 11). When analyzed in this way, a number of vague patterns emerge. In the Trinity Basin, occurrence of unusually high or low daily maximum temperature averages were most often the most extreme for actively urbanizing sites. Non-urban sites generally recorded lower maximum temperatures than did previously urbanized sites, and for the first six years of the study (1977-1982) non-urban temperatures were also consistently lower than the actively urbanizing sites' temperatures. In the San Antonio Basin, the average maximum air temperatures of the previously urbanized sites appear to generally be lower than those of the actively urbanizing or non-urban sites. The actively urbanizing, non-urban, and semi-urbanized areas' daily maximum air temperatures show no definitive patterns or hierarchy.

Graphs to compare the water temperatures of the four urbanization status categories were also created. The Trinity Basin water temperatures displayed no perceptible ordering of temperatures when grouped by urbanization status (Figures 12 and 13). For the San Antonio Basin maximum temperature graph analysis (Figure 14), if the San Antonio at Loop 410 station were excluded, non-urban sites would have had the highest temperatures on average, with actively urbanizing sites just below them, followed closely by the semi-urbanized category, and with previously urbanized site temperatures being generally less than or equal to those of semi-urbanized areas. However, with the inclusion of the Loop 410 site, previously urbanized site observations accounted for the highest temperatures by far in 1988, 1994, 1995, and 1996, with a virtual tie for highest average temperatures in 1993 with the San Antonio River near Falls City (non-urban) site. These five years account for all but one of the years for which the Loop 410 station's data is available or sufficient for analysis. The mean temperature analysis shows basically the same pattern, although the extremes at the Loop 410 station are somewhat subdued (Figure 15). The inconclusive findings of the Trinity Basin water temperature graphs, as well as the perceived patterns in the San Antonio Basin analysis, may not be truly representative of correlations (or lack of correlations) between average water temperatures and the various urbanization status categories. Localized and basin-wide temperatures

fluctuated considerably from year to year and many other variables contributed significant variability to the data. The *t*-tests were needed to determine if there were actually any significant differences between the means of the different urbanization status categories' observations. Even then, with such small variance, it is difficult to tell if those findings are genuine or if they are due more to variation in other variables. (The "non-urban" sites were generally downstream of the various urban sites, so it is reasonable to postulate that their water temperature values may be due to higher streamflow rates where the temperatures were lower (Trinity Basin) and possibly to wider, less well-shaded channels where water temperatures were higher (San Antonio Basin) rather than to the fact that they are not urbanized. The differing tree cover conditions within particular urbanization status categories also greatly affect the overall mean temperature values associated with that category.) A different methodology that uses a wider variance in water temperatures may reveal more about any genuine relationships between water temperature and the other variables.

Graphs were also constructed to further analyze the relationships between maximum daily air temperatures and maximum and mean daily water temperatures (Appendix D, Figures D-1 through D-34). As expected, there was a strong visual correlation between the air and water temperature variables, more so for the maximum water temperatures. Neither basin seemed to consistently display more correlation between the two variables than the other basin did. The same holds true for the different urbanization status categories, except that water temperatures at the Fort Worth station appear to be especially sensitive to air temperature variation, and are often almost as high as those air temperatures. In fact, in 1991 and 1992, the average of the five water temperature observations was right at or even slightly above the average air temperatures for those same five days. In the multiple regression analyses, the inclusion of both daily maximum air temperatures *and* previous-three-day average maximum air temperatures may have tempered the covariance of the air and water temperature variables.

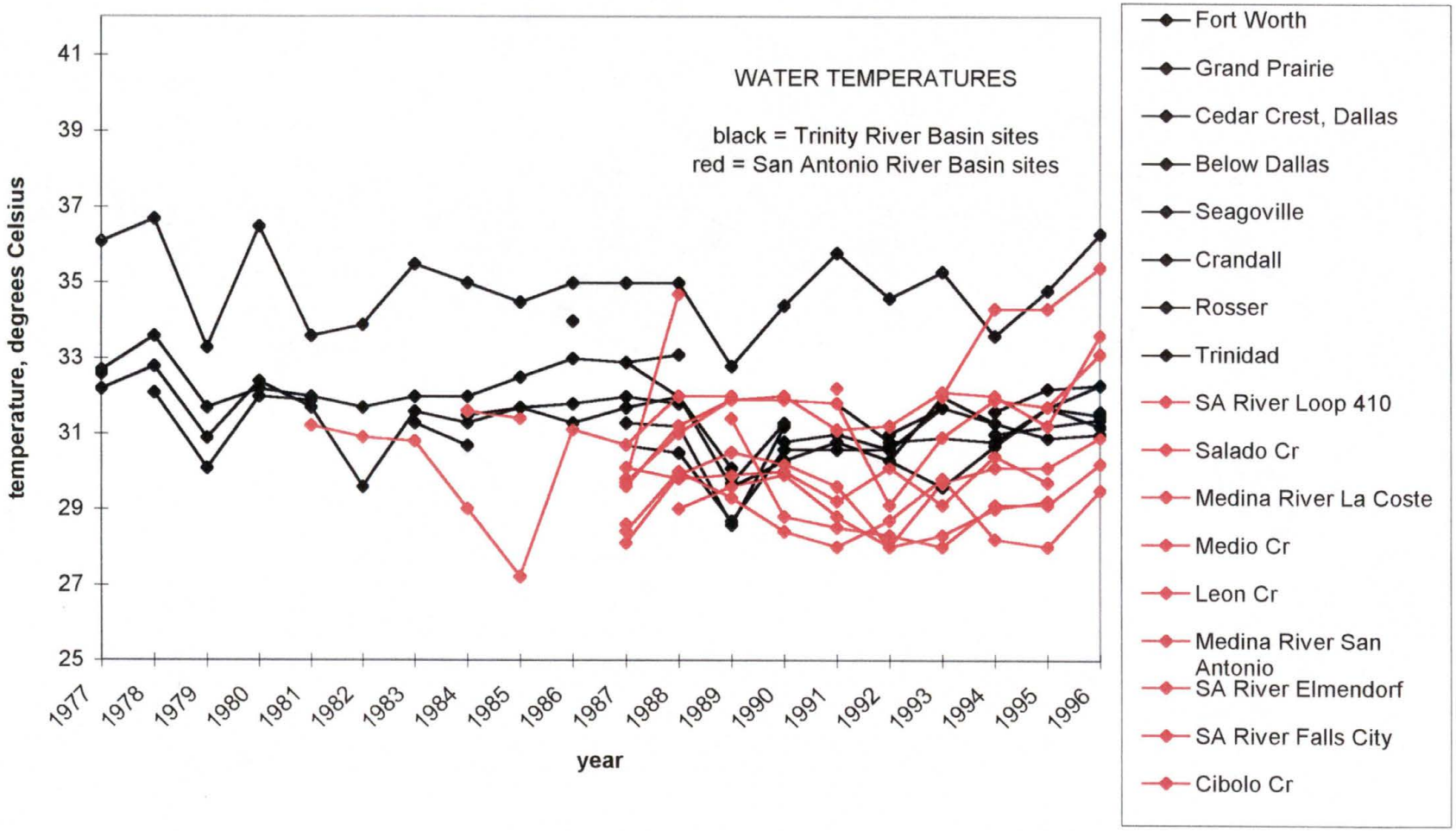

Figure 7. Comparison of daily maximum water temperatures, San Antonio River Basin and Trinity River Basin: 1977-1996 (Each point = mean value of 5 observations)

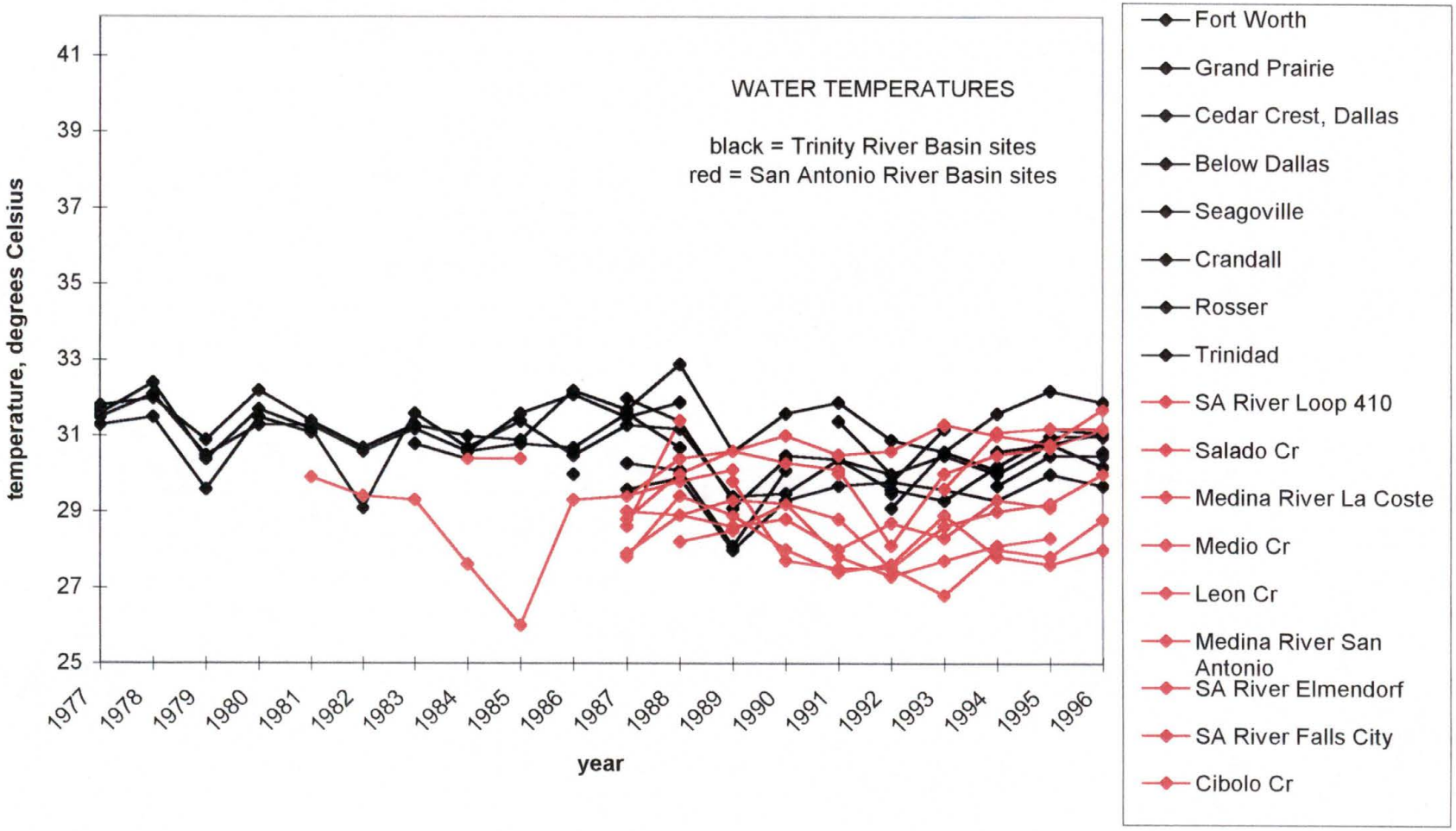

Figure 8. Comparison of daily mean water temperatures, San Antonio River Basin and Trinity River Basin: 1977-1996 (Each point = mean value of 5 observations)

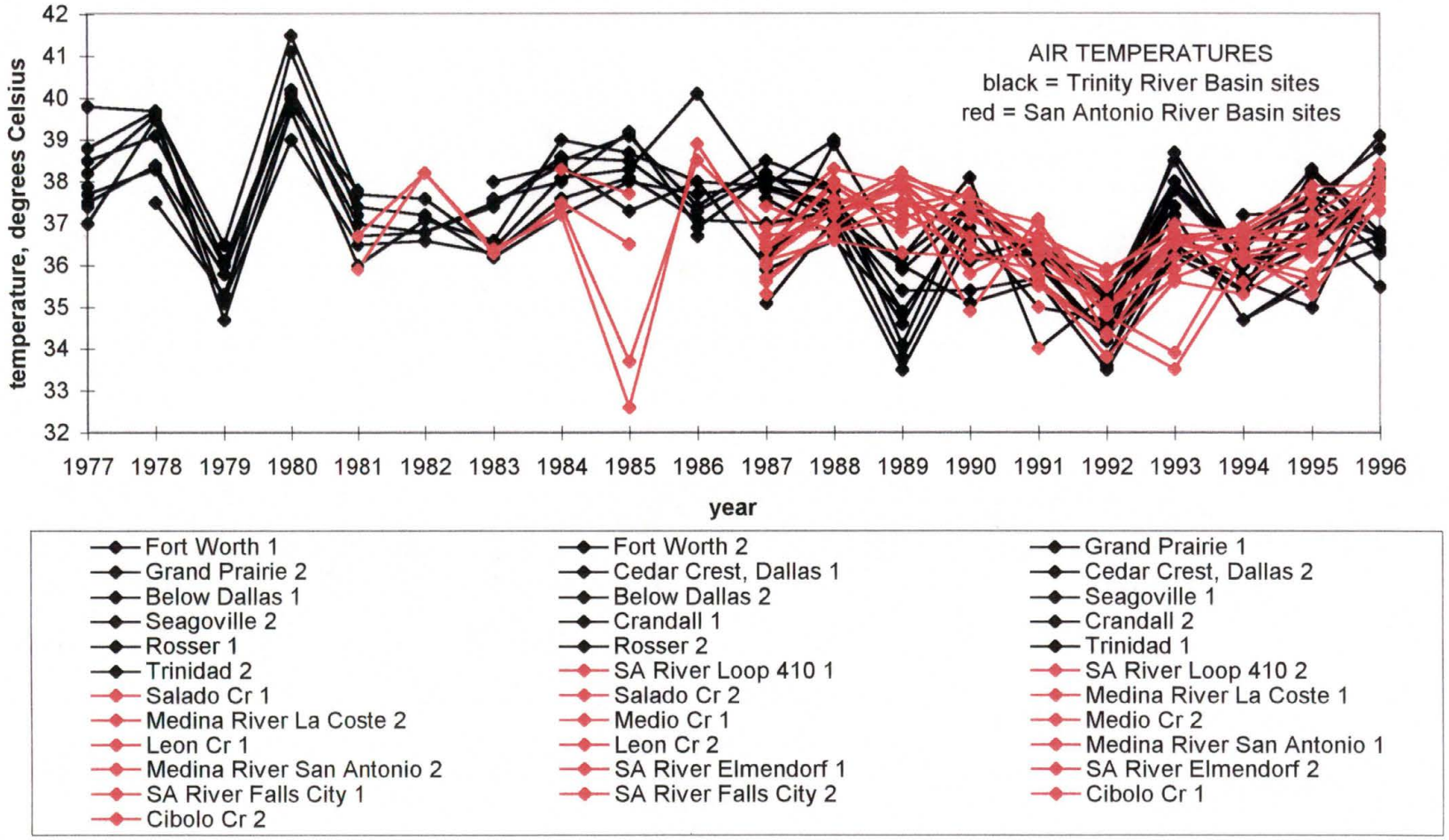

Figure 9. Comparison of daily maximum air temperatures - Trinity River basin vs San Antonio River basin: 1977-1996 (Each point = mean value of 5 observations; 2 points per site, per year)

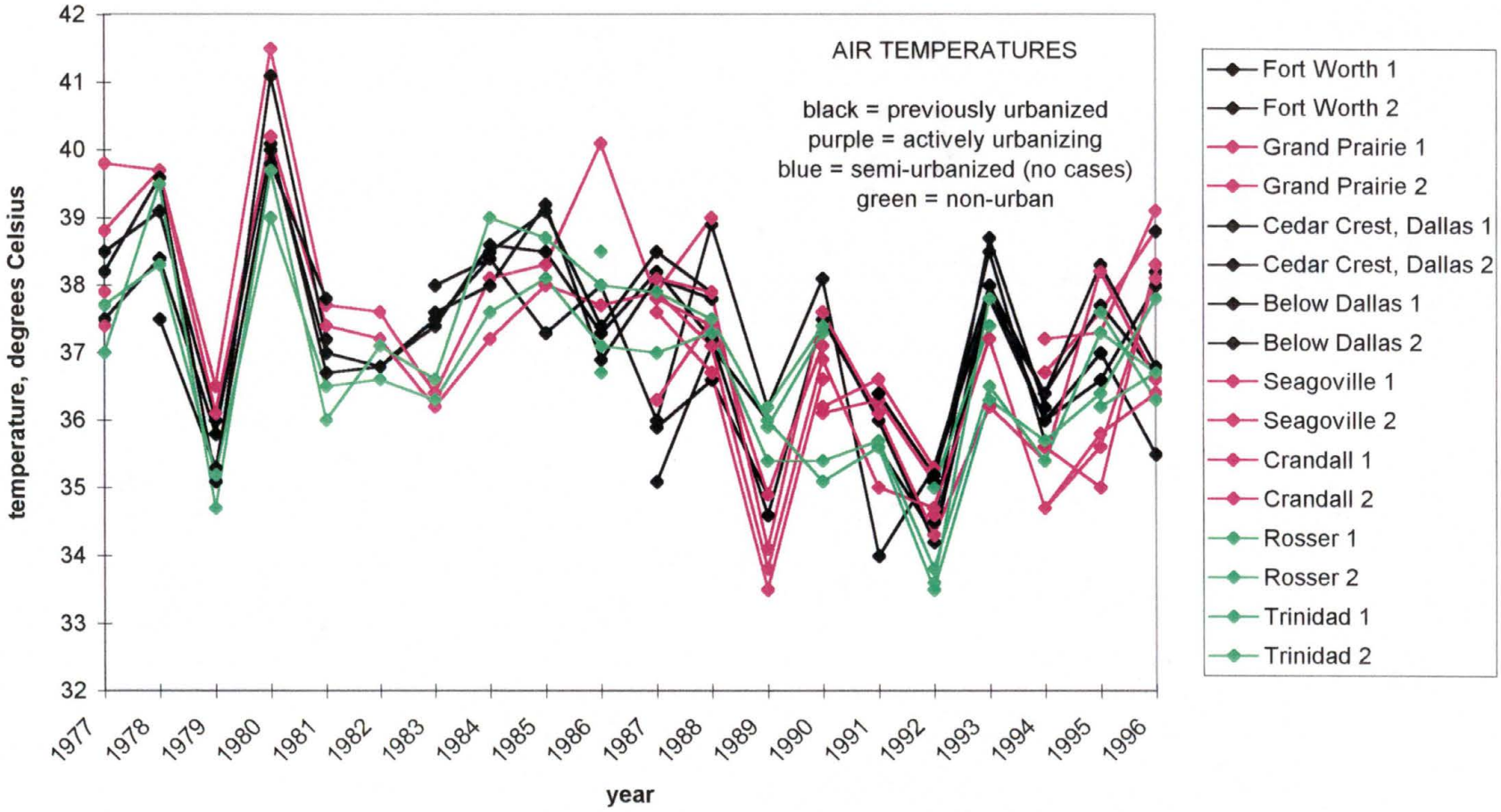

Figure 10. Trinity River Basin - sample of daily maximum air temperatures comparing sites from 4 "Urbanization Status" categories: 1977-1996 (Each point = mean value of 5 observations)

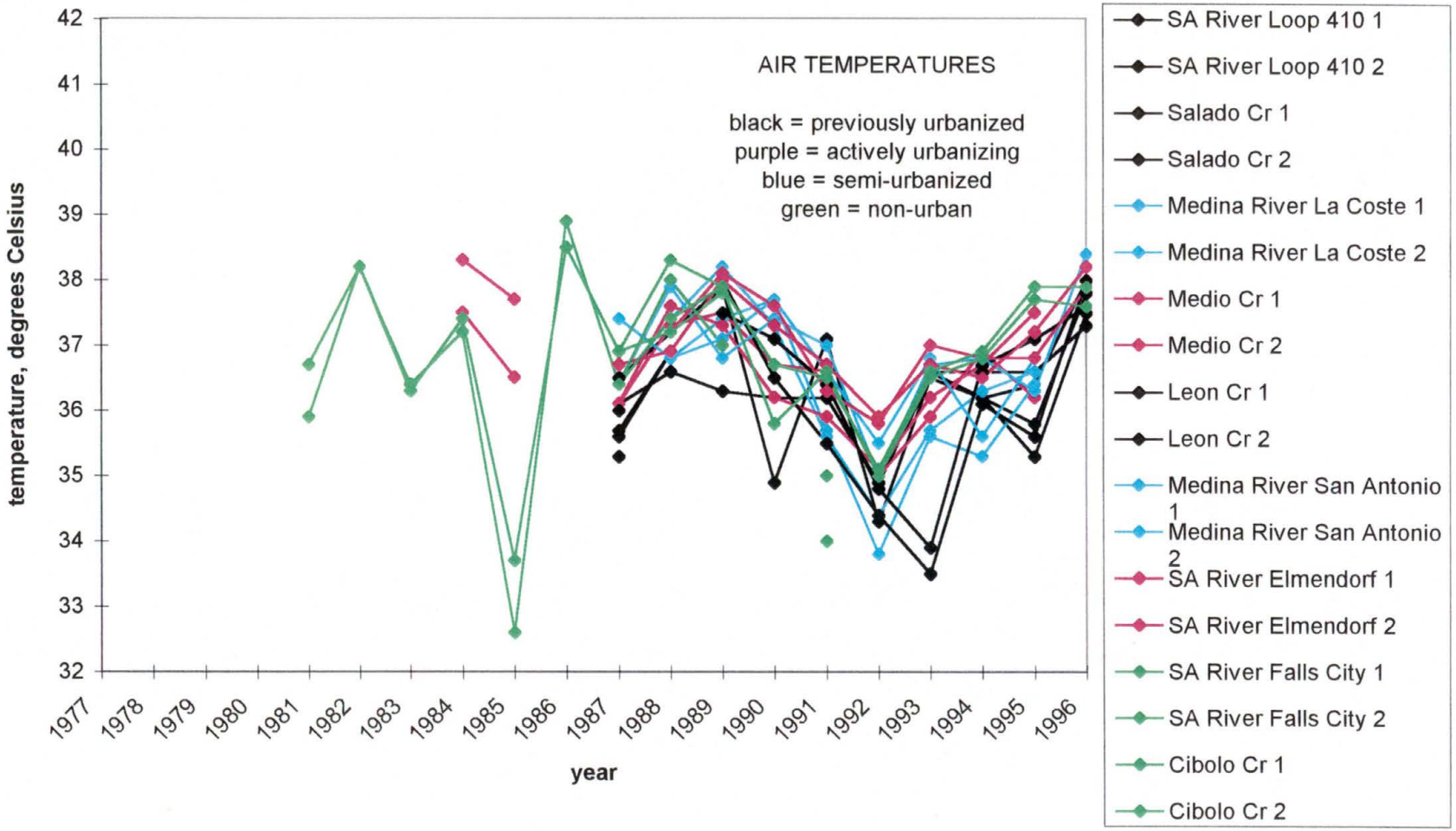

Figure 11. San Antonio River Basin - sample of daily maximum air temperatures comparing sites from 4 "Urbanization Status" categories: 1977-1996 (Each point = mean value of 5 observations)

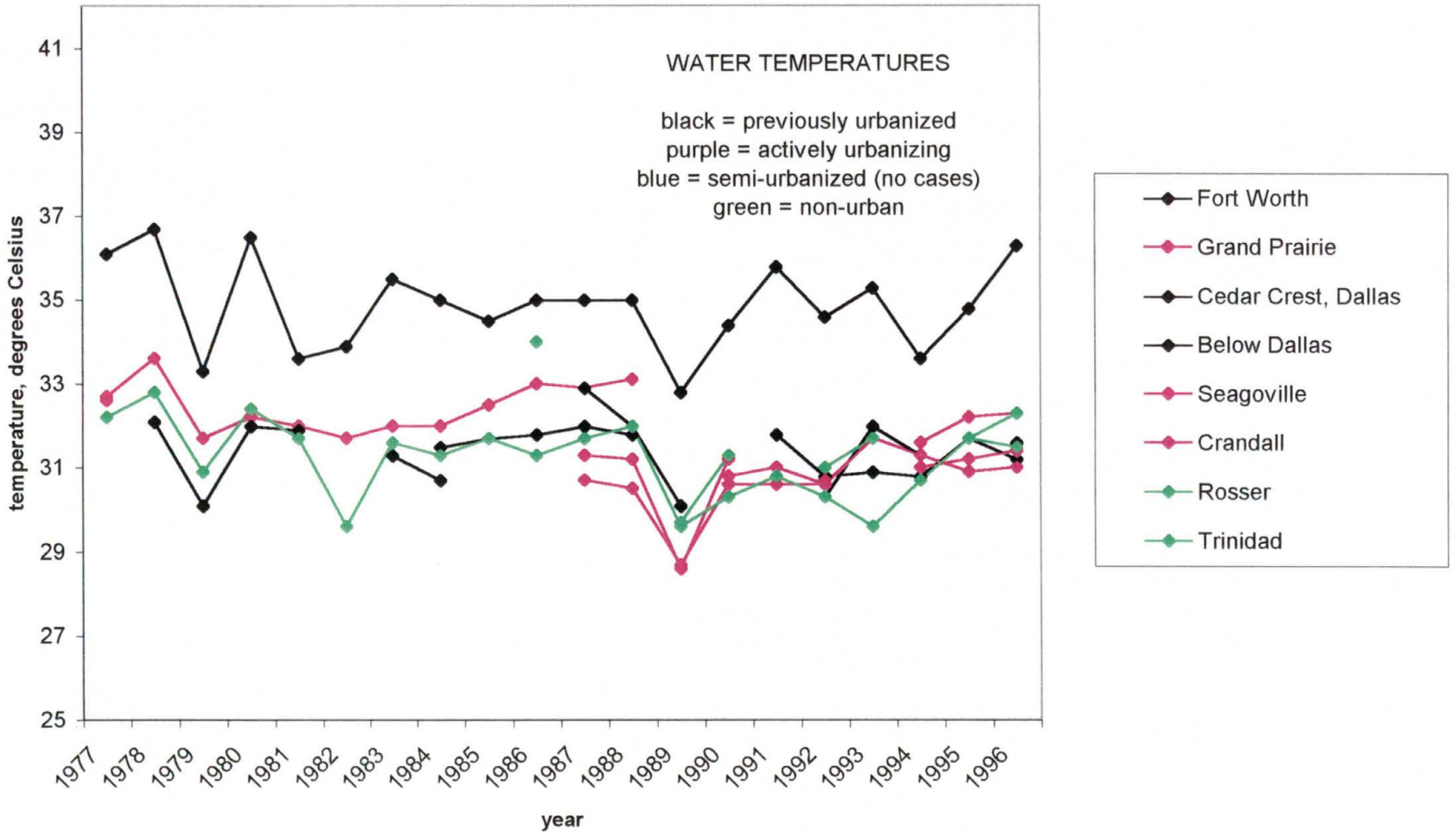

Figure 12. Trinity River Basin - sample of daily maximum water temperatures comparing sites from 4 "Urbanization Status" categories (Each point = mean value of 5 observations)

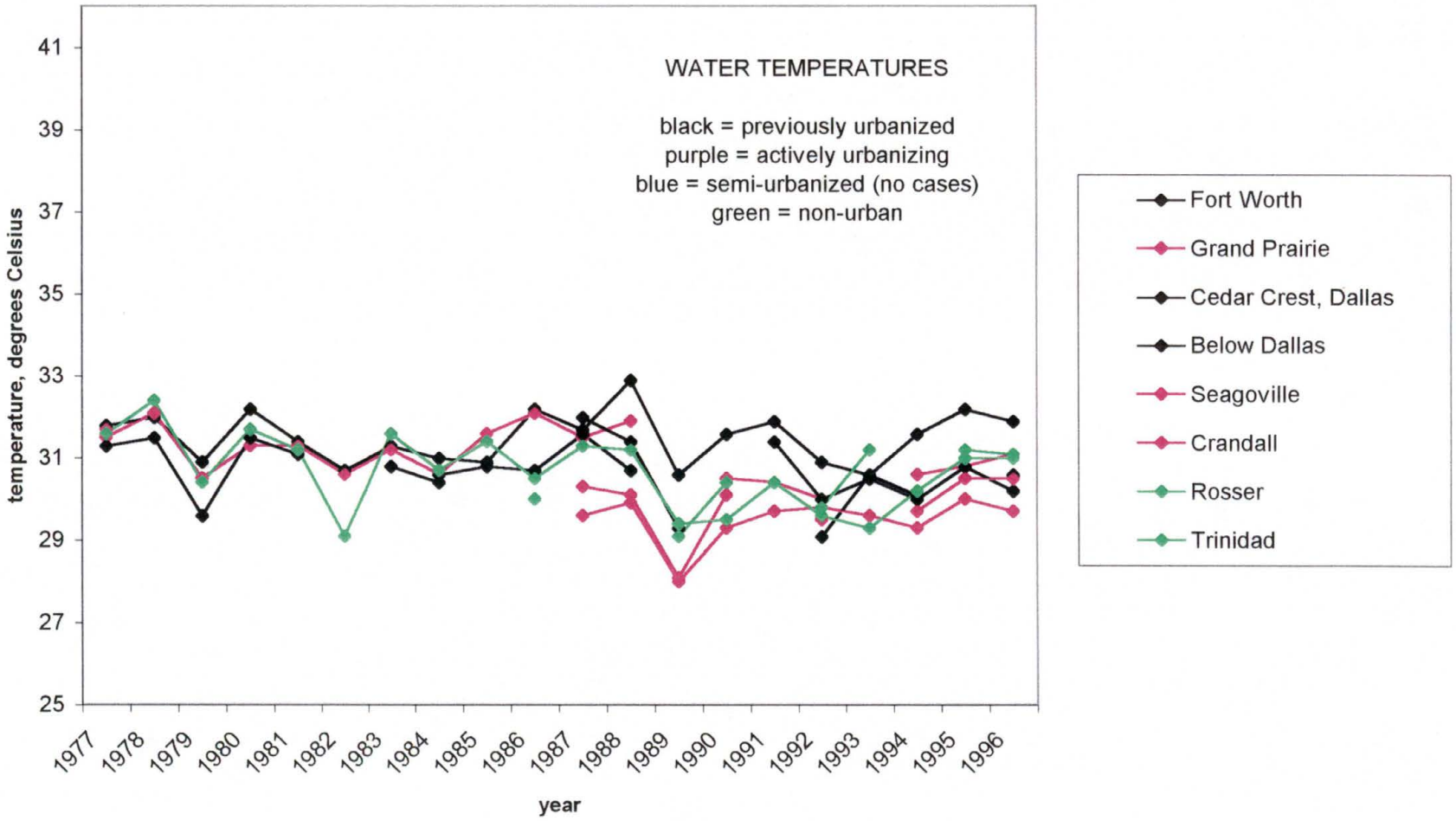

Figure 13. Trinity River Basin - sample of daily mean water temperatures comparing sites from 4 "Urbanization Status" categories (Each point = mean value of 5 observations)

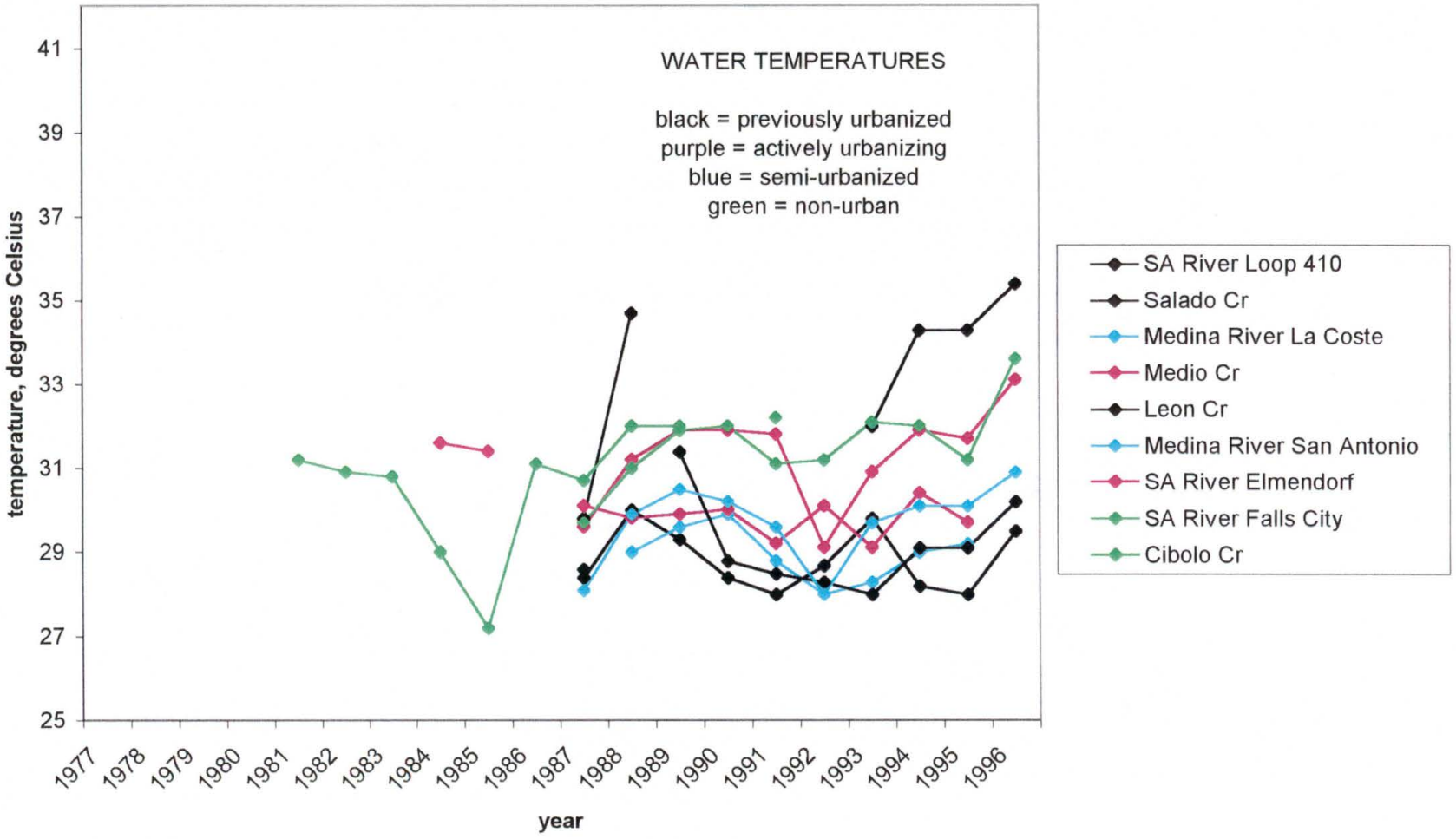

Figure 14. San Antonio River Basin - sample of daily maximum water temperatures comparing sites from 4 "Urbanization Status" categories (Each point = mean value of 5 observations)

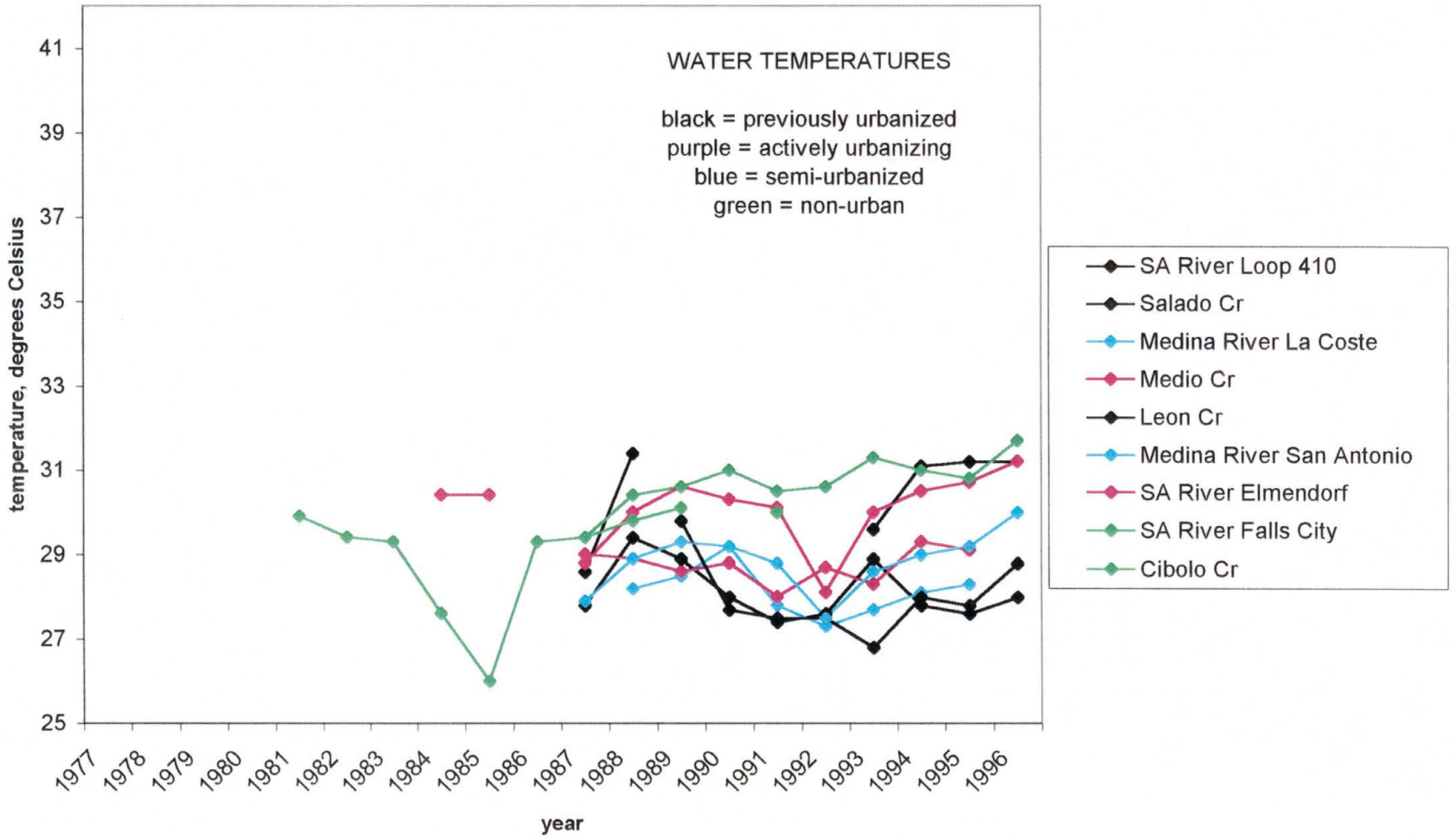

Figure 15. San Antonio River Basin - sample of daily mean water temperatures comparing sites from 4 "Urbanization Status" categories (Each point = mean value of 5 observations)

Digital Orthophoto Quarter Quad (DOQQ) Analyses

Further scrutiny of these two sites using digital orthophoto quarter quads (DOQQs) revealed both sites to be along channels that were almost completely devoid of trees and, especially in the case of the San Antonio site, denuded of most other vegetation. Figures 16 through 21 show the DOQQs for these two sites and for the other "previously urbanized" sites in each basin. The San Antonio River at Loop 410 site (Figure 16) is located 2.2 miles downstream from a small dam. From the dam to the gage site, the river channel is treeless and nearly barren. In contrast, the Salado Creek and Leon Creek sites (Figures 17 and 18) are shown to have considerable tree cover at the sites themselves, along the banks upstream, and in the surrounding watershed. Whether the dam above the San Antonio River site is top- or bottom-releasing is not clear from the DOQQs or U.S.G.S. information (*Water Resources Data, Texas*, digital raster graphics (DRGs), or the 1:100,000-scale metric topographic map). This study intended to eliminate sites immediately downstream of dams, but only when major reservoirs were indicated. The purpose of excluding such sites was to prevent interference from the cooling effects of low level outlet reservoir releases from the hypolimnion (the lower strata of the reservoir), which is colder than the normal area stream temperatures during summer months (Williams 1968). Pluhowski (1970) stated that lakes and ponds deeper than one foot do attenuate downstream daily temperature fluctuation. This dam appears too small to produce a significant cooling effect, but if such an effect *were* produced by this dam, that would imply *even warmer* temperatures upstream. The river does flow through the heart of downtown San Antonio, so warmer temperatures above the dam are plausible. However, as there are no water temperature gaging stations located above the dam, this study will not attempt to discern whether there is any validity to such a statement. Many parts of this upstream area are mostly treeless, but are shaded by low bridges and, except for mid-day periods, by buildings in close proximity to the river. The more likely culprit for such high temperatures at the San Antonio River at Loop 410 site is the paucity of vegetative cover around the river from the dam to the gage site, as indicated by the DOQQs.

The West Fork Trinity River also lacks tree cover along its banks for several miles upstream of the Beach Street at Fort Worth gage site (Figure 19). The channel immediately upstream of the site appears to be man-made, at least upstream of the creek (Sycamore Creek) entering from the south, as the river's former

path remains visible to the north. The north side of this section of riverbank appears very bare. In addition to the lack of tree cover upstream of the gage site, the river can also be seen to flow through very heavily urbanized land. A refinery approximately 4 to 4.5 miles upstream may also contribute to increased water temperatures. Figures 20 and 21 show the Trinity River at Cedar Crest Boulevard at Dallas and Trinity River below Dallas gage sites. Like the Salado Creek and Leon Creek sites in the San Antonio River Basin, the Trinity River below Dallas site (Figure 21) has extensive tree cover around the river, both in the vicintiy of the gage and upstream, and throughout its drainage basin. The area upstream of the Trinity River at Cedar Crest Boulevard site (Figure 20) does not have such extensive tree cover, but the gage itself is in a wooded area and there is significant tree cover along the tributary entering immediately upstream of the site, despite the fact that this creek flows through an extensive residential area. Upstream on the river's main channel, a thin buffer strip of trees is visible all along the banks. Even though the trees are fairly sparse, this condition did *not* exist upstream of the Fort Worth gage site, which was virtually treeless. The undeveloped area around the channel is much wider here than it was in Fort Worth also. This section of the Trinity River is designated as the Dallas Floodway. Light vegetation appears to grow throughout the open area. The lack of development in the Floodway increases the distance between the river and the heavily urbanized area surrounding it considerably compared to the conditions in the vicinity of the Fort Worth gage site.

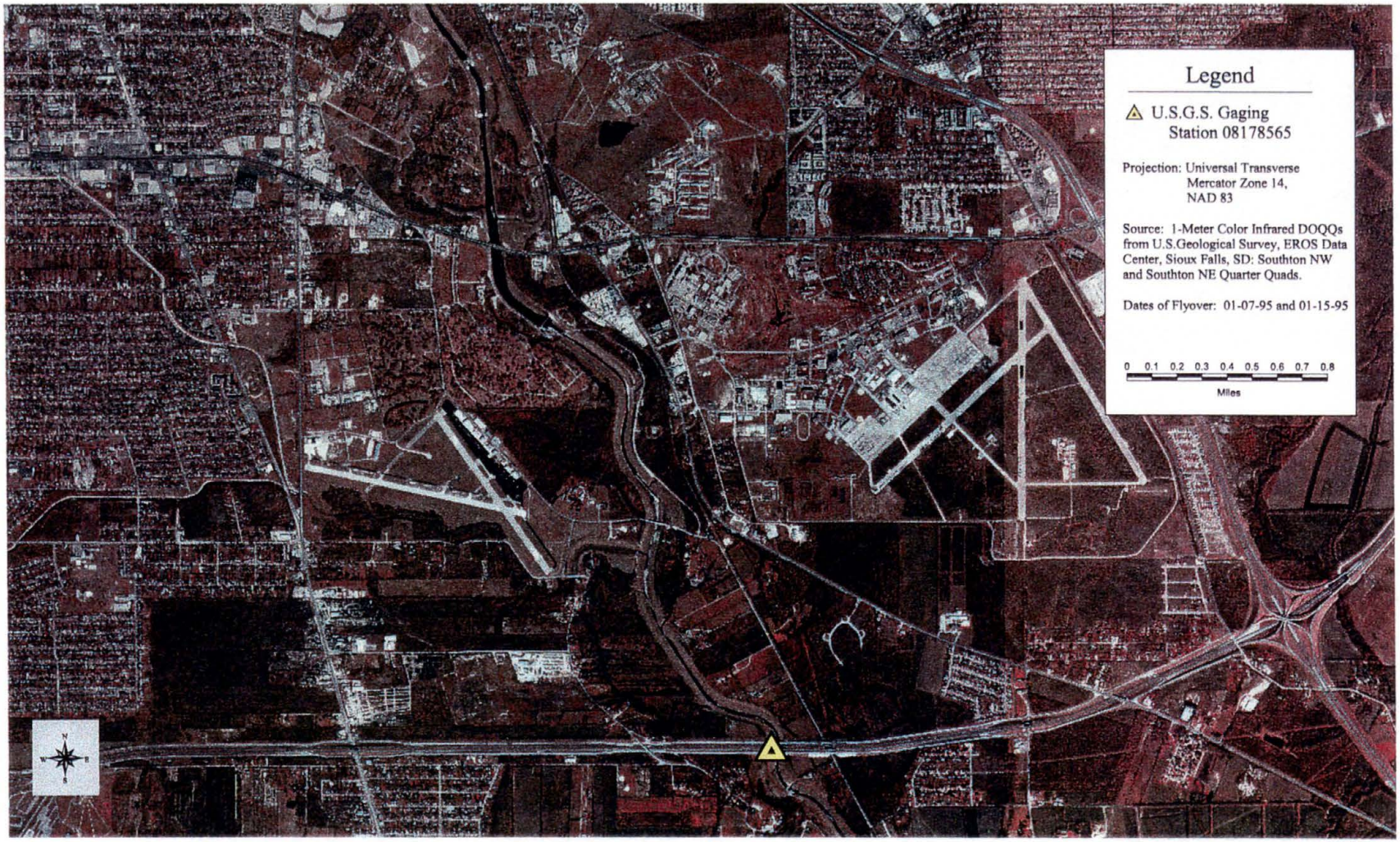

Figure 16. Digital Orthophoto Quarter Quads (DOQQs) of San Antonio River at Loop 410 at San Antonio (U.S.G.S. Gage 08178565) and upstream vicinity

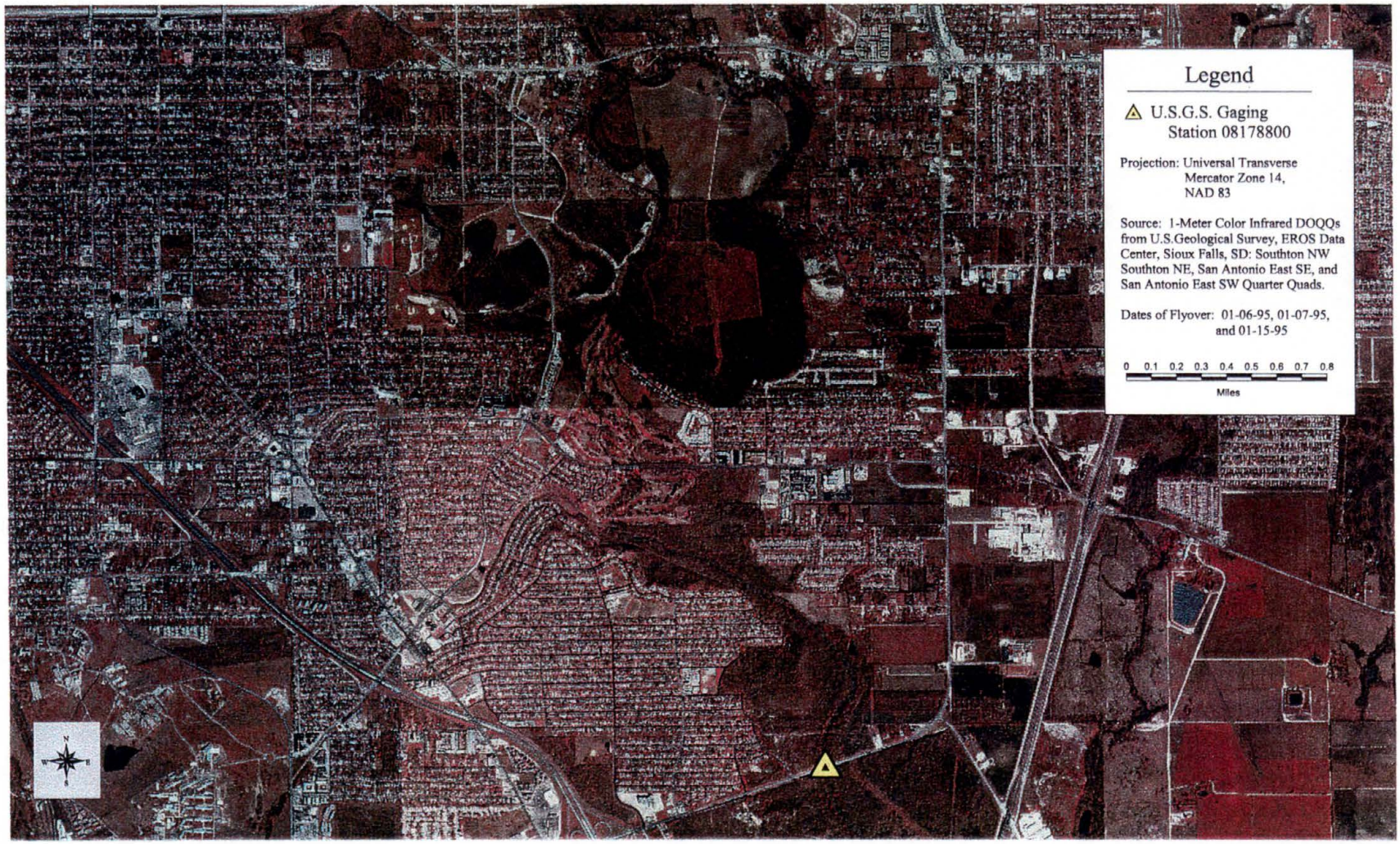

Figure 17. Digital Orthophoto Quarter Quads (DOQQs) of Salado Creek (lower station) at San Antonio (U.S.G.S. Gage 08178800) and upstream vicinity

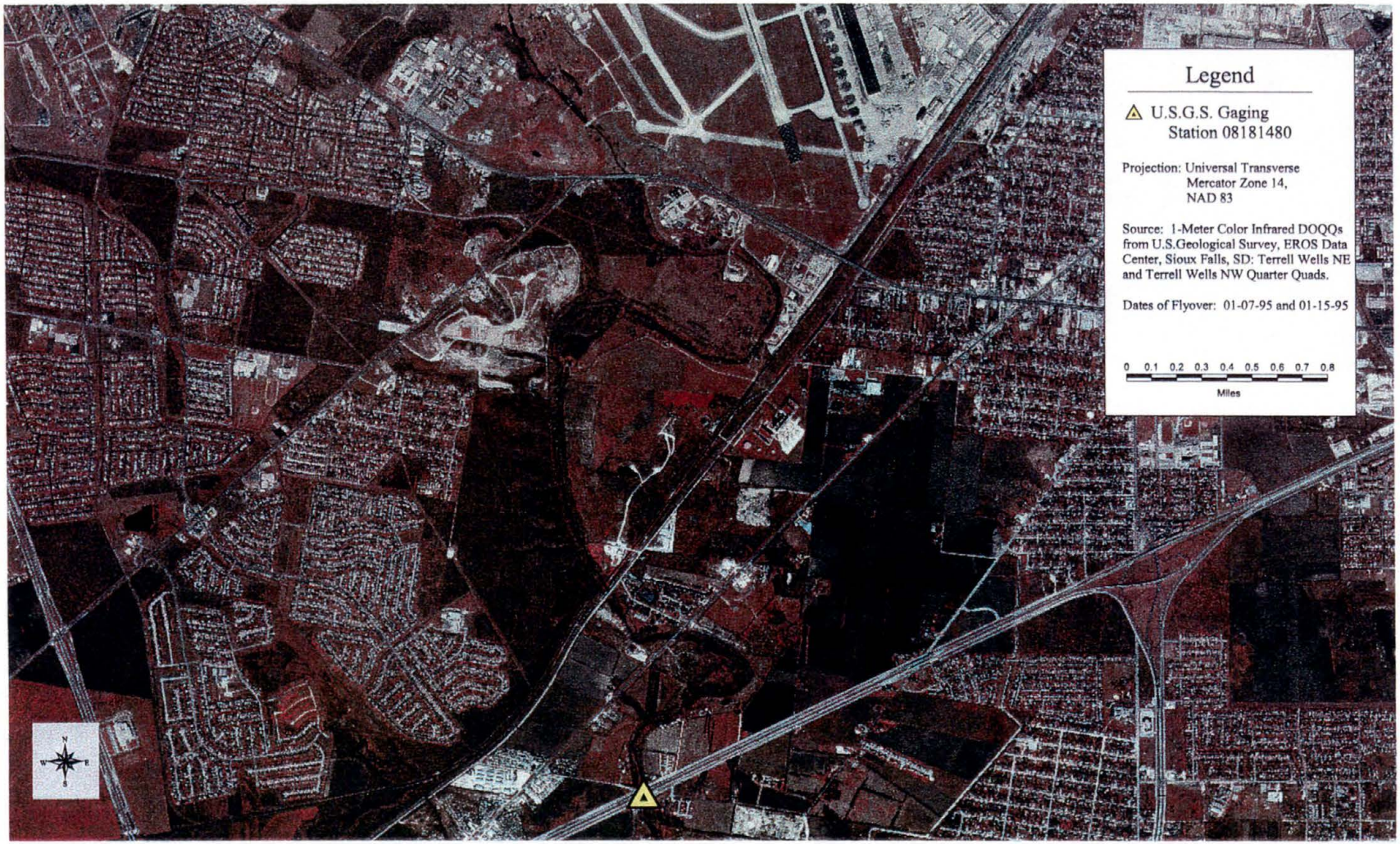

Figure 18. Digital Orthophoto Quarter Quads (DOQQs) of Leon Creek at IH-35 at San Antonio (U.S.G.S. Gage 08181480) and upstream vicinity

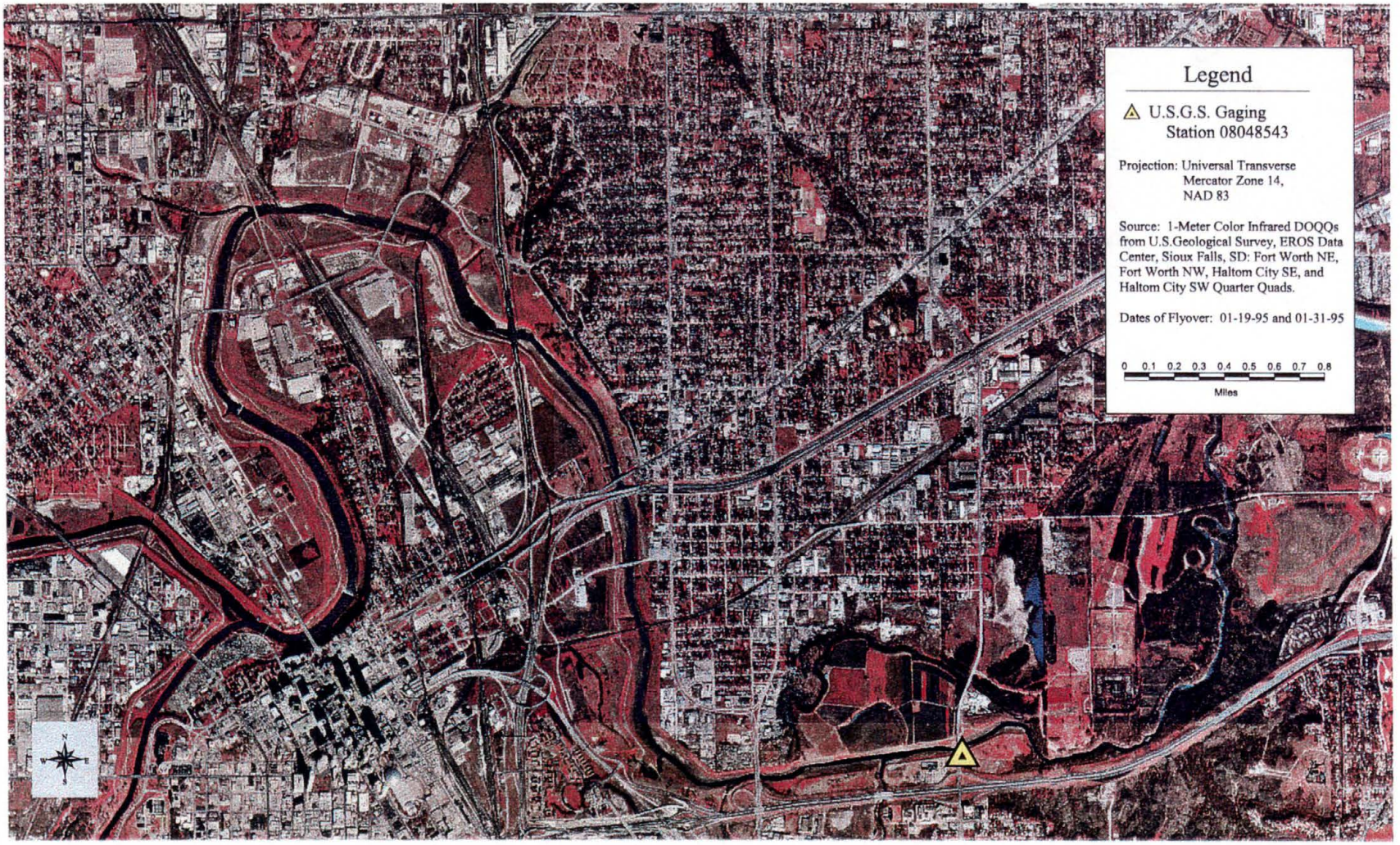

Figure 19. Digital Orthophoto Quarter Quads (DOQQs) of West Fork Trinity River at Beach Street at Fort Worth (U.S.G.S. Gage 08048543) and upstream vicinity

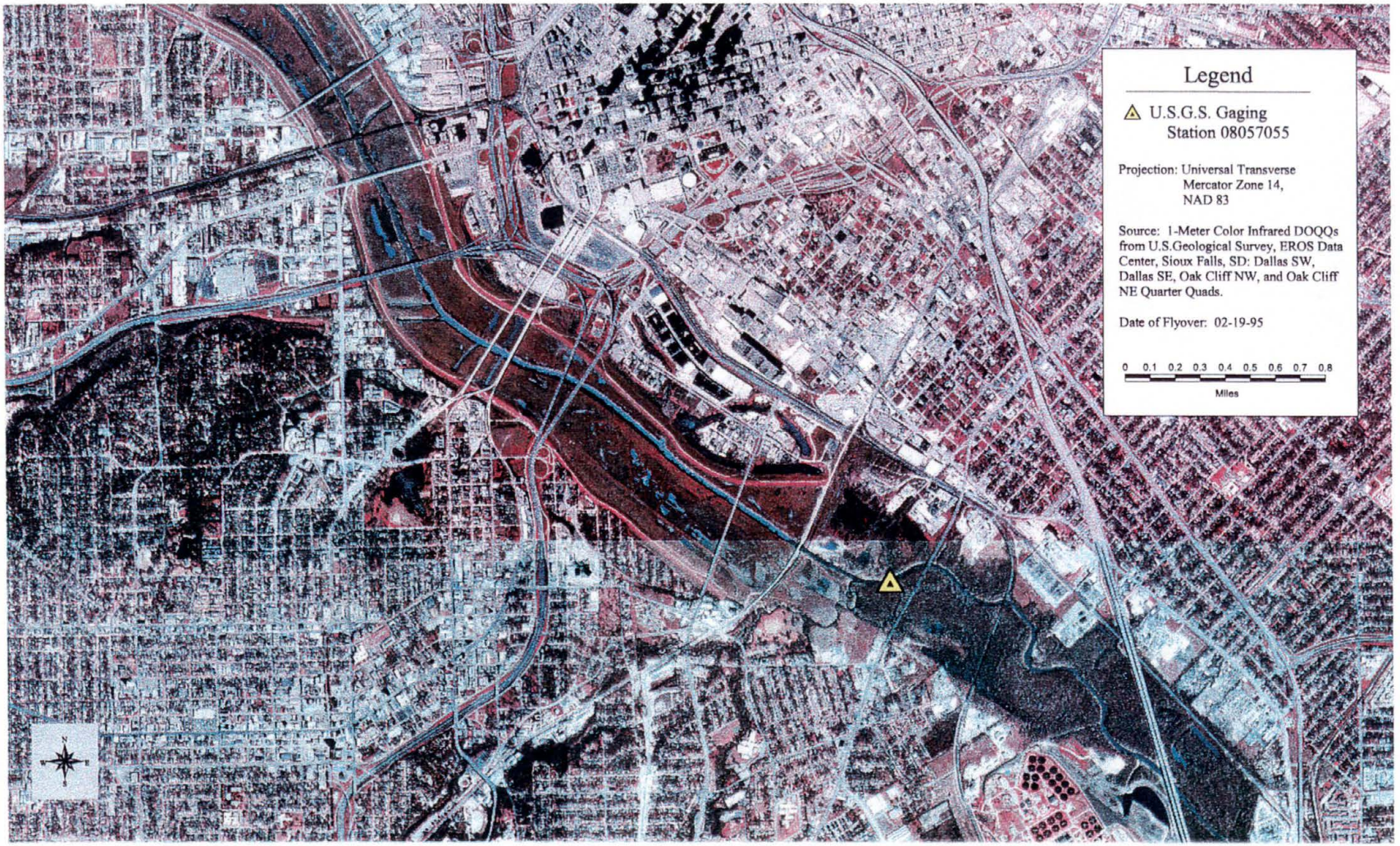

Figure 20. Digital Orthophoto Quarter Quads (DOQQs) of Trinity River at Cedar Crest Boulevard at Dallas (U.S.G.S. Gage 08057055) and upstream vicinity

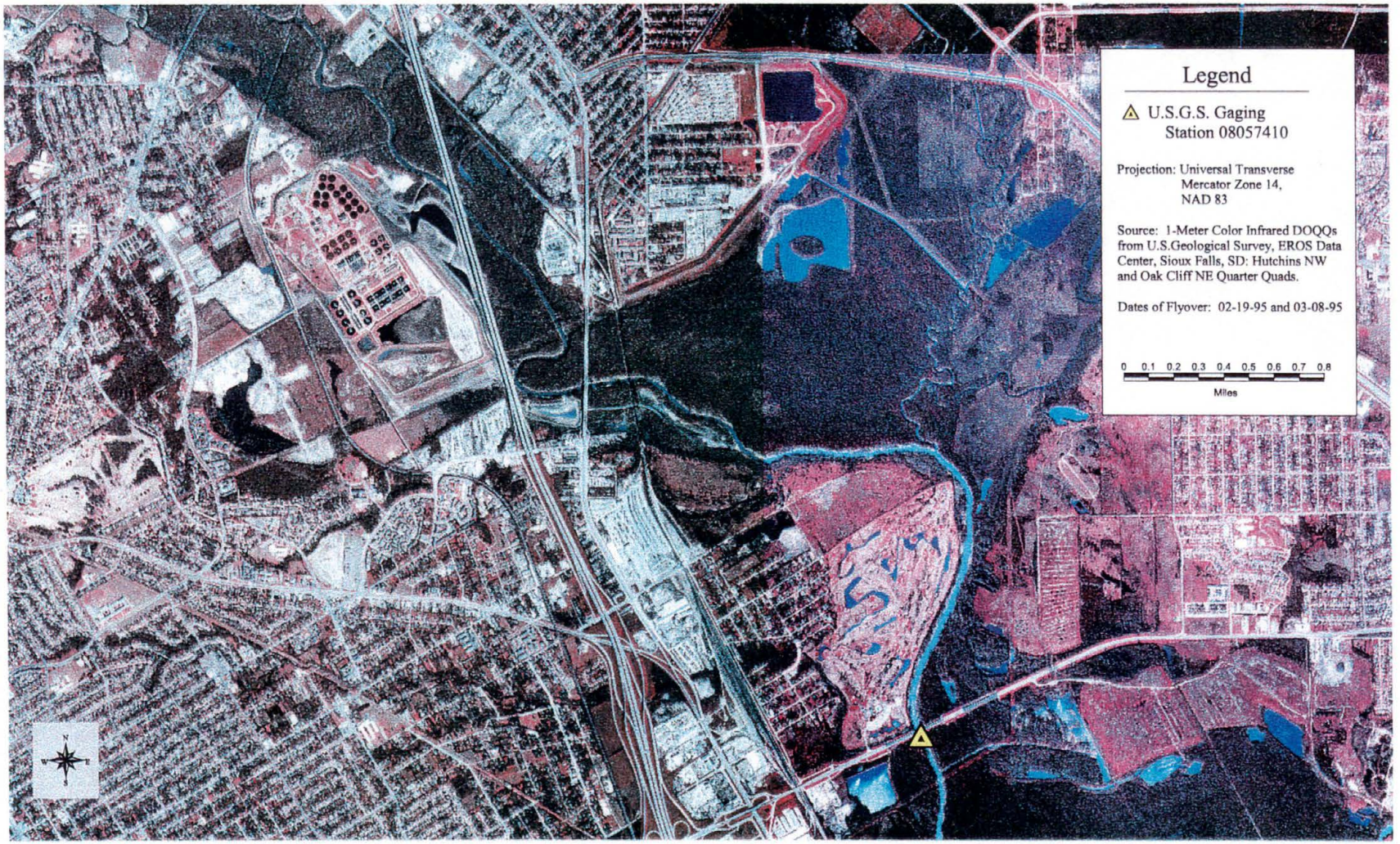

Figure 21. Digital Orthophoto Quarter Quads (DOQQs) of Trinity River below Dallas (U.S.G.S. Gage 08057410) and upstream vicinity

CHAPTER VI

FURTHER STUDY

Obstacles to Analysis

A number of difficulties presented themselves during the analysis of the data for this study. The main problems seem to derive from having relatively low observation numbers in many of the different methods of statistical analysis, having frequent intercorrelation between independent variables, not having sizeable variation in the water temperature observations, and having too many unquantifiable elements (such as springflow and groundwater inflow, reservoir and sewage effluent releases, and groundcover characteristics) which differed from site to site *and* between basins. While there was value in looking at the data in a variety of ways to try to discern any relevant patterns, the result may have been too much data to analyze in sufficient depth. The original sets of twenty water temperature observations per year had to be cut to five observations per year due to the necessity of calculating the values of the other variables from sometimes as many as a dozen different sites on each of those observation dates. The length of time for which maximum and mean (and minimum) water temperature data is available is also too short to realistically see relevant changes in water temperature records. Even in a study that did not eliminate years in which a considerable percentage of observation dates were missing, the only site in the San Antonio River Basin with observations predating 1984 was discontinued in 1991. The Trinity Basin fares slightly better, with four stations having fairly reliable, continuous data from 1977 through the present. However, the multiple regressions' F values indicated that only a few (three to four) of the forty-six analyses did not indicate statistically significant relationships.

Eliminating some of the independent variables from the multiple regression equations that did not seem to correlate both significantly and consistently with the water temperature variable may help eliminate some of the multi-collinearity problems. Either the maximum air temperature or the three-previous-days-

average maximum air temperature variables should seemingly be omitted to allow the other to display its proper level of influence over the dependent variable.

Wind, dew point, cloudcover, precipitation, and daterank were often left out of the final regression equations. Precipitation did not intercorrelate with discharge in any of the basin-wide analyses, but that relationship did show up in some of the individual site analyses, as would be expected. In the basin-wide studies, there is too much site-to-site variation in discharge rates for the precipitation variable to have made a significant impact. This observation may also reflect why precipitation did not show more of an effect in the analysis. Also, dry summers in both basins during this period were not a rarity. The precipitation variable was largely intended to act as a surrogate variable for determining groundflow rates, which otherwise were not calculable, and as such was included in the analysis as the amount of precipitation over the previous one-week period. The infrequency of rain events, combined with the possibility that the precipitation measurement included in the analysis may have been on the same date as the water temperature observation or up to six days previous, made this variable somewhat random. The inability to include an adequate measure of groundwater temperature and inflow rates may have contributed significantly to some of the low adjusted R^2 values.

Wind, dew point, and cloudcover did not generally have high intercorrelations with other independent variables. Cloudcover perhaps *should* have shown more correlation with water temperature, but the daily cloudcover values used were 7:00 a.m. readings and so were not necessarily indicative of cloudcover conditions at the time the maximum or even the mean daily water temperatures were reached. Additionally, cloudcover conditions were generally from the Dallas-Fort Worth Regional Airport or the San Antonio International Airport and may have been significantly different from actual site conditions. To discern the true relation, if any, of cloudcover to water temperatures, cloud conditions at the water temperature gaging station site must be recorded, ideally at the time the maximum readings occur, or at least sometime in the afternoon. Afternoon readings would also improve the usefulness of cloudcover data for the mean water temperture analysis. Dew point temperatures are also the 7:00 a.m. readings from the airport locations, although these readings should not be quite as variable as the cloudcover conditions.

The wind variable was of questionable value. Some of the wind measurement sites almost always had higher readings than others, and when one wind station had missing data, the overall calculation to estimate wind amounts at a water temperature site had to be made without that station, possibly skewing the resultant estimate. Adding to this problem was the fact that most wind measuring stations were associated with lakes, which are often windier than nearby land-based sites. The combined result of these factors was a wind variable with very suspect accuracy. It was kept in the analysis though because, except for observation dates when some wind station had missing data, the wind variable did accurately reflect the *relative* amount of wind compared to other days at the *specific* sites.

Daterank did not exhibit much of a correlation with water temperature in the analyses. It may have shown more relevance had it been analyzed as a parabolic function with the summer solstice date (highest angle of summer sun) at its vertex, or as some other geometric expression instead of as a linear function. Regarding daterank in such a way may have revealed more correlation between water temperatures and certain solar angles, the intent behind its inclusion. However, Beschta and Taylor's (1988) study indicated no such treatment of this variable. In fact, as the majority of observation dates occur after this date, such further manipulation of the variable would probably not benefit the analysis in any significant way. The daterank variable may also be closely linked to groundwater inflow levels, dam discharge, and precipitation amounts, as these factors would vary month-to-month in a fairly regular, year-to-year pattern.

Suggestions for Future Research

A number of alternate methodologies or completely new studies could improve upon the ideas set forth in this paper. To alleviate some of the problems encountered with this study, a number of potential changes could be made or added to the research method. One suggestion would be to concentrate on a few specific sites rather than seventeen different sites. It may be better to concentrate on some of the Trinity Basin sites, now knowing that those stations have a wider range of water temperature observations as well as longer, more complete periods of record. Additionally, they are not subject to the alleviating effects of springflow during periods when the river's rate of flow is low, as are the San Antonio Basin sites.

To further control for the effect of reservoir releases upstream of the gaging station sites, a variable could be incorporated that takes into account lake distance, release amounts, and the temperature of the water as it is released from the reservoir. *Water Resources Data, Texas* does not provide sufficient data from contributing lakes to calculate such a variable, so another source would be required. Additionally, the minimum threshold distance from the study sites to reservoirs, sewage plants, and power plants could be increased. Daily effluent release rates and temperatures may also be obtainable through contacts with sewage and power plant personnel.

Among the methods that would increase the variability of summer water temperature observations would be either to randomly select observation dates each year from *all* the days between May 15 and September 30 or to include all days from a particular summer month every year. Picking dates from such a sample population instead of from a pool of the twenty warmest days of the year would provide more potential samples from overcast days, cooler days, and rainy days, thereby increasing the variability of air and water temperature observations. The inclusion of more disparate water temperature observations may make differences in maximum and mean summer stream temperature mean values more obvious and truly reflective of any differences between urbanization status categories. Another strategy to increase the variability of observations would be to do a year-round water temperature study, picking random dates throughout the year. An analysis of this type would include more observation dates when streams are not at low flow, and during rain events, when the effects of clearcutting a stream environs and its contributing watershed and replacing the natural groundcover of the watershed and areas that provide baseflow (groundwater) with impervious cover would be more clearly in evidence. A study could also include an analysis of daily stream temperature fluctuations in addition to, or instead of, just examining maximum, mean, or minimum daily observations.

The available water temperature data does not go far enough back in time to reveal any real trends related to population increases at specific sites. With the data available, it is more likely that a study could detect patterns related more significantly to comparative population density levels than to actual increases in population density over time. A method to quantify the different degrees of urbanization at various study sites would be to use DOQQs (digital orthophoto quarter quads) or other aerial photography of the sites and

their contributing watersheds. The researcher could then create a classification system based on percent coverage by various vegetation categories and urban features. However, only water temperature data for the specific time periods of the photos would be truly applicable. If enough time-specific photographic data could be found, an ideal method would be to analyze water temperature data for every few years, similar to using the Census population density data, but with less than ten-year intervals. This method would be limited only by the availability of water temperature data and aerial photography/DOQQs. Even if only one sample of photographic data is available at any given site, quantifying groundcover types and percentages may reveal more about the influence of urbanization than did equating urbanization directly with population density figures.

CHAPTER VII

CONCLUSIONS

Summary and Remarks

According to this study, maximum and mean daily stream temperatures during the warmest summer periods are affected most by variation in maximum air temperatures, stream discharge rates, and shade coverage of streams and watersheds. Weekly precipitation, wind speed, dew point temperatures, cloudcover (7:00 a.m. conditions), and date of observation do not demonstrate consistent relationships with the water temperature variation. However, the water temperature observations analyzed had a relatively small degree of variation. A method with more variance may have shown more consistent and obvious relations (or total lack of correlation) between the various independent variables and observed water temperatures. Frequent intercorrelation of the independent variables also may have masked some of the true relationships between water temperature and the other variables.

After analyzing DOQQs of some of the more "heavily urbanized" gage sites, tree cover did not seem to correlate very well with census tract population density. A very cursory emamination of the six sites classified as "previously urbanized" indicated that tree cover *did* correlate with stream temperatures The two consistently hottest sites, Trinity River at Beach Street at Fort Worth and San Antonio River at Loop 410 at San Antonio, were along barren, treeless channels with little substantial vegetation upstream. The two Dallas Trinity River sites had more tree cover and lower water temperatures, despite the Cedar Crest Boulevard at Dallas area having a higher population density (as measured) than any other site. The two other San Antonio Basin sites were well-shaded, narrow creeks with abundant wooded areas throughout their drainage basins, and were also two of the coolest sites in the entire study.

The maximum and mean water temperatures overall did not display significantly more or less variation in one basin than in the other. Several sites in the San Antonio Basin showed very little variation

from the average throughout the period of study (particularly the Medina River at La Coste (maximums) and Medio Creek (maximums and means) sites), but others (San Antonio River at Loop 410 (maximums) and Cibolo Creek (maximums)) varied considerably from year to year. The overall pattern of variation from the means was similar for the two basins. Figures 22 and 23 show the percent of study years included for each observation site in which the arithmetic mean of the five annual water temperature observations (maximum and mean) were within one, two, and three degrees Celsius of the overall mean of observations over the entire study period for which that site's data was available and sufficient for inclusion. Figure 24 shows a similar analysis of calculated maximum daily air temperatures. Deviation from the average maximum *air* temperatures at each site *was* considerably more noticeable for the Trinity River Basin.

In general, the San Antonio River Basin sites also had fewer occurrences of very warm water conditions despite having lower average streamflow rates. This fact demonstrates the moderating effect of significant springflow as a determinant in river and stream temperature levels. However, within particular urbanization status categories, the *overall* maximum and mean daily water temperatures generally displayed *more* variation over the period of study in the San Antonio River Basin. This result is indicated by the standard deviations of the different categories' mean values. Table 31 denotes the various water temperature means and their standard deviations as determined by the Student's *t*-test analyses. This table shows that when the same variables are compared between the two basins, for every urbanization status category pairing except the NONURB mean water temperature analyses, the San Antonio River Basin categories have greater variance in their means than their Trinity River Basin counterparts. The exceptionally large standard deviation of the San Antonio River Basin's PREVURB category was due to the different tree cover conditions at and upstream of the three gage sites and throughout their contributing watersheds. Although a similar scenario contributed to significant differences in water temperatures at the three Trinity River Basin PREVURB sites, wider river channels kept these conditions from causing as much site-to-site water temperature variation, thus keeping the standard deviation smaller.

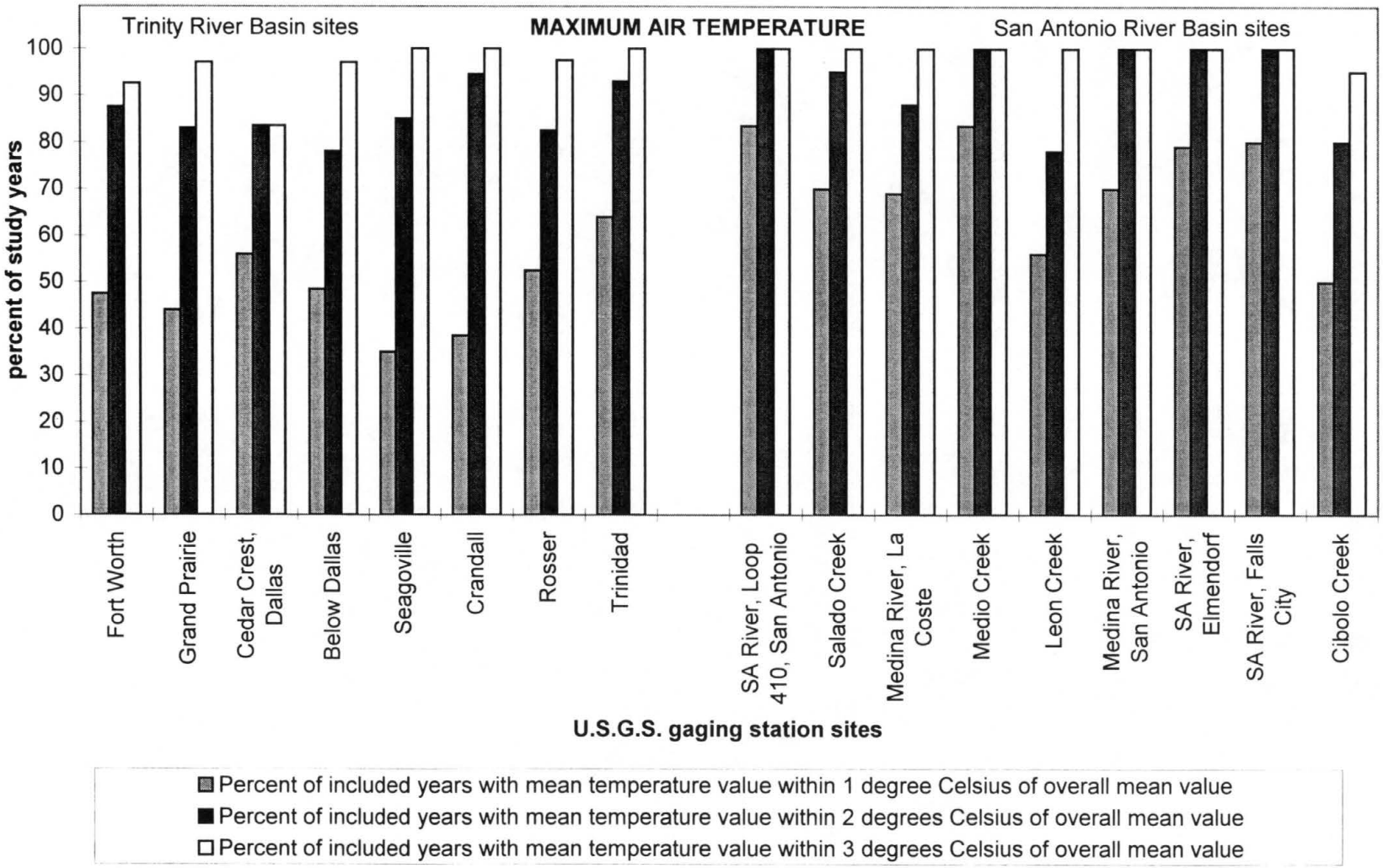

Figure 22. Percent of study years included for each site with arithmetic mean of daily maximum air temperature observations within 1, 2, or 3 degrees Celsius of overall mean of observations for entire study period: Trinity and San Antonio River Basins, Texas

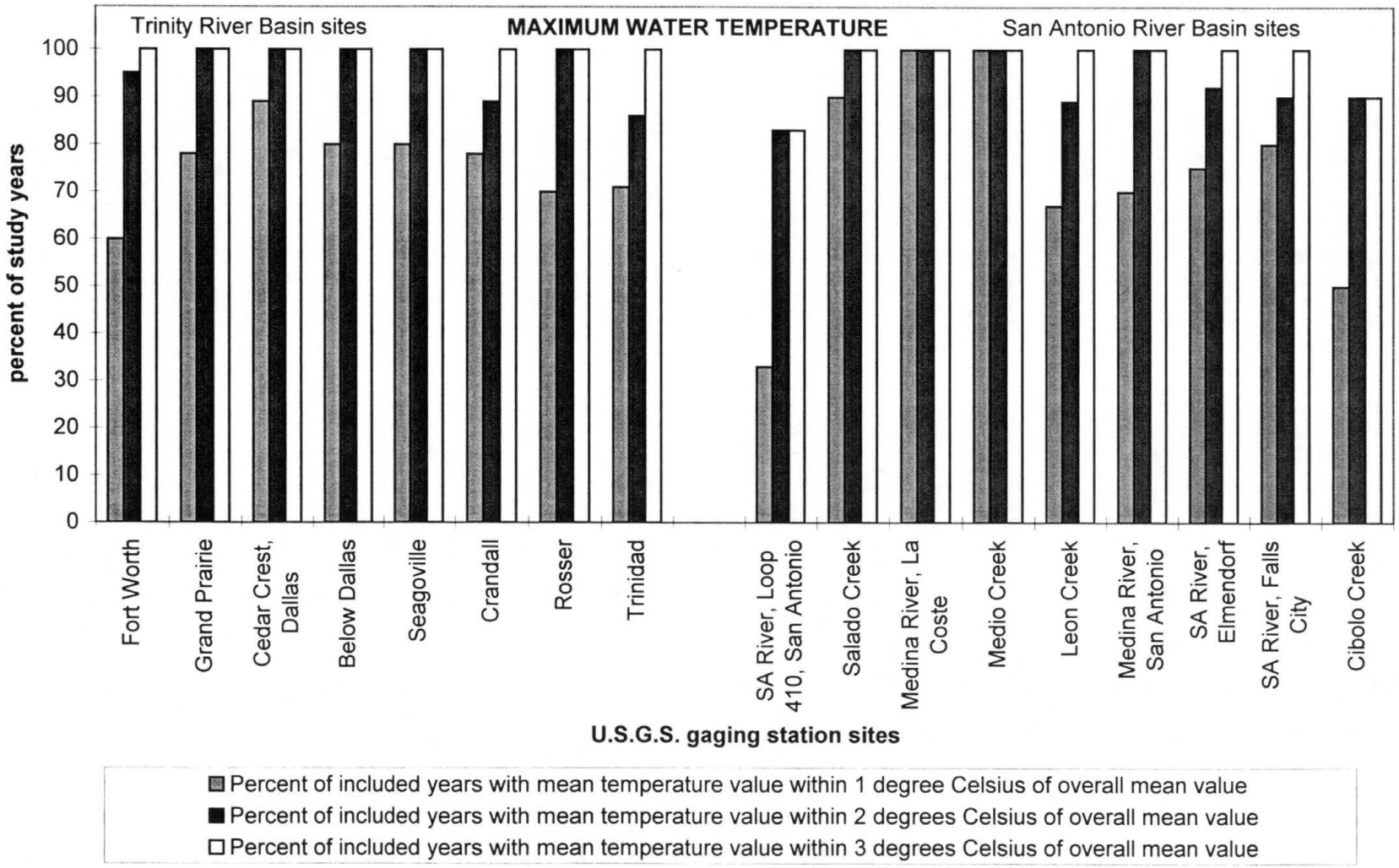

Figure 23. Percent of study years included for each site with arithmetic mean of daily maximum water temperature observations within 1, 2, or 3 degrees Celsius of overall mean of observations for entire study period: Trinity and San Antonio River Basins, Texas

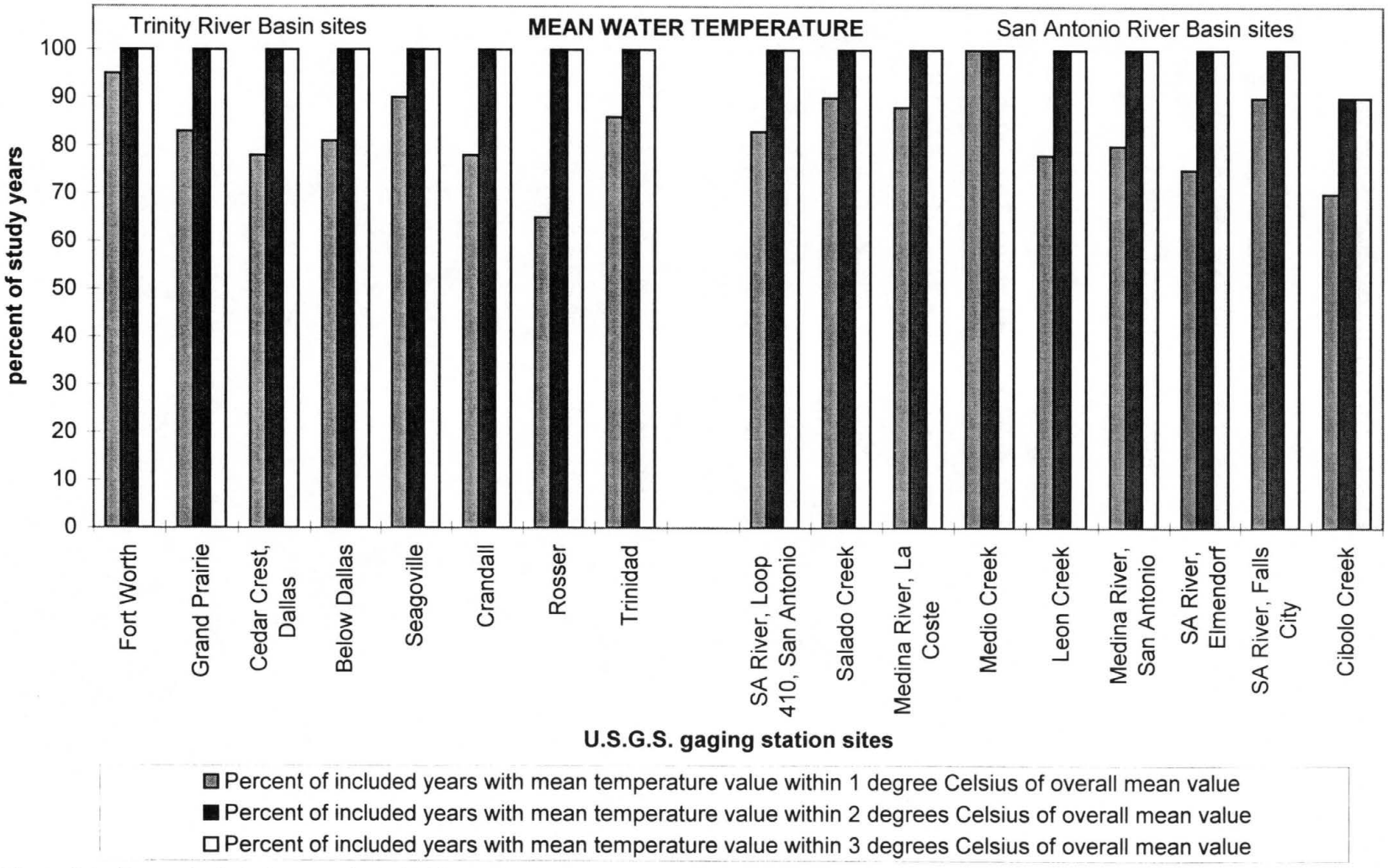

Figure 24. Percent of study years included for each site with arithmetic mean of daily mean water temperature observations within 1, 2, or 3 degrees Celsius of overall mean of observation for entire study period: Trinity and San Antonio River Basins, Texas

TABLE 31

STUDENT'S *T*-TEST RESULTS: STANDARD DEVIATION OF WATER TEMPERATURE MEANS BY URBANIZATION STATUS CATEGORY
Trinity and San Antonio River Basins

Specific River Basin Analysis	Variable	Water Temperature Mean	Standard Deviation
Trinity River Basin			
- maximum	PREVURB	32.75	1.92
	ACTIVURB	31.07	1.04
	NONURB	30.99	.96
- mean	PREVURB	30.97	1.06
	ACTIVURB	30.02	.92
	NONURB	30.36	.89
San Antonio River Basin			
- maximum	PREVURB	30.03	2.31
	ACTIVURB	30.60	1.18
	NONURB	31.58	1.05
	SEMIURB	29.38	.92
- mean	PREVURB	28.65	1.38
	ACTIVURB	29.42	.98
	NONURB	30.73	.66
	SEMIURB	28.53	.75

Exceptionally warm water conditions consistently appeared at the West Fork Trinity River at Beach Street at Fort Worth and at the San Antonio River at Loop 410 at San Antonio stations, both classified in this paper as "previously urbanized" sites. These two stations far above any others frequently had summer days with maximum stream temperatures exceeding not only the 33.5°C maximum temperatures recommended for satisfactory growth of the chosen indicator species, *Micropterus salmoides*, but also above its lethal level (35.5°C) and above maximum temperatures suggested for the sites' specific river segments by TNRCC (93.9°F (33.9°C) and 90°F (32.2°C), respectively). The Loop 410 site had only six years of data with enough observations for inclusion in this study, five of which recorded days with maximum temperatures above the TNRCC recommended maximum temperature and four with days above both the satisfactory growth and lethal temperature thresholds for *M. salmoides*. The Fort Worth station had twenty years of reliable data, and for all twenty summers there were days above the TNRCC and

satisfactory growth maximums. In sixteen of those summers, the lethal temperature limit was also exceeded.

These two stations appear to be so consistently and significantly warmer than any other sites because not only are they in heavily urbanized areas with relatively low discharge rates (compared to areas downstream), but their banks are devoid of tree cover in the vicinity of the gage and well upstream. The other five sites classified as "previously urbanized" all have some tree cover to attenuate water temperatures. The Salado Creek and Leon Creek sites in the San Antonio River Basin and the Trinity River below Dallas site all have major tree cover at the gage site, upstream, and throughout their drainage basins. The Trinity River upstream of the Cedar Crest Boulevard site has a thin buffer strip of trees along its banks, and the gage site itself is in a wooded area. A tributary entering the river just above this gage has good tree cover despite flowing through a heavily populated residential area.

Water temperatures overall exhibited a tendency to increase over time in the San Antonio River Basin and to decrease in the Trinity River Basin. More specifically, the actively urbanizing, semi-urbanized, and non-urban sites tended to show a positive correlation with the year of analysis in the San Antonio Basin, while the previously urbanized sites tended toward an inverse relationship. Breaking down the Trinity Basin sites by urbanization status revealed a lack of any real temporal relationship patterns between water temperature fluctuation and urbanization status.

Water temperature levels showed a significant correlation with population density in both basins in the regression analyses that included the actual population density figures (cross-sectional analyses of 1980 and 1990 data only). In the Trinity Basin, population density exhibited a positive correlation with water temperatures. In the San Antonio Basin, population density and water temperatures were inversely related. Although the amount of variation in water temperature explained by variation in the other variables was high in all four analyses, the total number of observations was fairly low, so the results may be deceptive.

The contradictory findings may result from the influence of springflow in the San Antonio River Basin, or because several of the "previously urbanized" and "actively urbanizing" sites in this basin were actually in heavily wooded areas. These creeks were fairly narrow, allowing the tree cover to provide ample shade over the stream surfaces. This shade kept water temperatures from increasing to the degree

that temperatures did in the wider, "non-urban" river channels downstream. Some of the more heavily urbanized sites in the Trinity River Basin also had significant tree cover in the river channel, but the river was wider, and the trees did not shade as much of the water surface. This factor, combined with a lack of significant springflow and the influx of very warm water from the largely unshaded West Fork of the Trinity River from Fort Worth, kept the Trinity River Basin's heavily urbanized gage sites comparatively warmer than the less urbanized sites downstream. These less urbanized sites were either on different forks of the Trinity River that had not already been through Fort Worth or Dallas, or were far enough downstream that the water had already flowed through additional wooded areas and combined with more rural streams. Reservoir releases into waterways upstream of the less urbanized sites may have also contributed to cooler temperatures. Another possible influence was the different orientation of the waterways in the two basins. East-west oriented streams tend to receive more direct sunlight than north-south oriented streams. The Trinity River and the West Fork of the Trinity River flow generally west to east through the more heavily urbanized parts of the basin. The East Fork of the Trinity River and downstream portion of the Trinity River main stem (less urbanized) flow north-south and northwest-southeast, respectively. The creeks and rivers in the San Antonio Basin contrastingly flow generally north to south in the more heavily urbanized part of the basin, and more west to east or northwest to southeast in the less urbanized parts.

Water temperature analyses that included the various urbanization status categories as independent variables found non-urbanized areas in the San Antonio Basin to raise water temperatures more than actively urbanizing areas, and both of these more than previously urbanized areas. The same analyses in the Trinity Basin revealed a tendency for non-urban areas to have slightly "above normal" water temperatures while actively urbanizing and previously urbanized areas tended to have slightly "below normal" water temperatures (actively urbanizing zones more so than previously urbanized ones). However, the adjusted R^2 values of these four analyses varied considerably.

Student's *t*-test analyses also found the San Antonio Basin sites to have the highest water temperatures in non-urban areas, followed by actively urbanizing areas, then previously urbanized areas. These results are consistent with the findings of the multiple regression analyses that incorporated actual population density and those that used the urbanization status categories. (Semi-urbanized areas were also

included in the *t*-test analyses; their water temperatures were generally equal to or lower than those of the previously urbanized areas.) In the Trinity Basin, the *t*-test results vary from the urbanization status regression findings. (The *t*-tests agree *more*, but not completely, with the population density regressions.) The *t*-tests show the previously urbanized areas to have higher average temperatures than either the actively urbanizing or non-urban sites. The non-urban sites generally had higher mean water temperatures than the actively urbanizing sites did, whereas their maximum temperatures were determined to not differ significantly. In short, the *t*-tests ranked the Trinity site categories in order of highest average temperatures as previously urbanized first, followed by non-urban and then actively urbanizing. The regressions found the actively urbanizing sites to have the most correlation with water temperature levels, and sequenced them as non-urban areas having the highest average temperatures, then previously urbanized sites, with actively urbanizing areas having the lowest overall maximum and mean daily water temperatures.

The consensus seems to be that previously urbanized areas tend to have higher water temperatures than do actively urbanizing areas, where springflow is not a significant contributing factor. Groundwater inflow in areas with high natural occurrence of springs and artesian wells obscures the relationship of population density levels and growth rates to elevated water temperatures (some of the San Antonio Basin analyses found previously urbanized areas to have higher water temperatures while others found actively urbanizing areas to tend to have the higher temperatures). Most analyses found temperatures to be highest on average, in non-urban areas (although the highest actual individual temperatures were consistently at the Fort Worth site in the Trinity Basin and at the Loop 410, San Antonio site in the San Antonio Basin, both previously urbanized sites). Several factors could account for the higher average temperatures observed in non-urban areas, including clearing of rural farmland in the contributing watersheds and a coincidental relationship between non-urban areas in this study and greater average streamflow. All of the non-urban sites in this study happen to be downstream of the primary urban centers, and the resulting greater discharge rates also generally mean wider river channels, and therefore more direct solar radiation and surface warming and less temperature modificaton from riverbank shading.

Significance of Study

Rising water temperatures in urbanizing areas can cause a variety of environmentally and economically detrimental effects. Increased water temperatures in freshwater systems decrease the ecological quality of habitat for aquatic life, in turn affecting other wildlife dependent on aquatic life for survival. Higher water temperatures reduce dissolved oxygen (DO) levels, contributing to the decreased quality of aquatic habitat. DO levels also affect the amount of waste materials and other factors contributing to biochemical oxygen demand (BOD) that can be naturally assimilated by the river. These conditions can diminish the esthetic quality and recreational value of rivers and streams. The economies of areas that depend on river recreation activities to attract tourists can be seriously damaged. The economic effect of deteriorating river quality can also be felt in urban areas dependent on river-associated tourism, such as riverwalks and riverfront shops and restaurants. Water temperature is also of considerable significance to the use of water for industrial cooling purposes.

Relatively little research has been done concerning water temperature in urban or urbanizing areas. The majority of research done correlating water temperature with urbanization and other land use changes, such as logging, has studied short-term effects. Studies covering a period of a decade or more are relatively rare (Vannote and Sweeney 1980; Webb and Walling 1985; Beschta et al. 1987; Beschta and Taylor 1988; Ludwig et al. 1990; Hostetler 1991; Webb and Walling 1992; Webb and Walling 1993; Rowe and Taylor 1994). This study presents an analysis of the effects of urbanization and of changes in population density over time on river and stream temperatures in urban areas, areas entering an urbanizing period, and nearby rural areas.

The benefits of this study include assessing the severity of the problem of elevated water temperatures in urban areas, as well as locating those river sections most affected. The study also gives indications as to the factors most responsible for water temperature variation and elevation. Unfortunately, the goal of producing a definitive "model" for the effects of urbanization on water temperatures has been mostly unsuccessful, as there was little consensus among the regression equations as pertained to the population density, urbanization status, or temporal aspects of the study. Although there was evidence suggesting correlations between water temperature and population density, urbanization status, and even

time, the relationships and their significance varied considerably between river basins, from site-to-site within each basin, and between maximum and mean water temperature analyses.

APPENDICES

APPENDIX A

Graphs

Population Density vs. Warmest Annual Daily Maximum
and Mean Water Temperatures

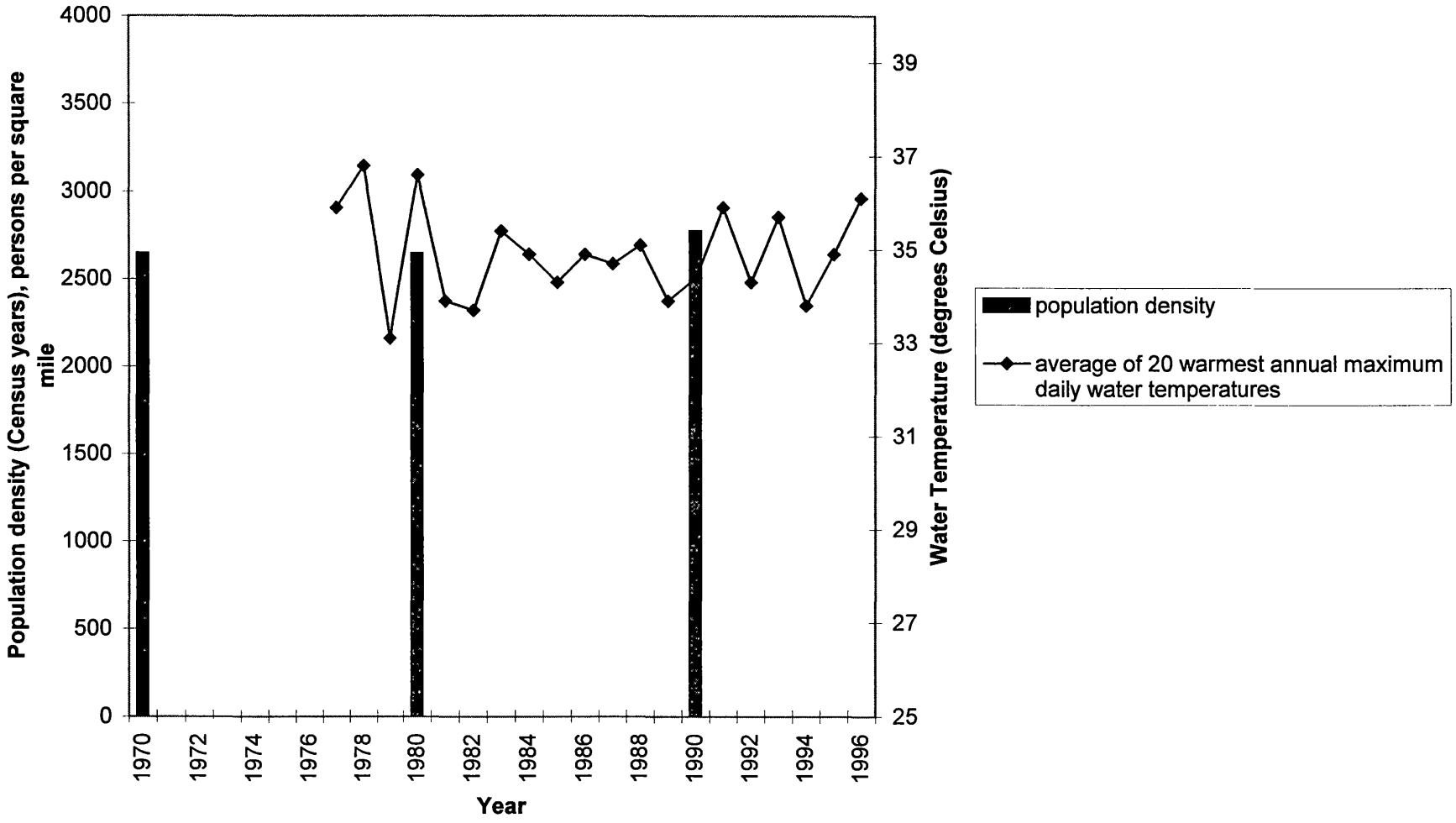

Figure A-1. Population density vs. average of twenty warmest annual daily maximum water temperatures: West Fork Trinity River at Beach Street at Fort Worth, TX - 1970-1996

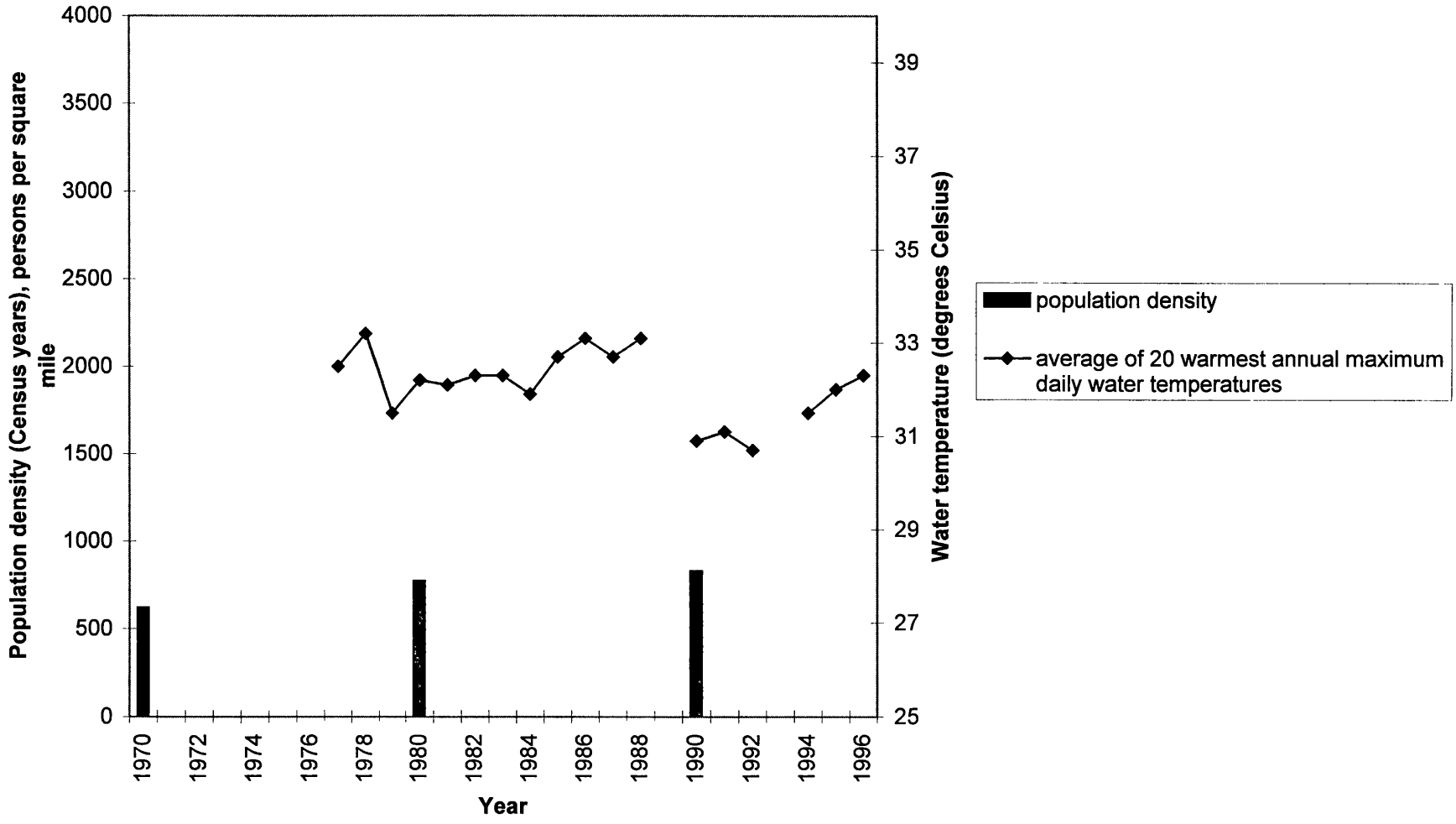

Figure A-2. Population density vs. average of twenty warmest annual daily maximum water temperatures: West Fork Trinity River at Grand Prairie, TX - 1970-1996

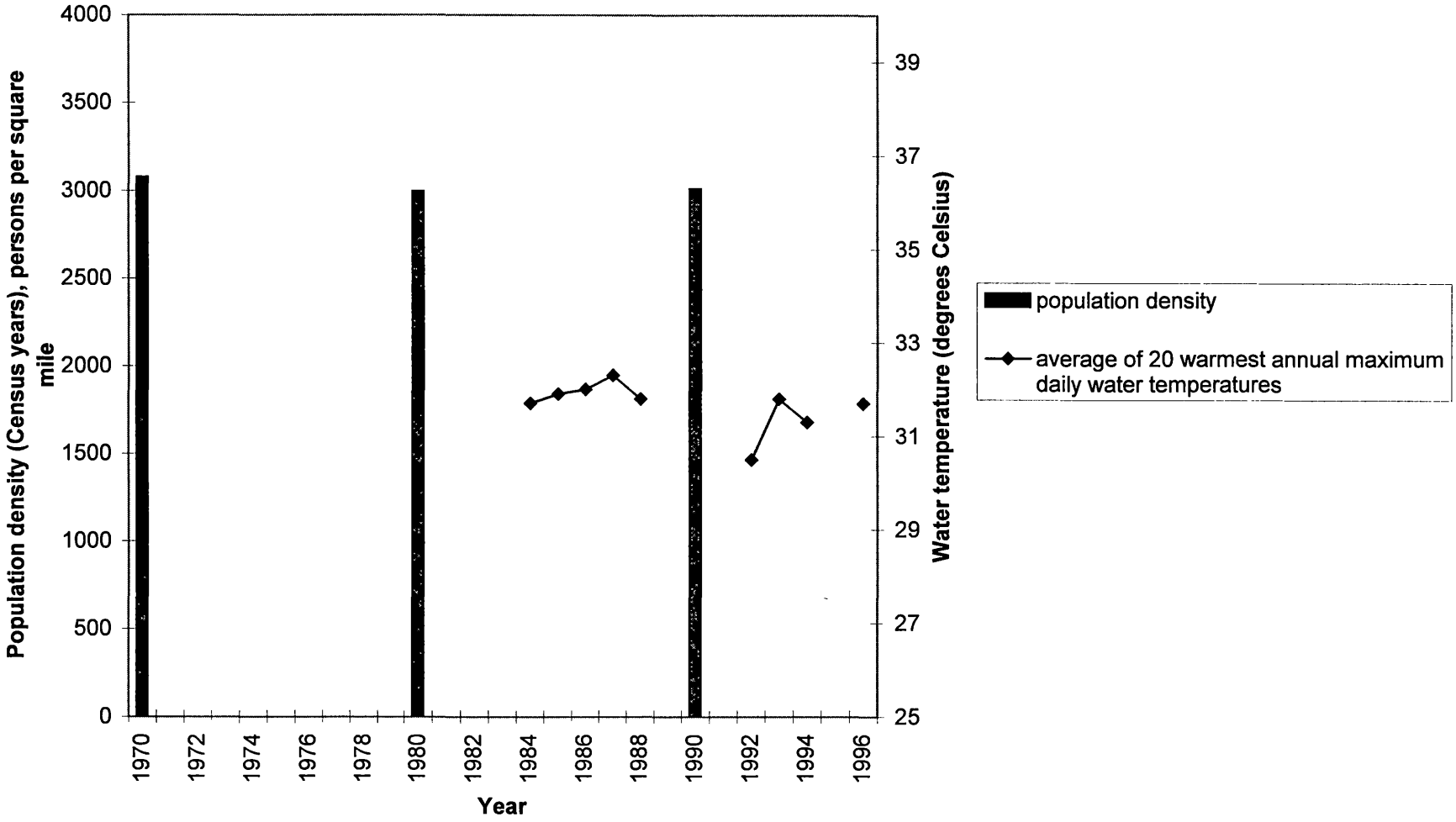

Figure A-3. Population density vs. average of twenty warmest annual daily maximum water temperatures: Trinity River at Cedar Crest Blvd. at Dallas, TX - 1970-1996

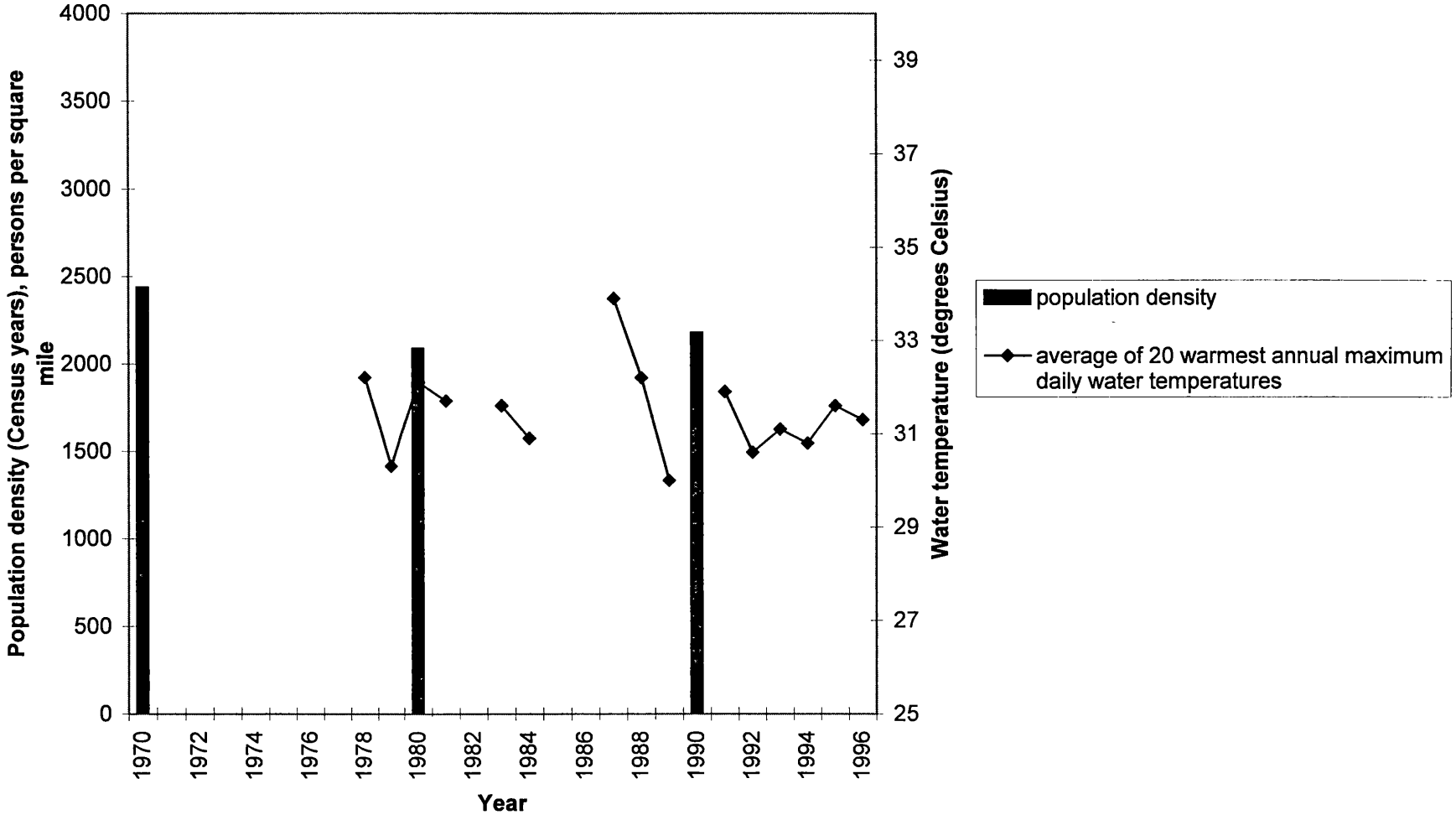

Figure A-4. Population density vs. average of twenty warmest annual daily maximum water temperatures: Trinity River below Dallas, TX - 1970-1996

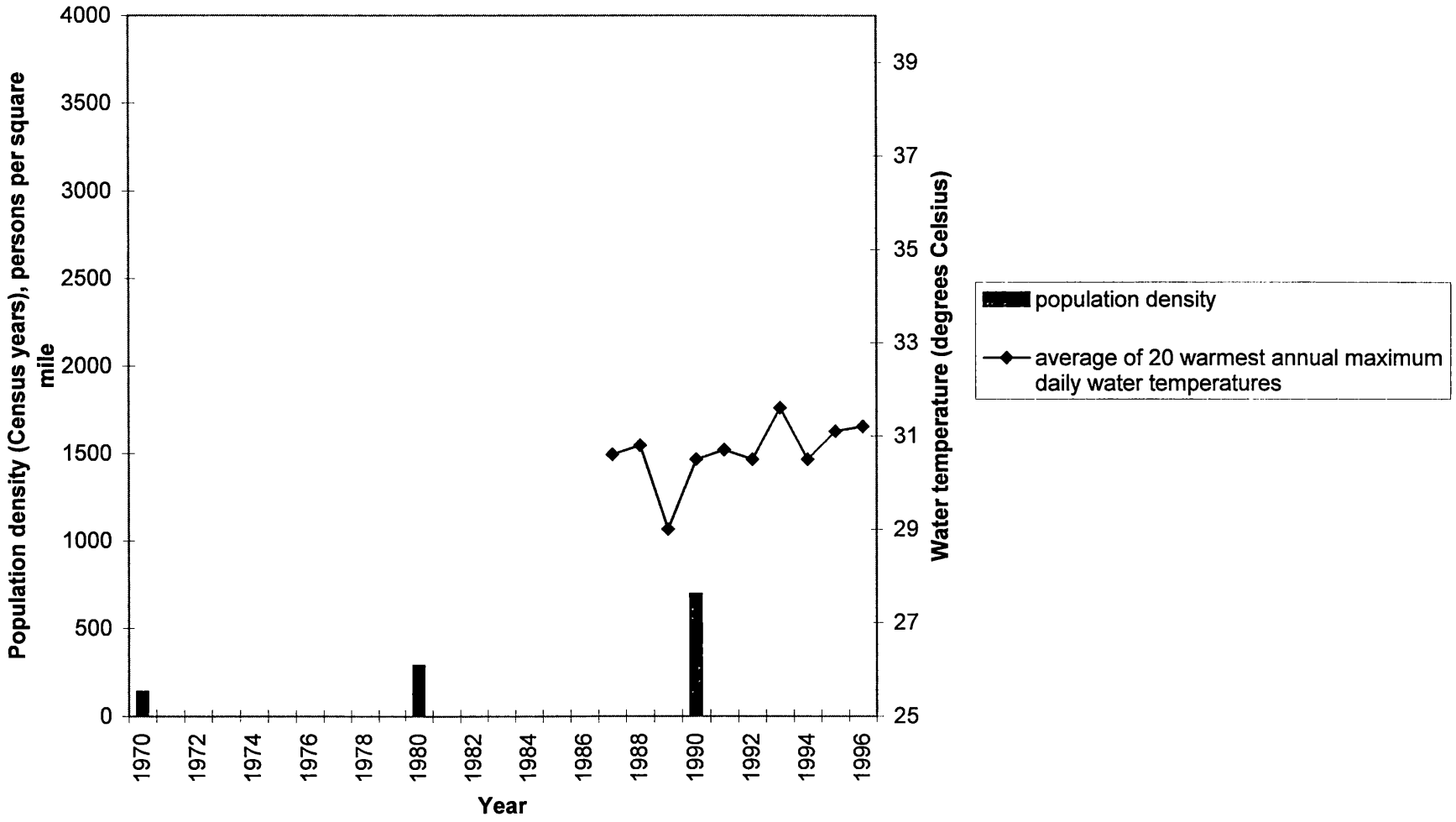

Figure A-5. Population density vs. average of twenty warmest annual daily maximum water temperatures: East Fork Trinity River at Seagoville, TX - 1970-1996

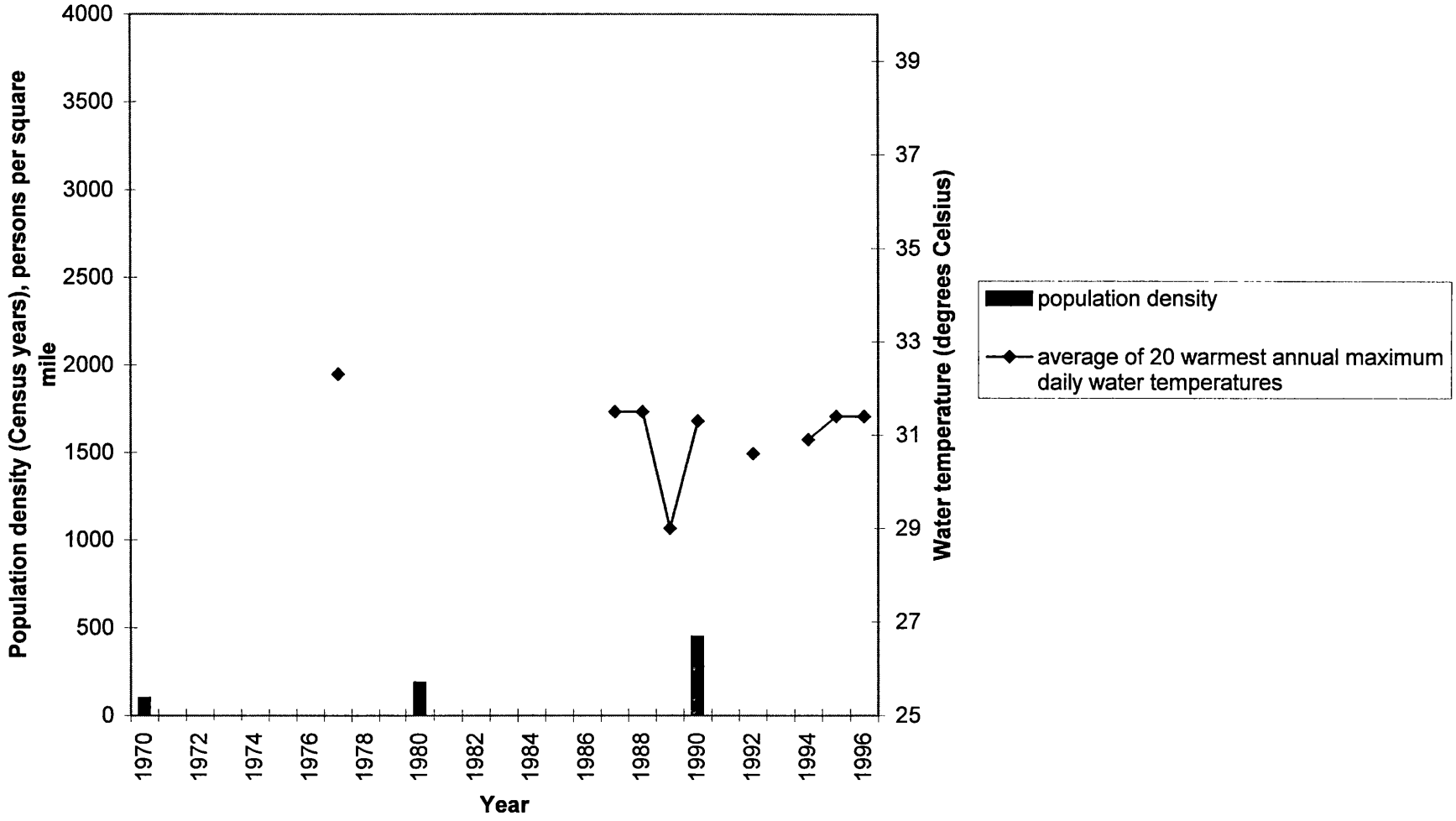

Figure A-6. Population density vs. average of twenty warmest annual daily maximum water temperatures. East Fork Trinity River near Crandall, TX - 1970-1996

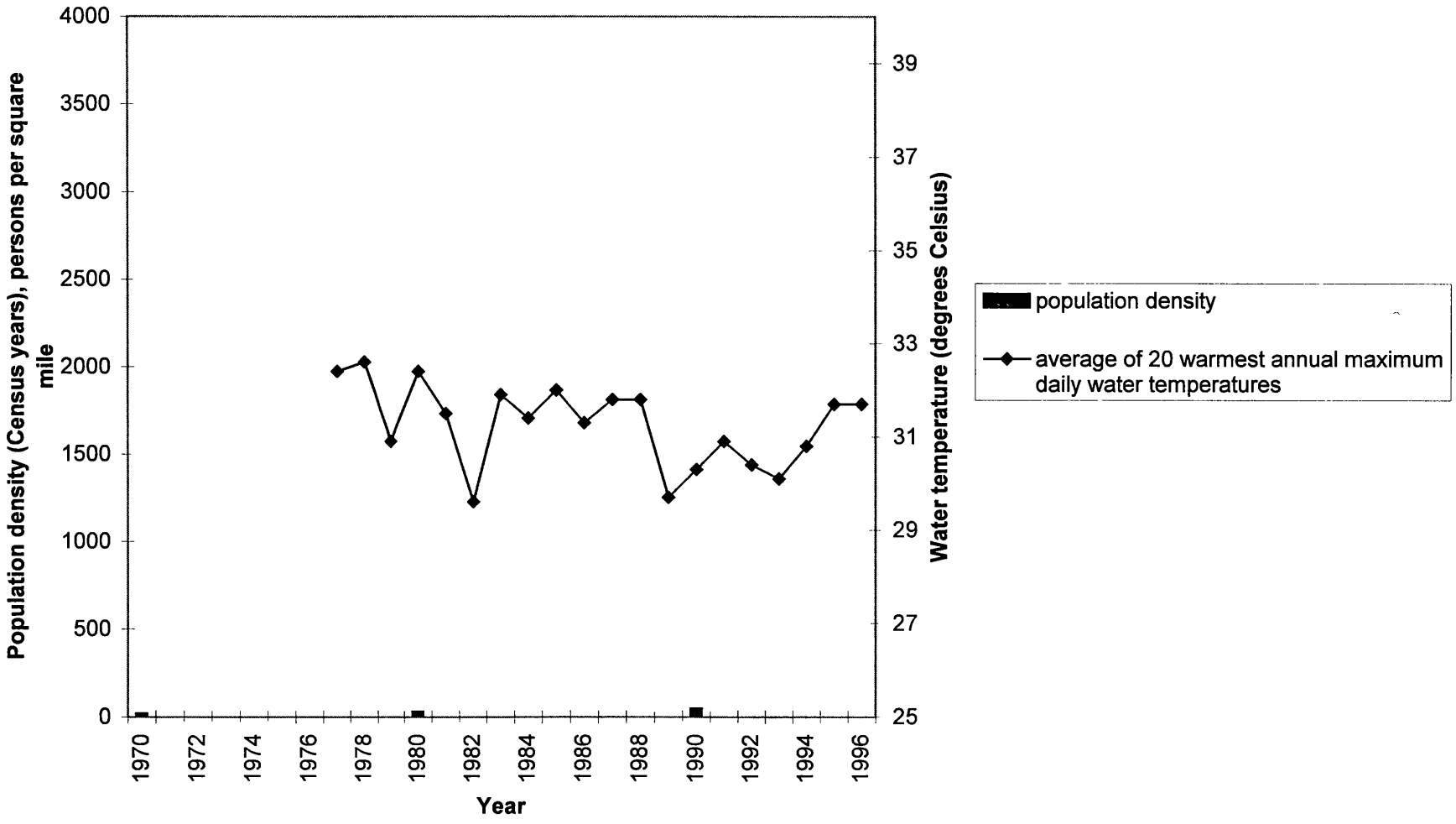

Figure A-7. Population density vs. average of twenty warmest annual daily maximum water temperatures: Trinity River near Rosser, TX - 1970-1996

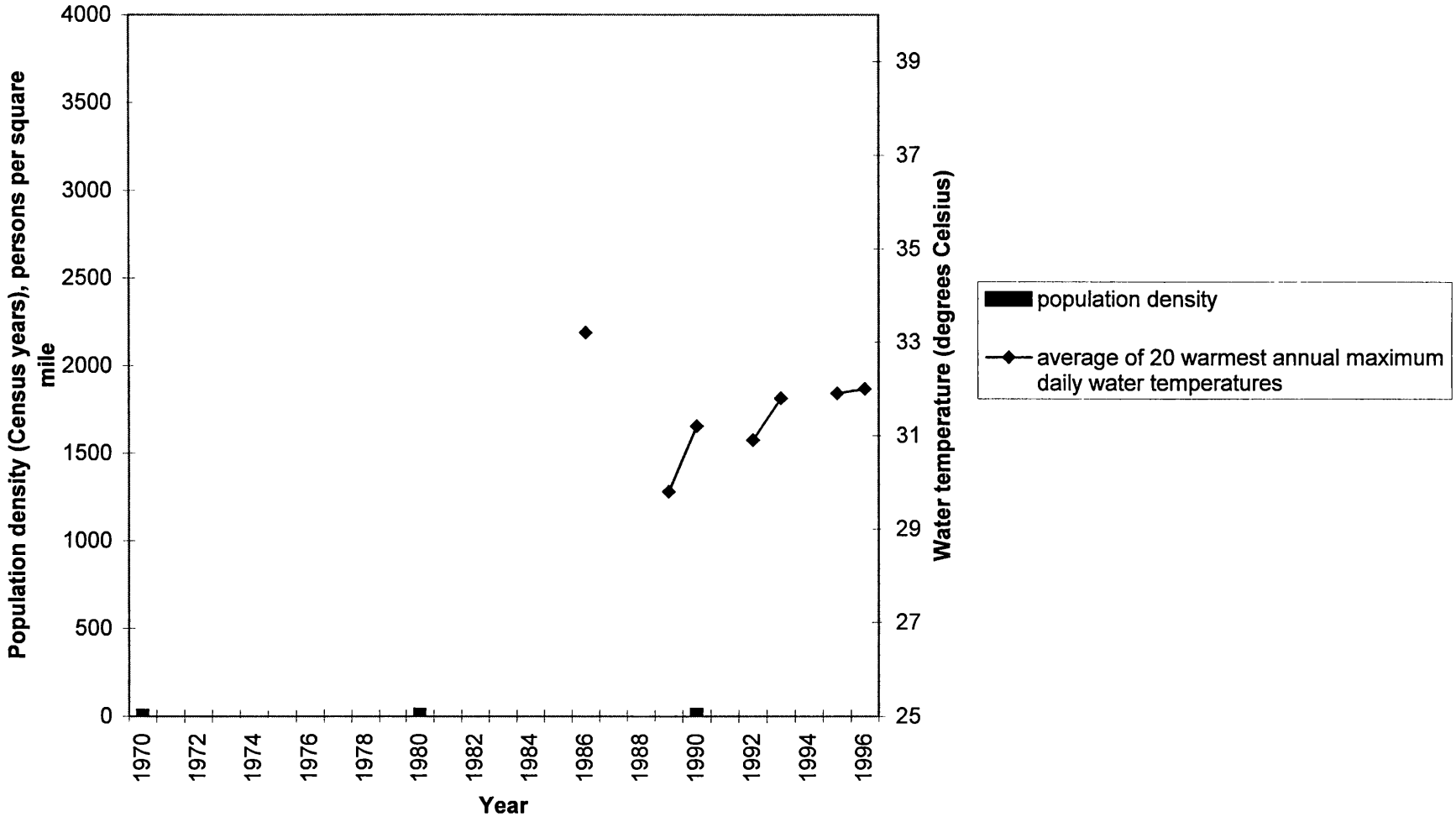

Figure A-8. Population density vs. average of twenty warmest annual daily maximum water temperatures: Trinity River at Trinidad, TX - 1970-1996

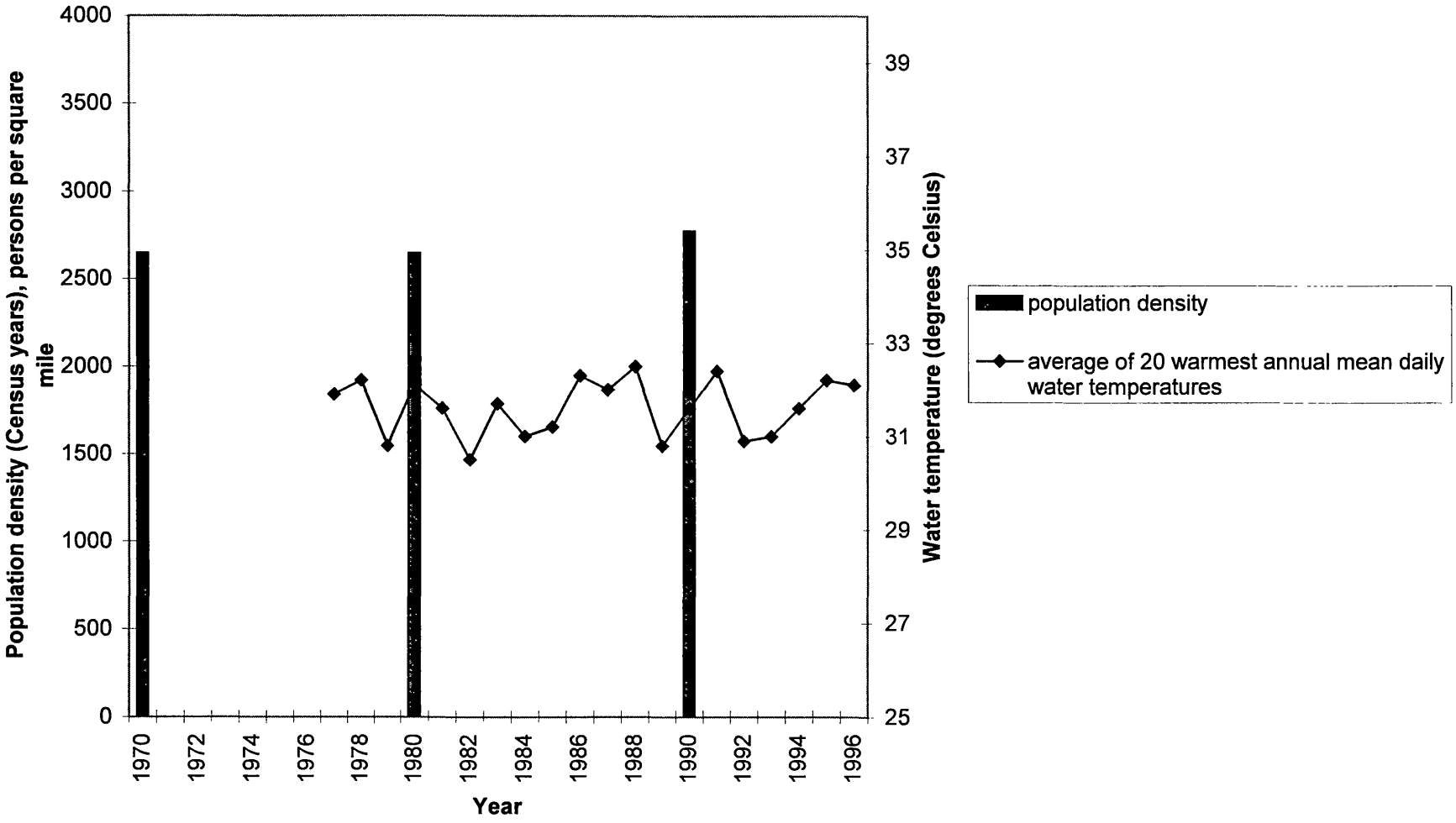

Figure A-9. Population density vs. average of twenty warmest annual daily mean water temperatures: West Fork Trinity River at Beach Street at Fort Worth, TX - 1970-1996

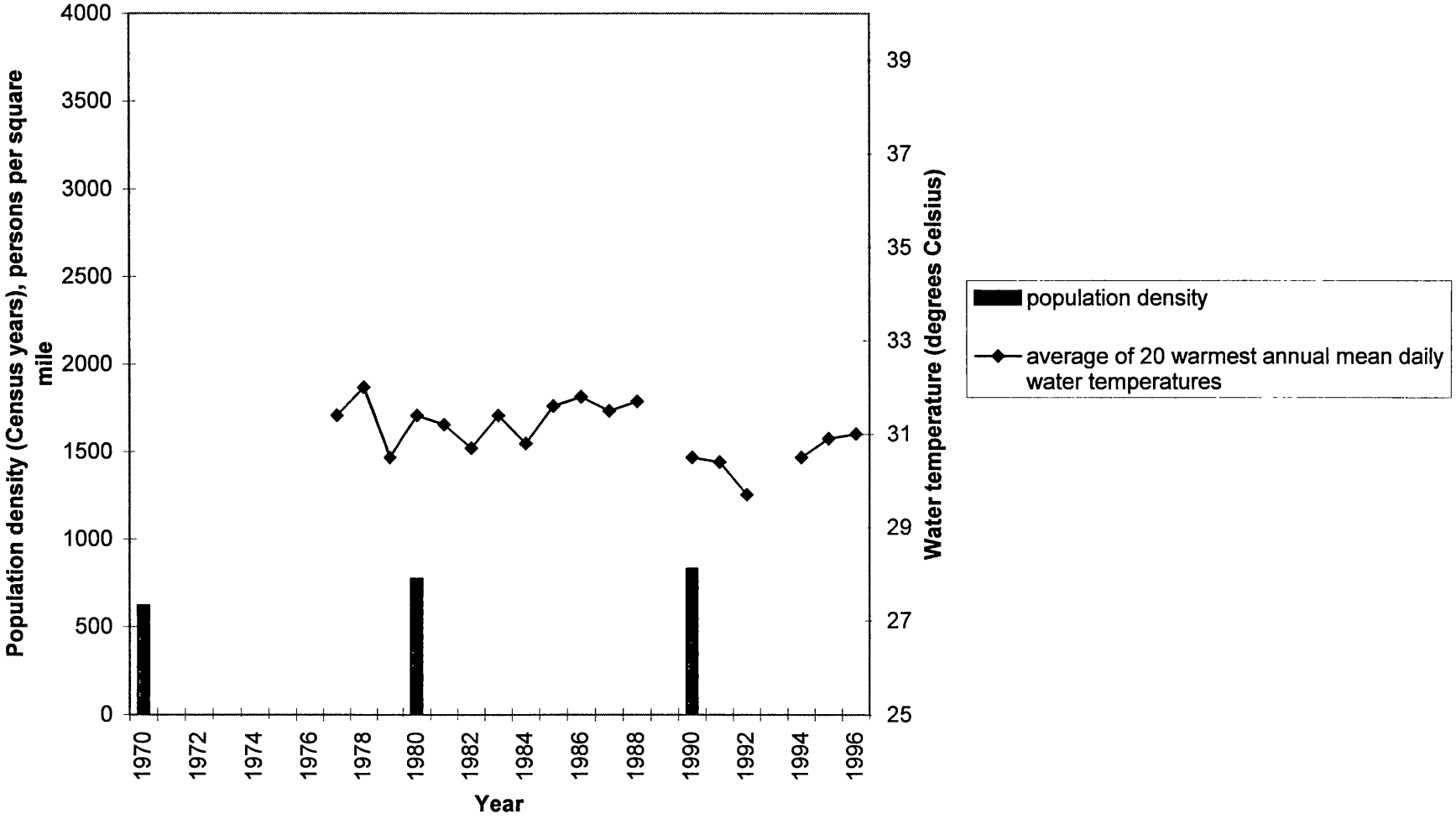

Figure A-10. Population density vs. average of twenty warmest annual daily mean water temperatures: West Fork Trinity River at Grand Prairie, TX - 1970-1996

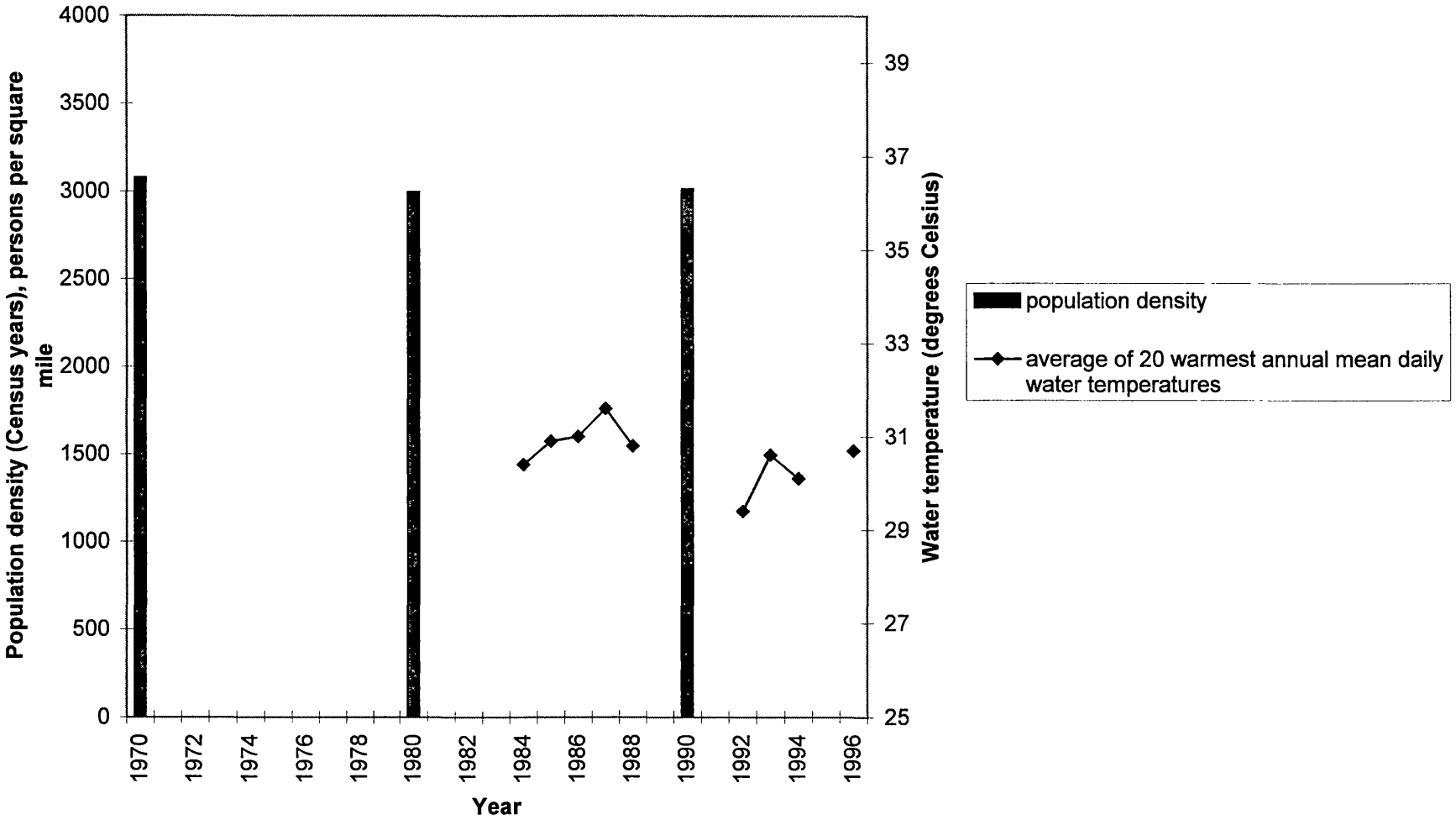

Figure A-11. Population density vs. average of twenty warmest annual daily mean water temperatures: Trinity River at Cedar Crest Blvd. at Dallas, TX - 1970-1996

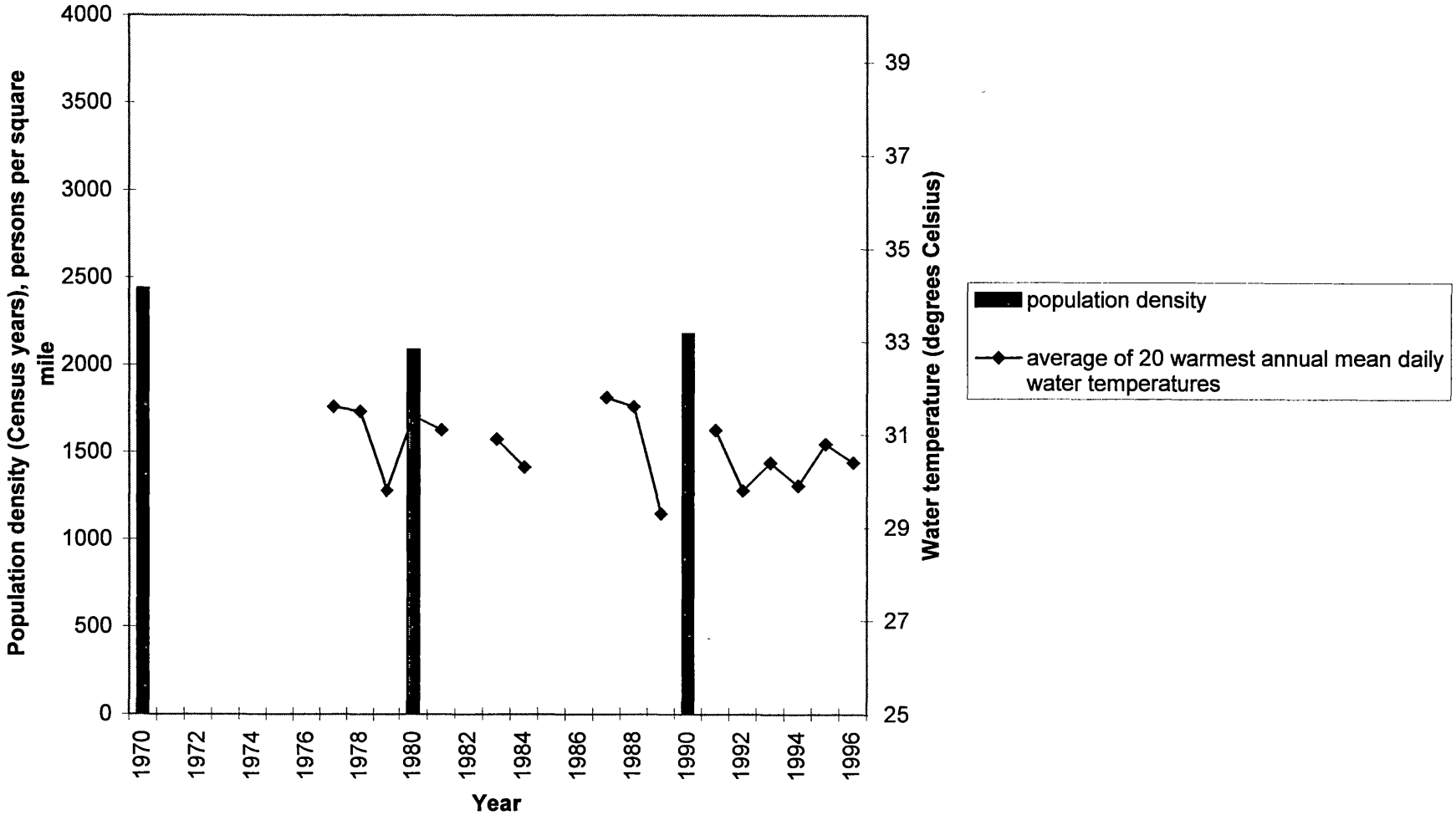

Figure A-12. Population density vs. average of twenty warmest annual daily mean water temperatures: Trinity River below Dallas, TX - 1970-1996

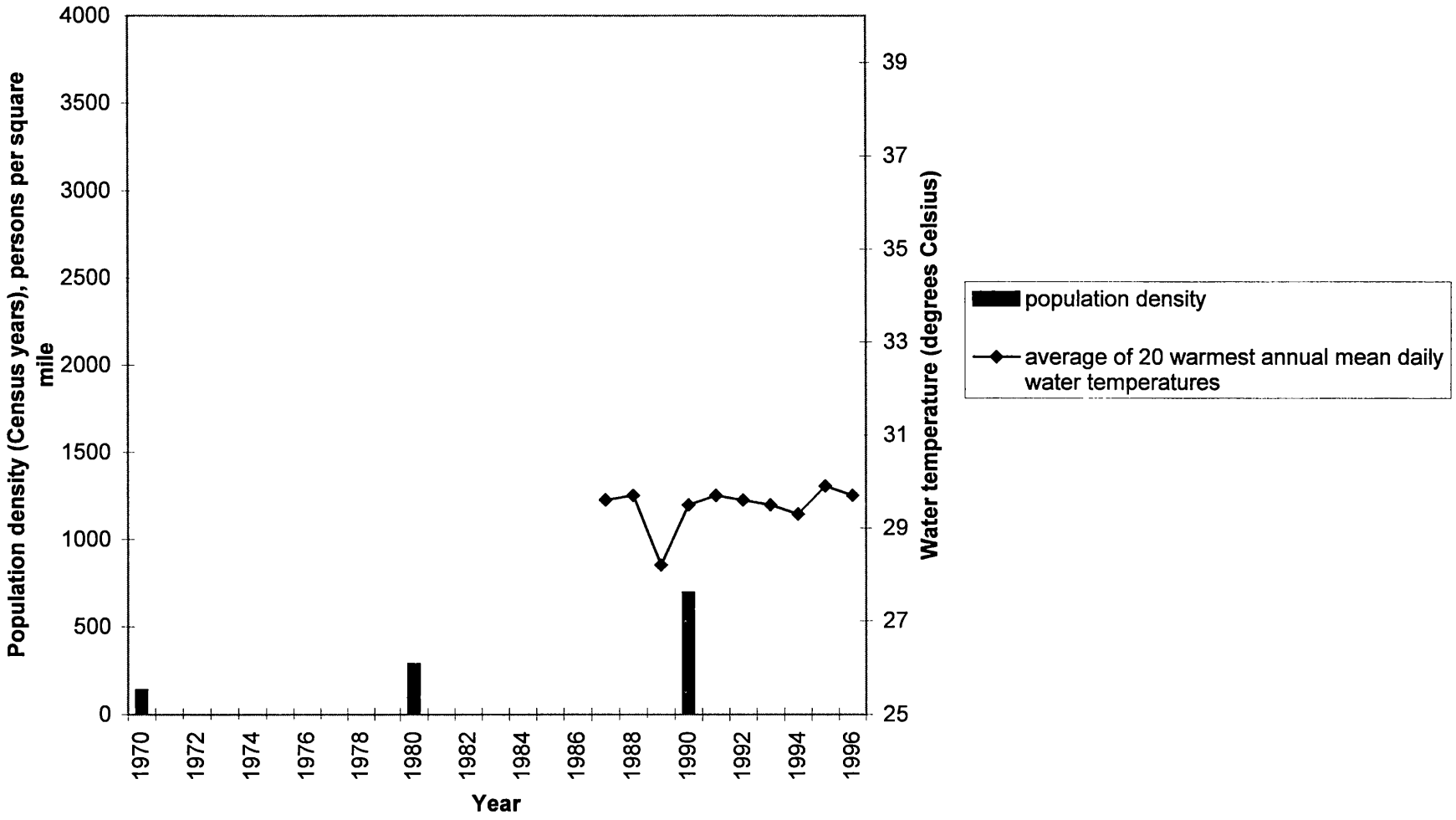

Figure A-13. Population density vs. average of twenty warmest annual daily mean water temperatures: East Fork Trinity River at Seagoville, TX - 1970-1996

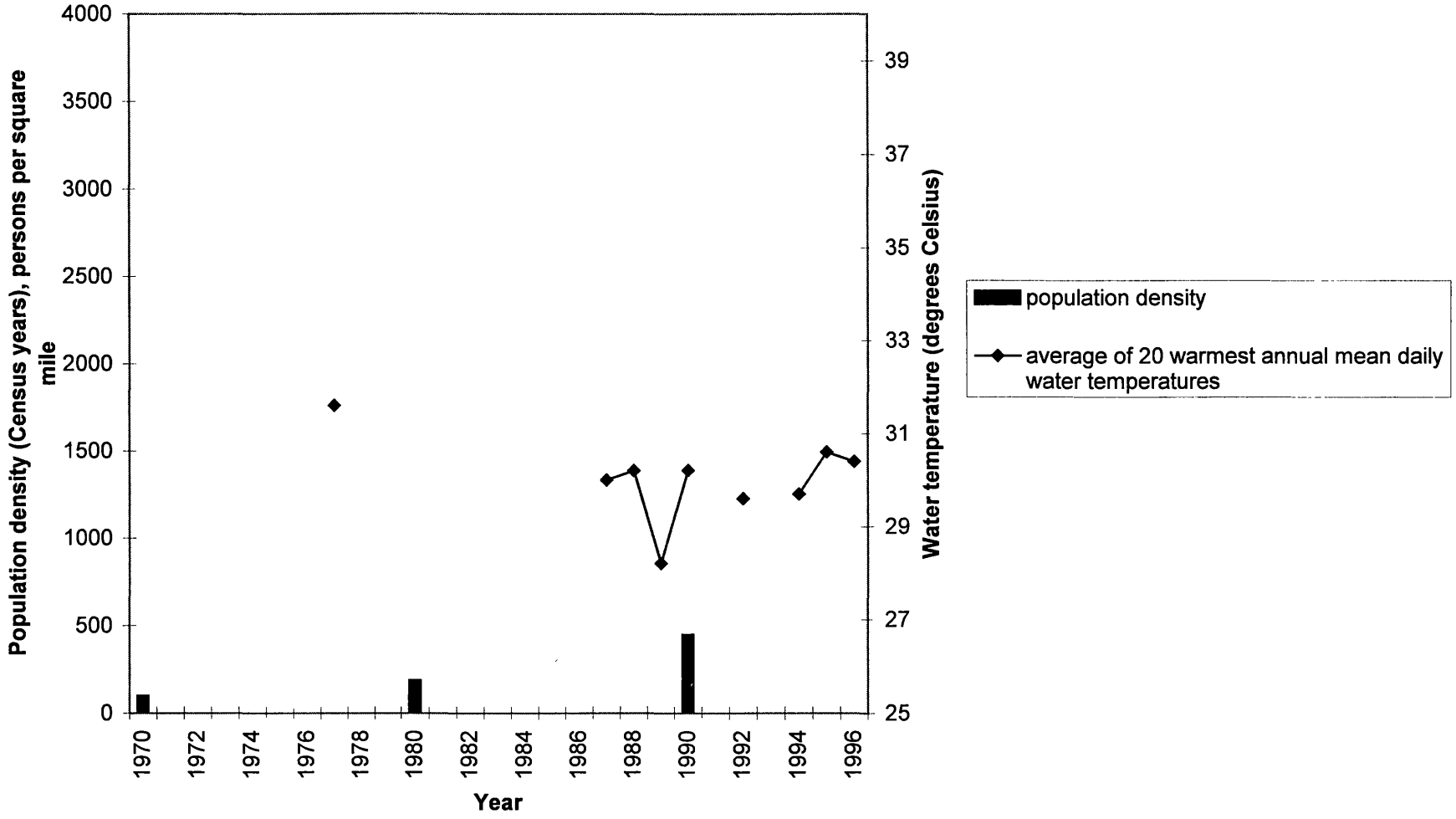

Figure A-14. Population density vs. average of twenty warmest annual daily mean water temperatures: East Fork Trinity River near Crandall, TX - 1970-1996

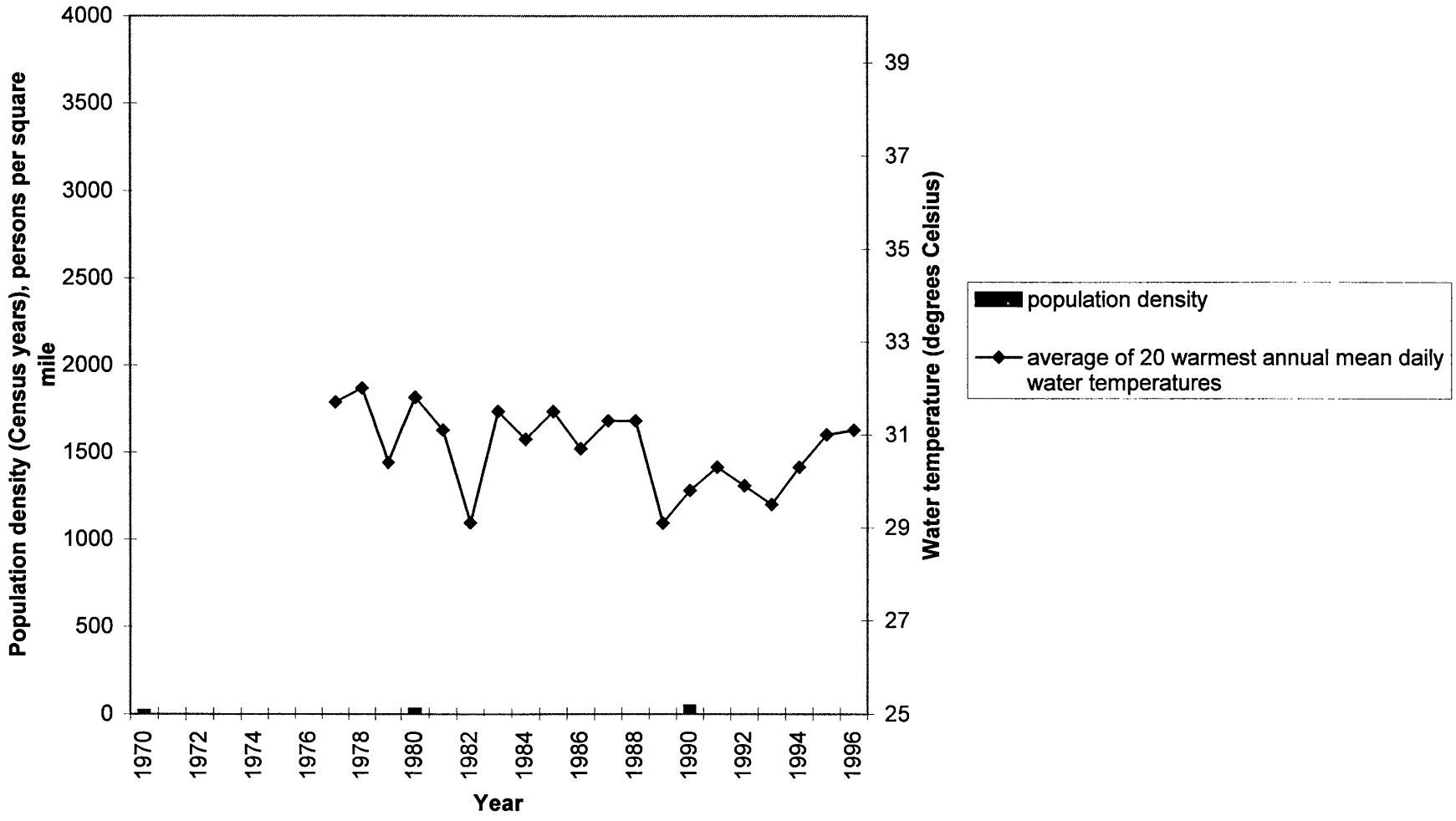

Figure A-15. Population density vs. average of twenty warmest annual daily mean water temperatures: Trinity River near Rosser, TX - 1970-1996

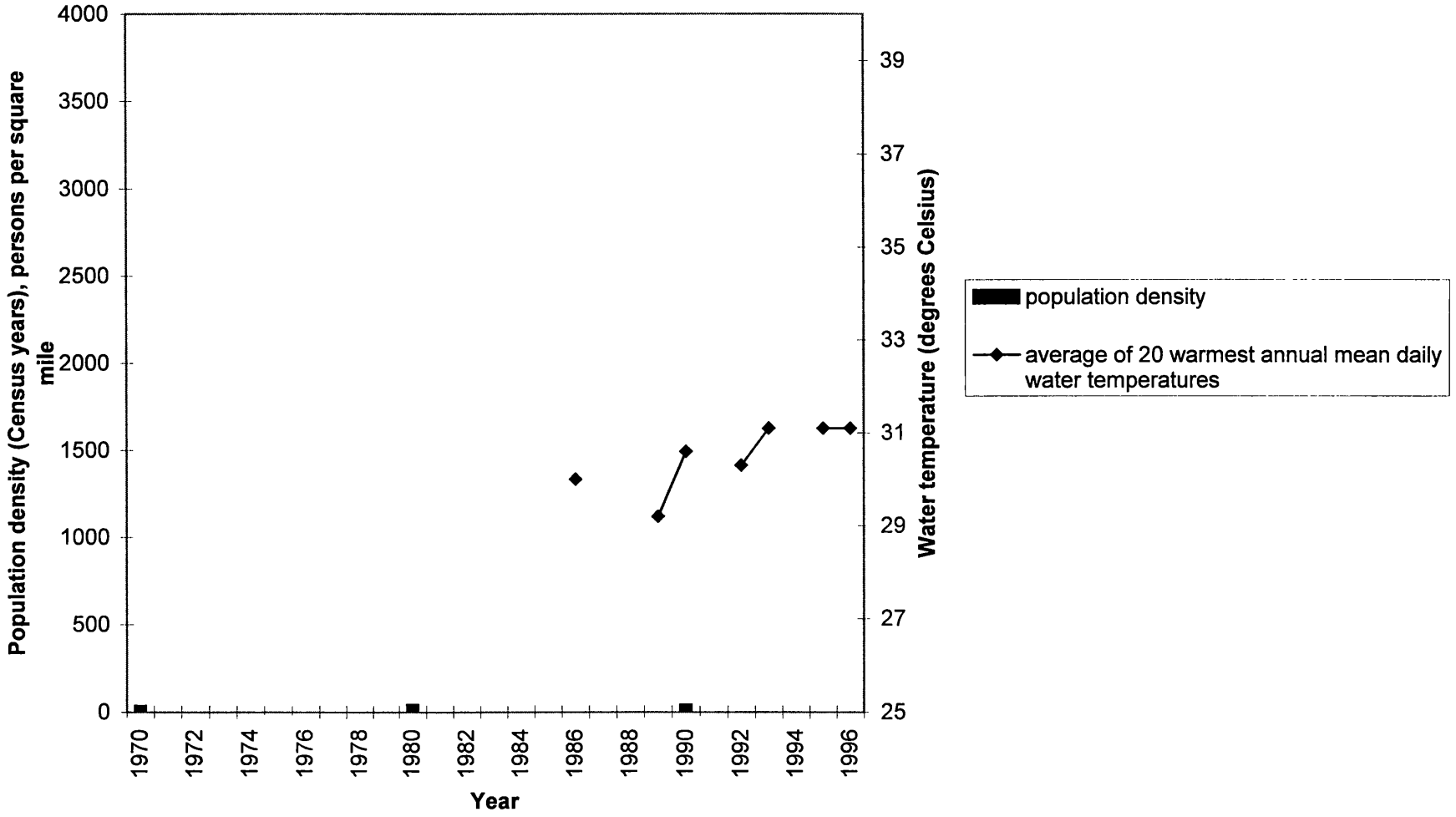

Figure A-16. Population density vs. average of twenty warmest annual daily mean water temperatures: Trinity River at Trinidad, TX - 1970-1996

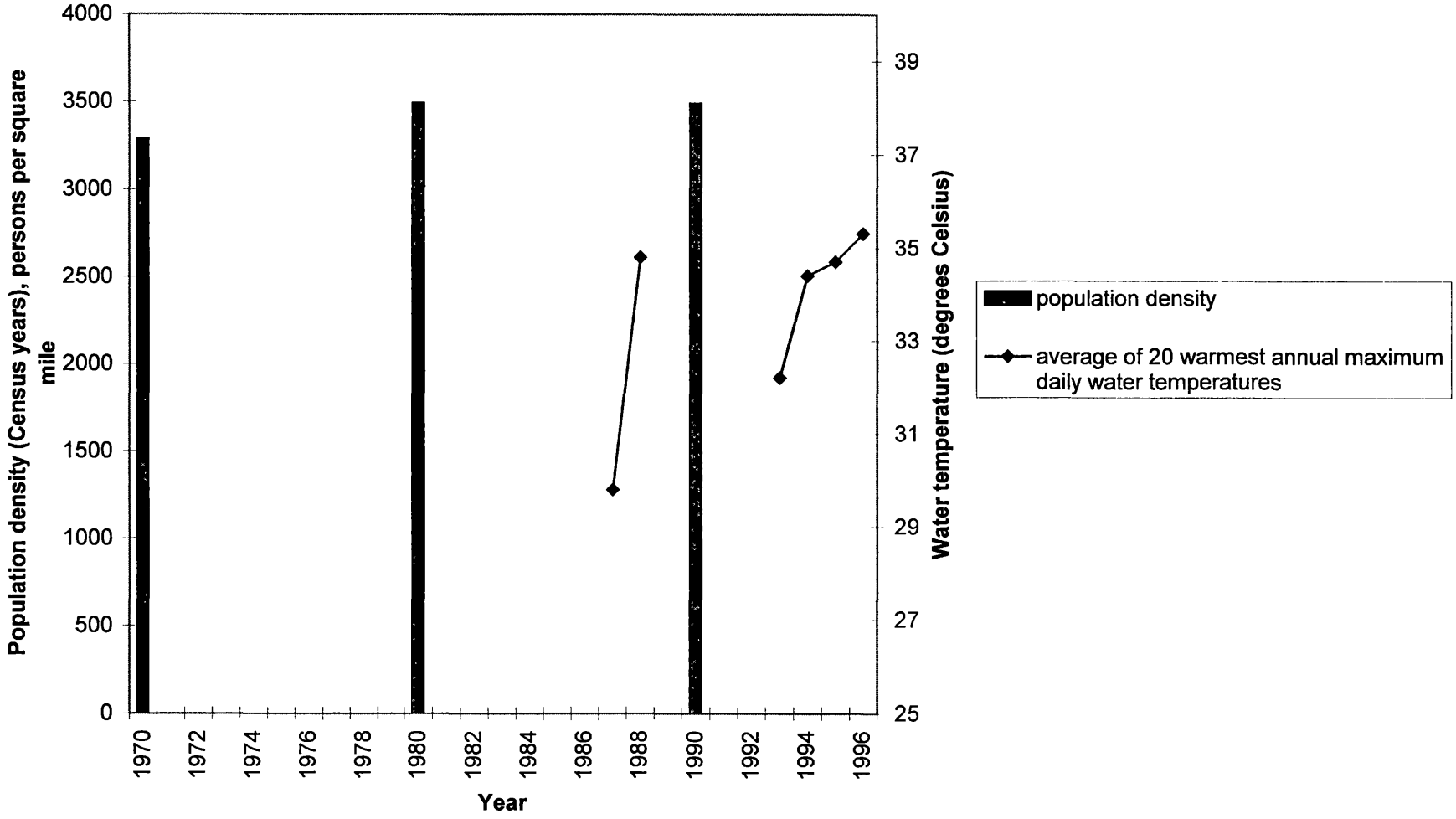

Figure A-17. Population density vs. average of twenty warmest annual daily maximum water temperatures: San Antonio River at Loop 410 at San Antonio, TX - 1970-1996

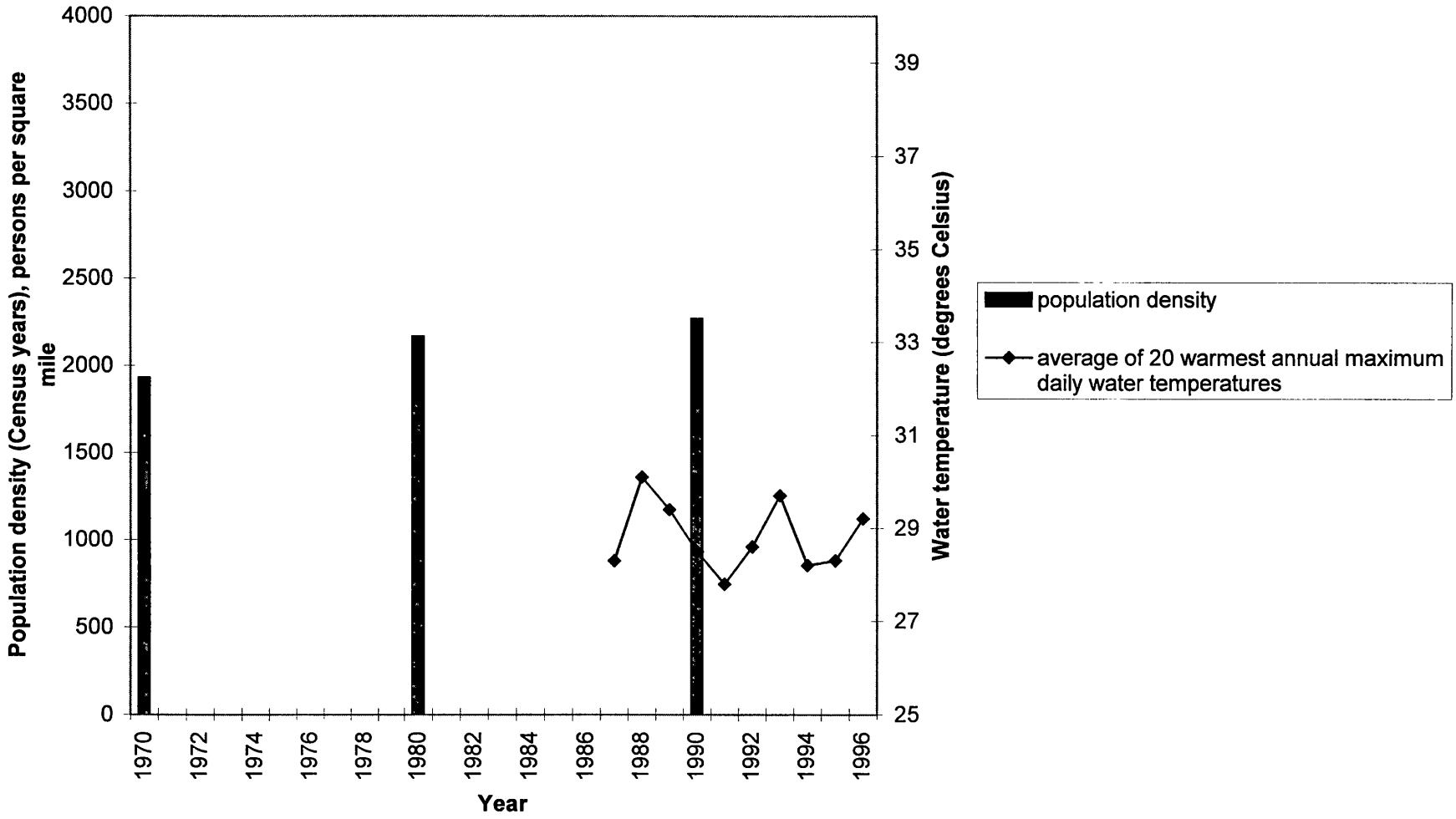

Figure A-18. Population density vs. average of twenty warmest annual daily maximum water temperatures: Salado Creek (lower station) at San Antonio, TX - 1970-1996

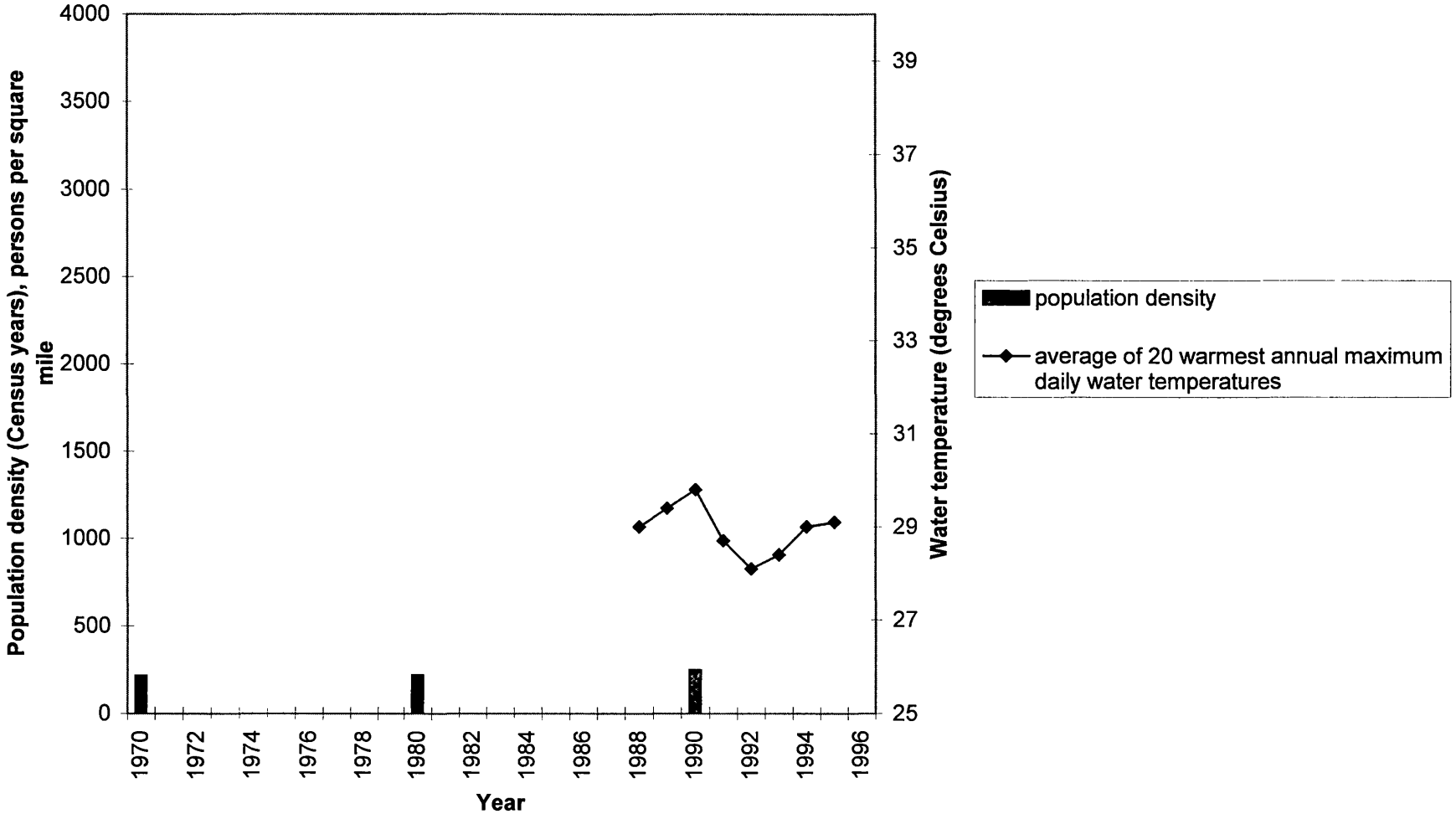

Figure A-19. Population density vs. average of twenty warmest annual daily maximum water temperatures: Medina River at La Coste, TX - 1970-1996

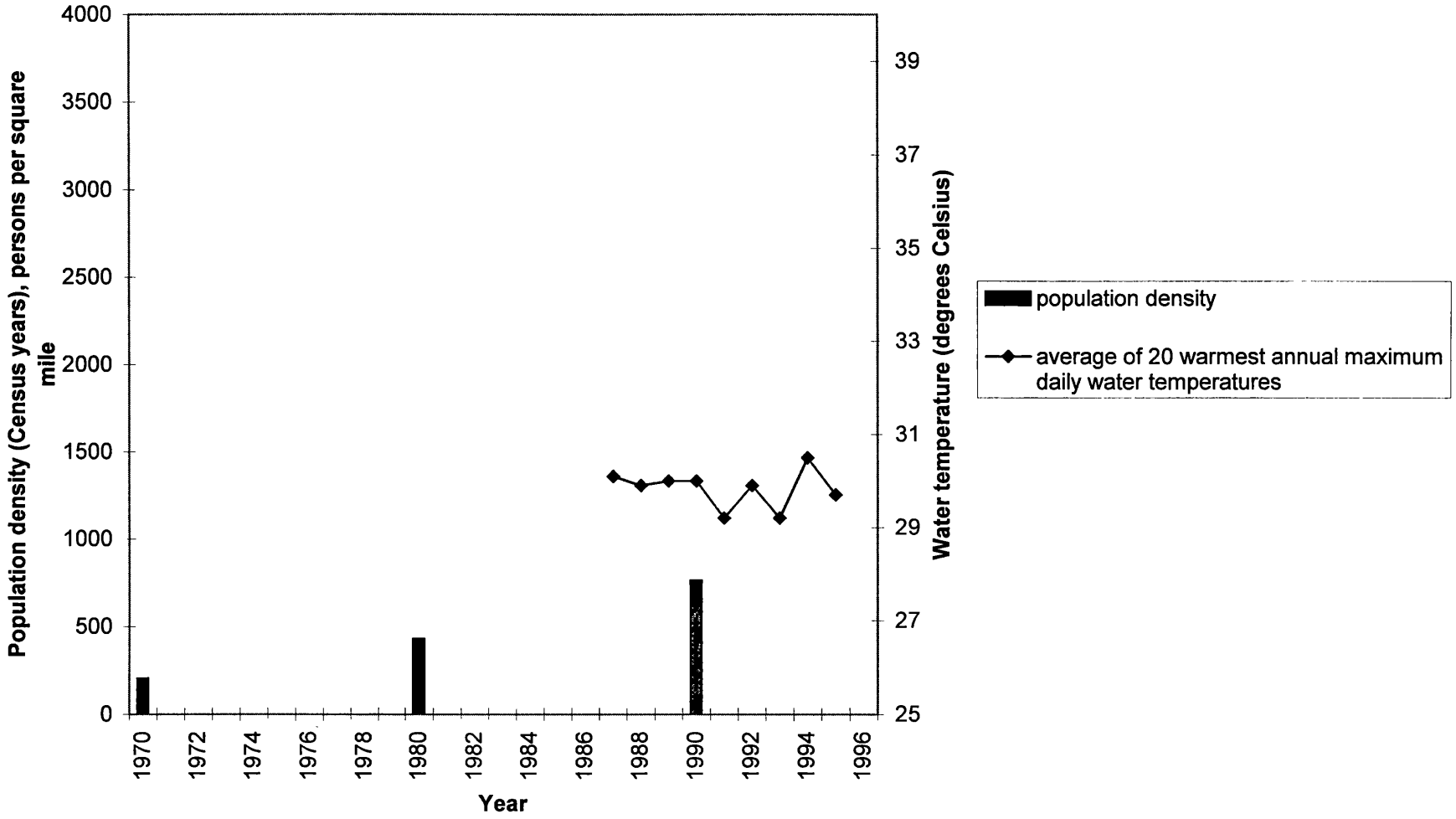

Figure A-20. Population density vs. average of twenty warmest annual daily maximum water temperatures: Medio Creek at Pearsall Road at San Antonio, TX - 1970-1996

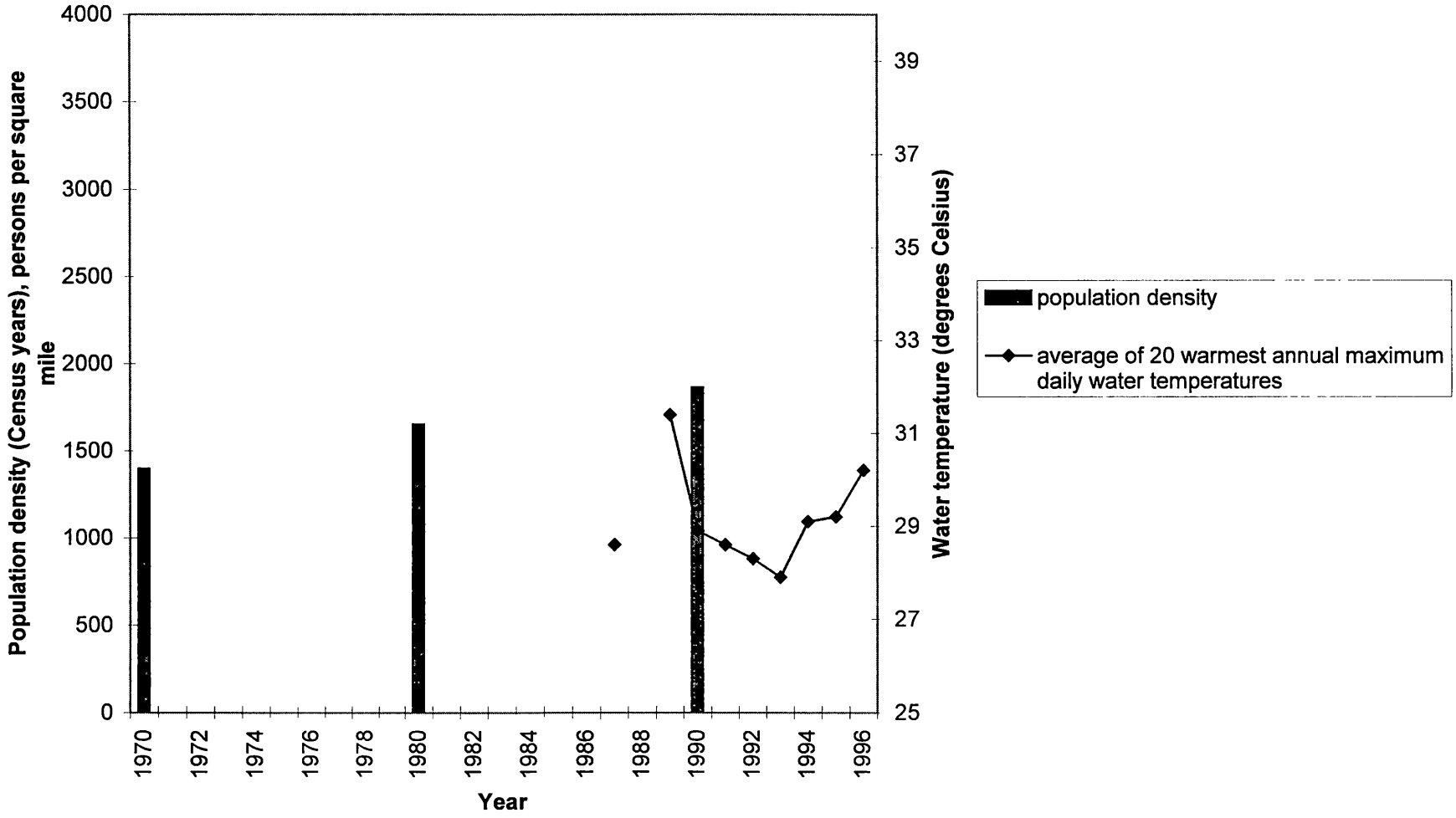

Figure A-21. Population density vs. average of twenty warmest annual daily maximum water temperatures: Leon Creek at IH-35 at San Antonio, TX - 1970-1996

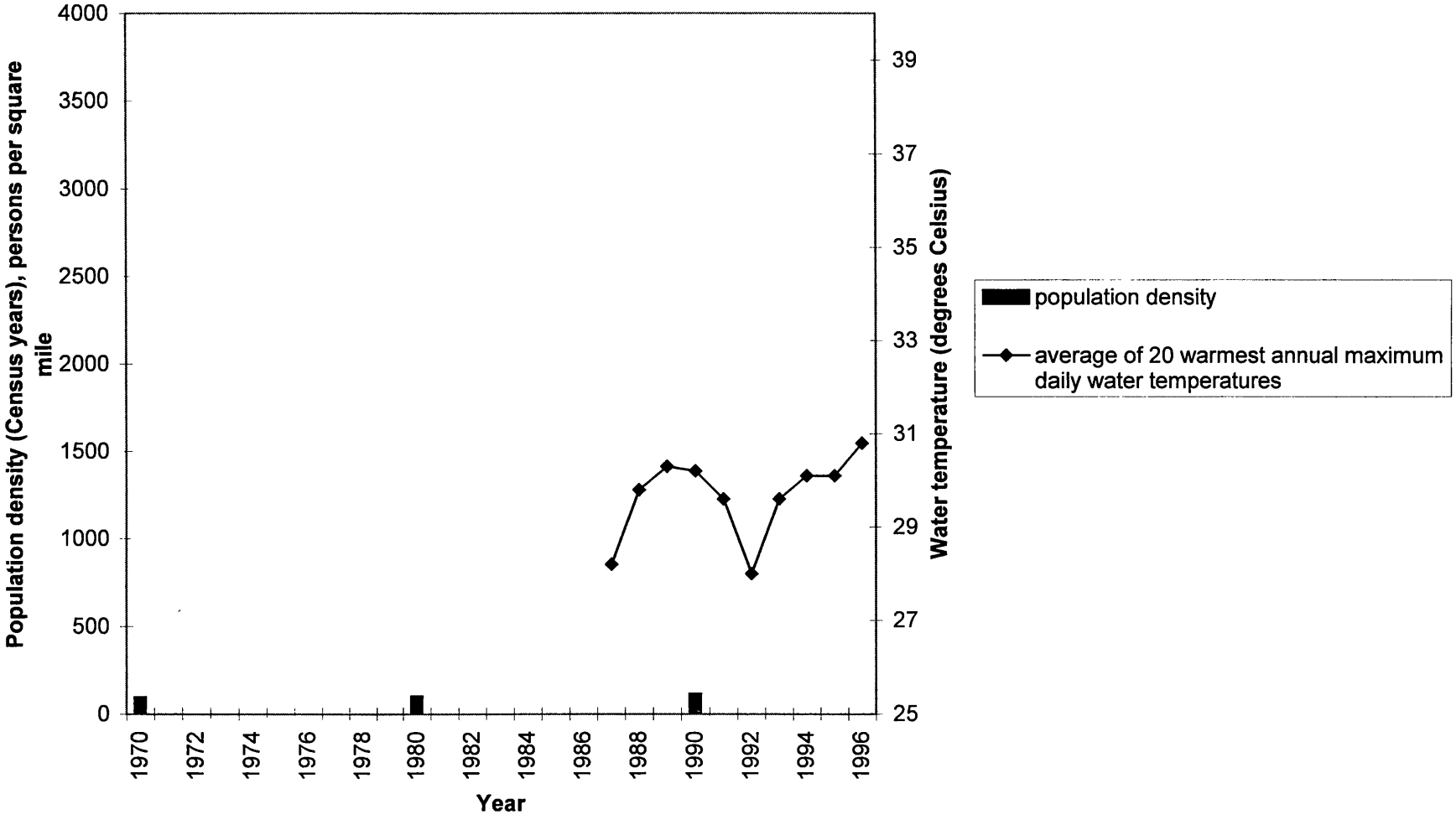

Figure A-22. Population density vs. average of twenty warmest annual daily maximum water temperatures: Medina River at San Antonio, TX - 1970-1996

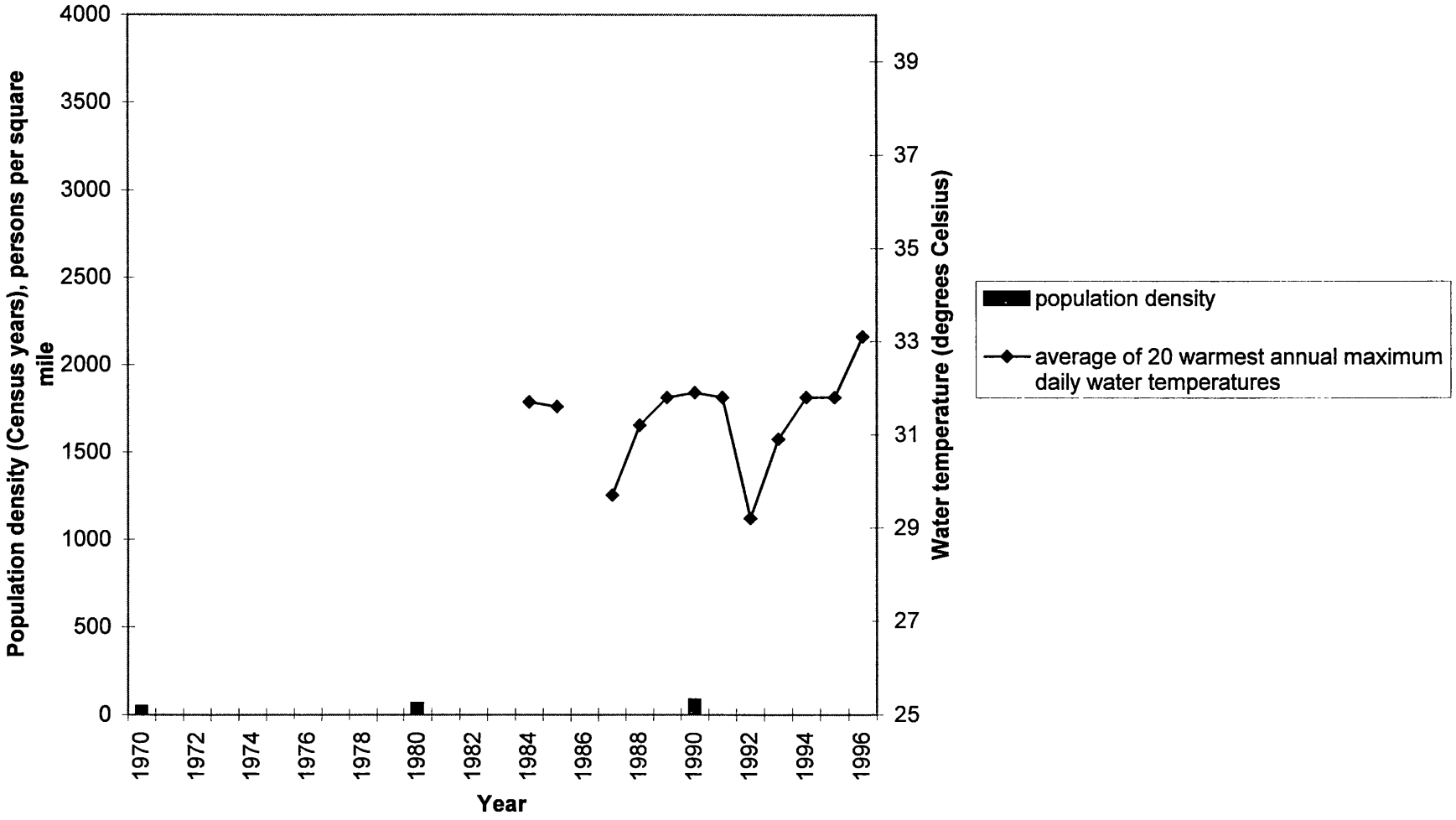

Figure A-23. Population density vs. average of twenty warmest annual daily maximum water temperatures: San Antonio River near Elmendorf, TX - 1970-1996

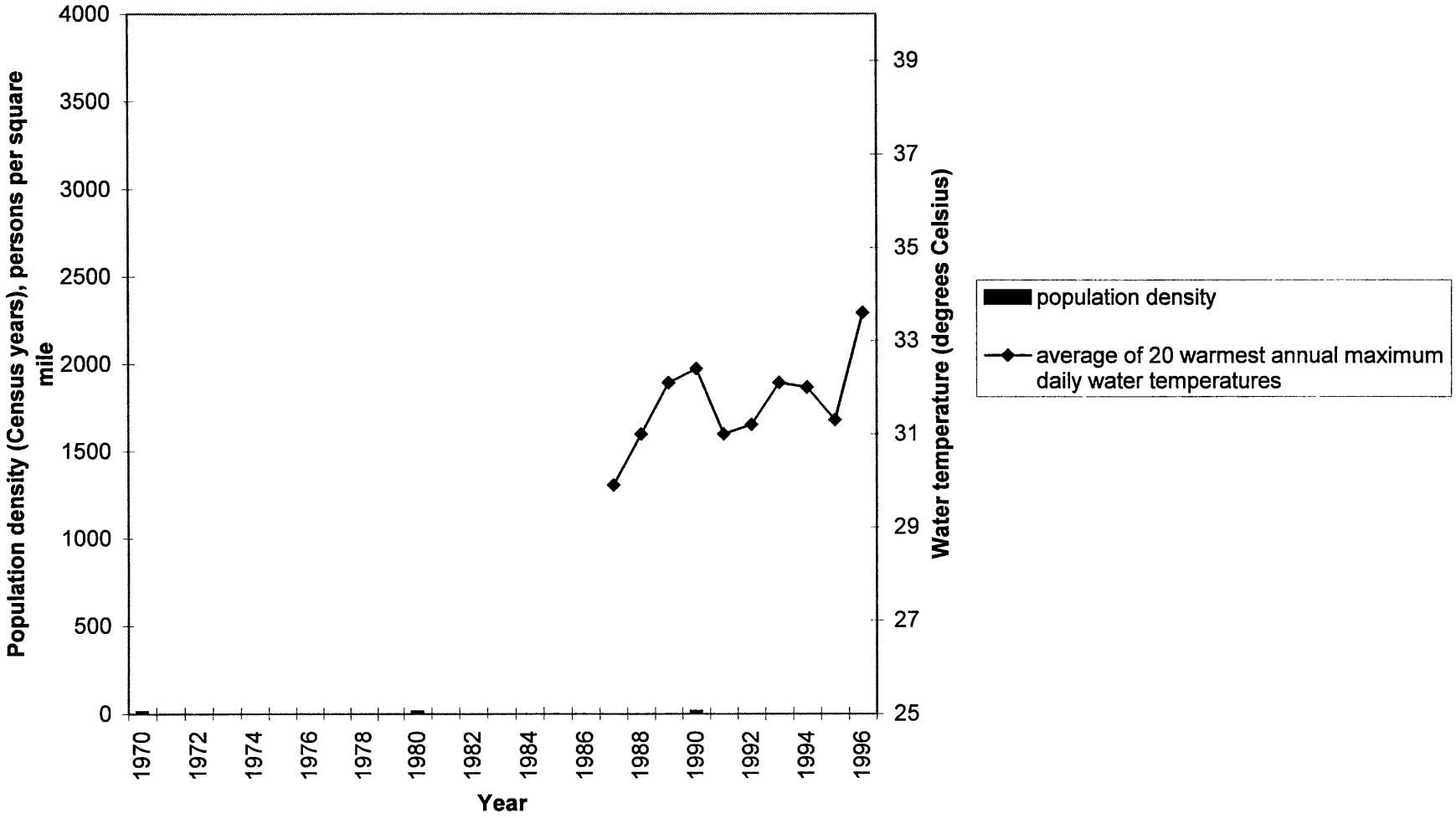

Figure A-24. Population density vs. average of twenty warmest annual daily maximum water temperatures: San Antonio River near Falls City, TX - 1970-1996

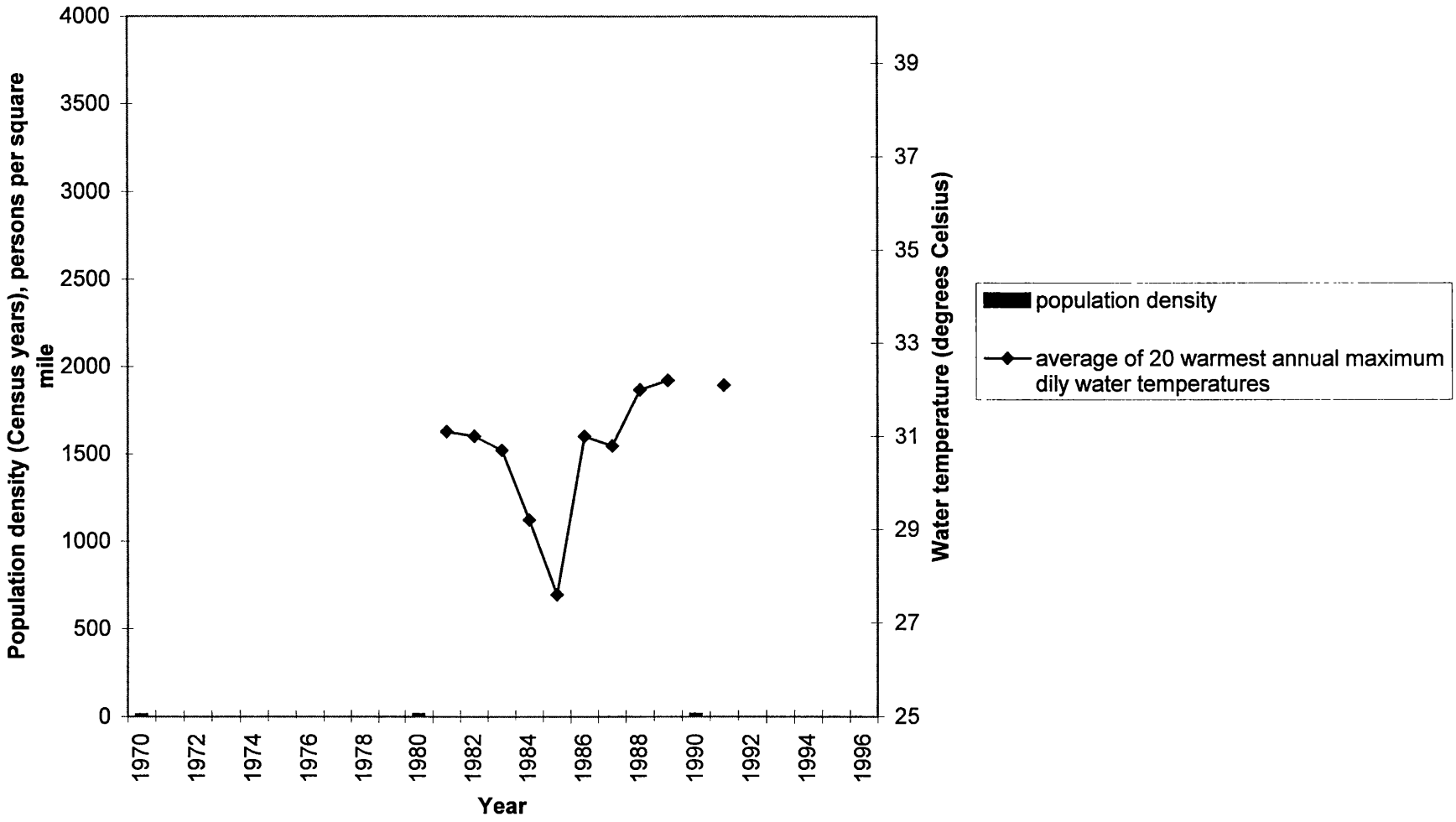

Figure A-25. Population density vs. average of twenty warmest annual daily maximum water temperatures: Cibolo Creek near Falls City, TX - 1970-1996

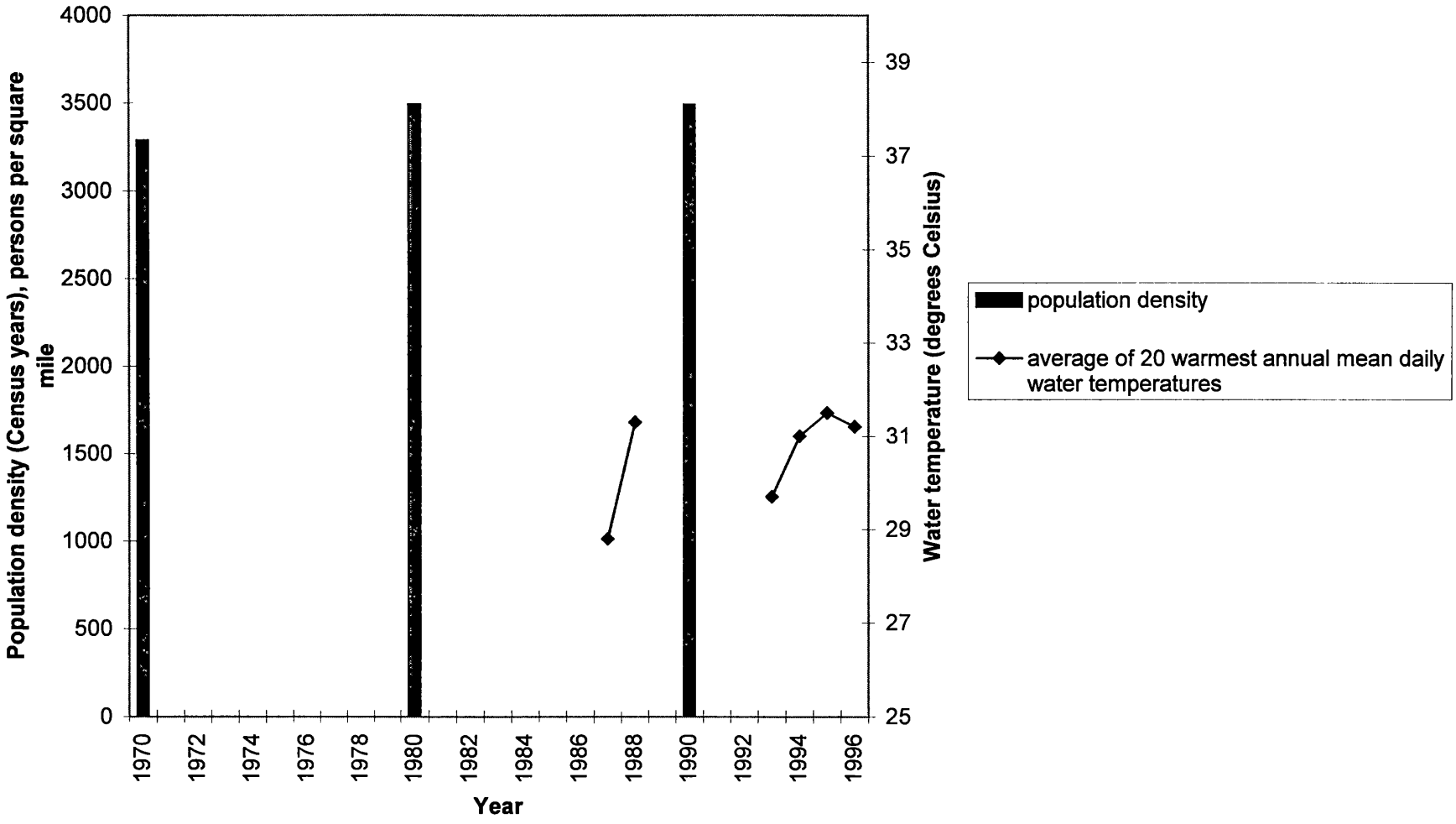

Figure A-26. Population density vs. average of twenty warmest annual daily mean water temperatures: San Antonio River at Loop 410 at San Antonio, TX - 1970-1996

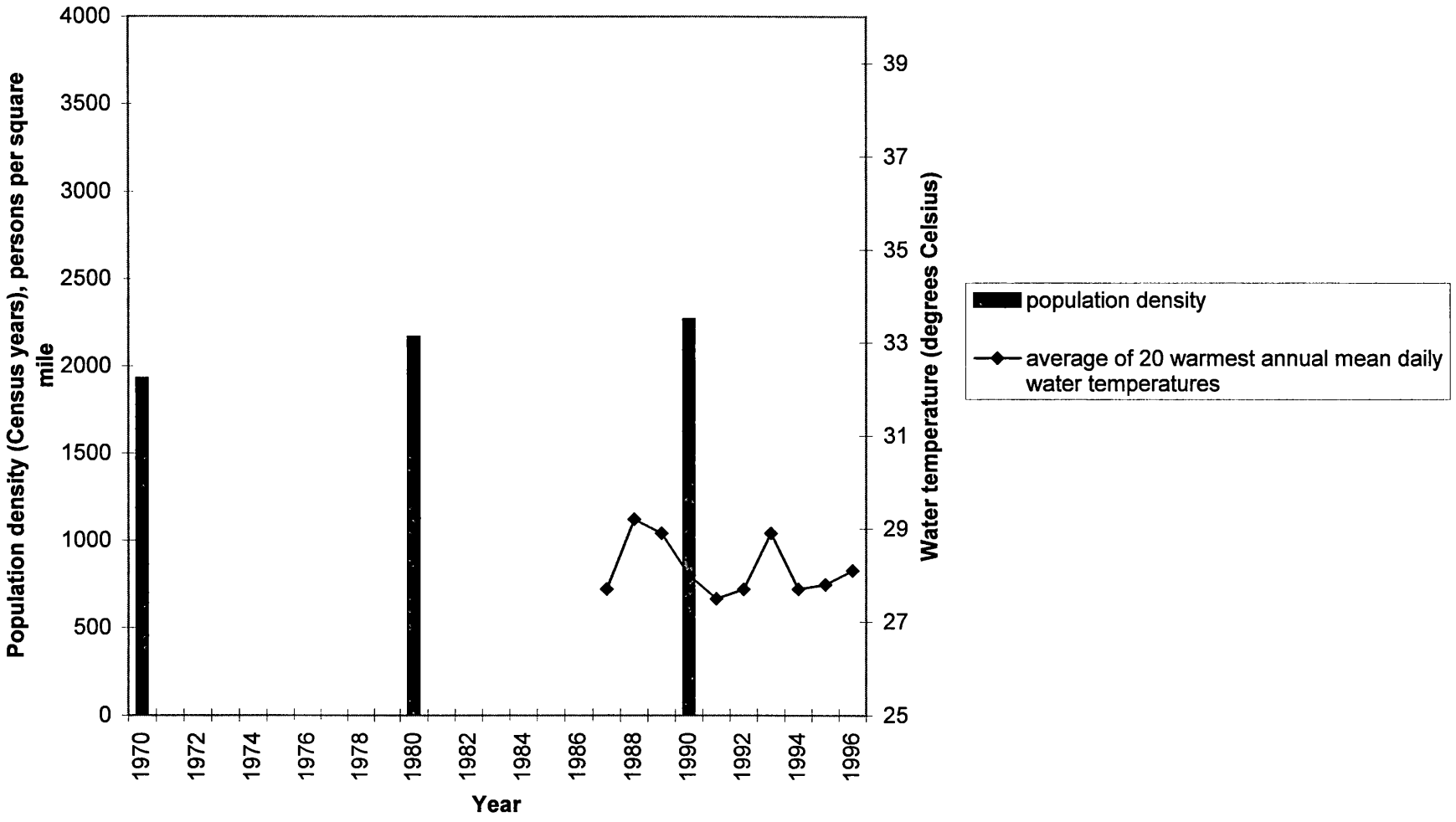

Figure A-27. Population density vs. average of twenty warmest annual daily mean water temperatures: Salado Creek (lower station) at San Antonio, TX - 1970-1996

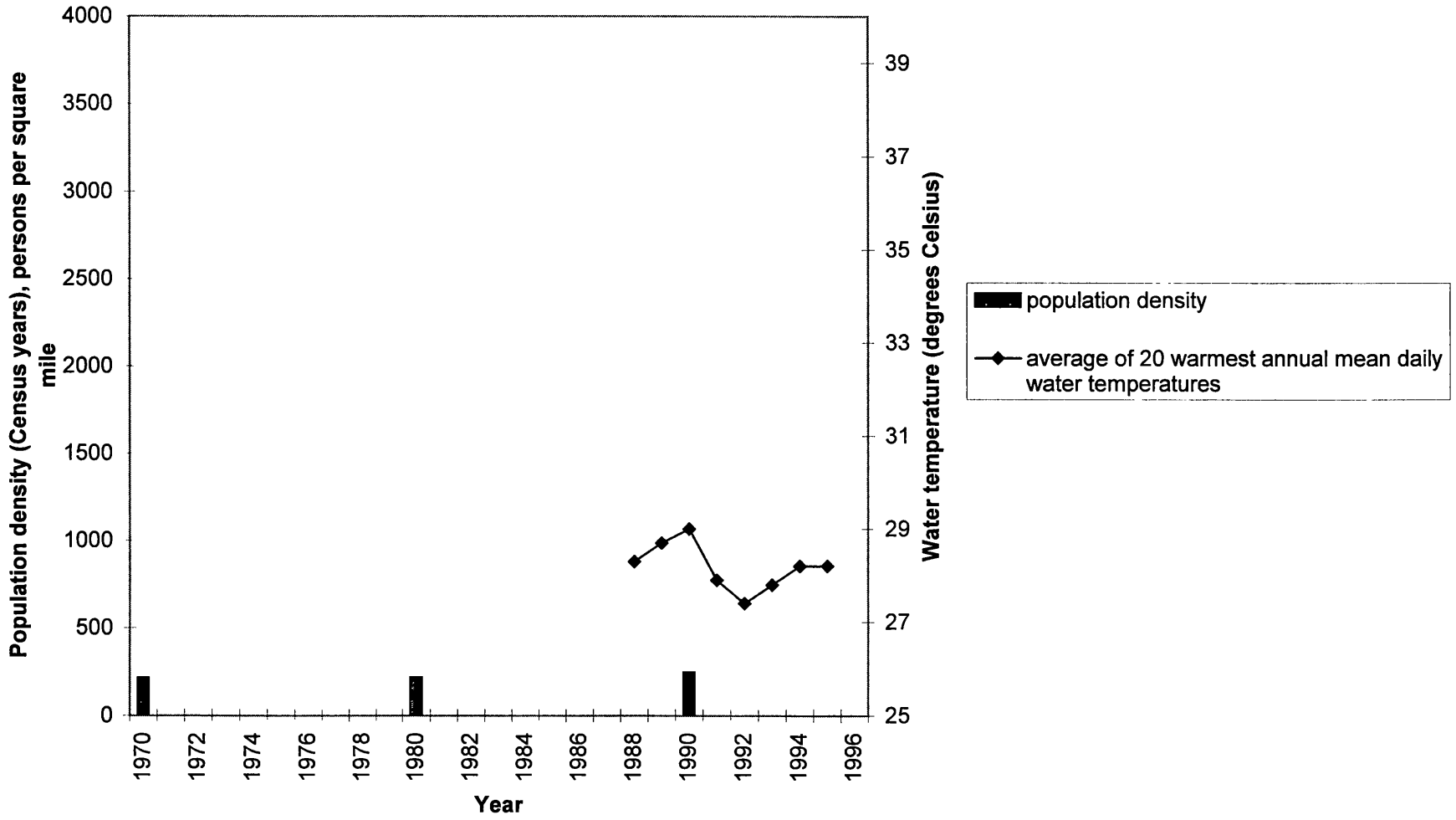

Figure A-28. Population density vs. average of twenty warmest annual daily mean water temperatures: Medina River at La Coste, TX - 1970-1996

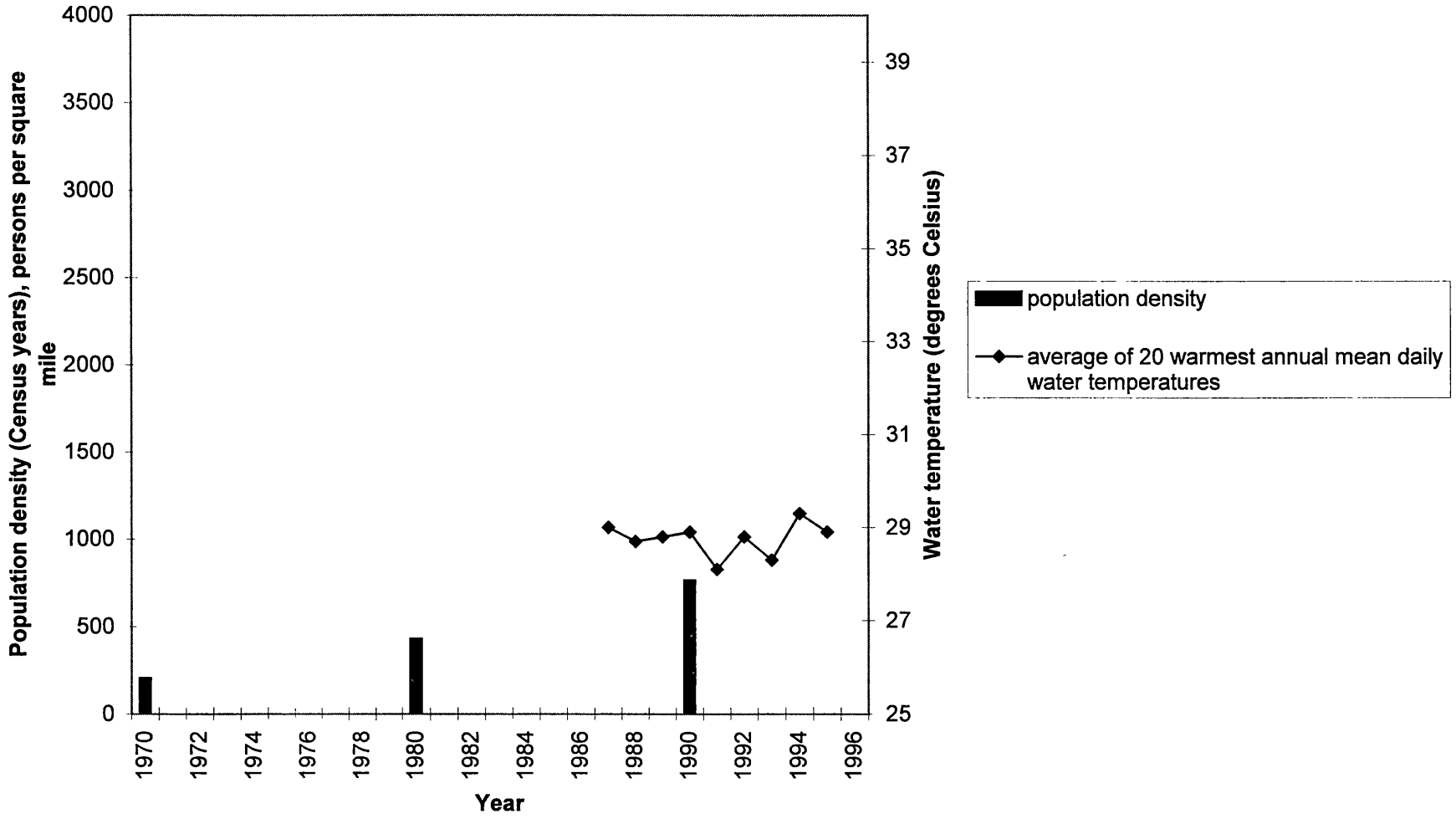

Figure A-29. Population density vs. average of twenty warmest annual daily mean water temperatures: Medio Creek at Pearsall Road at San Antonio, TX - 1970-1996

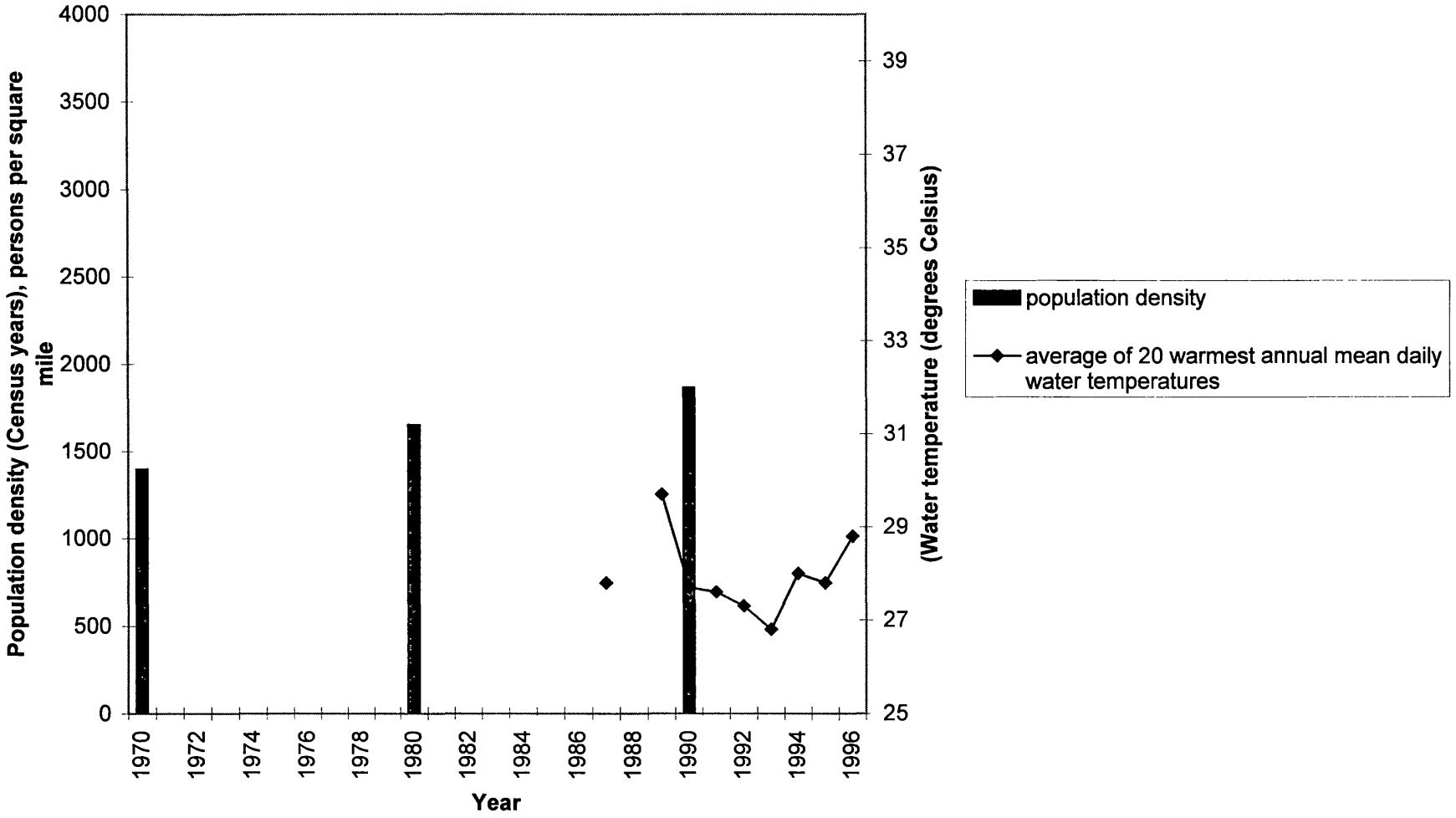

Figure A-30. Population density vs. average of twenty warmest annual daily mean water temperatures: Leon Creek at IH-35 at San Antonio, TX - 1970-1996

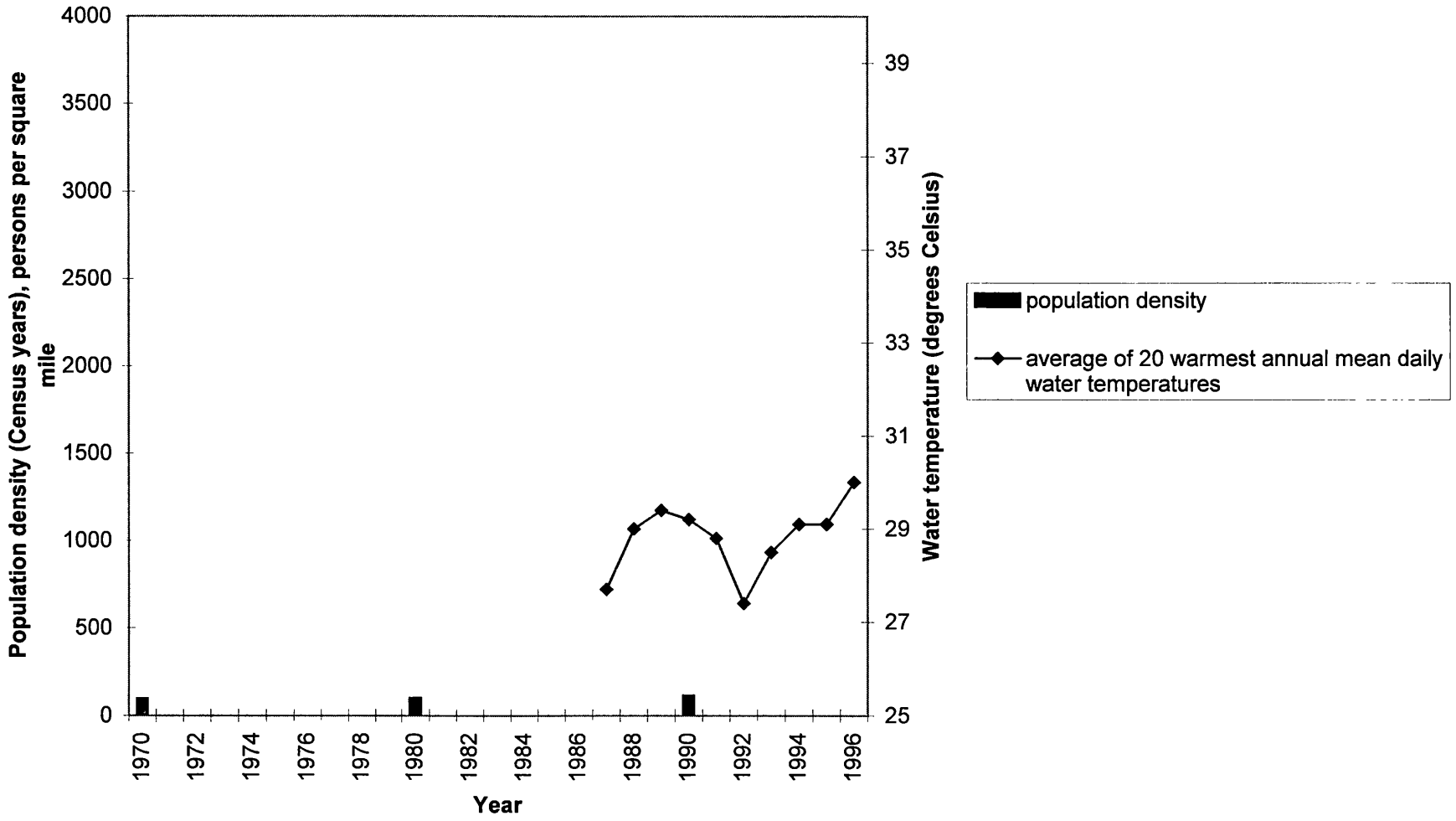

Figure A-31. Population density vs. average of twenty warmest annual daily mean water temperatures: Medina River at San Antonio, TX - 1970 1996

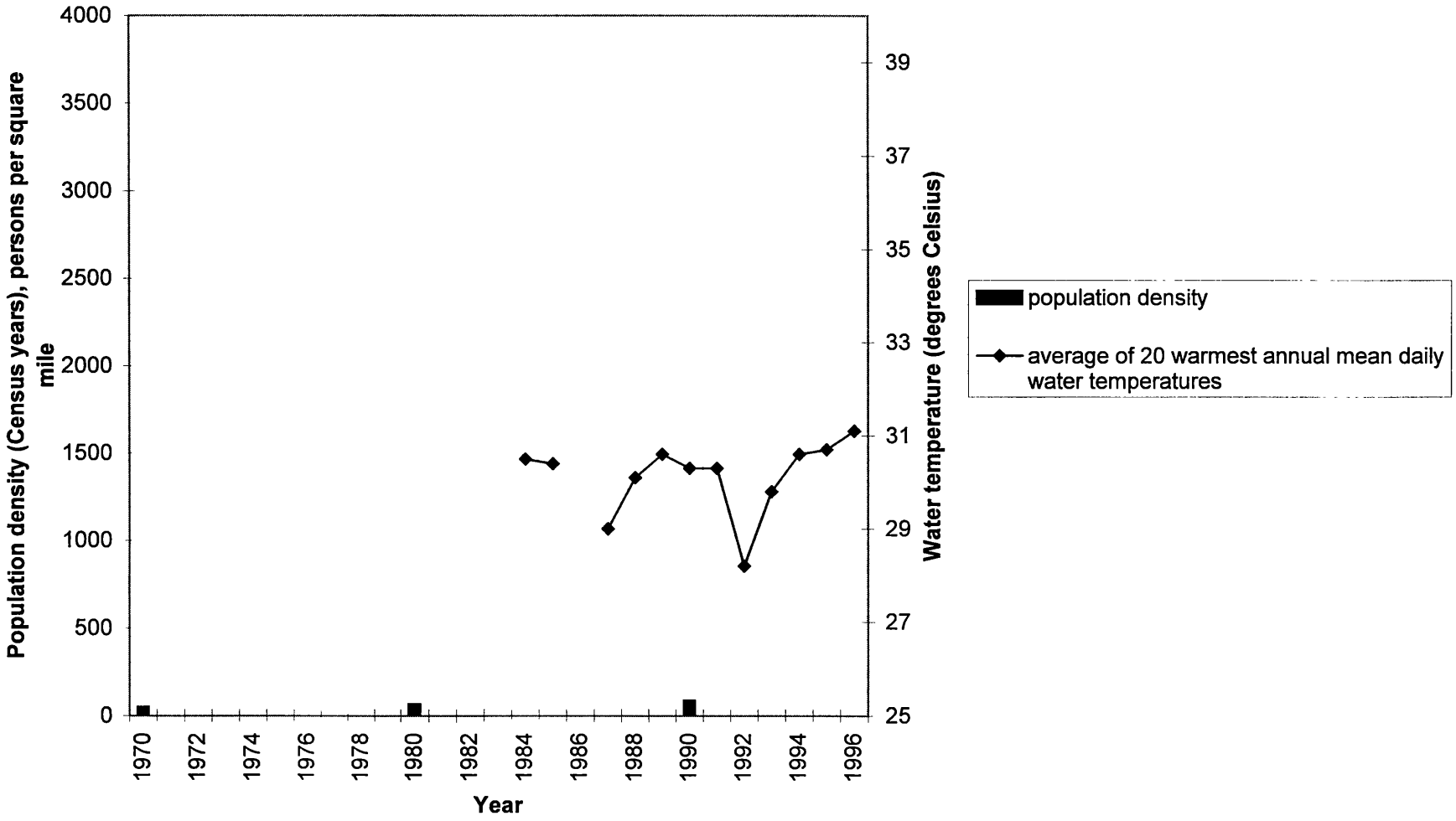

Figure A-32. Population density vs. average of twenty warmest annual daily mean water temperatures: San Antonio River near Elmendorf, TX - 1970-1996

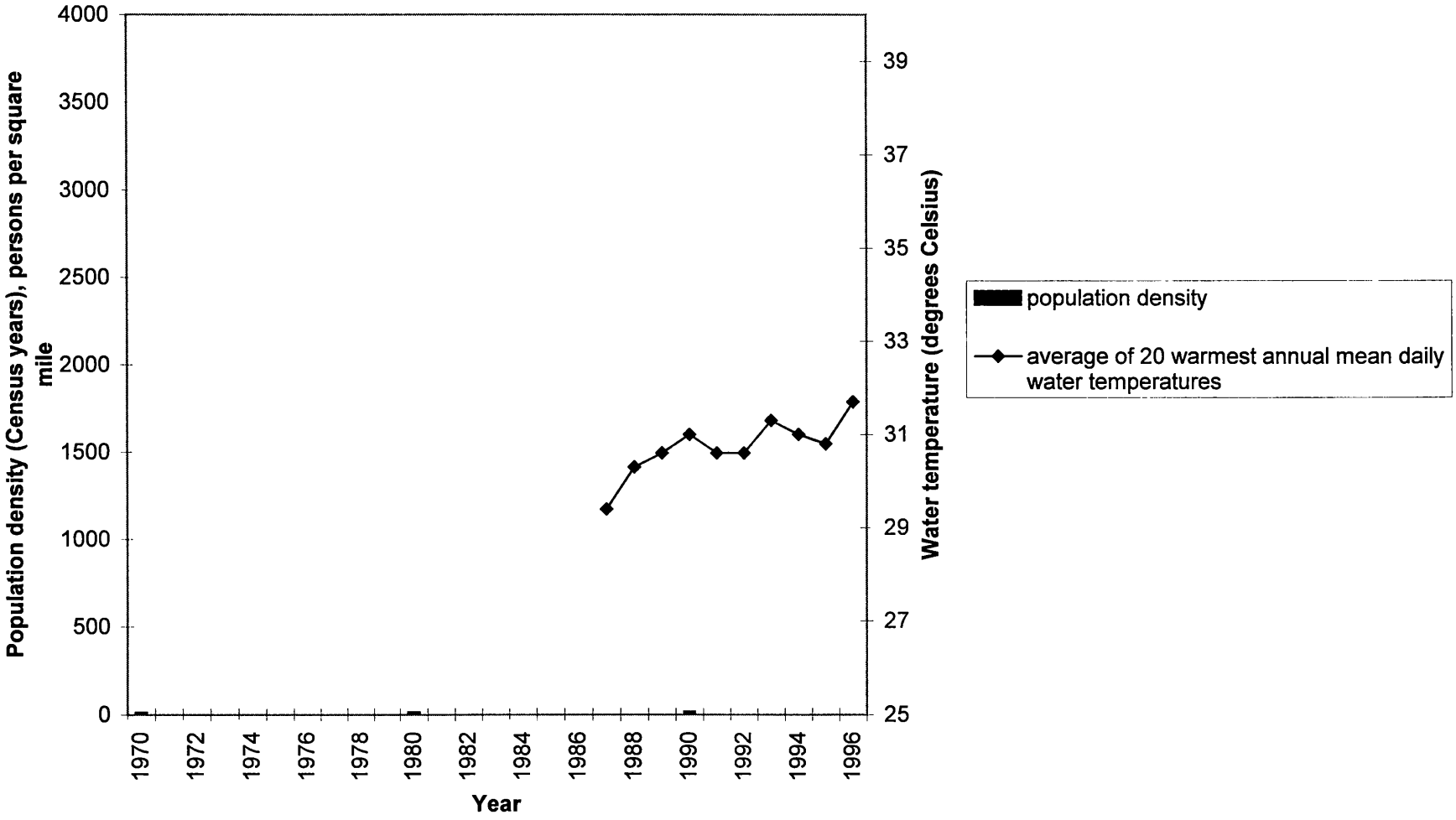

Figure A-33. Population density vs. average of twenty warmest annual daily mean water temperatures: San Antonio River near Falls City, TX - 1970-1996

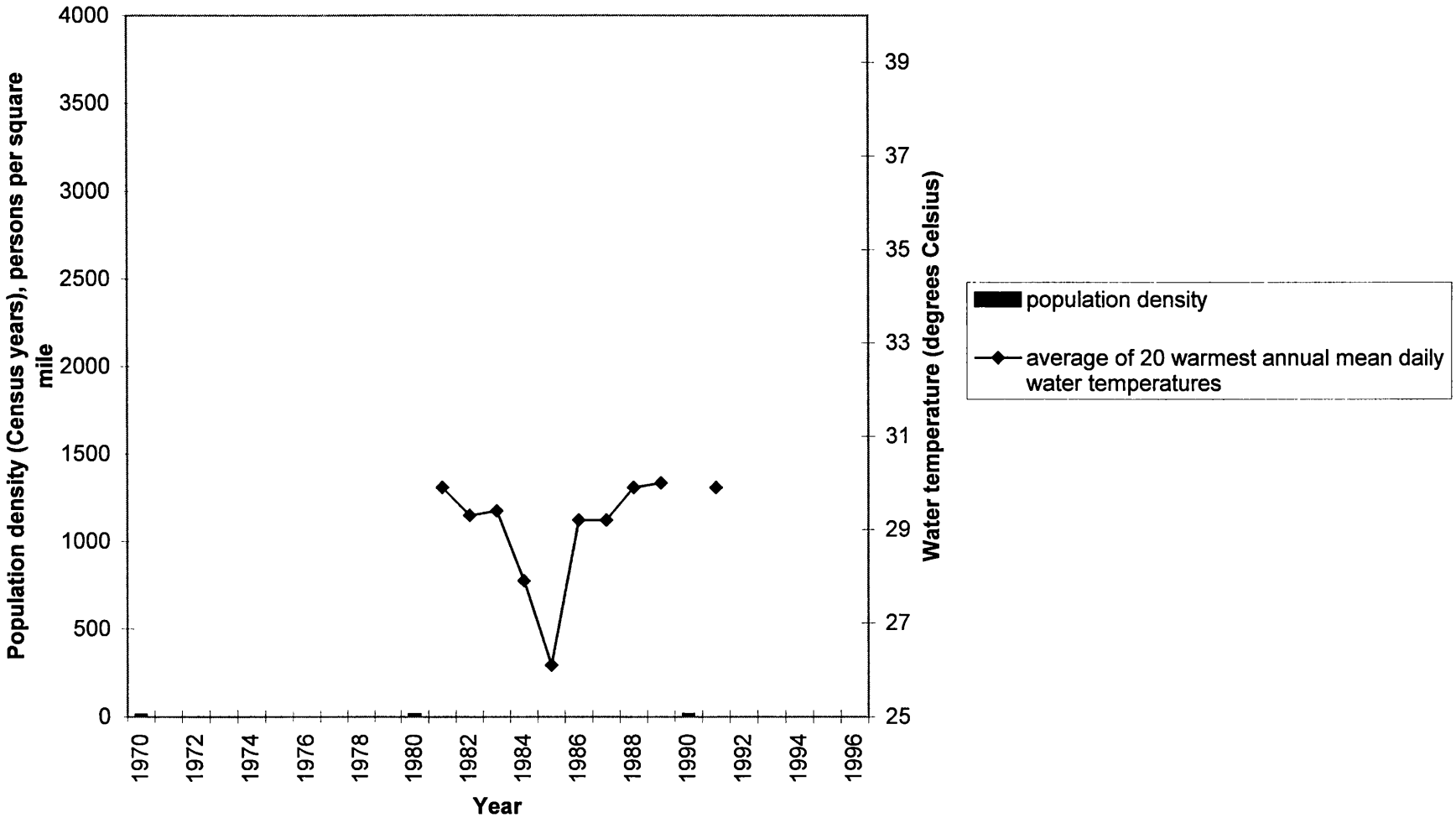

Figure A-34. Population density vs. average of twenty warmest annual daily mean water temperatures: Cibolo Creek near Falls City, TX - 1970-1996

APPENDIX B

Graphs

Maximum Water Temperatures in Exceedence of Critical Temperatures for *Micropterus salmoides*

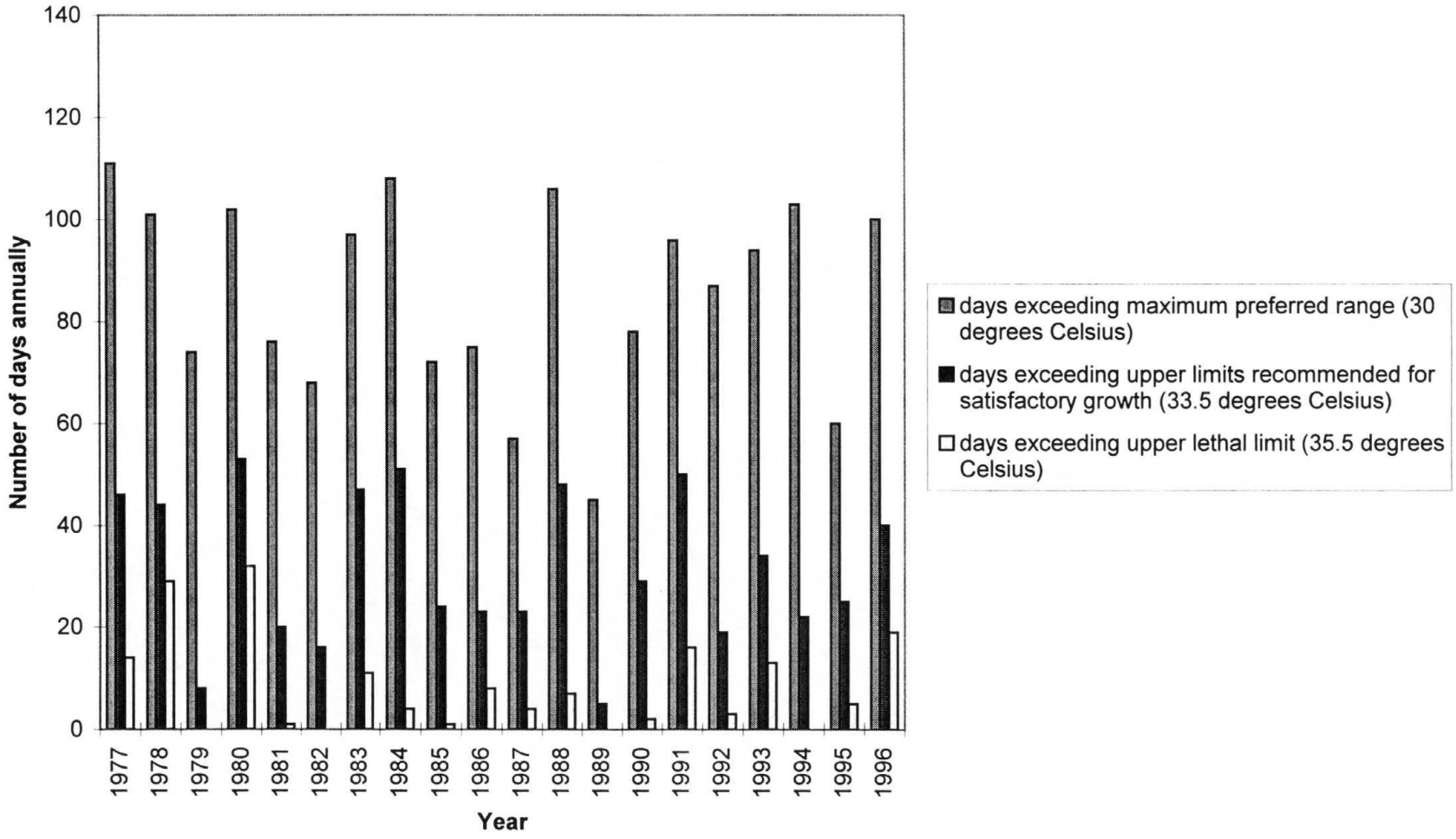

Figure B-1. Number of days per year with daily maximum water temperatures at or exceeding critical temperatures for largemouth bass (Micropterus salmoides): West Fork Trinity River at Beach Street at Fort Worth, TX - 1977-1996

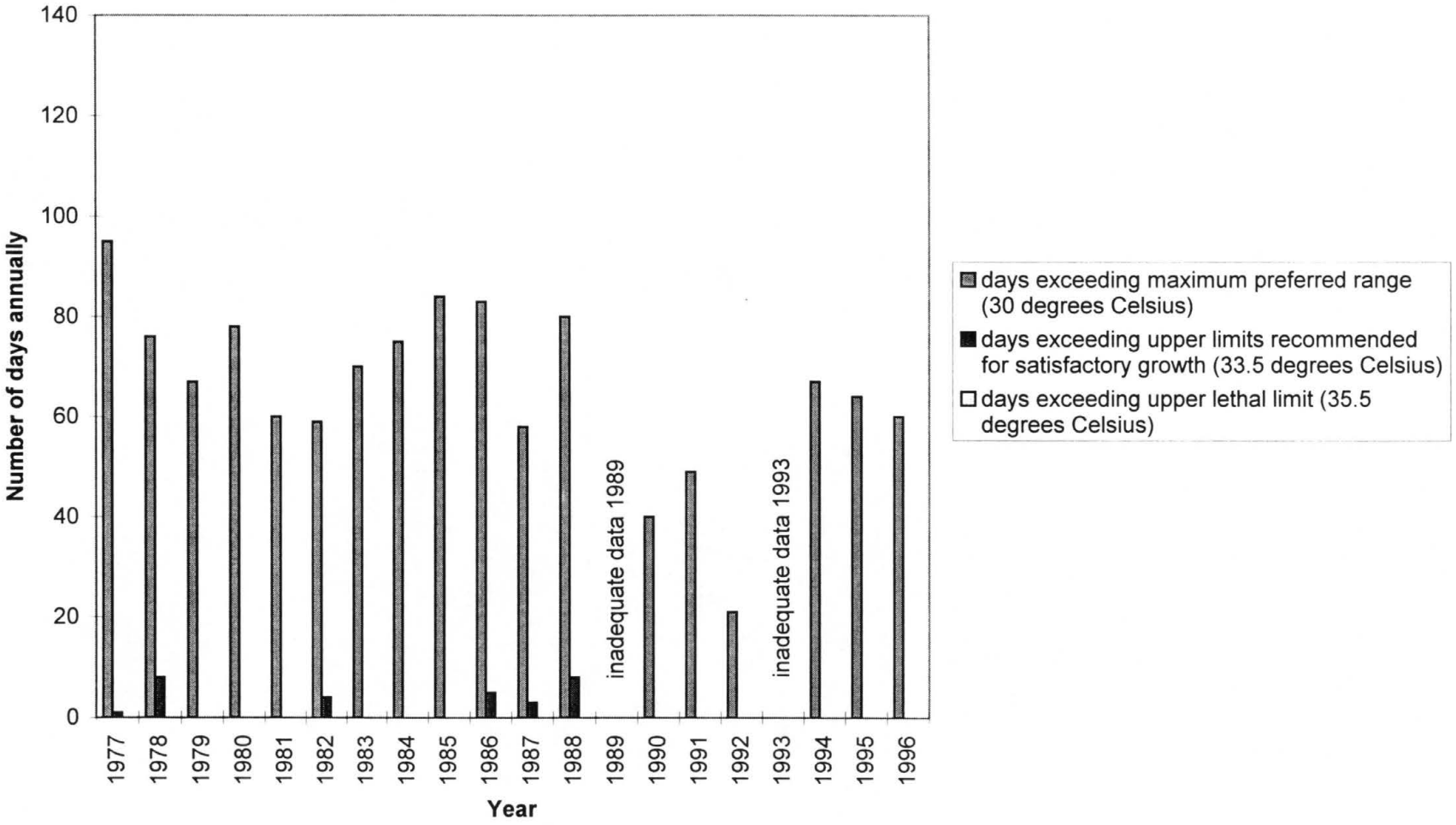

Figure B-2. Number of days per year with daily maximum water temperatures at or exceeding critical temperatures for largemouth bass (Micropterus salmoides): West Fork Trinity River at Grand Prairie, TX - 1977-1996

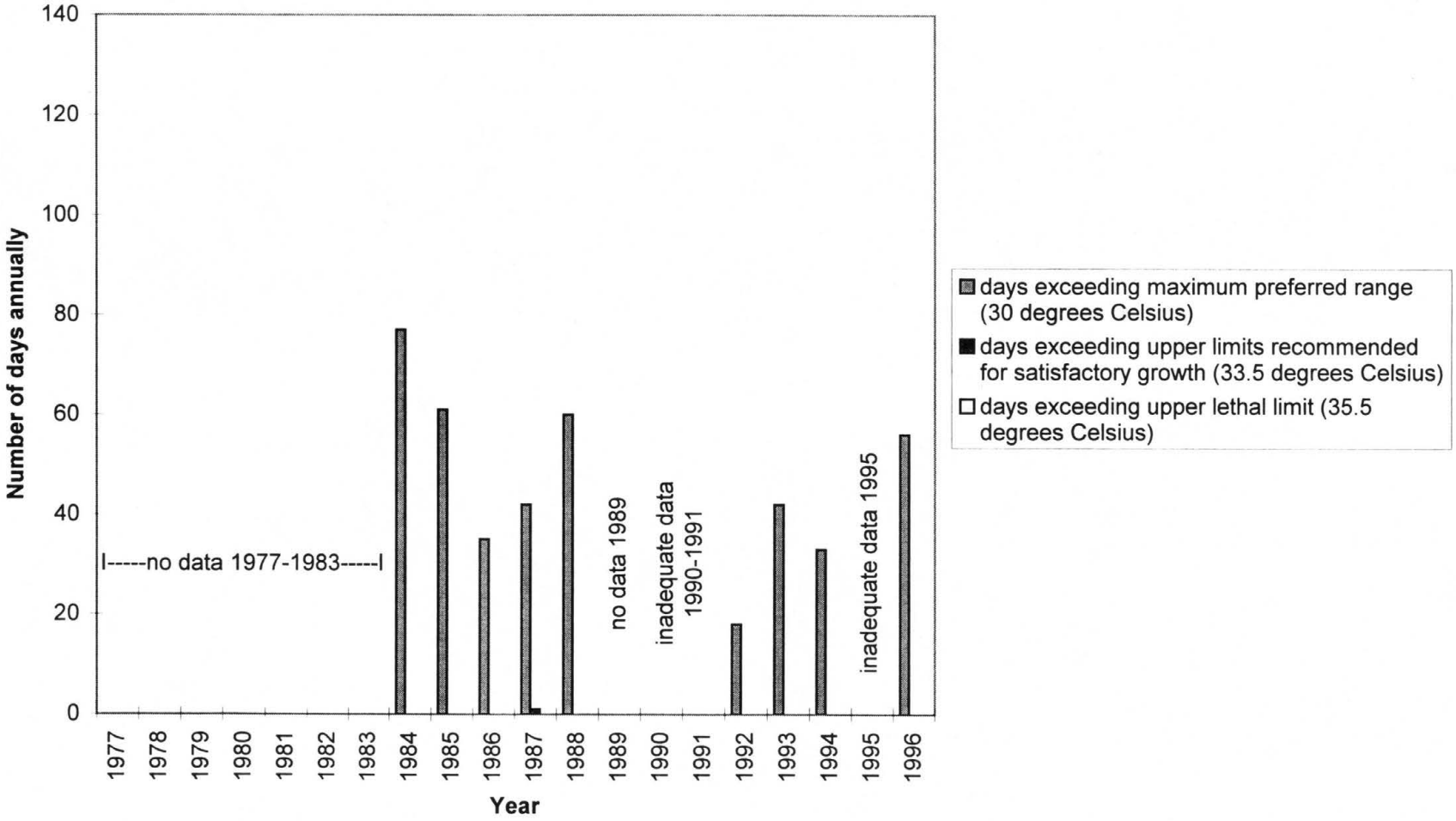

Figure B-3. Number of days per year with daily maximum water temperatures at or exceeding critical temperatures for largemouth bass (Micropterus salmoides): Trinity River at Cedar Crest Blvd. at Dallas, TX - 1977-1996

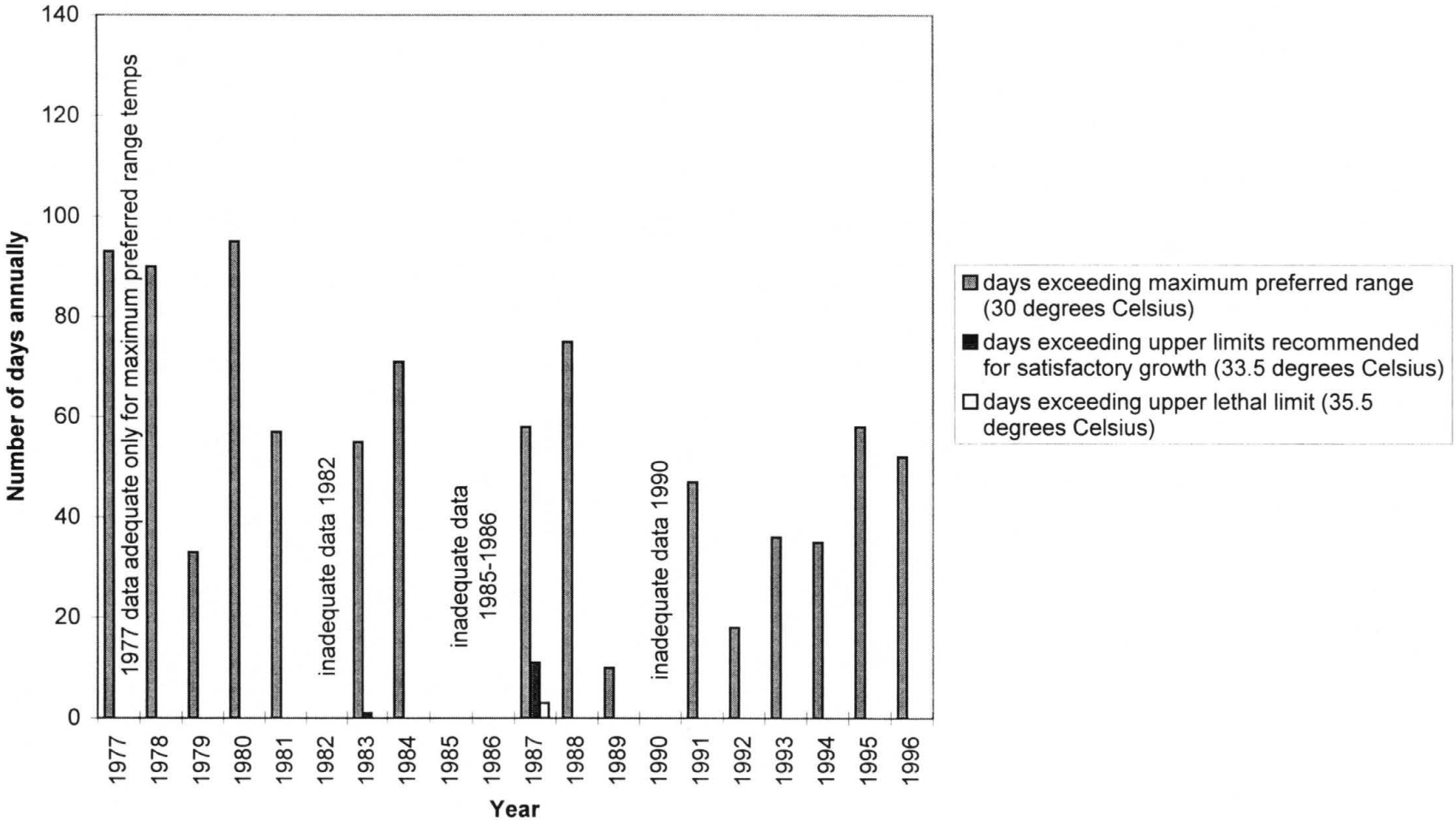

Figure B-4. Number of days per year with daily maximum water temperatures at or exceeding critical temperatures for largemouth bass (Micropterus salmoides): Trinity River below Dallas, TX - 1977-1996

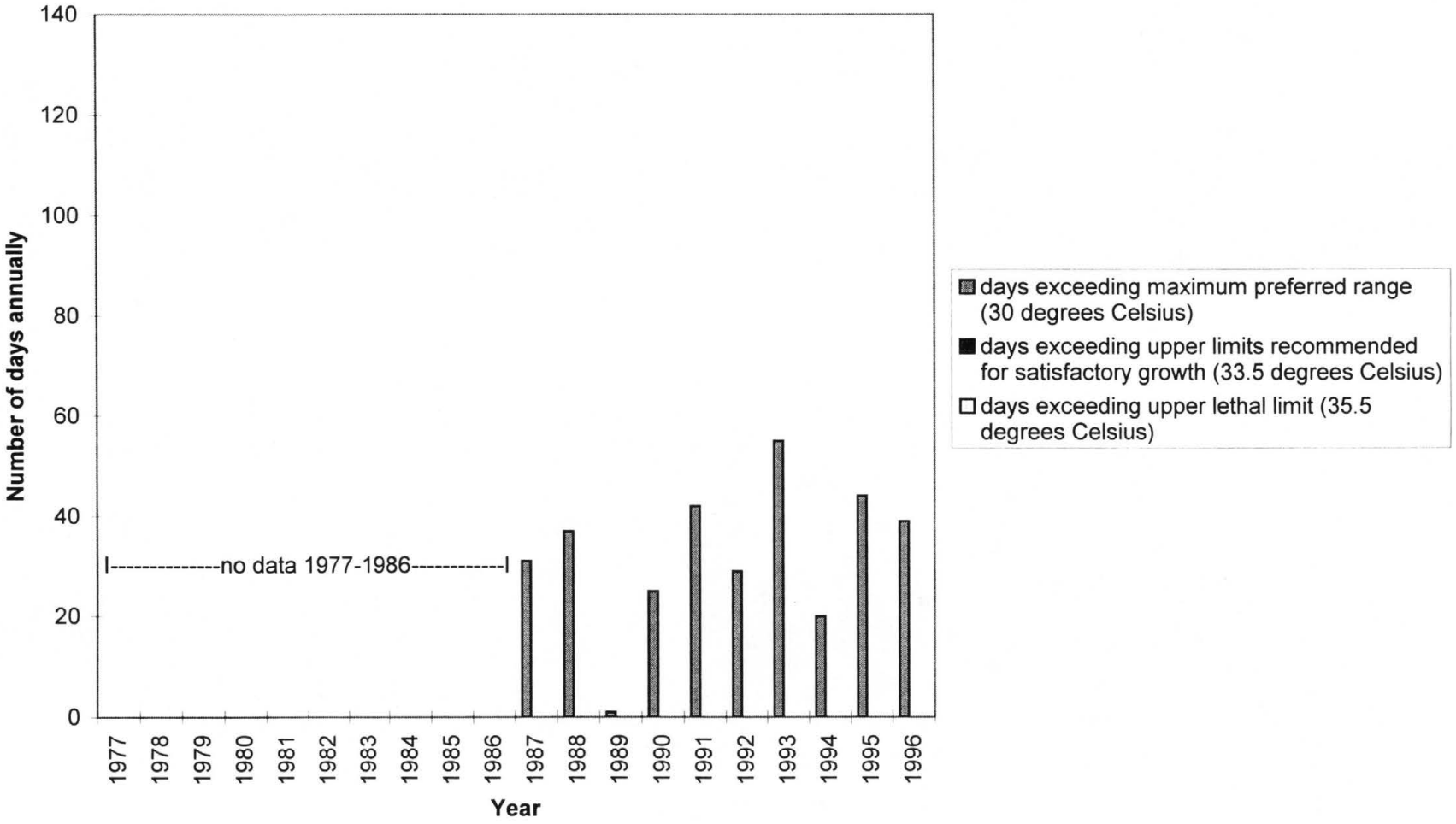

Figure B-5. Number of days per year with daily maximum water temperatures at or exceeding critical temperatures for largemouth bass (Micropterus salmoides): East Fork Trinity River at Seagoville, TX - 1977-1996

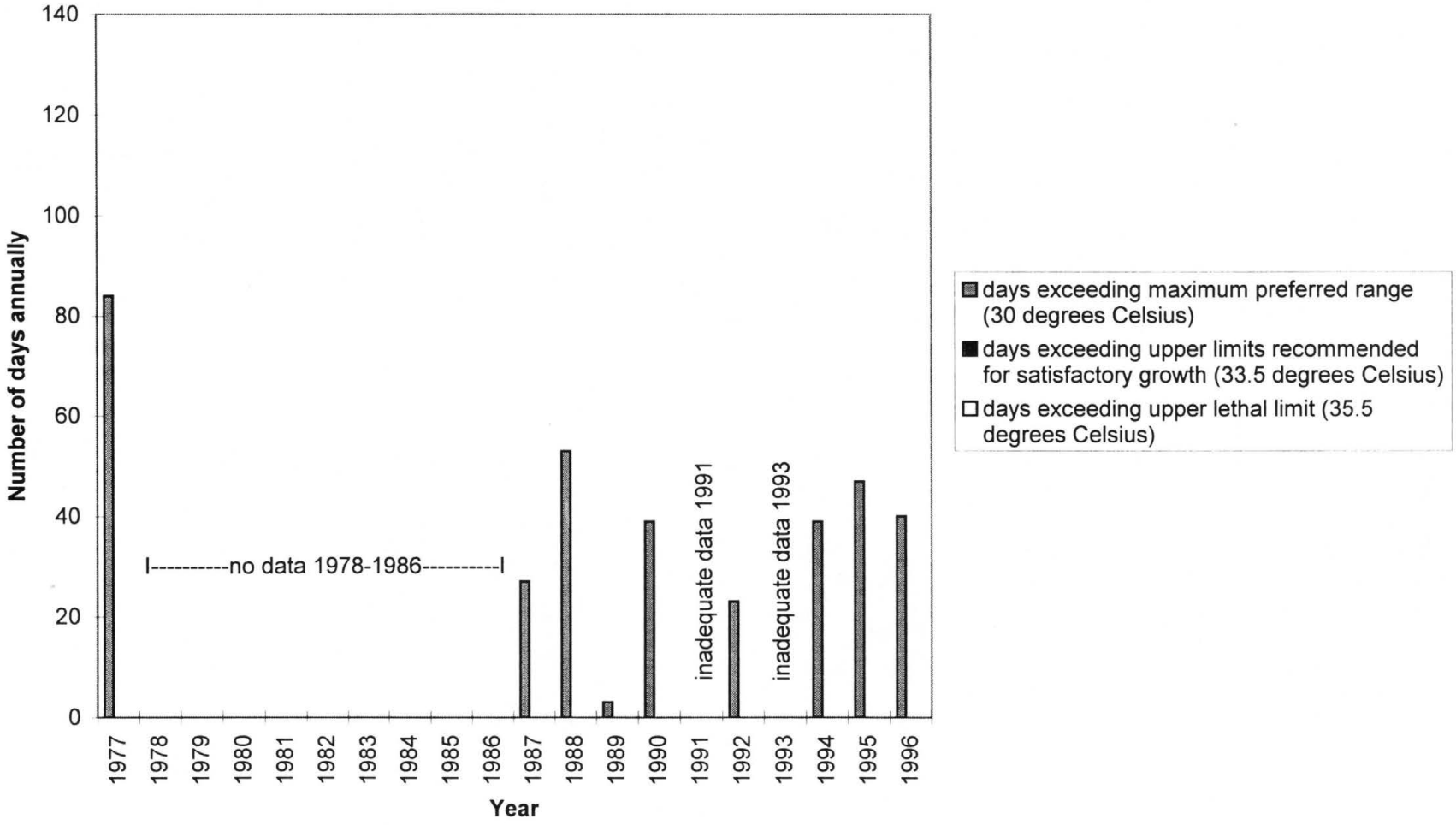

Figure B-6. Number of days per year with daily maximum water temperatures at or exceeding critical temperatures for largemouth bass (Micropterus salmoides): East Fork Trinity River near Crandall, TX - 1977-1996

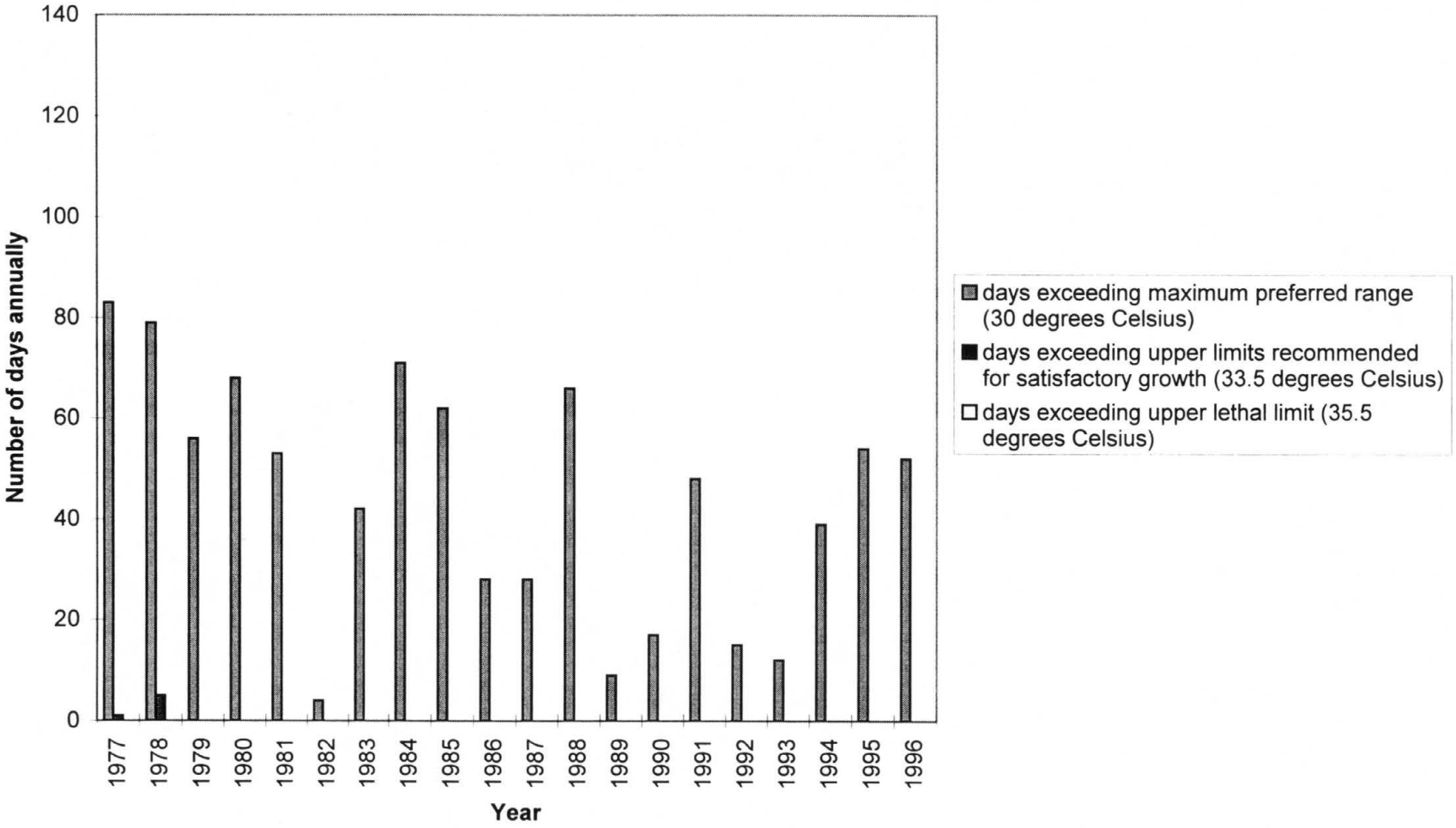

Figure B-7. Number of days per year with daily maximum water temperatures at or exceeding critical temperatures for largemouth bass (Micropterus salmoides): Trinity River near Rosser, TX - 1977-1996

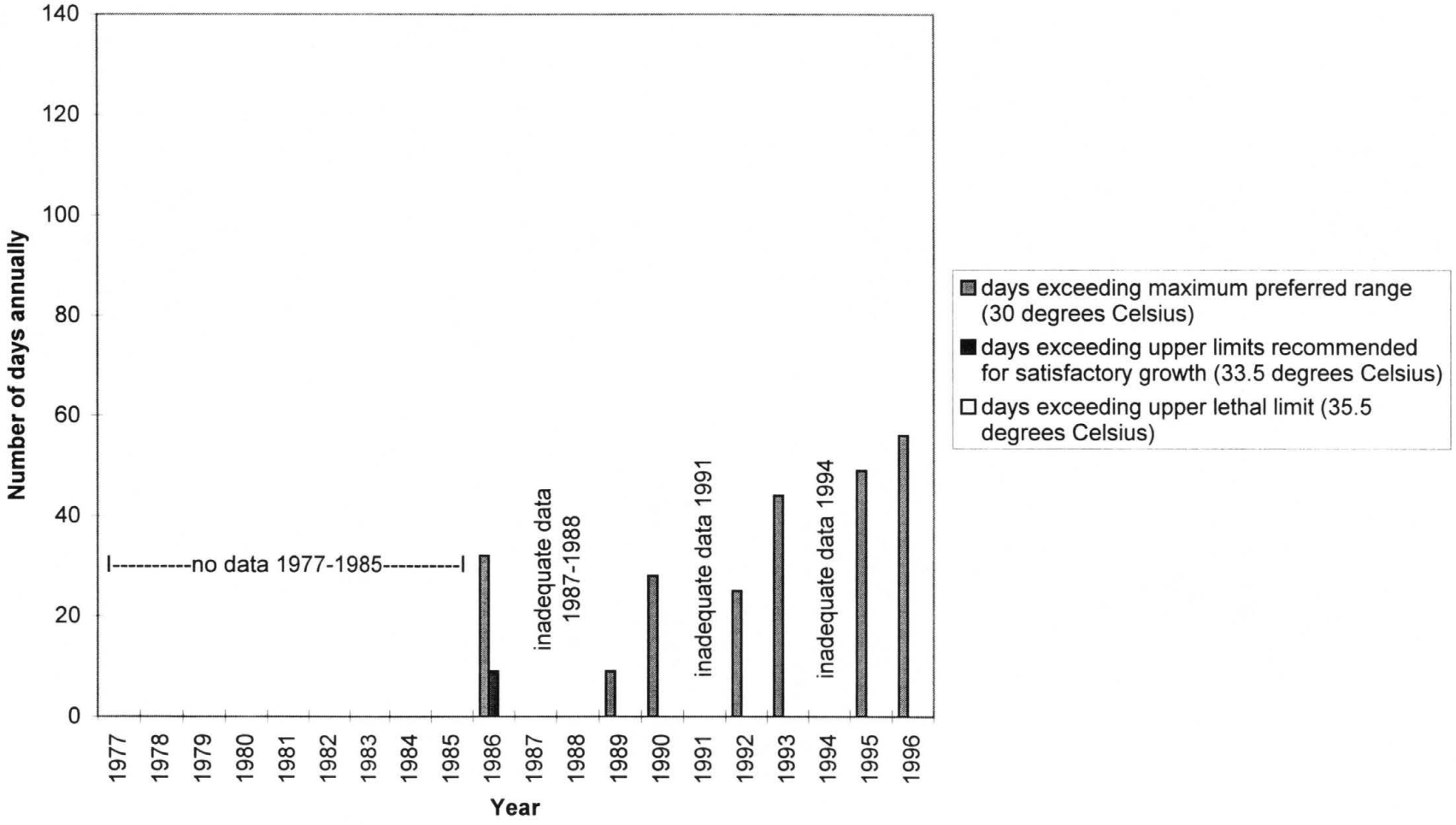

Figure B-8. Number of days per year with daily maximum water temperatures at or exceeding critical temperatures for largemouth bass (Micropterus salmoides): Trinity River at Trinidad, TX - 1977-1996

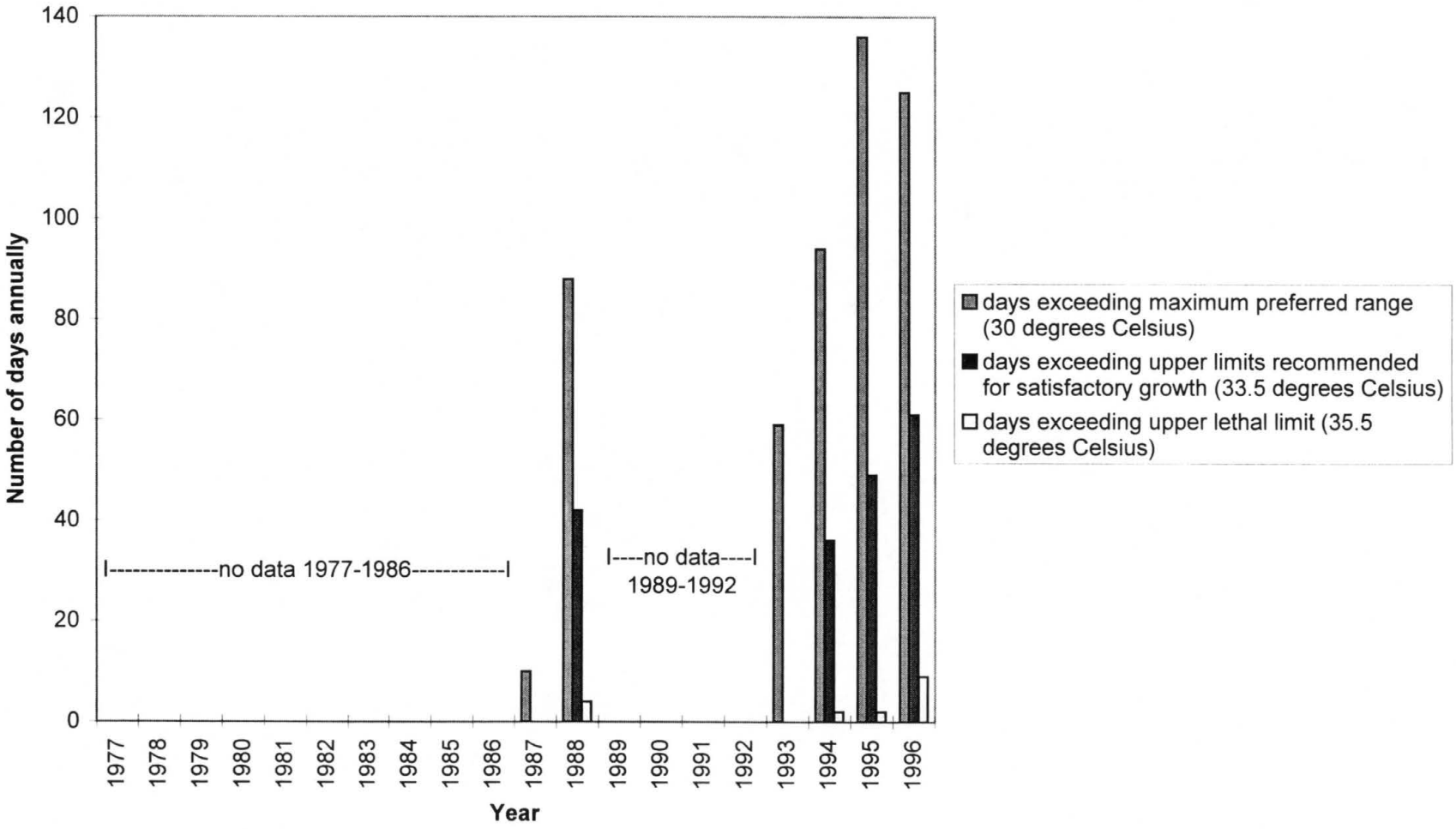

Figure B-9. Number of days per year with daily maximum water temperatures at or exceeding critical temperatures for largemouth bass (Micropterus salmoides): San Antonio River at Loop 410 at San Antonio, TX - 1977-1996

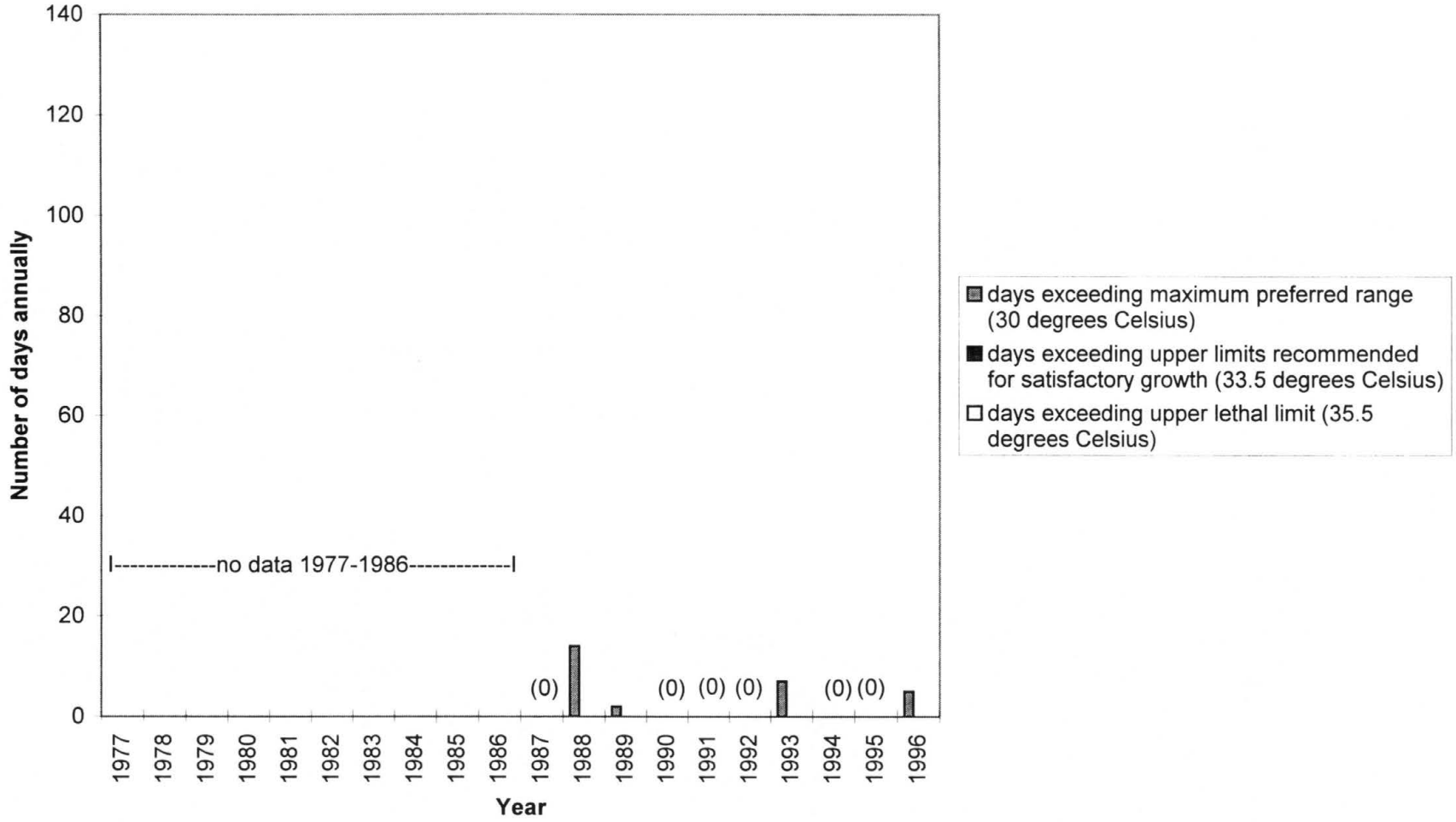

Figure B-10. Number of days per year with daily maximum water temperatures at or exceeding critical temperatures for largemouth bass (Micropterus salmoides): Salado Creek (lower station) at San Antonio, TX - 1977-1996

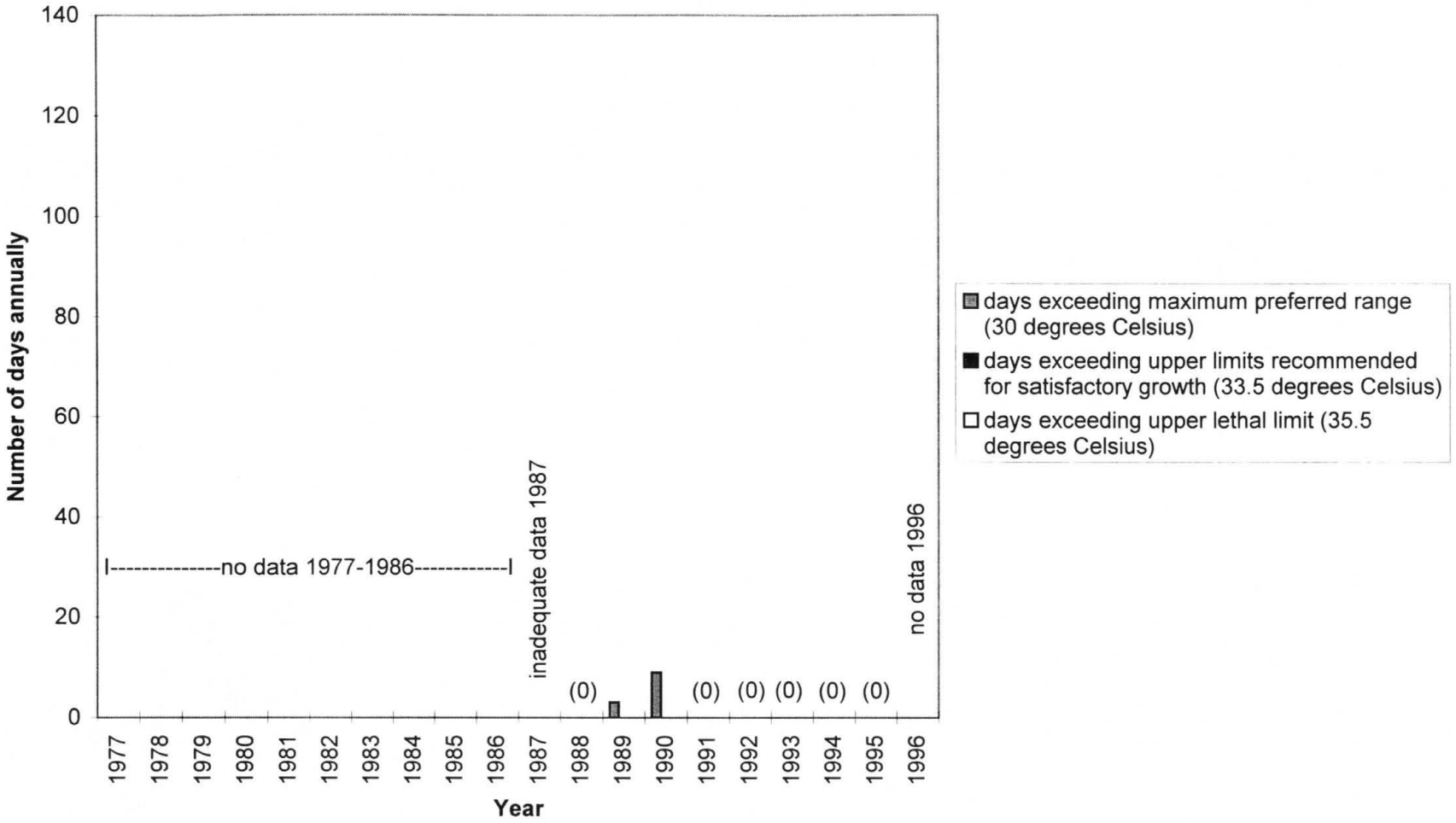

Figure B-11. Number of days per year with daily maximum water temperatures at or exceeding critical temperatures for largemouth bass (Micropterus salmoides): Medina River at La Coste, TX - 1977-1996

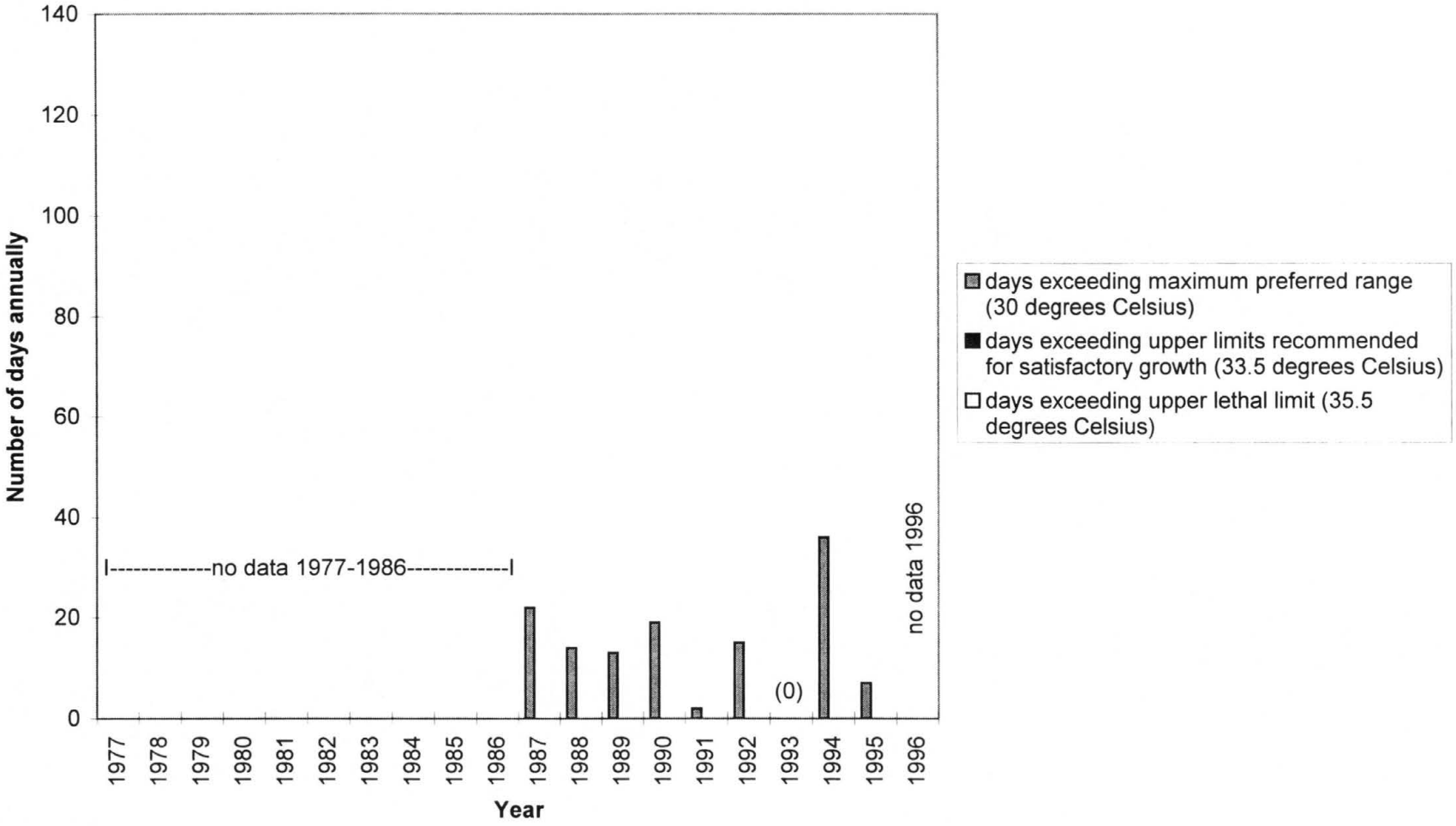

Figure B-12. Number of days per year with daily maximum water temperatures at or exceeding critical temperatures for largemouth bass (Micropterus salmoides): Medio Creek at Pearsall Road at San Antonio, TX - 1977-1996

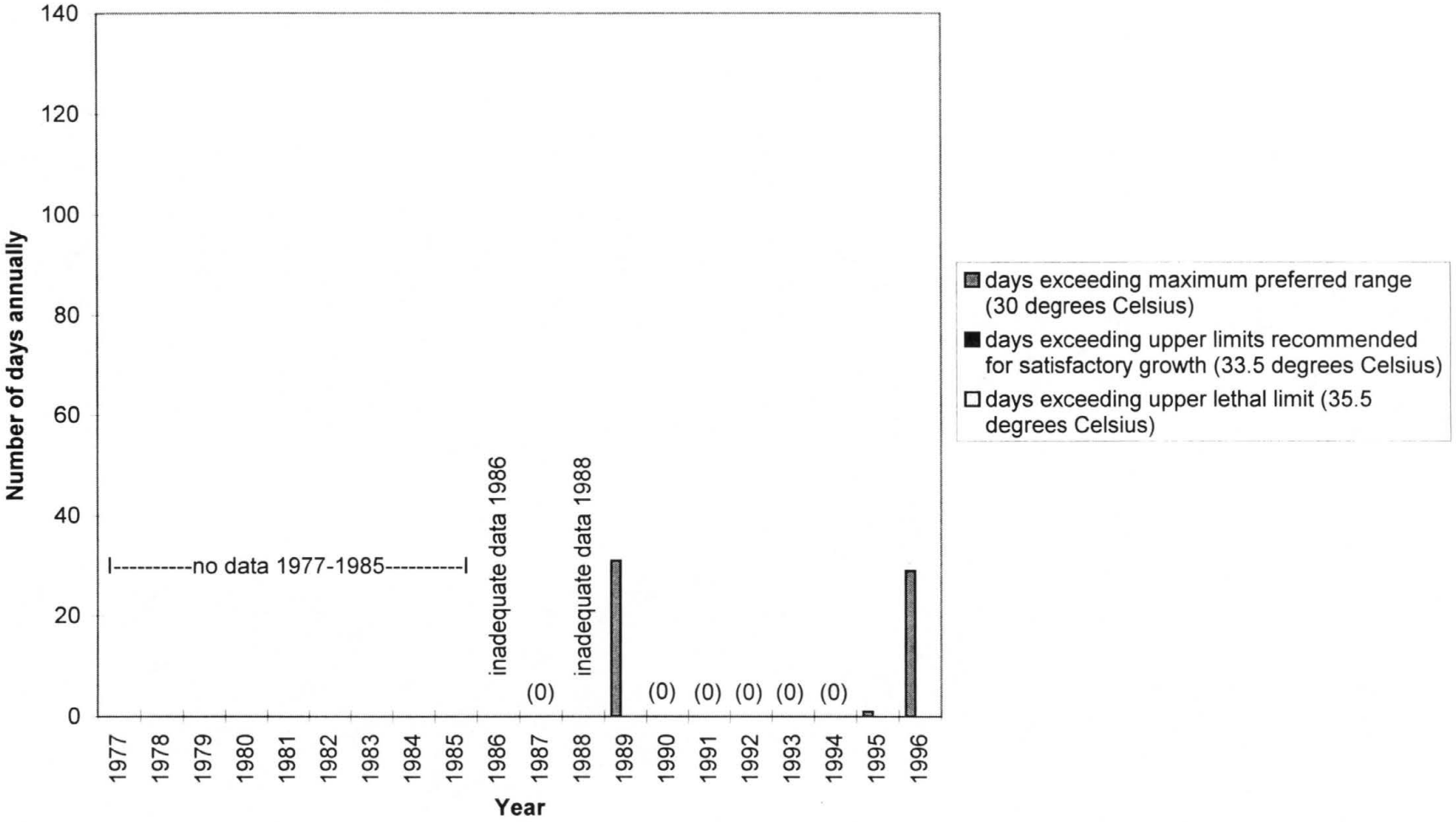

Figure B-13. Number of days per year with daily maximum water temperatures at or exceeding critical temperatures for largemouth bass (Micropterus salmoides): Leon Creek at IH-35 at San Antonio, TX - 1977-1996

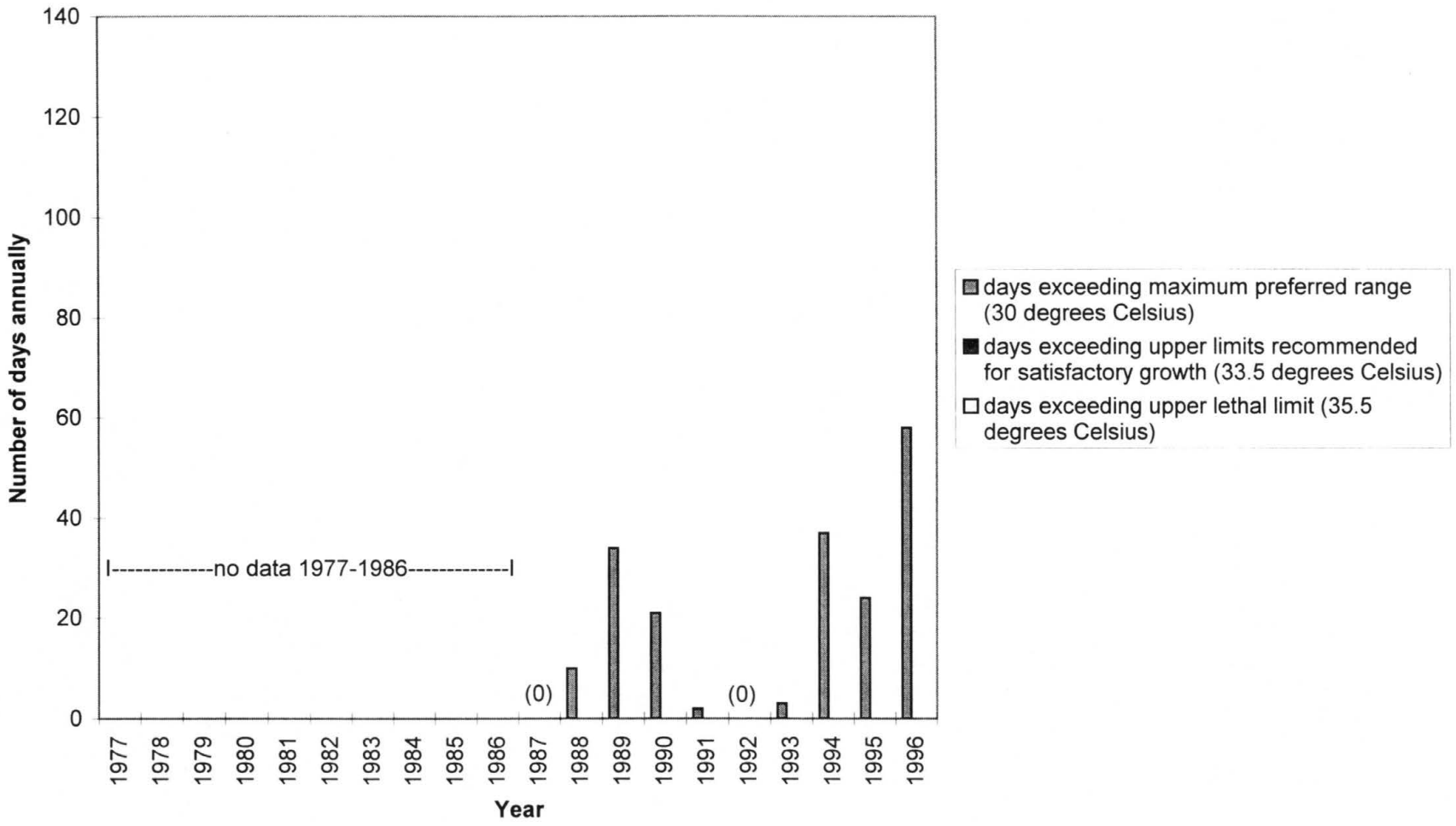

Figure B-14. Number of days per year with daily maximum water temperatures at or exceeding critical temperatures for largemouth bass (Micropterus salmoides): Medina River at San Antonio, TX - 1977-1996

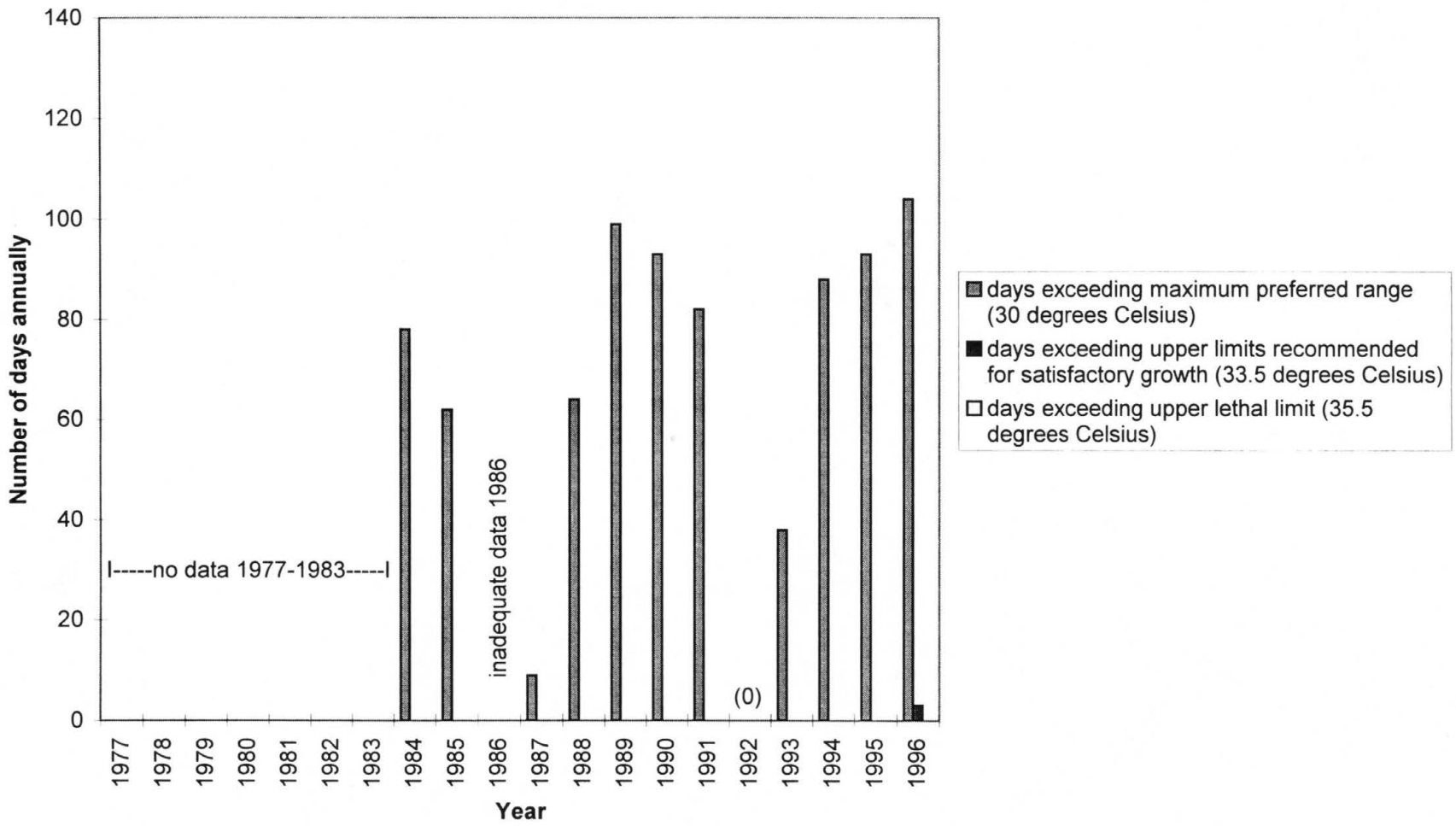

Figure B-15. Number of days per year with daily maximum water temperatures at or exceeding critical temperatures for largemouth bass (Micropterus salmoides): San Antonio River near Elmendorf, TX - 1977-1996

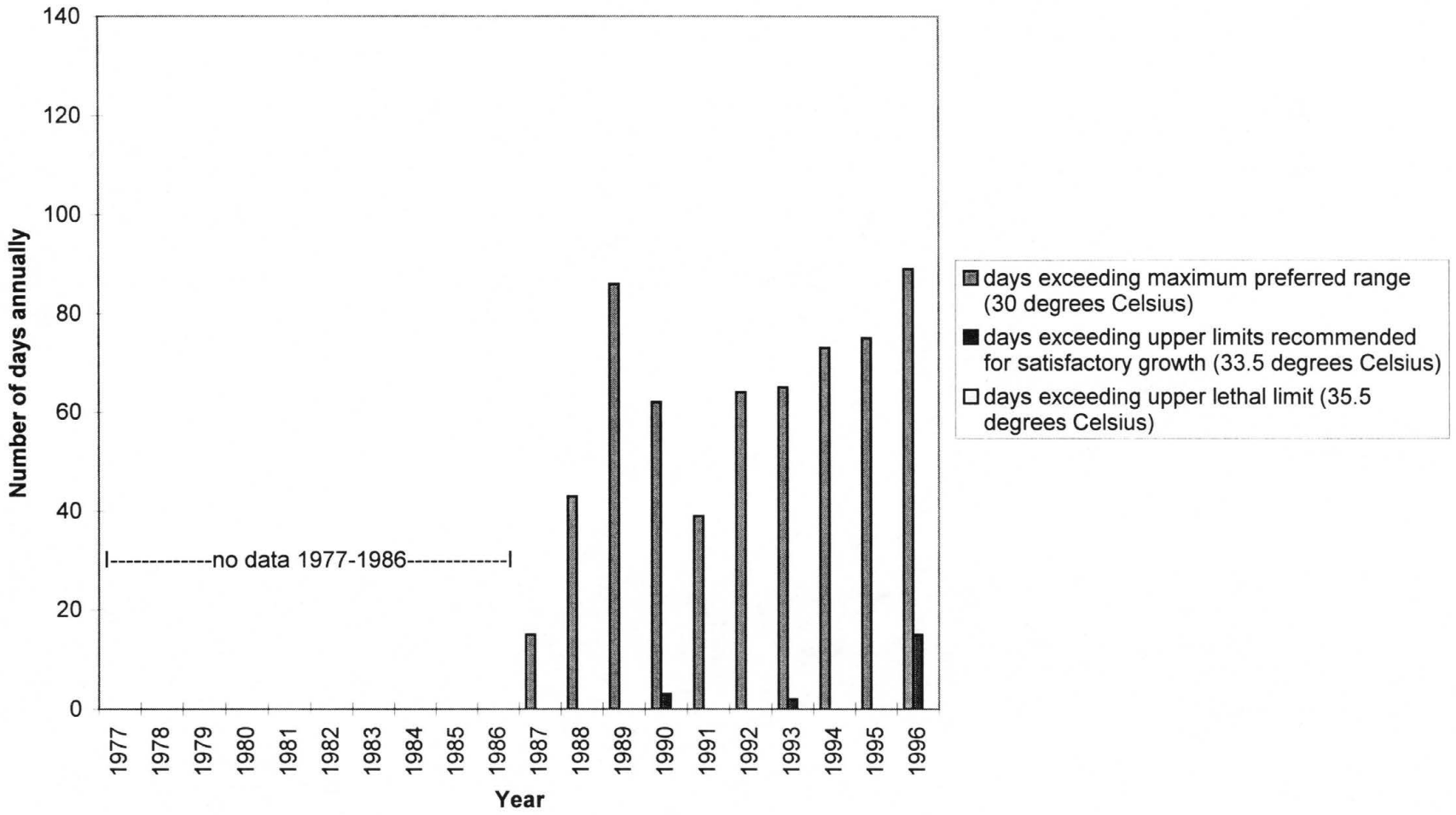

Figure B-16. Number of days per year with daily maximum water temperatures at or exceeding critical temperatures for largemouth bass (Micropterus salmoides): San Antonio River near Falls City, TX - 1977-1996

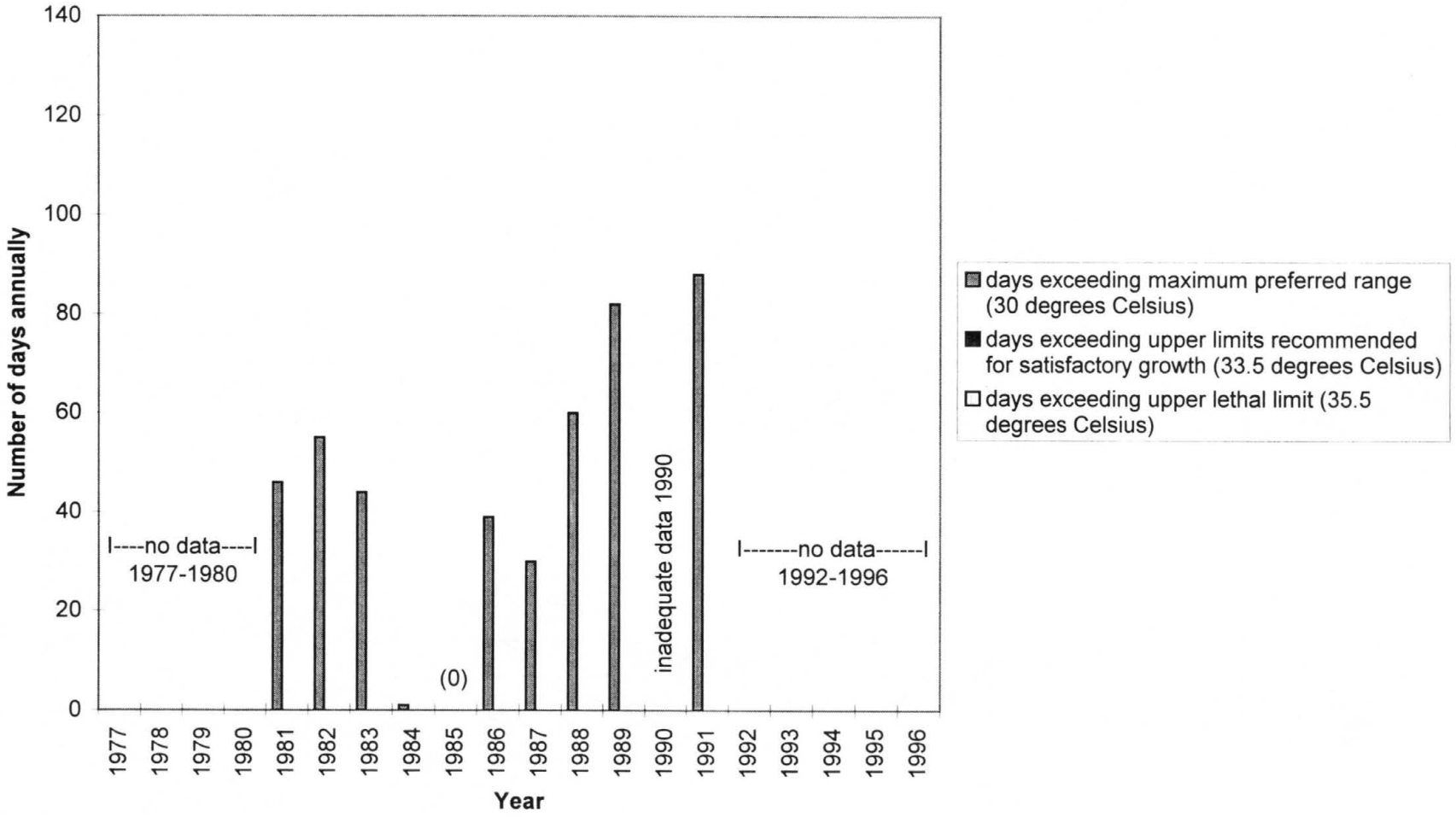

Figure B-17. Number of days per year with daily maximum water temperatures at or exceeding critical temperatures for largemouth bass (Micropterus salmoides): Cibolo Creek near Falls City, TX - 1977-1996

APPENDIX C

Graphs

Maximum Water Temperatures in Exceedence of TNRCC
Suggested Maximum Temperatures

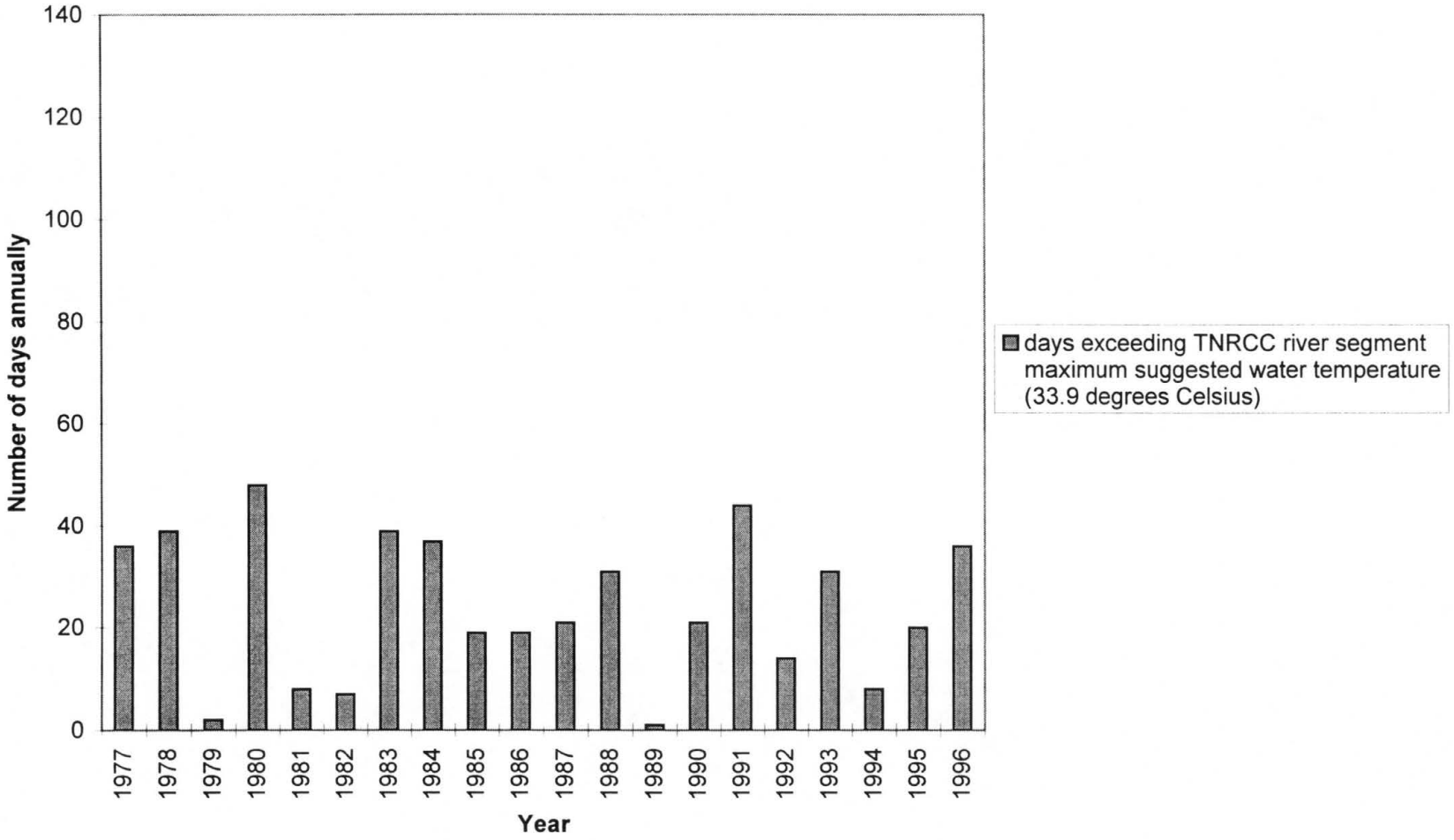

Figure C-1. Number of days per year with daily maximum water temperatures at or exceeding TNRCC suggested maximum water temperatures, by river segment: West Fork Trinity River at Beach Street at Fort Worth, TX - 1977-1996

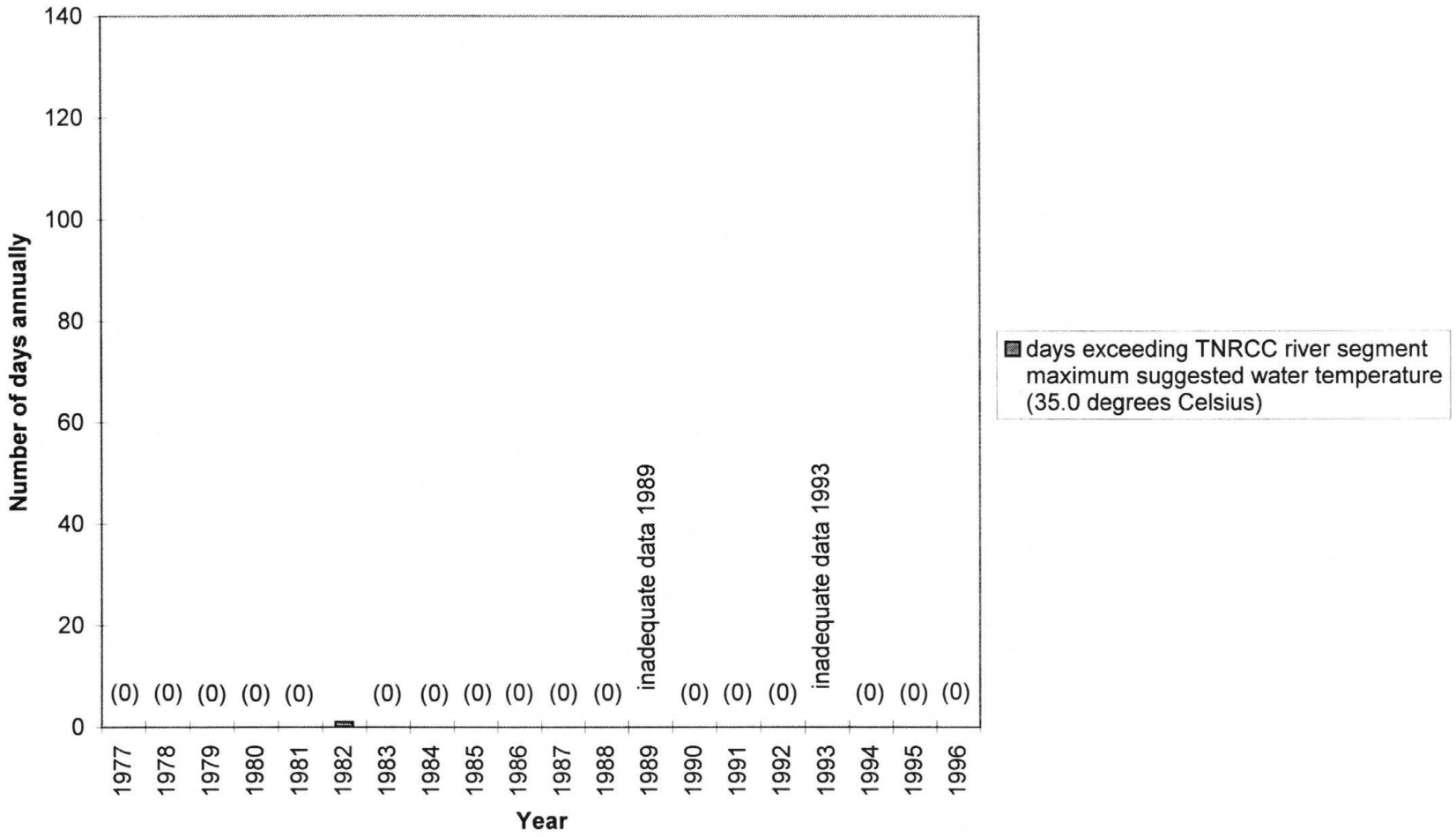

Figure C-2. Number of days per year with daily maximum water temperatures at or exceeding TNRCC suggested maximum water temperatures, by river segment: West Fork Trinity River at Grand Prairie, TX - 1977-1996

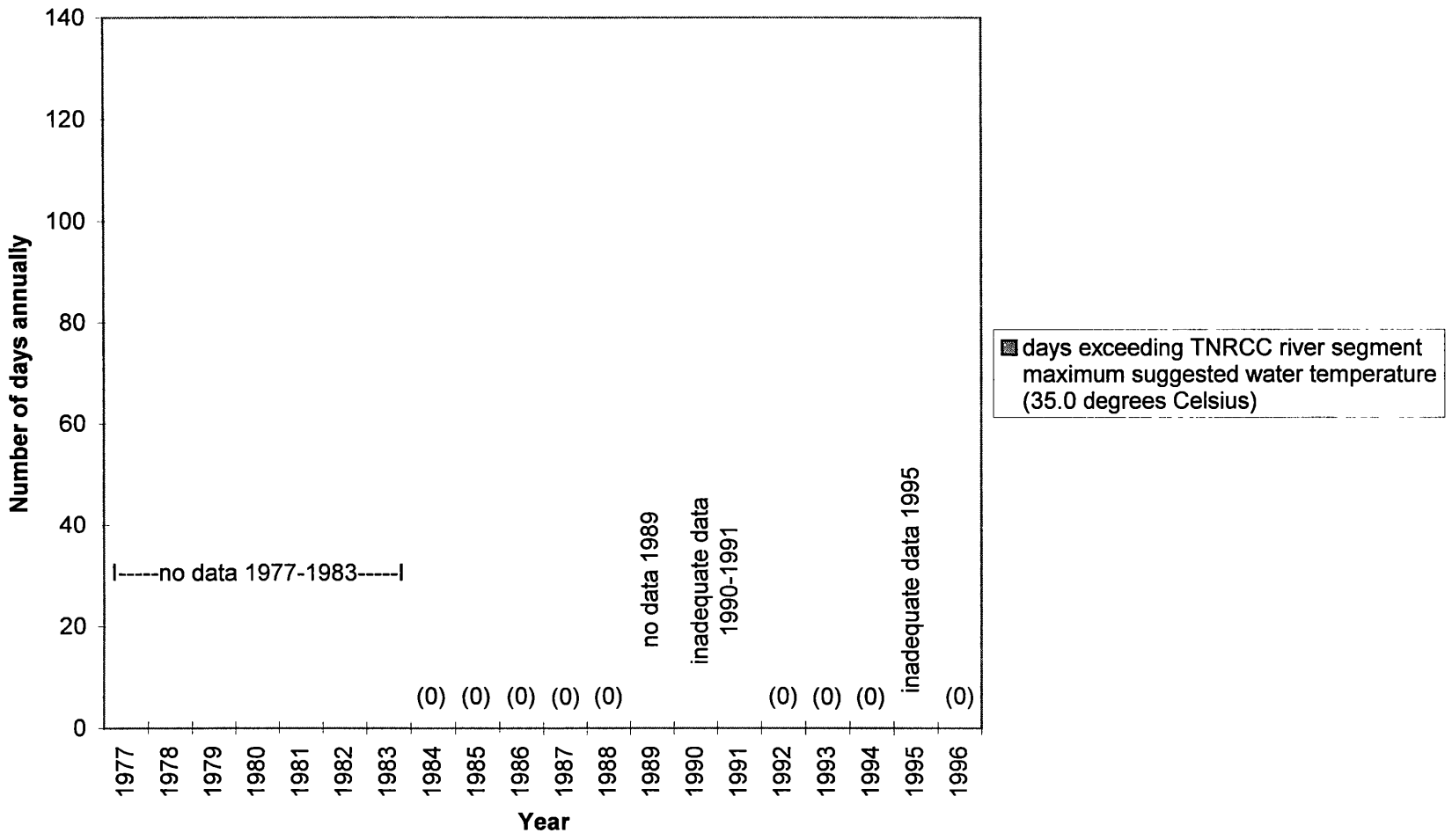

Figure C-3. Number of days per year with daily maximum water temperatures at or exceeding TNRCC suggested maximum water temperatures, by river segment: Trinity River at Cedar Crest Blvd. at Dallas, TX - 1977-1996

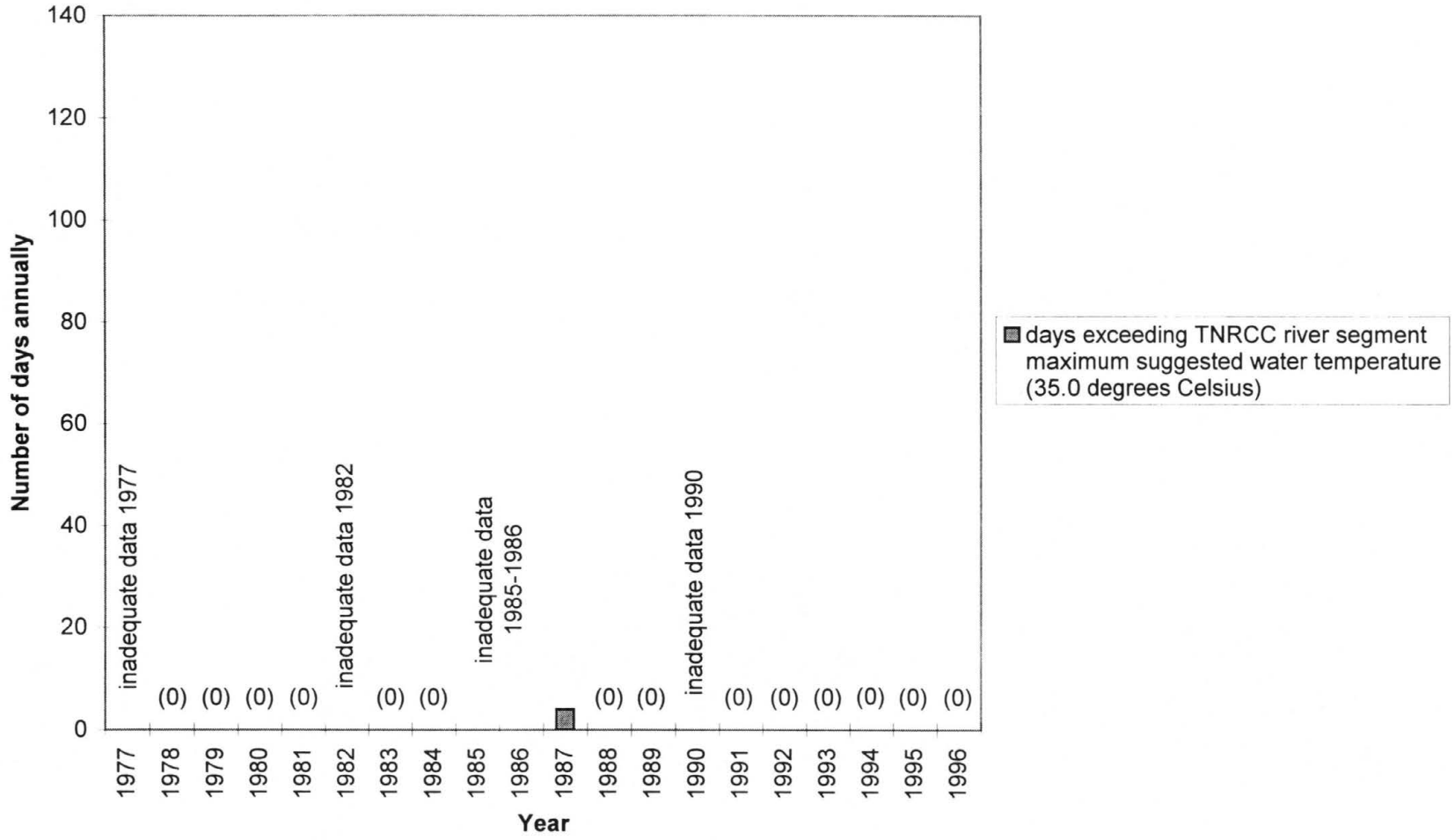

Figure C-4. Number of days per year with daily maximum water temperatures at or exceeding TNRCC suggested maximum water temperatures, by river segment: Trinity River below Dallas, TX - 1977-1996

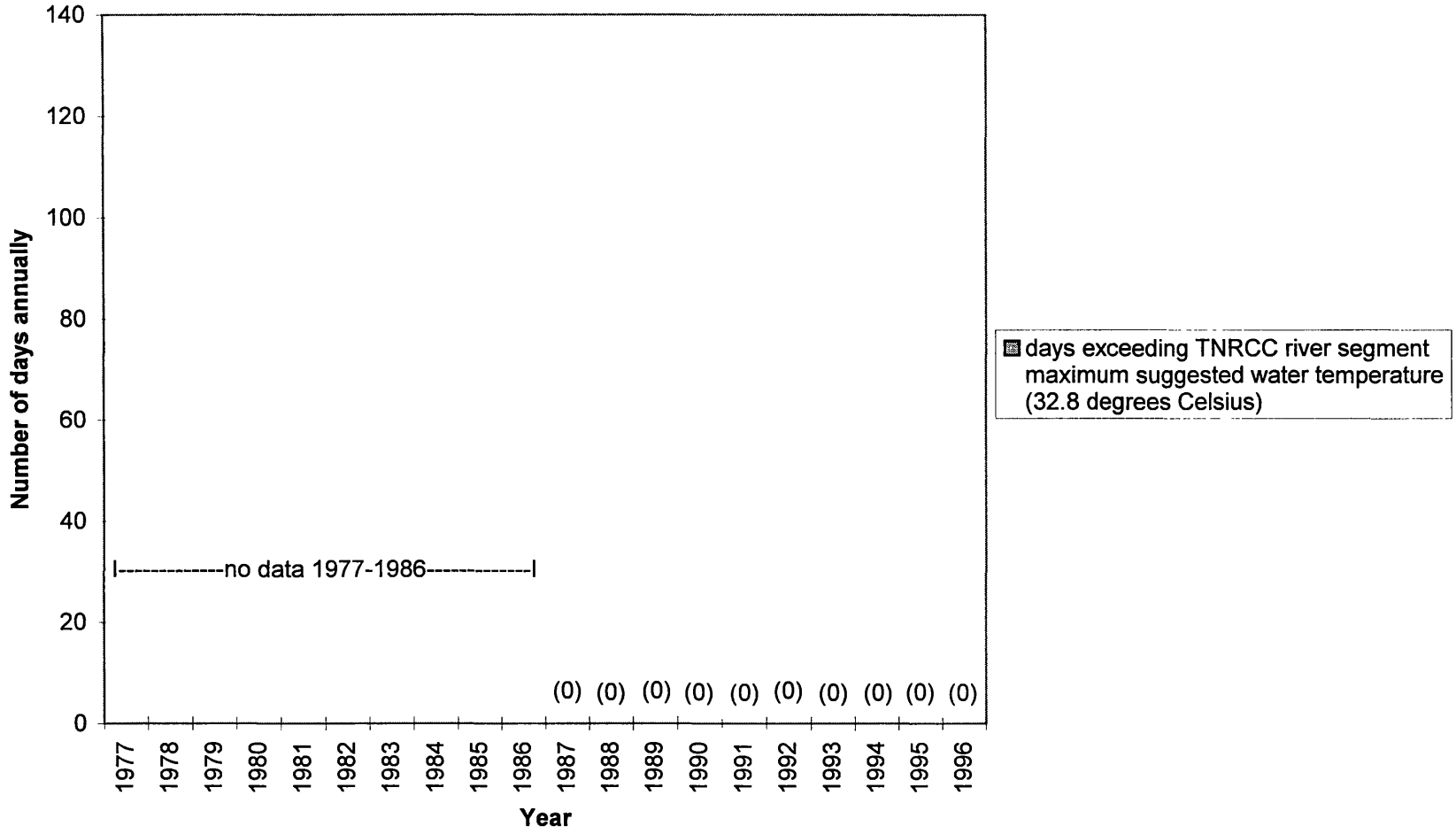

Figure C-5. Number of days per year with daily maximum water temperatures at or exceeding TNRCC suggested maximum water temperatures, by river segment: East Fork Trinity River at Seagoville, TX - 1977-1996

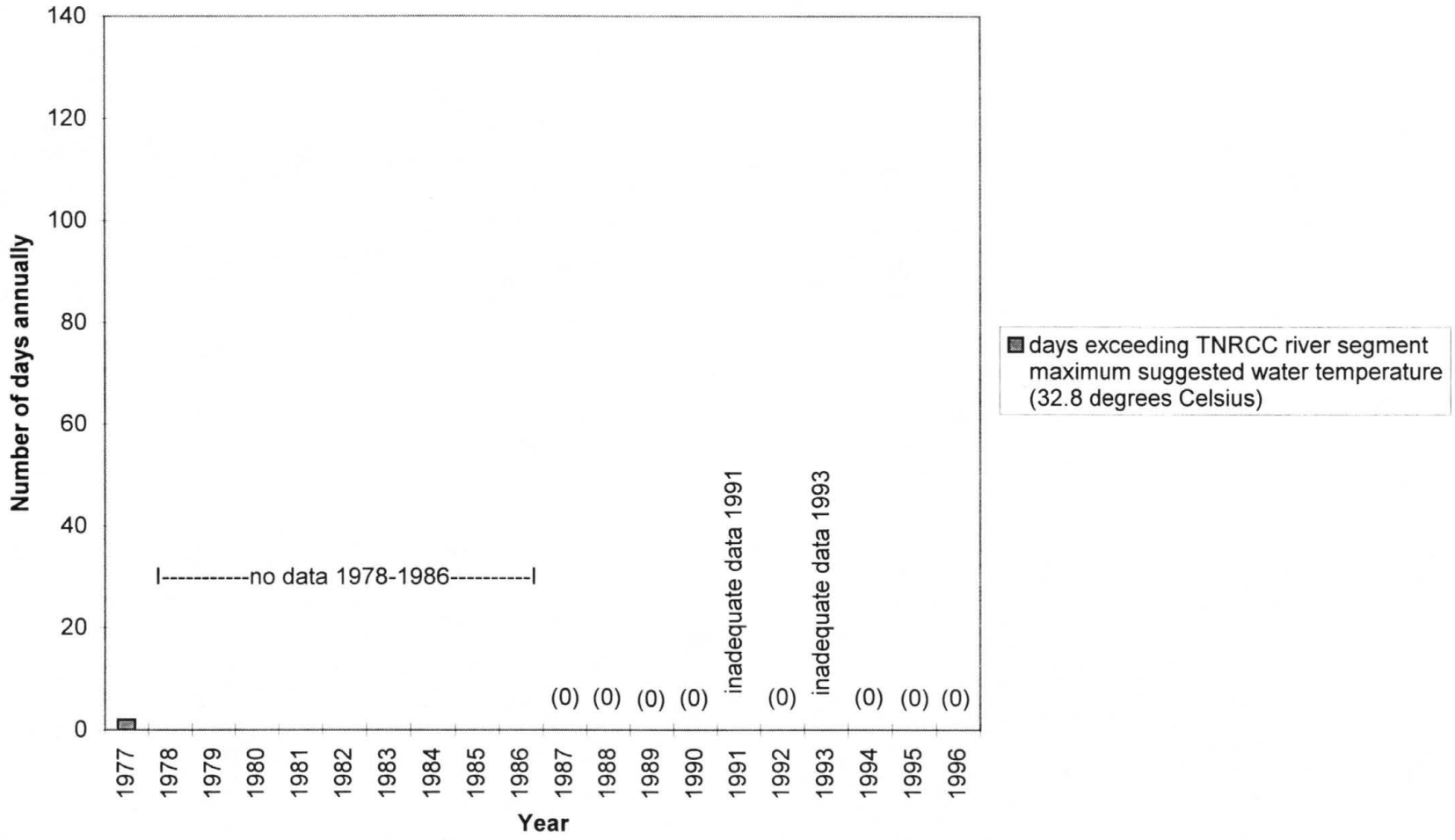

Figure C-6. Number of days per year with daily maximum water temperatures at or exceeding TNRCC suggested maximum water temperatures, by river segment: East Fork Trinity River near Crandall, TX - 1977-1996

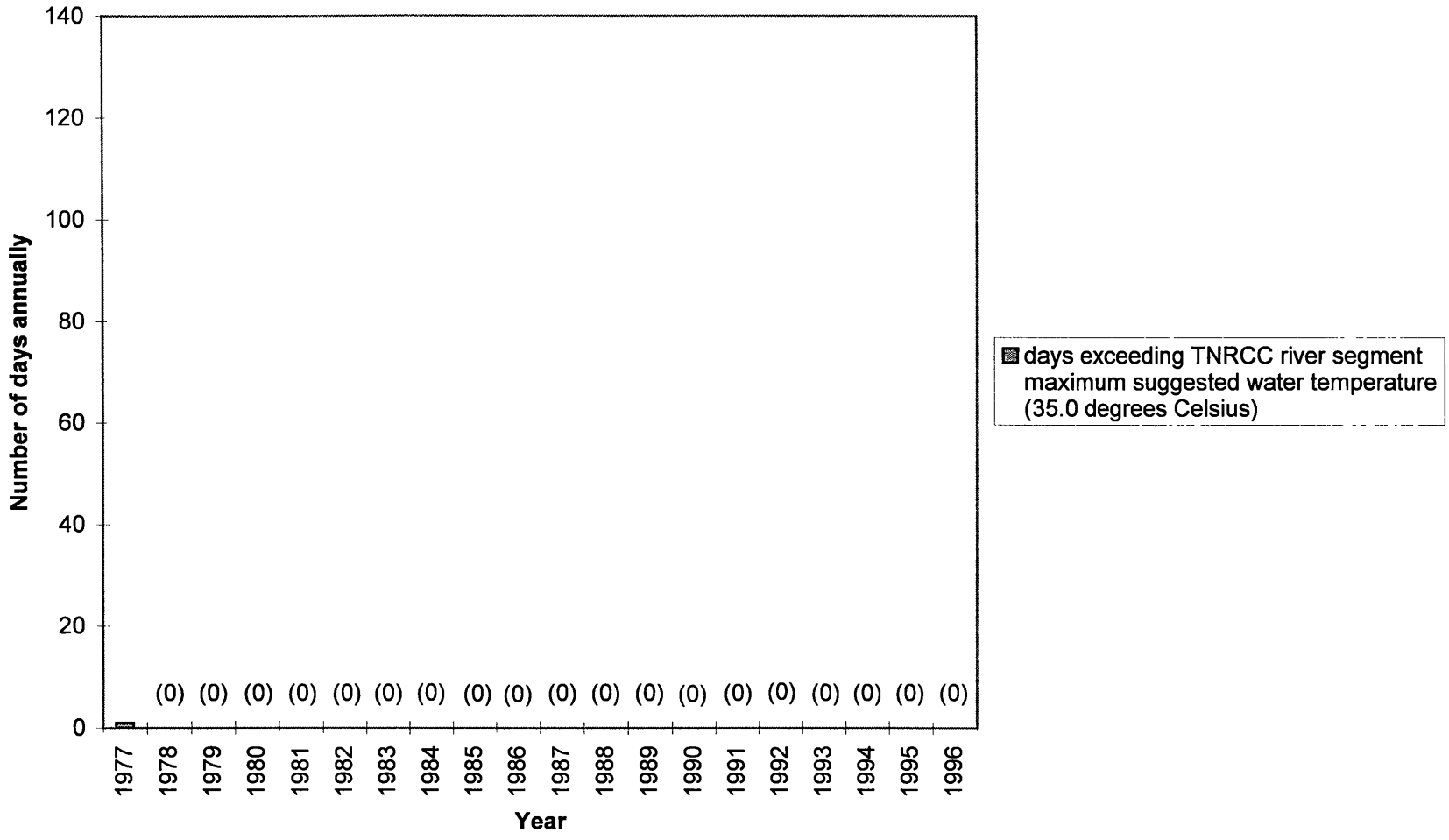

Figure C-7. Number of days per year with daily maximum water temperatures at or exceeding TNRCC suggested maximum water temperatures, by river segment: Trinity River near Rosser, TX - 1977-1996

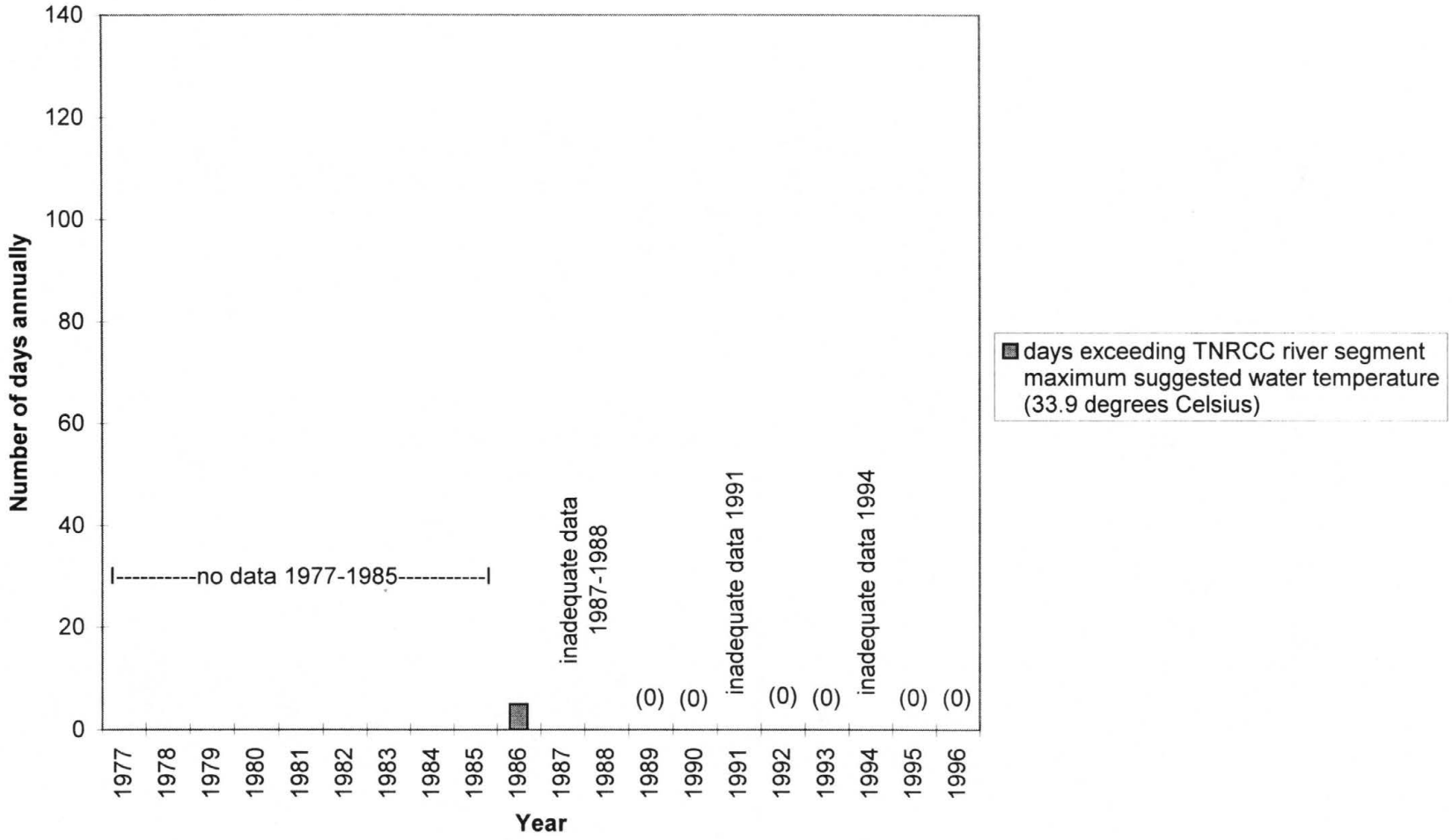

Figure C-8. Number of days per year with daily maximum water temperatures at or exceeding TNRCC suggested maximum water temperatures, by river segment: Trinity River at Trinidad, TX - 1977-1996

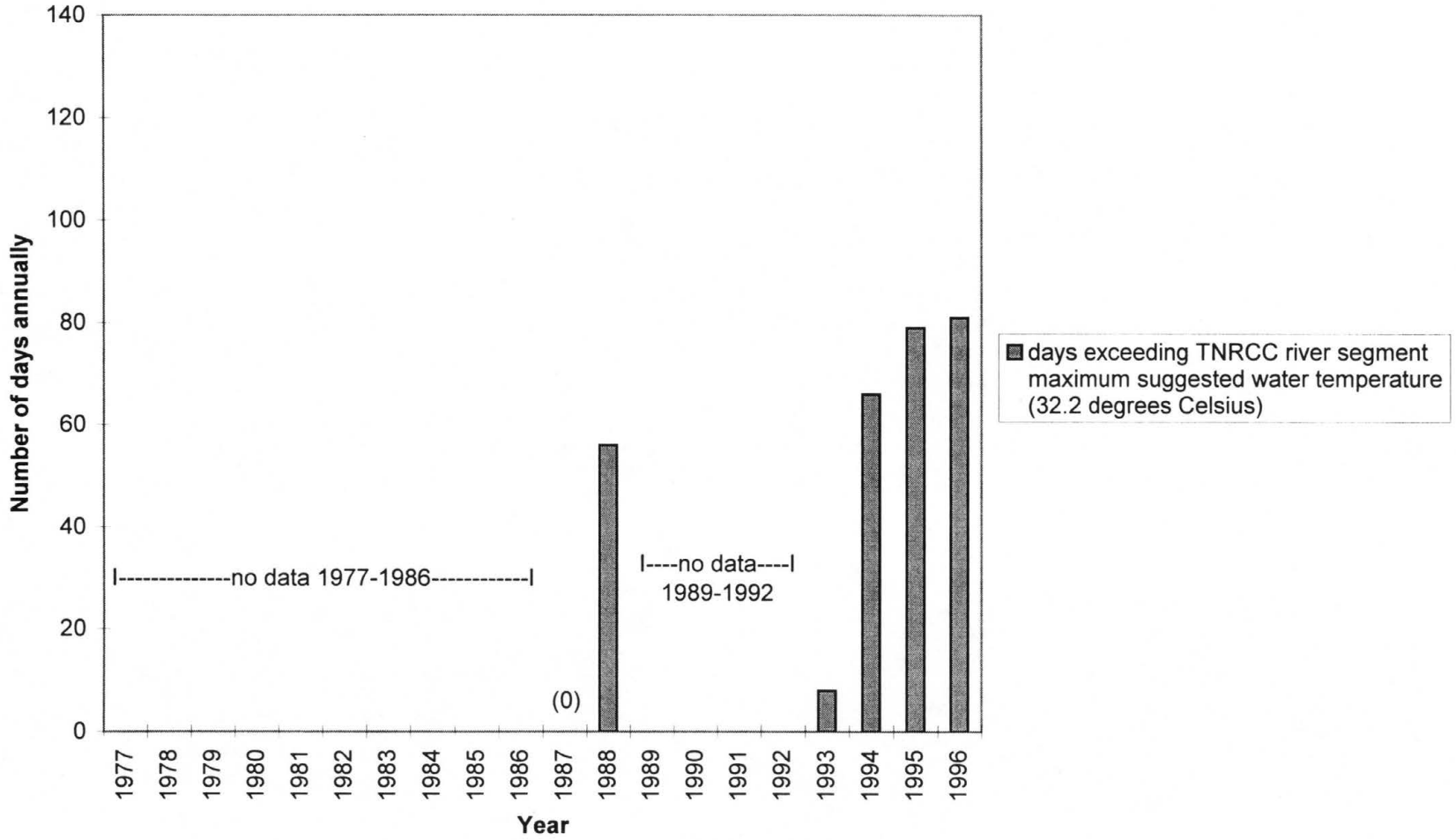

Figure C-9. Number of days per year with daily maximum water temperatures at or exceeding TNRCC suggested maximum water temperatures, by river segment: San Antonio River at Loop 410 at San Antonio, TX - 1977-1996

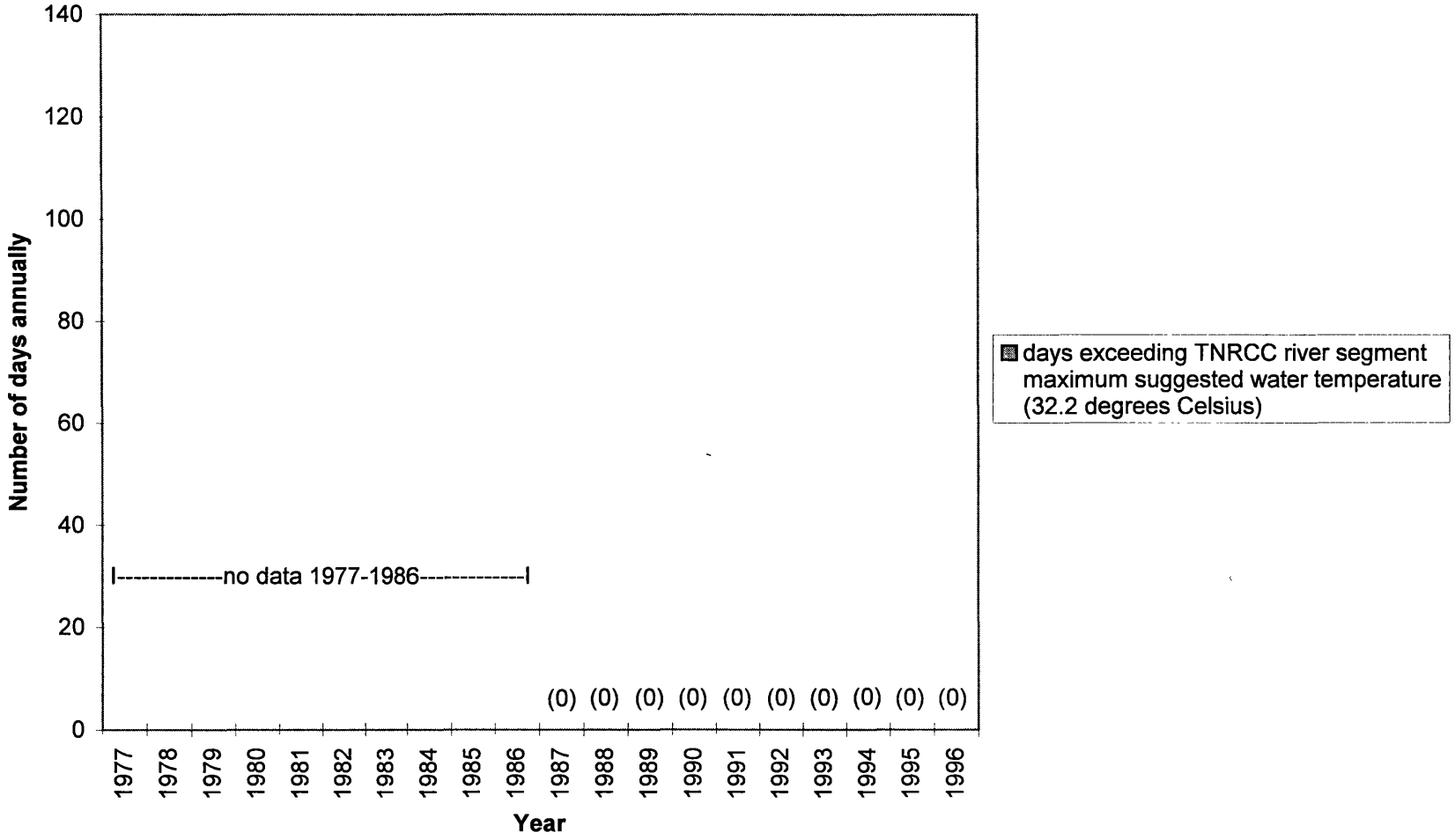

Figure C-10. Number of days per year with daily maximum water temperatures at or exceeding TNRCC suggested maximum water temperatures, by river segment: Salado Creek (lower station) at San Antonio, TX - 1977-1996

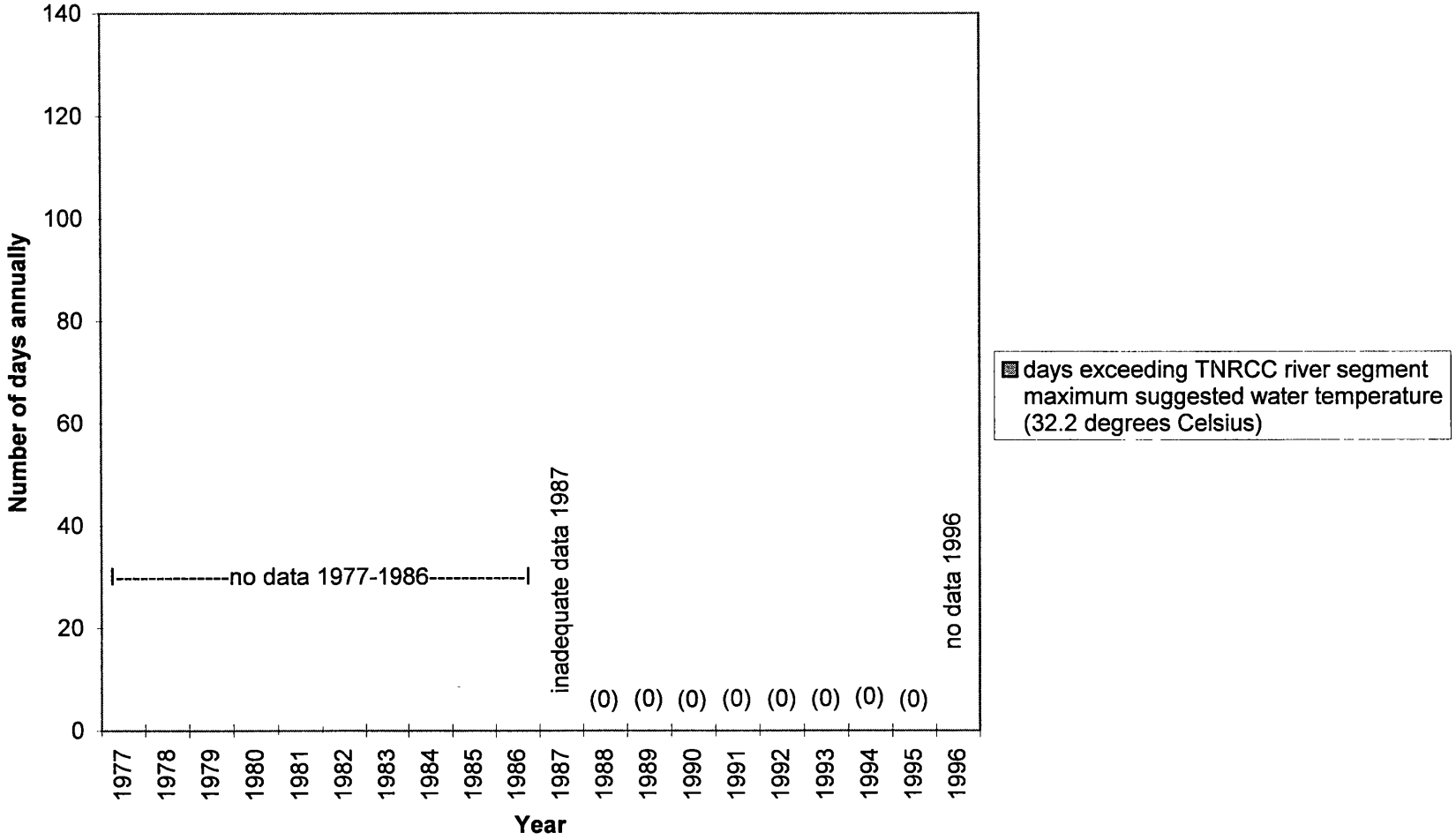

Figure C-11. Number of days per year with daily maximum water temperatures at or exceeding TNRCC suggested maximum water temperatures, by river segment: Medina River at La Coste, TX - 1977-1996

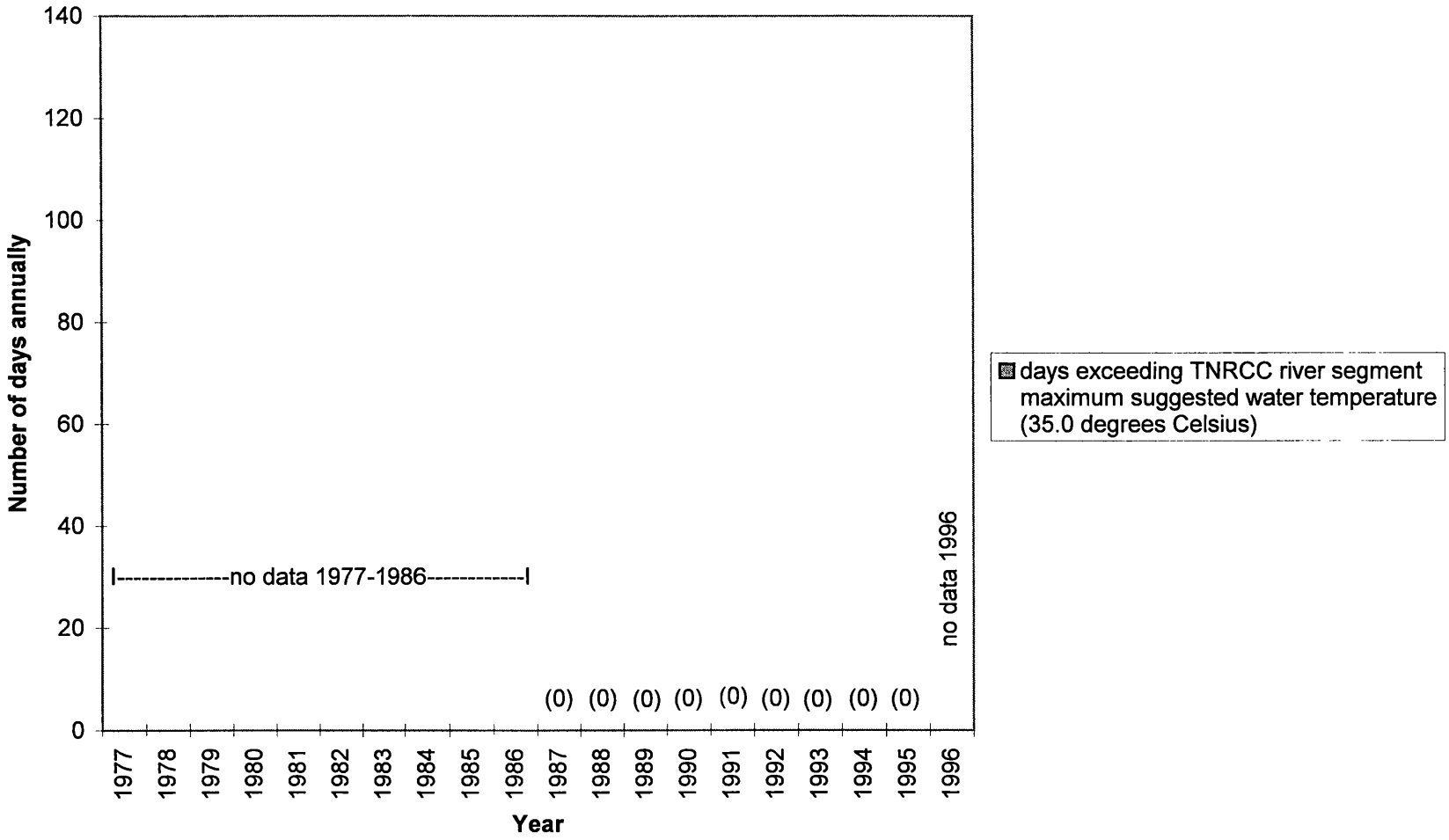

Figure C-12. Number of days per year with daily maximum water temperatures at or exceeding TNRCC suggested maximum water temperatures, by river segment: Medio Creek at Pearsall Road at San Antonio, TX - 1977-1996

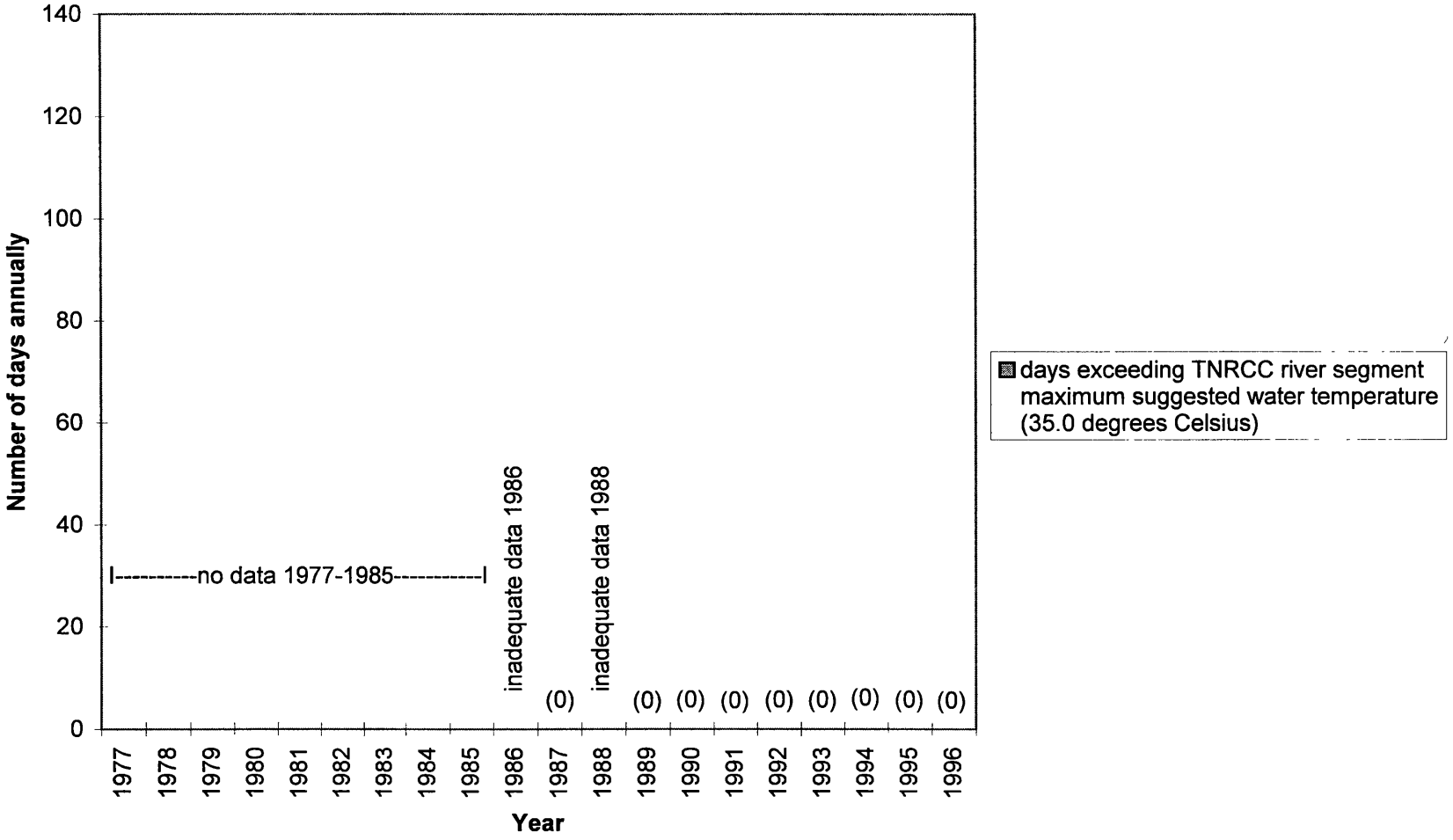

Figure C-13. Number of days per year with daily maximum water temperatures at or exceeding TNRCC suggested maximum water temperatures, by river segment: Leon Creek at IH-35 at San Antonio, TX - 1977-1996

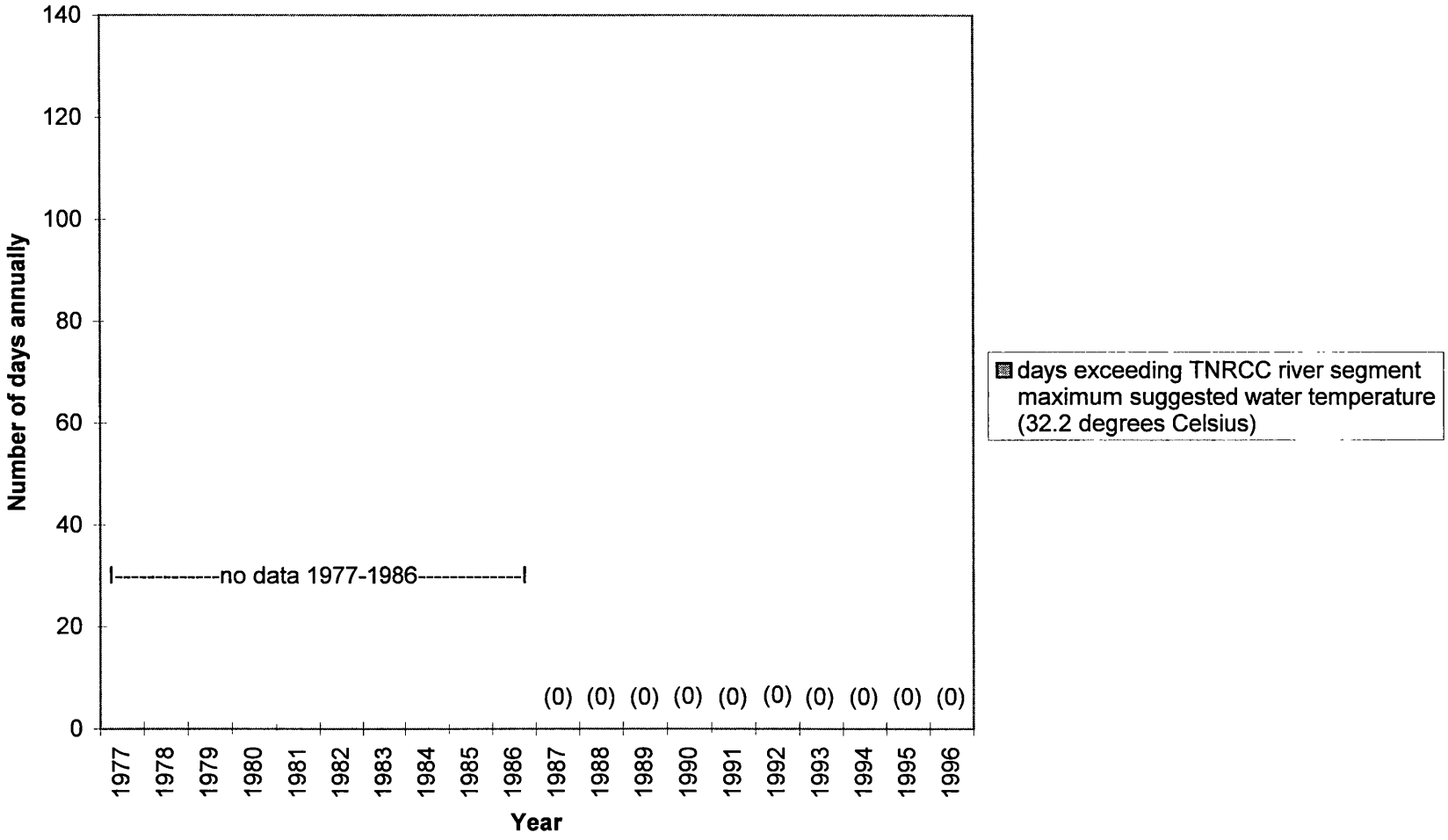

Figure C-14. Number of days per year with daily maximum water temperatures at or exceeding TNRCC suggested maximum water temperatures, by river segment: Medina River at San Antonio, TX - 1977-1996

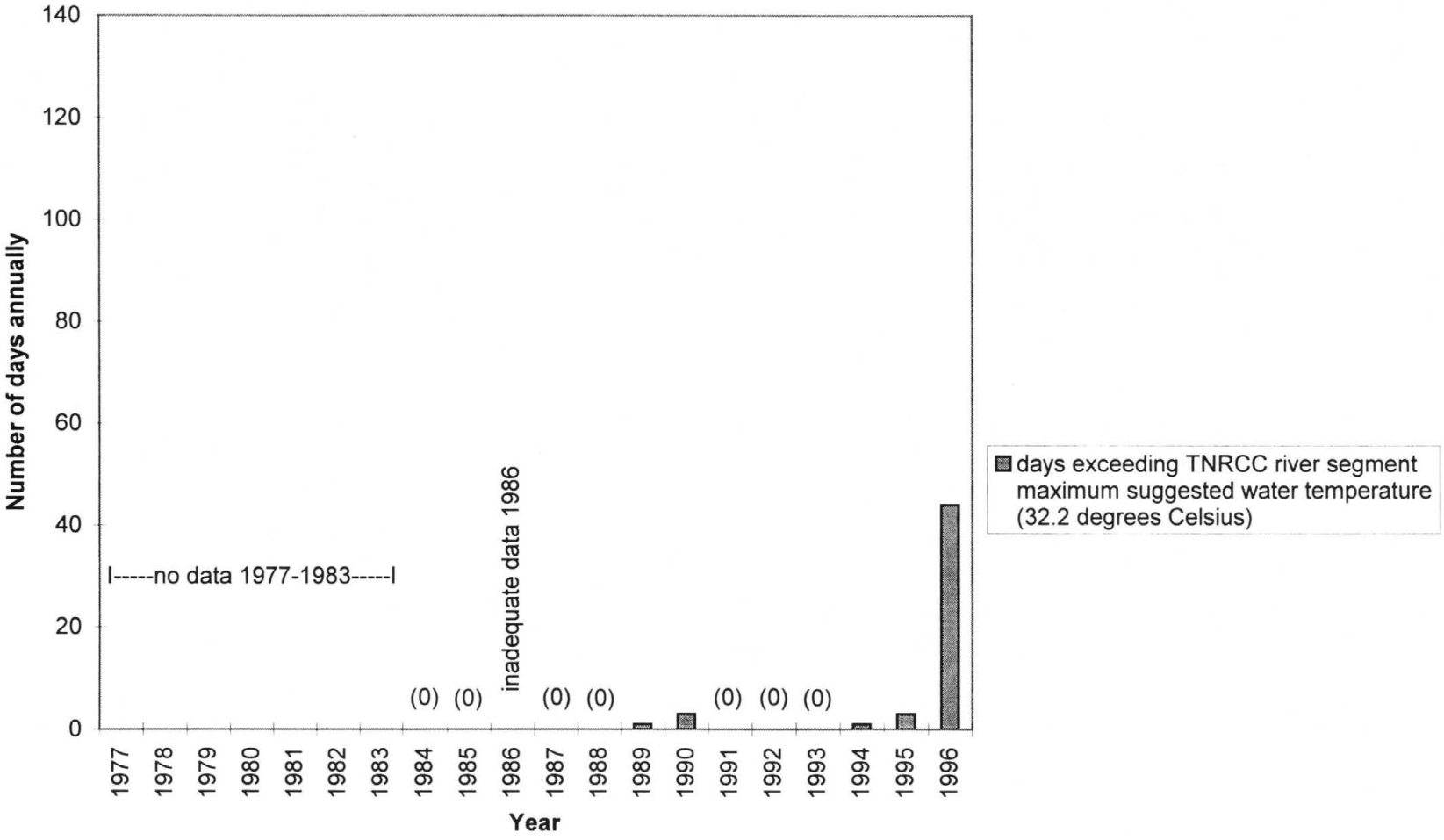

Figure C-15. Number of days per year with daily maximum water temperatures at or exceeding TNRCC suggested maximum water temperatures, by river segment: San Antonio River near Elmendorf, TX - 1977-1996

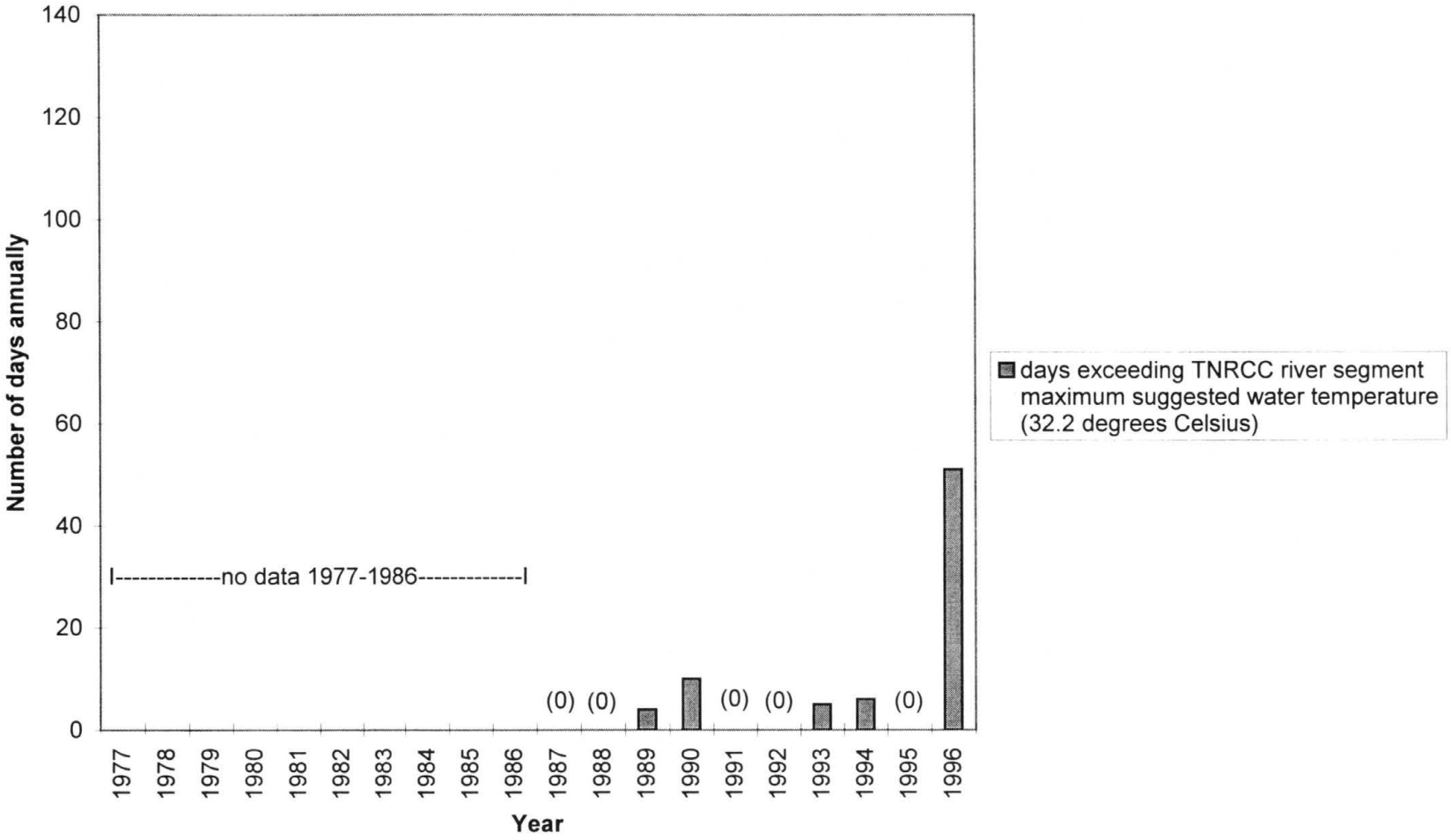

Figure C-16. Number of days per year with daily maximum water temperatures at or exceeding TNRCC suggested maximum water temperatures, by river segment: San Antonio River near Falls City, TX - 1977-1996

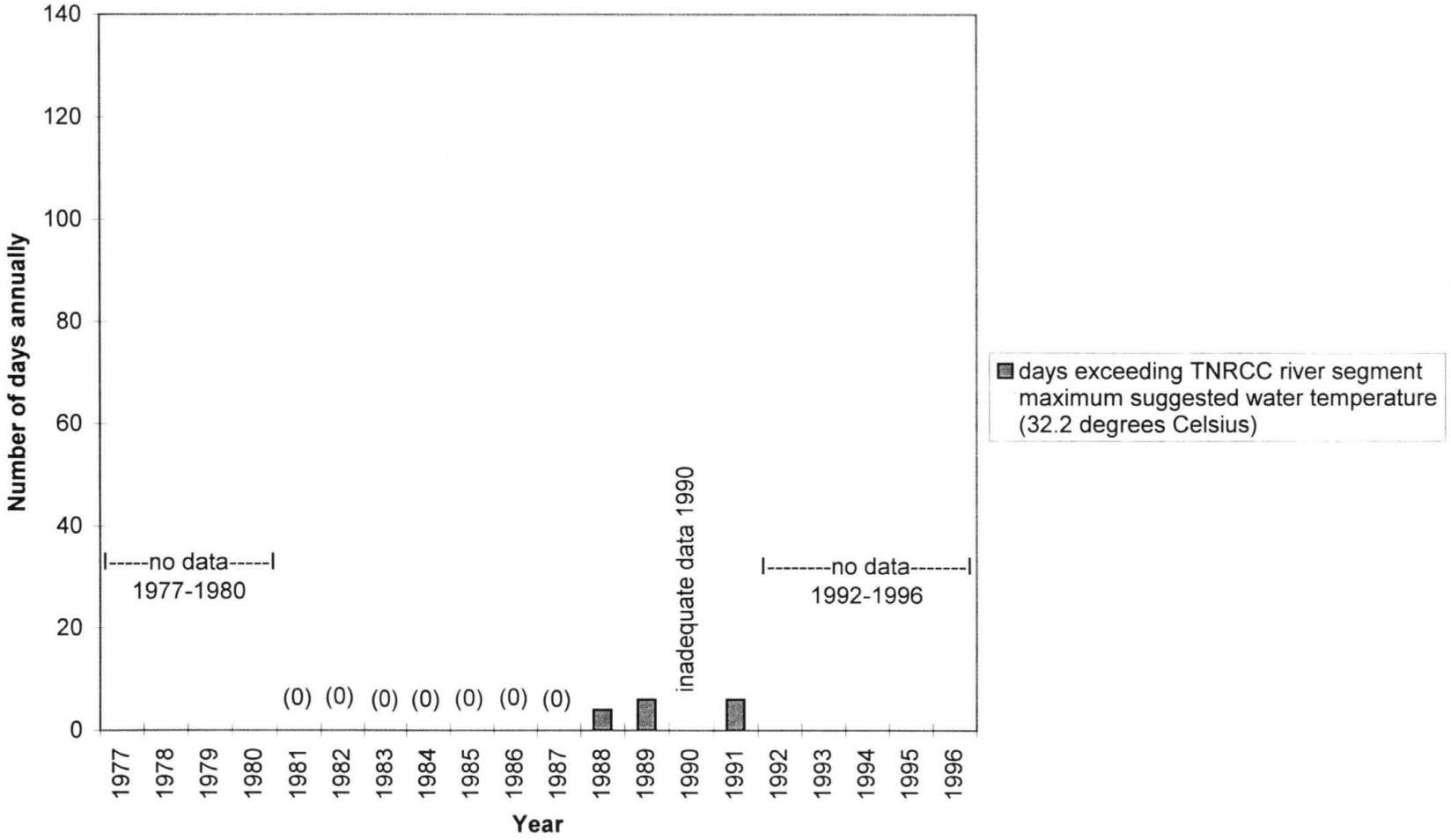

Figure C-17. Number of days per year with daily maximum water temperatures at or exceeding TNRCC suggested maximum water temperatures, by river segment: Cibolo Creek near Falls City, TX - 1977-1996

APPENDIX D

Graphs

Site Analyses of Maximum and Mean Water Temperatures
vs.
Maximum Air Temperatures

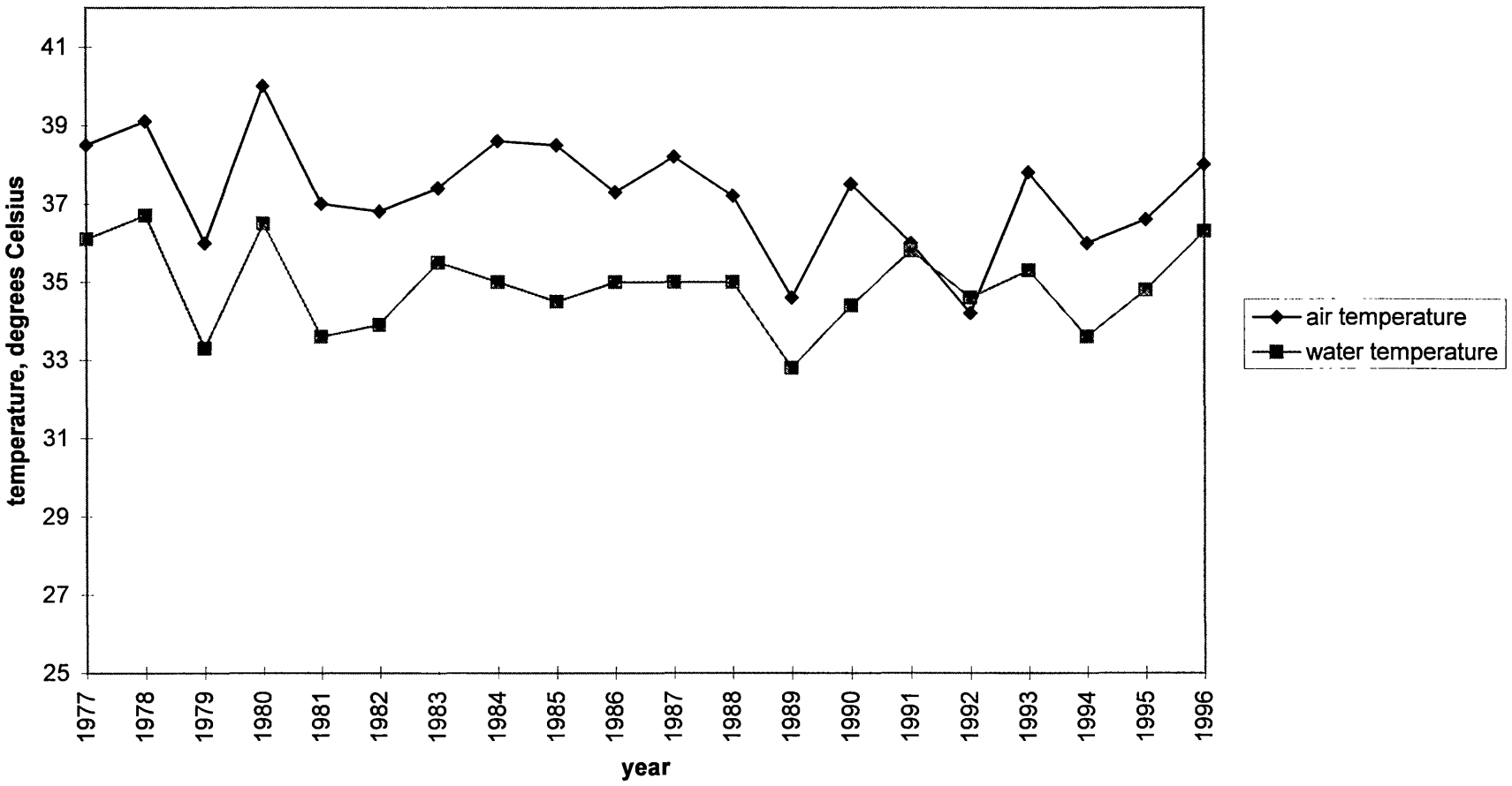

Figure D-1. Daily maximum water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, West Fork Trinity River at Beach Street, Fort Worth, TX: 1977-1996

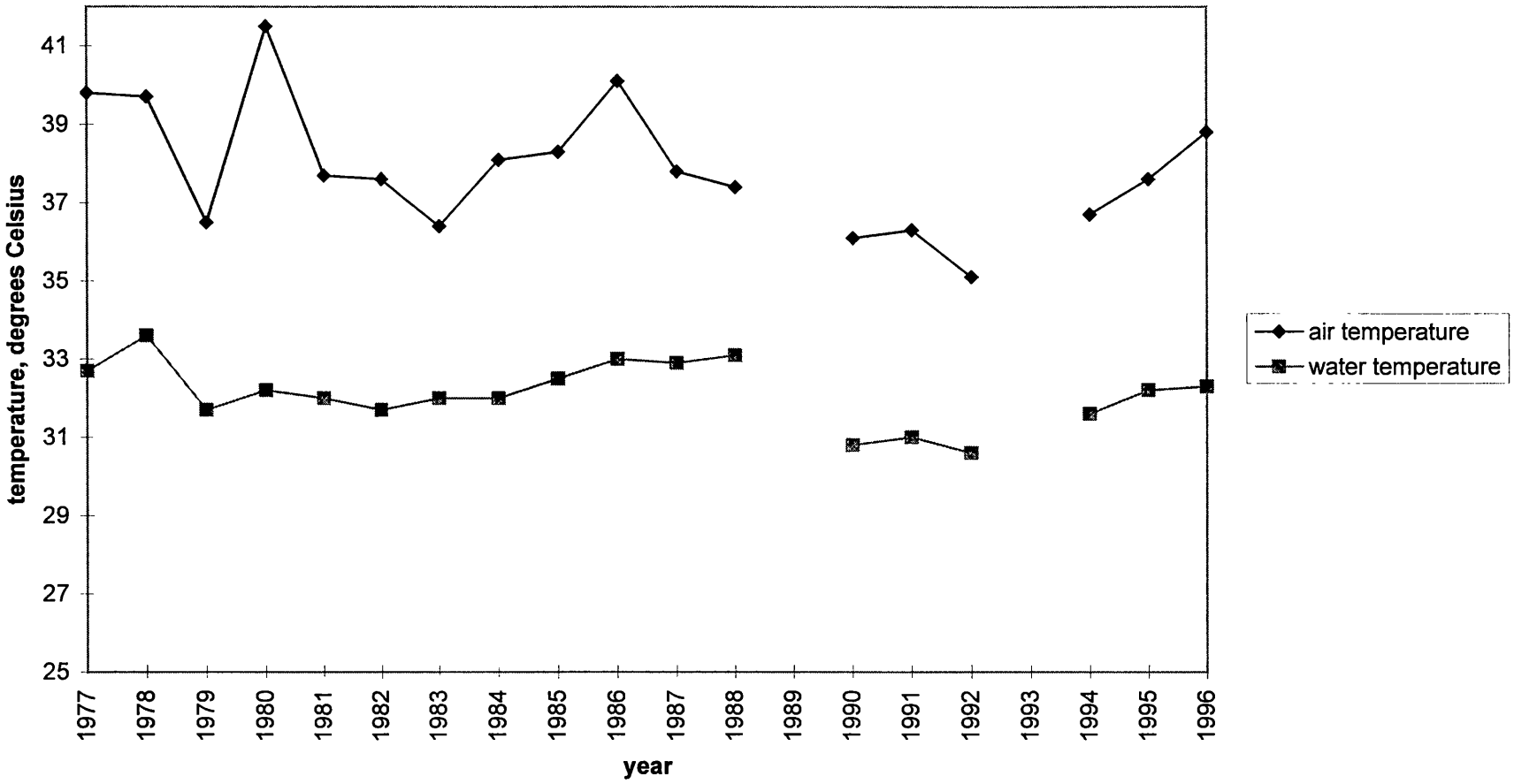

Figure D-2. Daily maximum water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, West Fork Trinity River at Grand Prairie, TX: 1977-1996

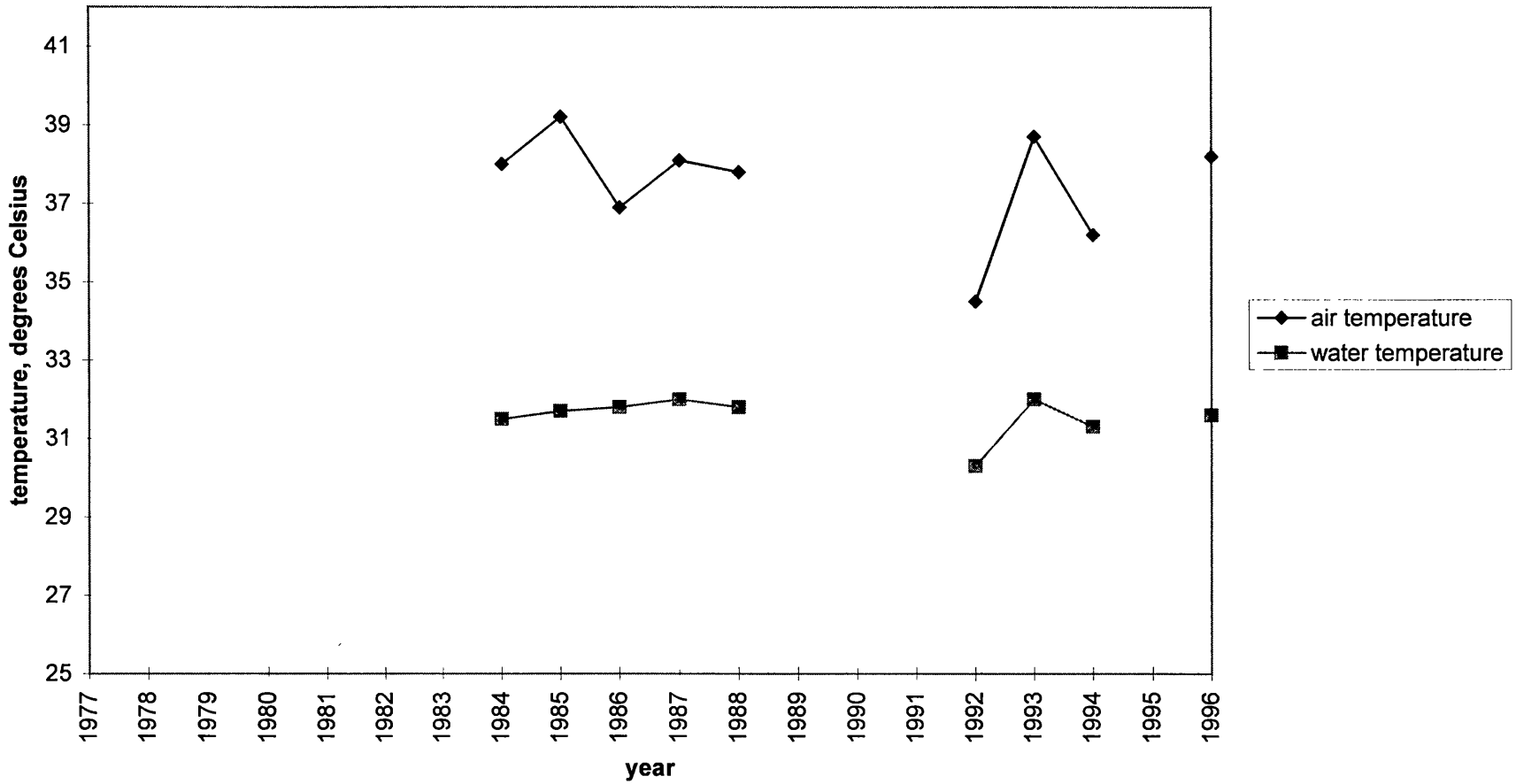

Figure D-3. Daily maximum water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, Trinity River at Cedar Crest Blvd., Dallas, TX: 1977-1996

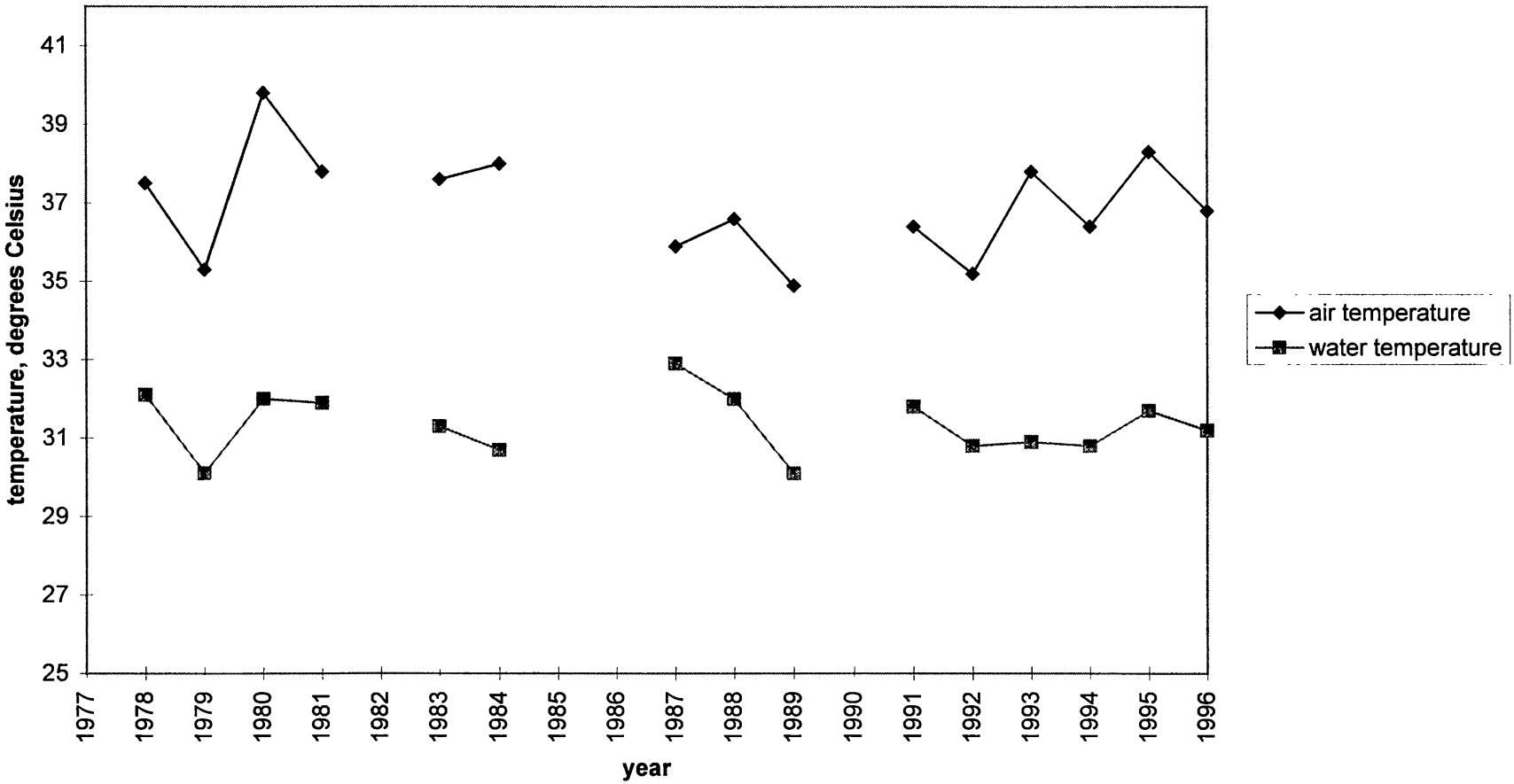

Figure D-4. Daily maximum water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, Trinity River below Dallas, TX: 1977-1996

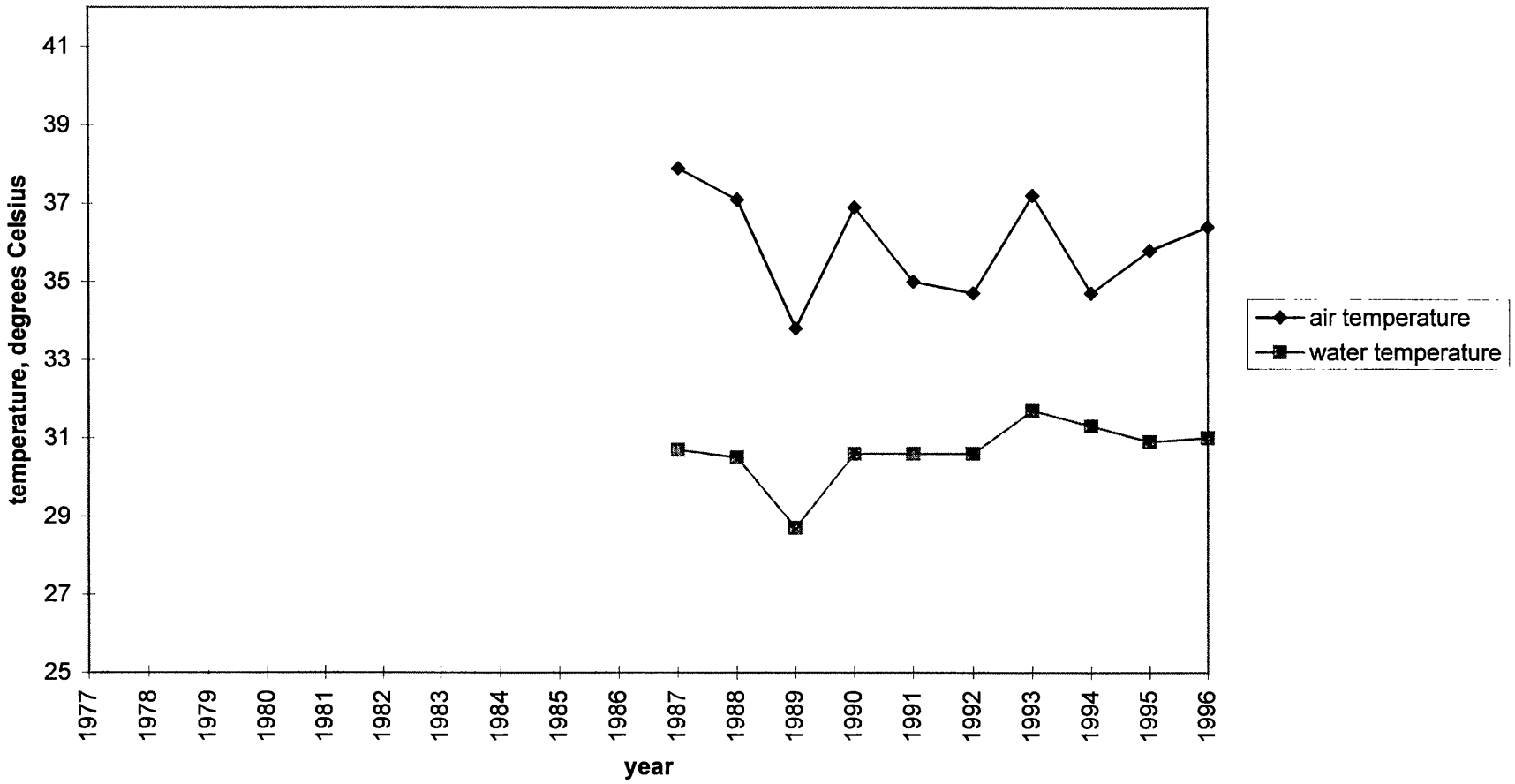

Figure D-5. Daily maximum water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, East Fork Trinity River at Seagoville, TX: 1977-1996

Figure D-6. Daily maximum water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, East Fork Trinity River near Crandall, TX: 1977-1996

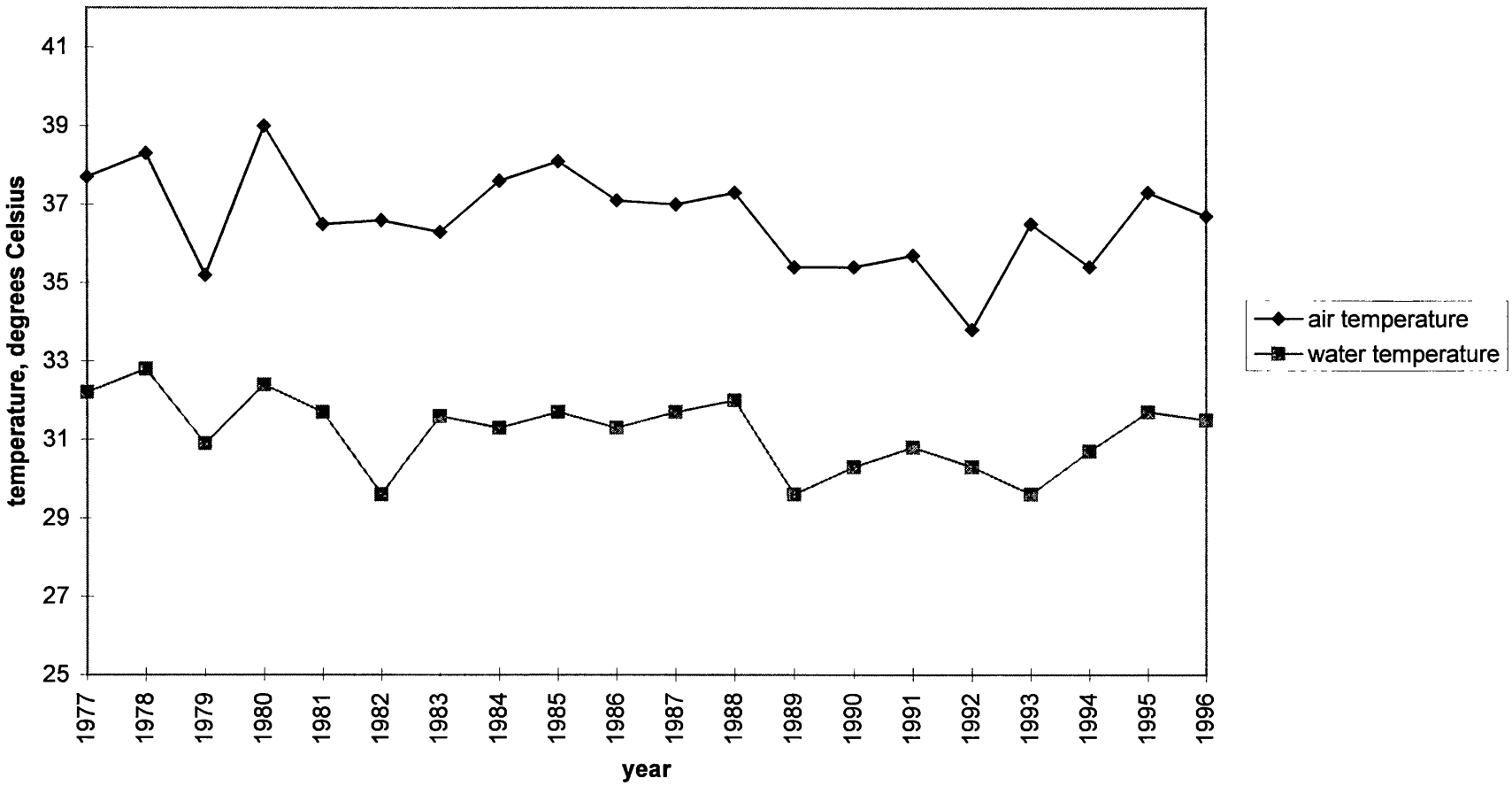

Figure D-7. Daily maximum water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, Trinity River near Rosser, TX: 1977-1996

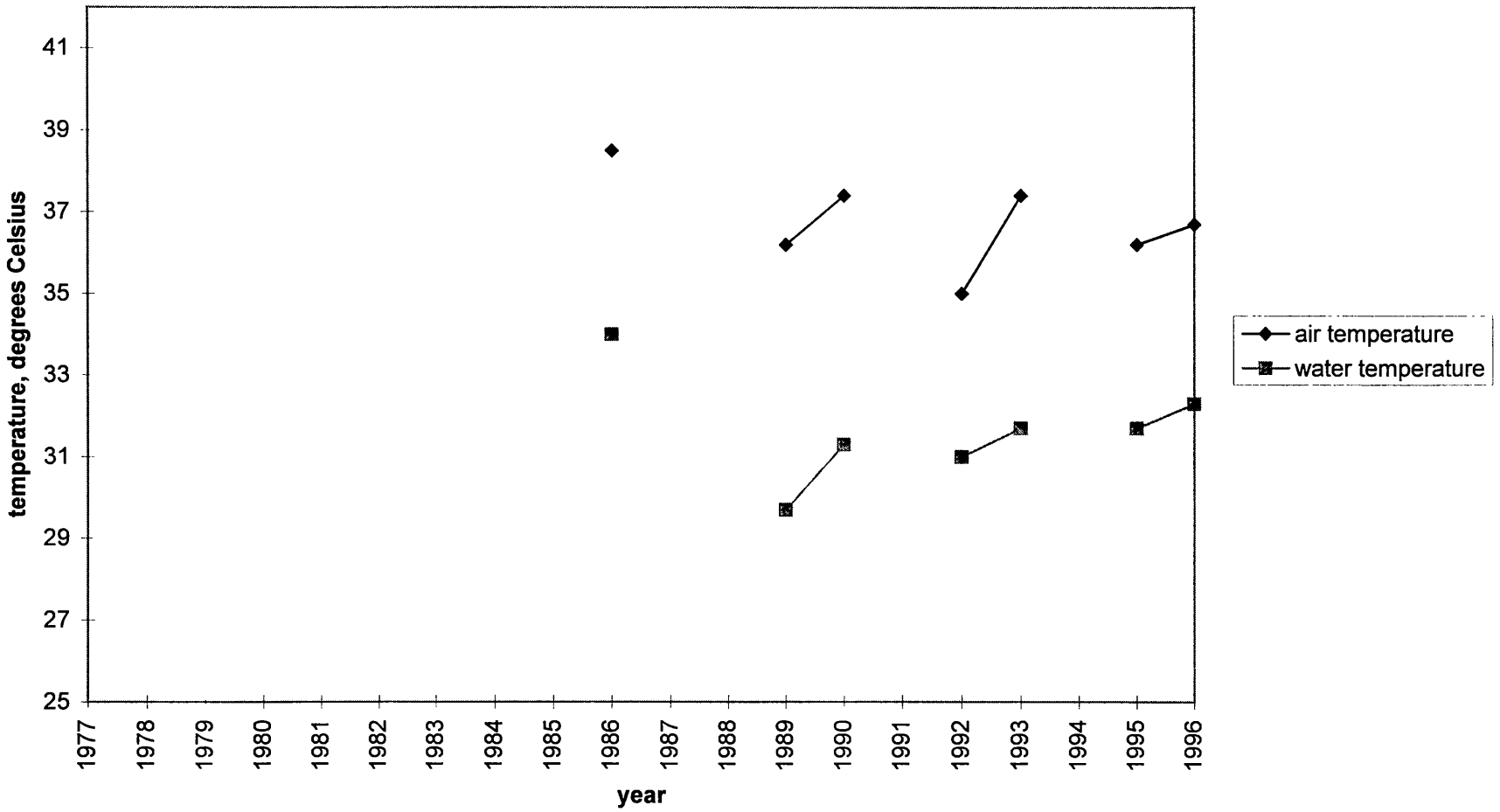

Figure D-8. Daily maximum water temperatures, average of 5 summer observation dates, vs. corresponding days maximum air temperatures, Trinity River at Trinidad, TX: 1977-1996

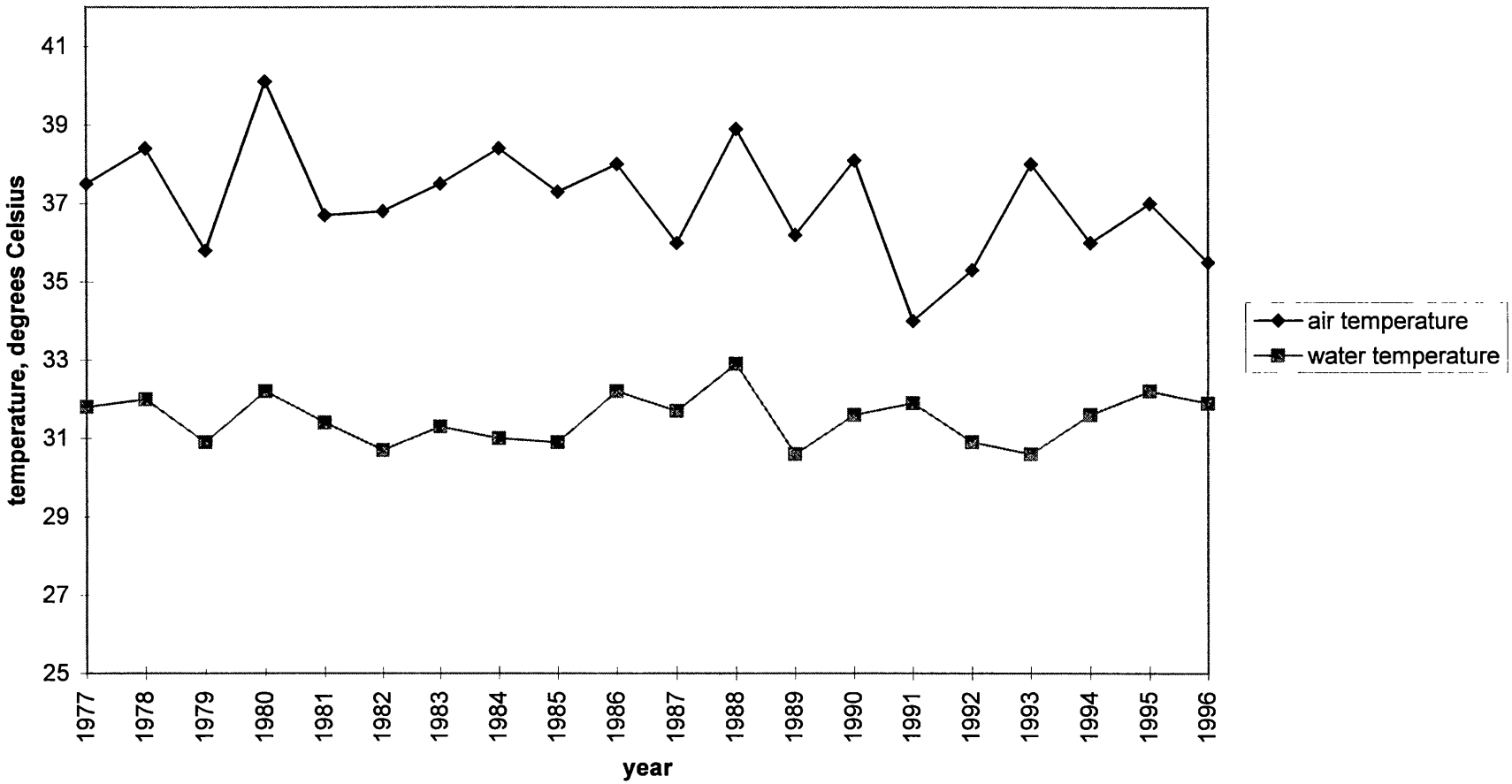

Figure D-9. Daily mean water temperatures, average of 5 summer observation dates annually, vs corresponding days maximum air temperatures, West Fork Trinity River at Beach Street, Fort Worth, TX: 1977-1996

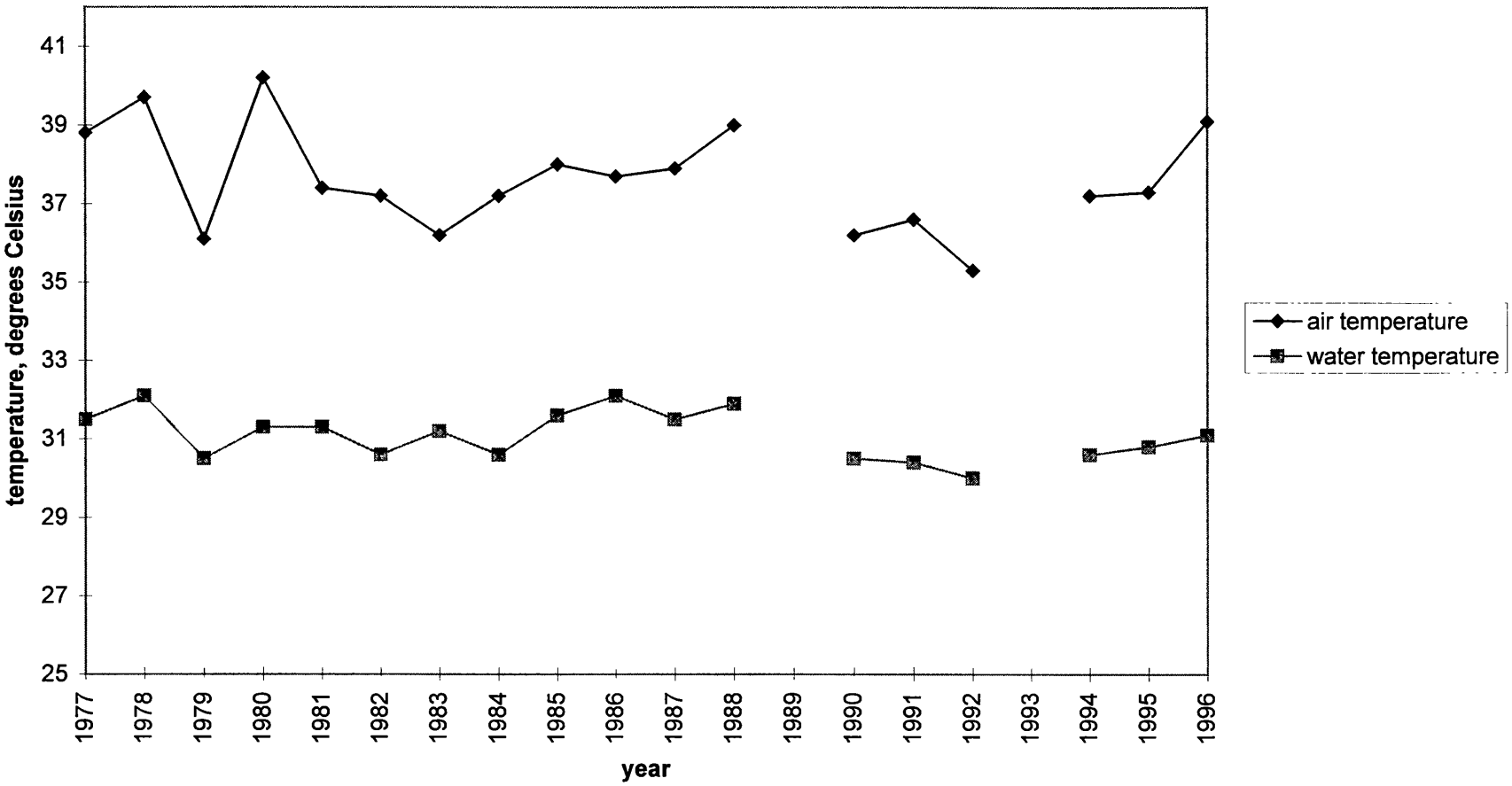

Figure D-10. Daily mean water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, West Fork Trinity River at Grand Prairie, TX: 1977-1996

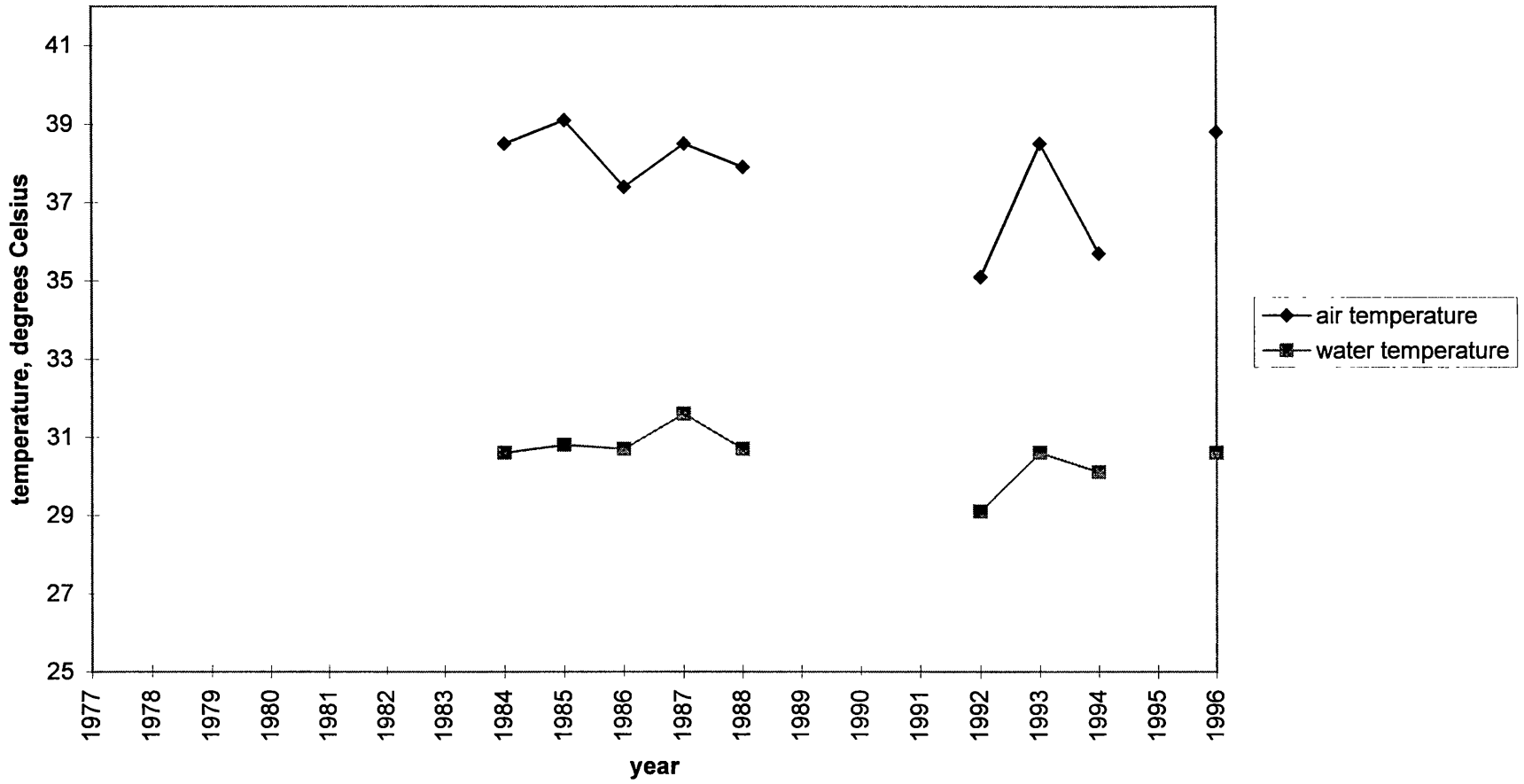

Figure D-11. Daily mean water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, Trinity River at Cedar Crest Blvd., Dallas, TX: 1977-1996

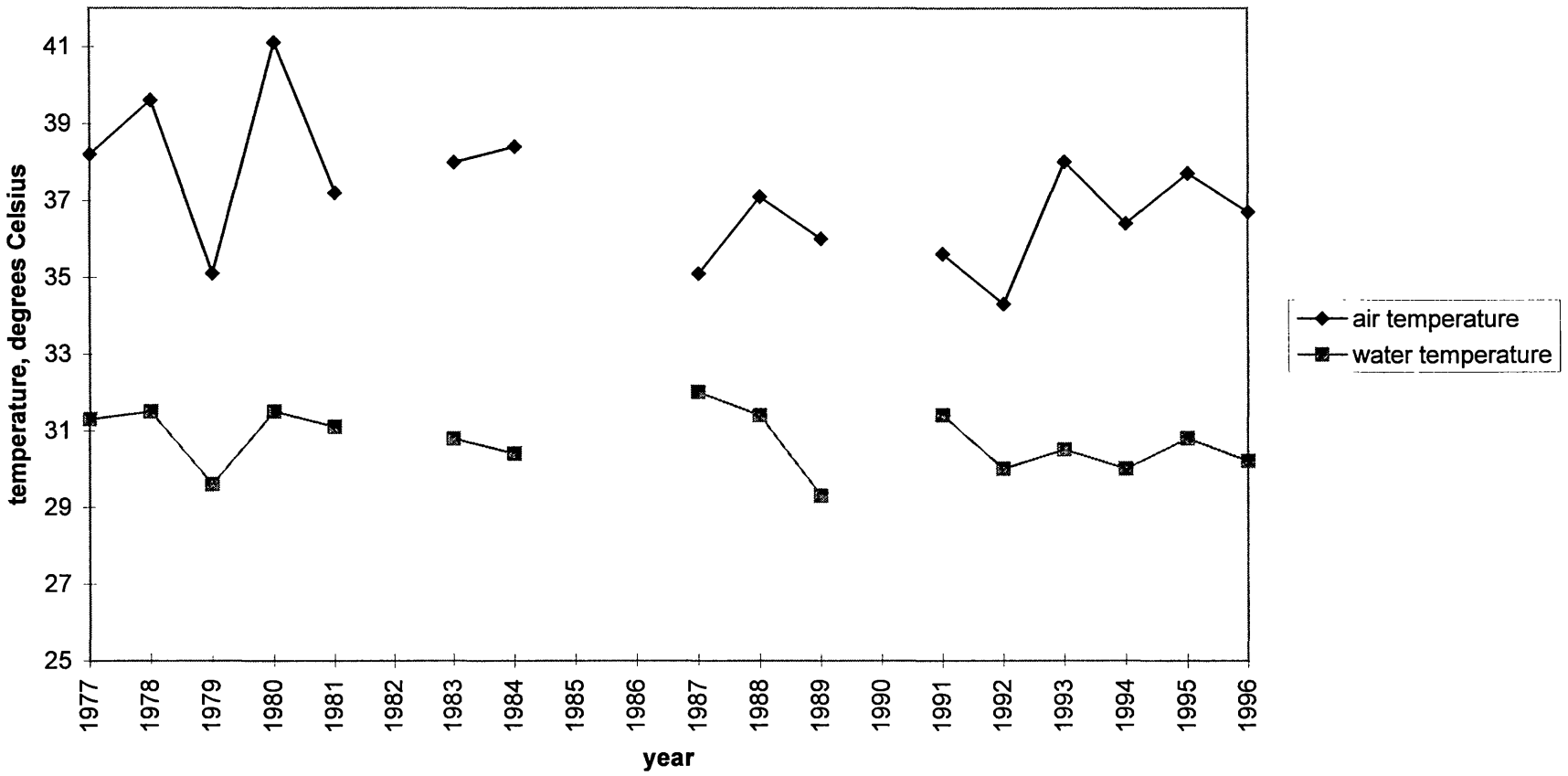

Figure D-12. Daily mean water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, Trinity River below Dallas, TX: 1977-1996

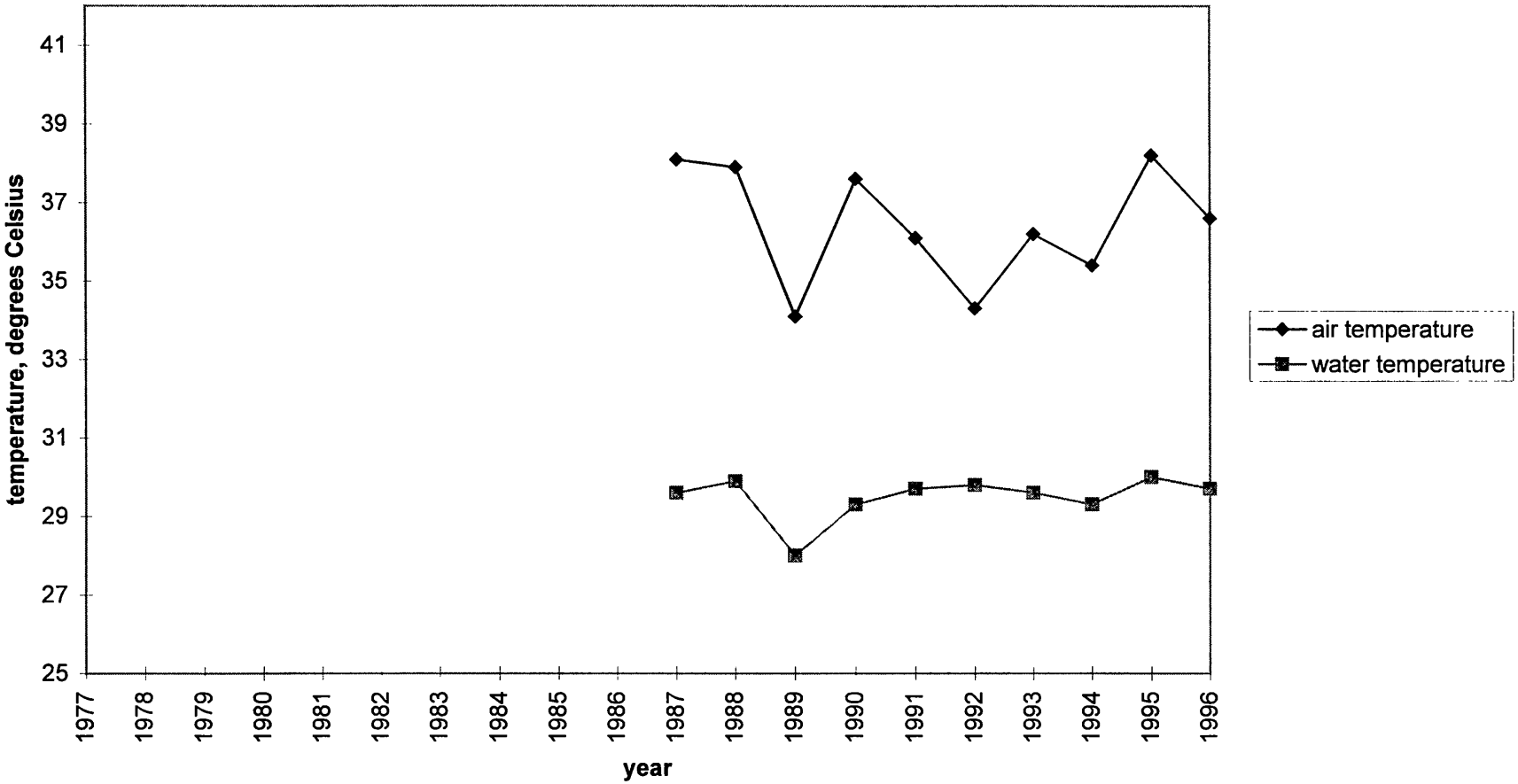

Figure D-13. Daily mean water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, East Fork Trinity River at Seagoville, TX: 1977-1996

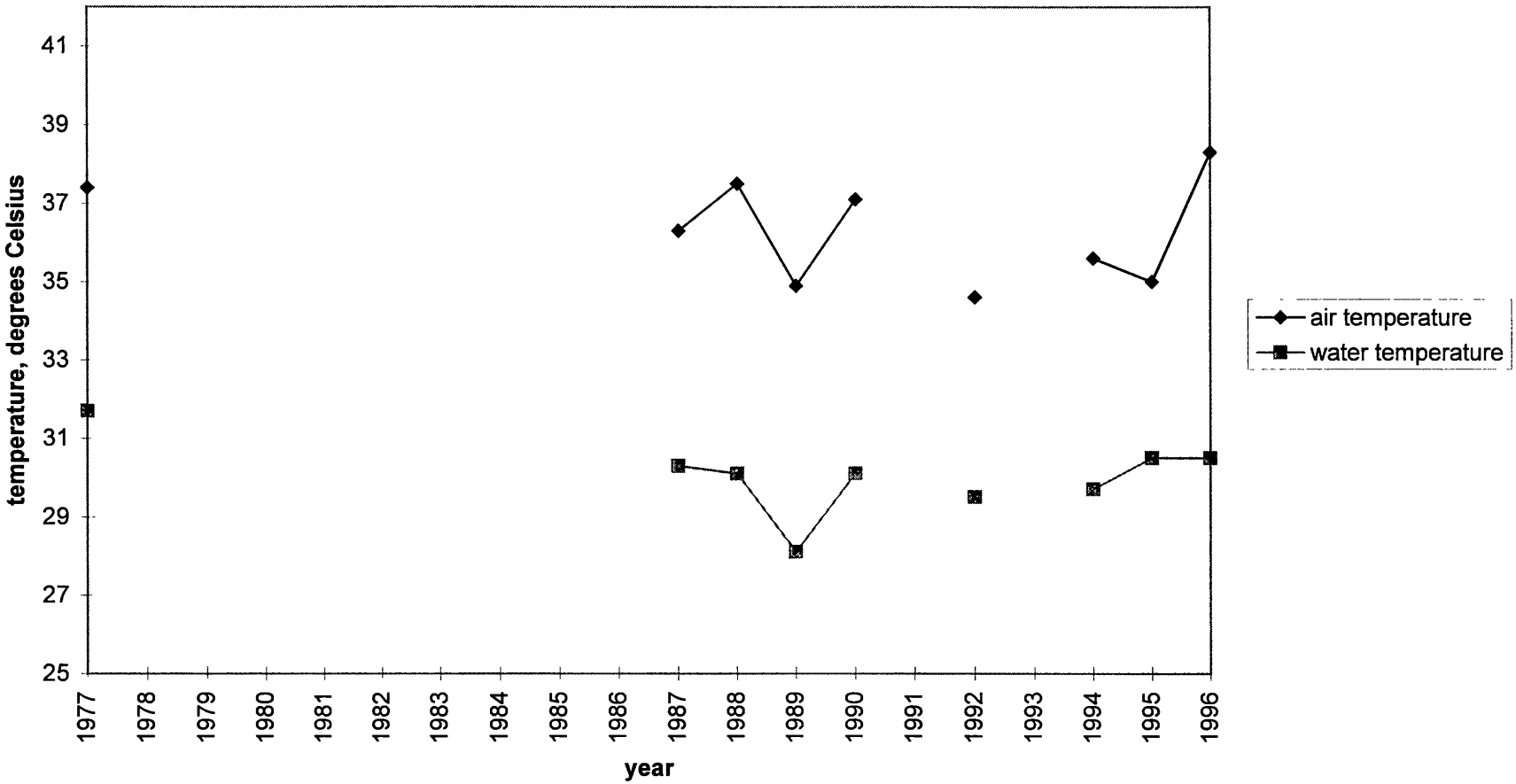

Figure D-14. Daily mean water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, East Fork Trinity River near Crandall, TX: 1977-1996

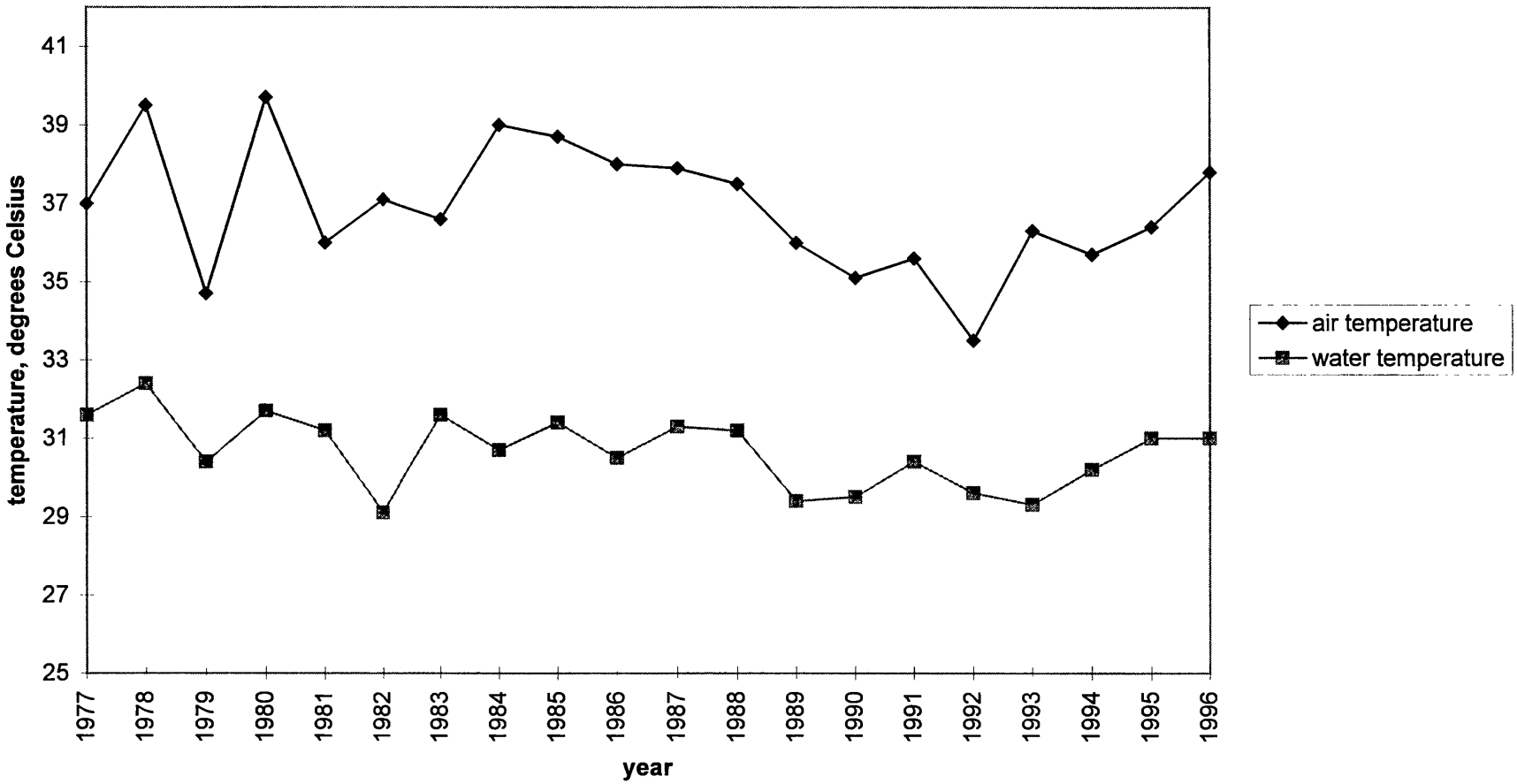

Figure D-15. Daily mean water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, Trinity River near Rosser, TX: 1977-1996

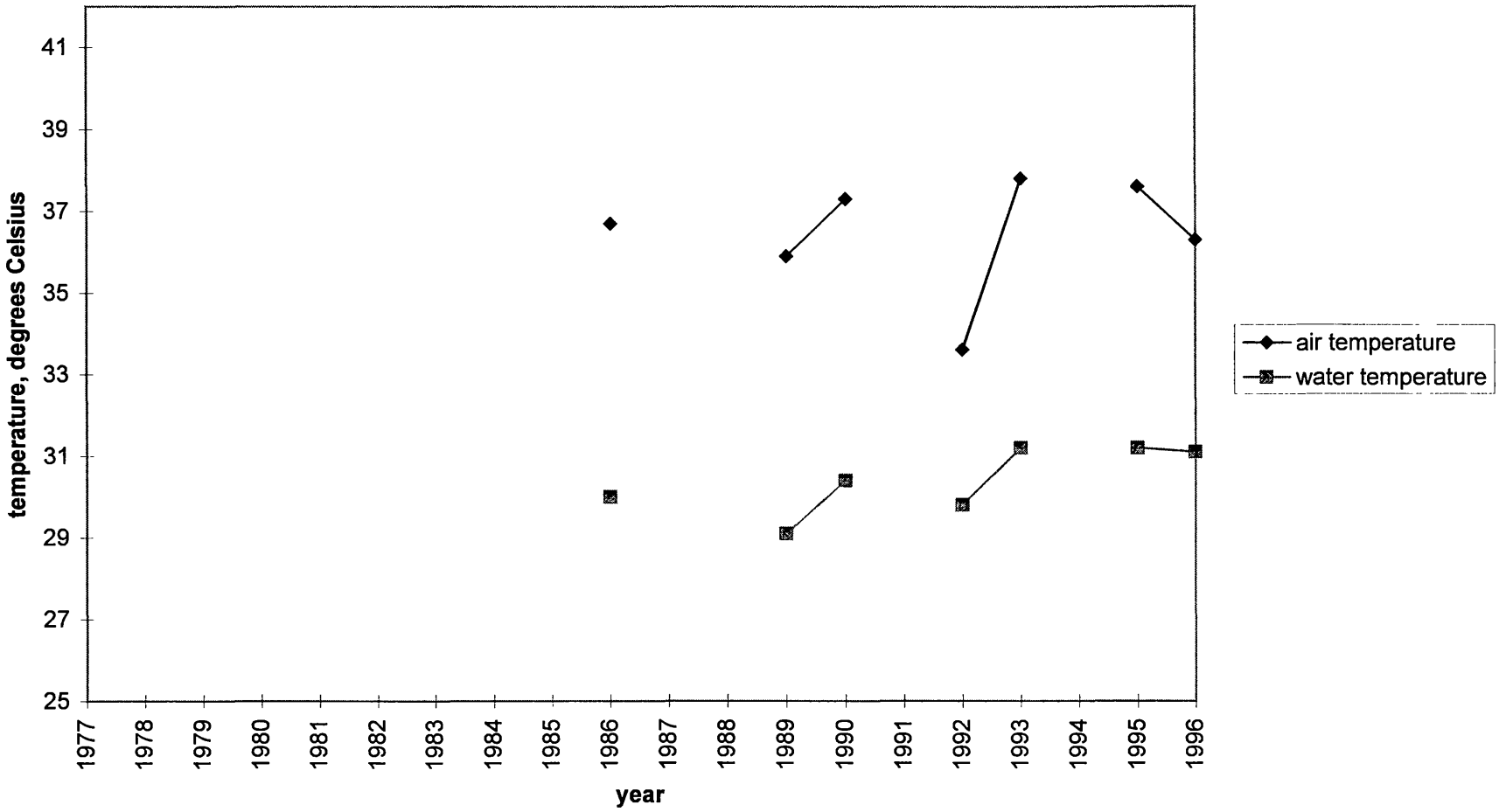

Figure D-16. Daily mean water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, Trinity River at Trinidad, TX: 1977-1996

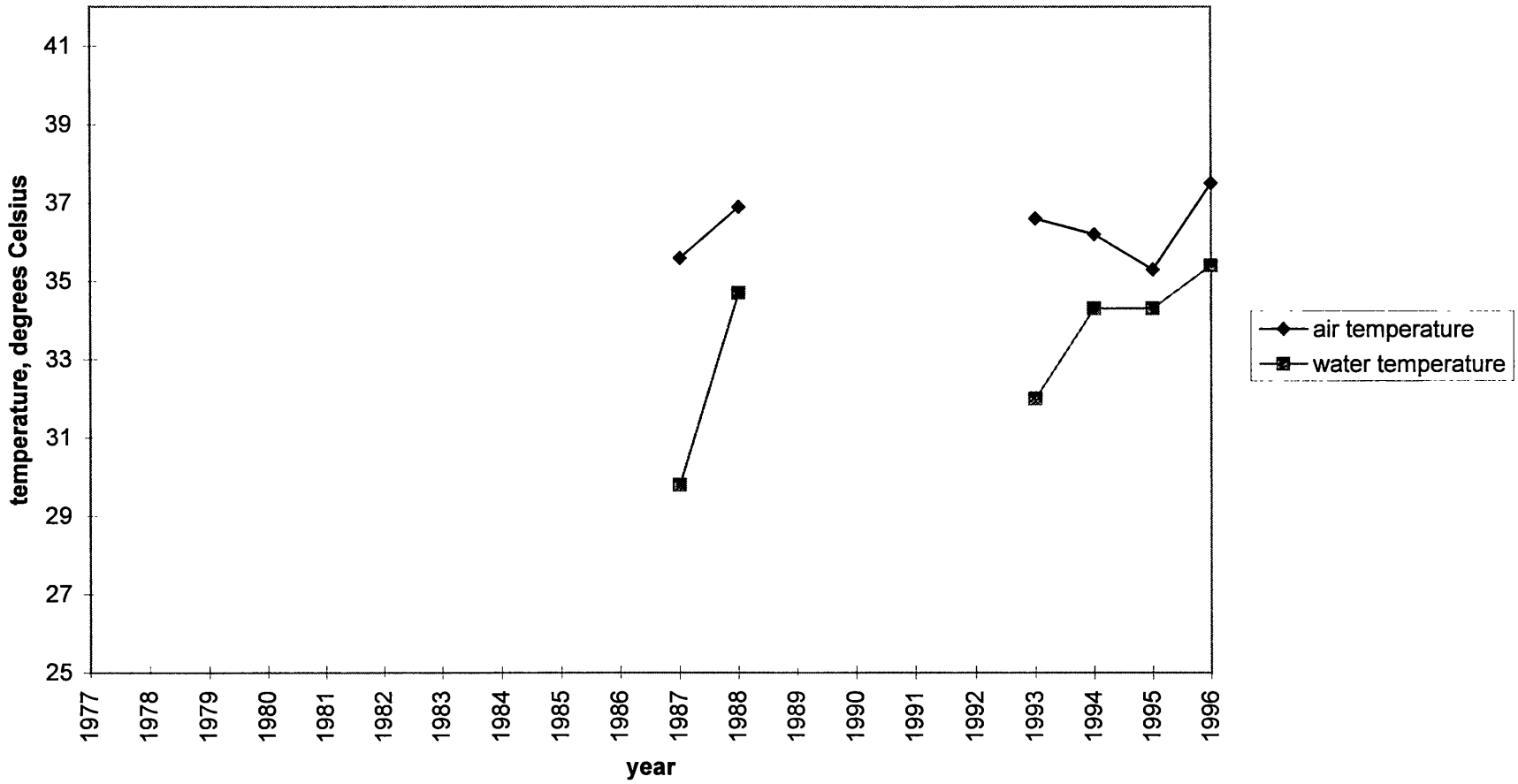

Figure D-17. Daily maximum water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, San Antonio River at Loop 410, San Antonio, TX: 1977-1996

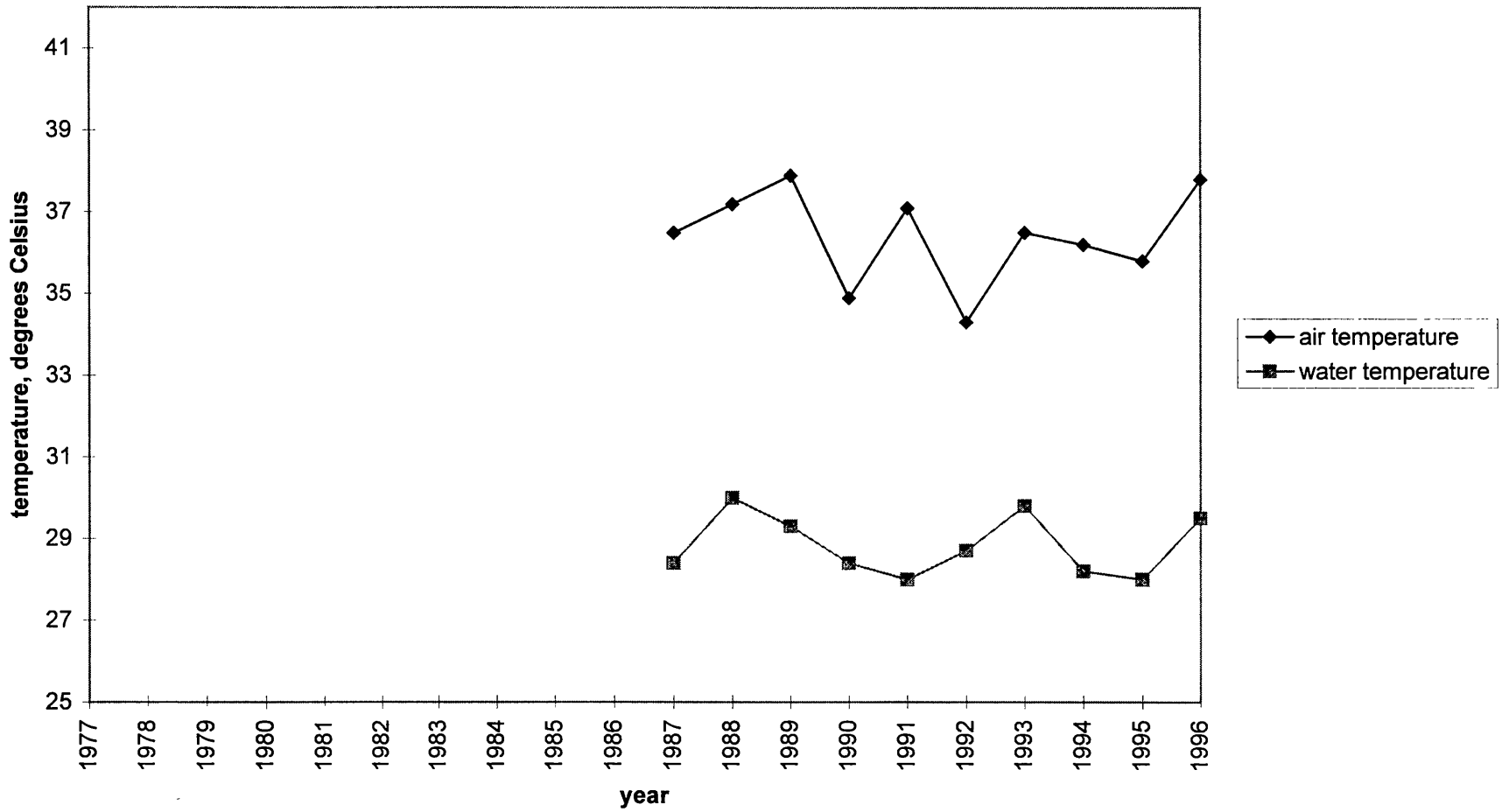

Figure D-18. Daily maximum water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, Salado Creek (lower station) at San Antonio, TX· 1977-1996

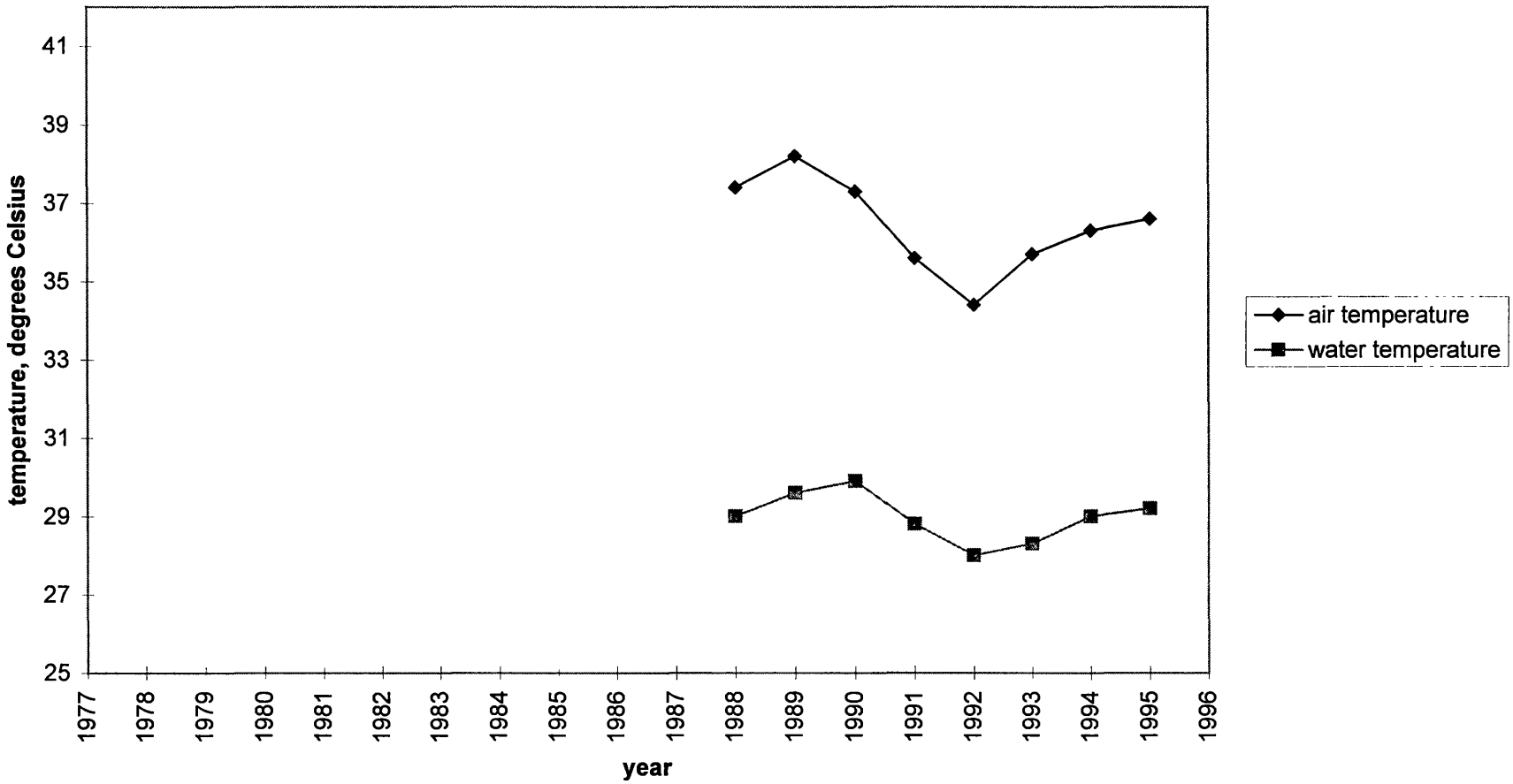

Figure D-19. Daily maximum water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, Medina River at La Coste, TX: 1977-1996

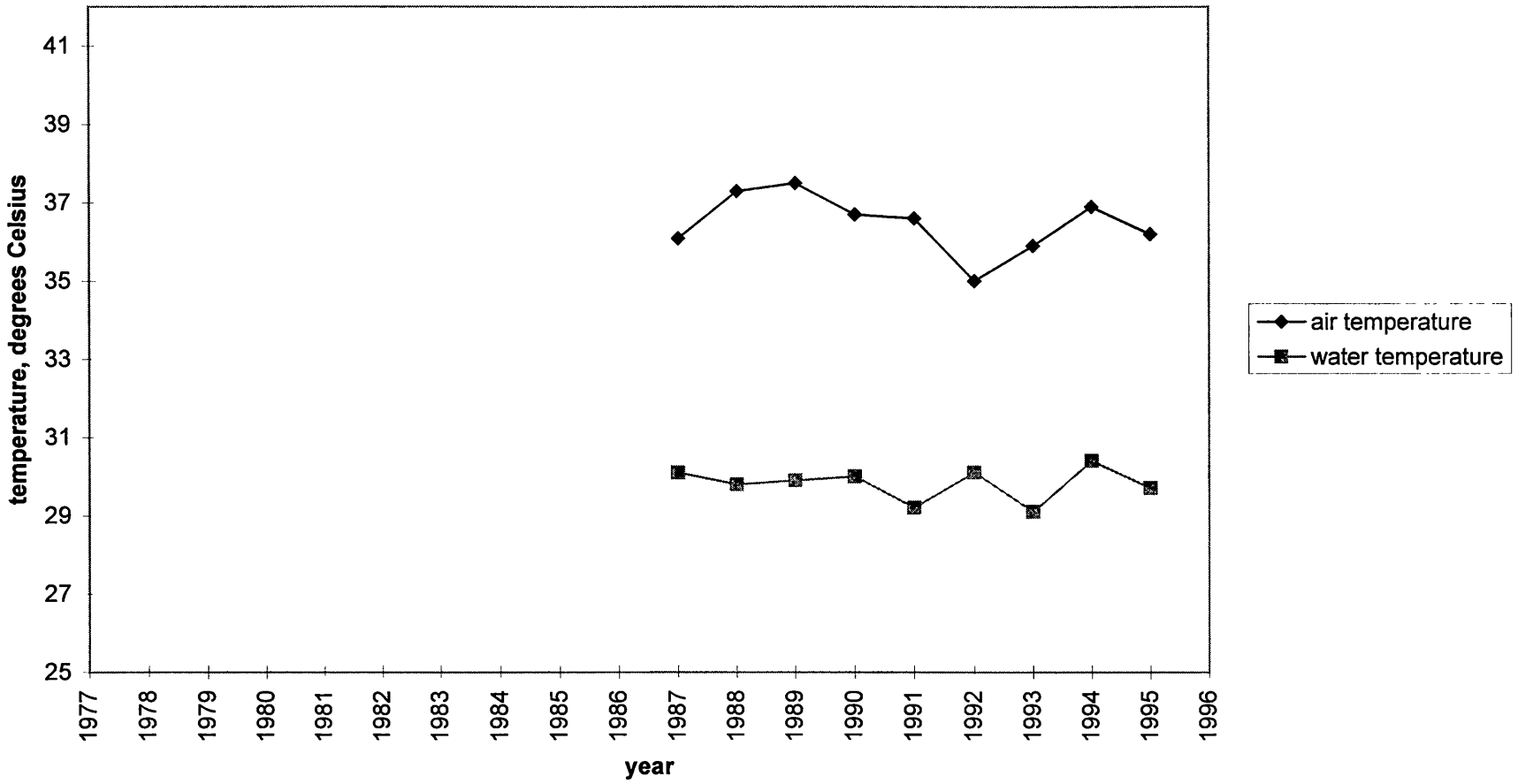

Figure D-20. Daily maximum water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, Medio Creek at Pearsall Rd., San Antonio, TX: 1977-1996

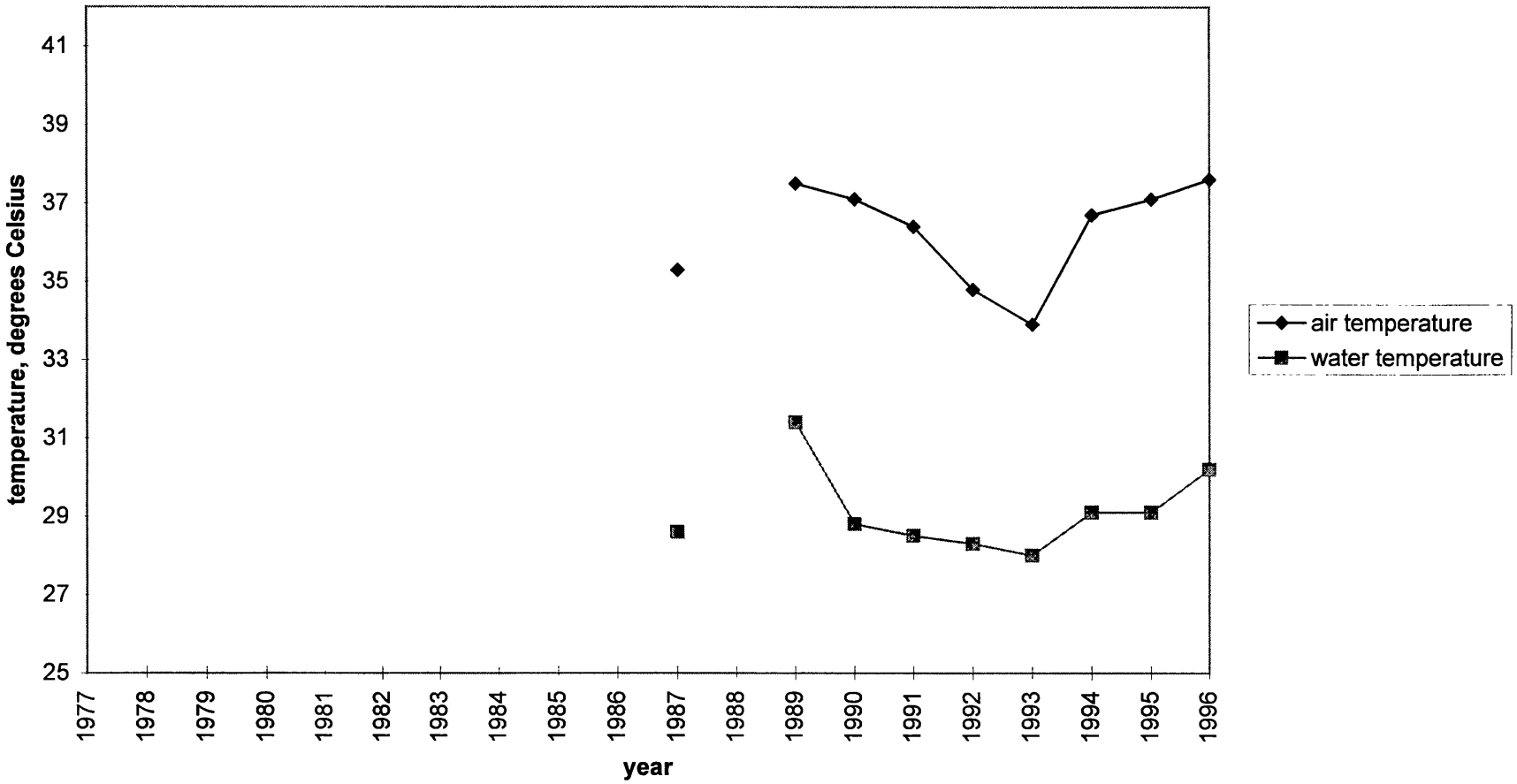

Figure D-21. Daily maximum water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, Leon Creek at IH-35, San Antonio, TX: 1977-1996

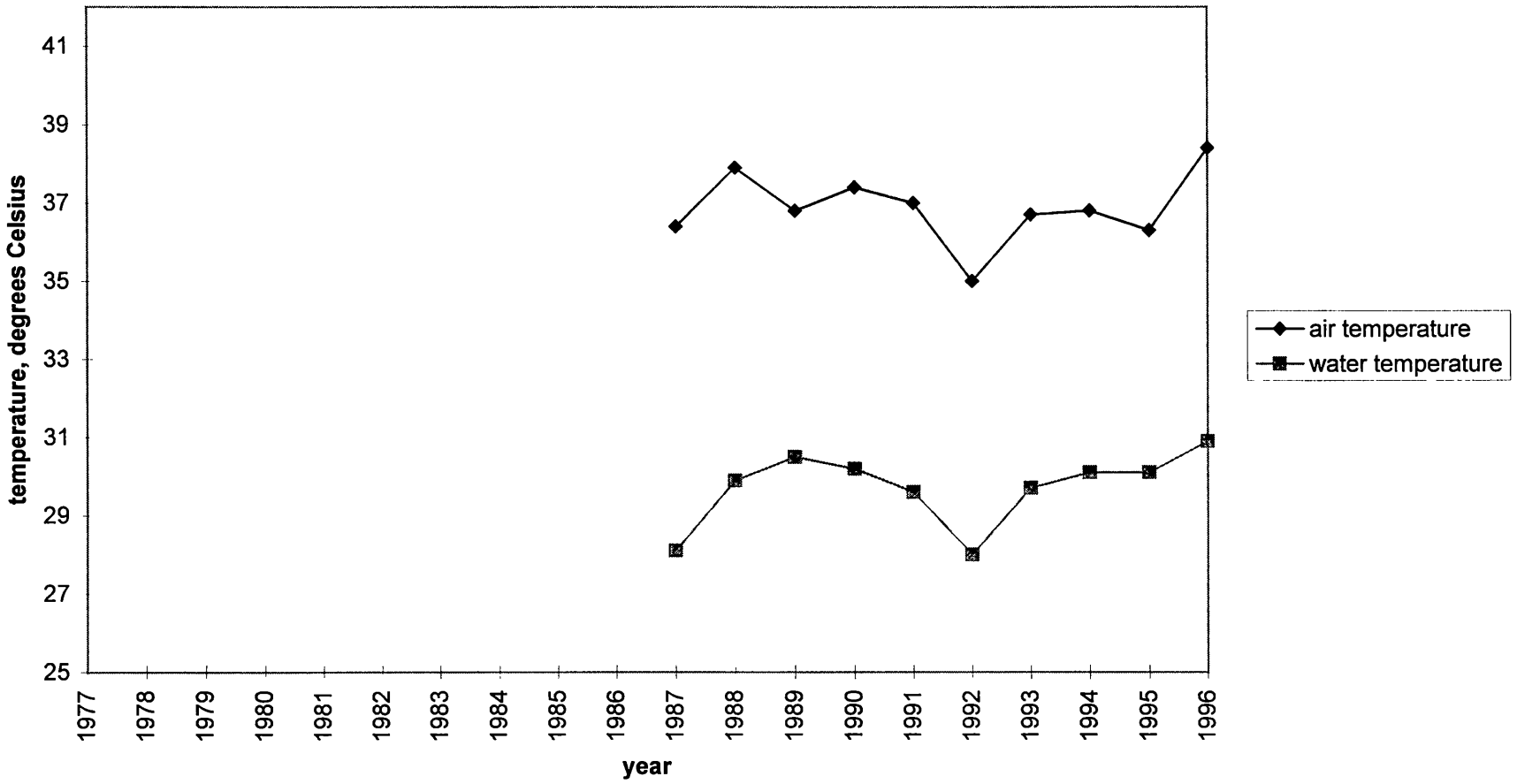

Figure D-22. Daily maximum water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, Medina River at San Antonio, TX: 1977-1996

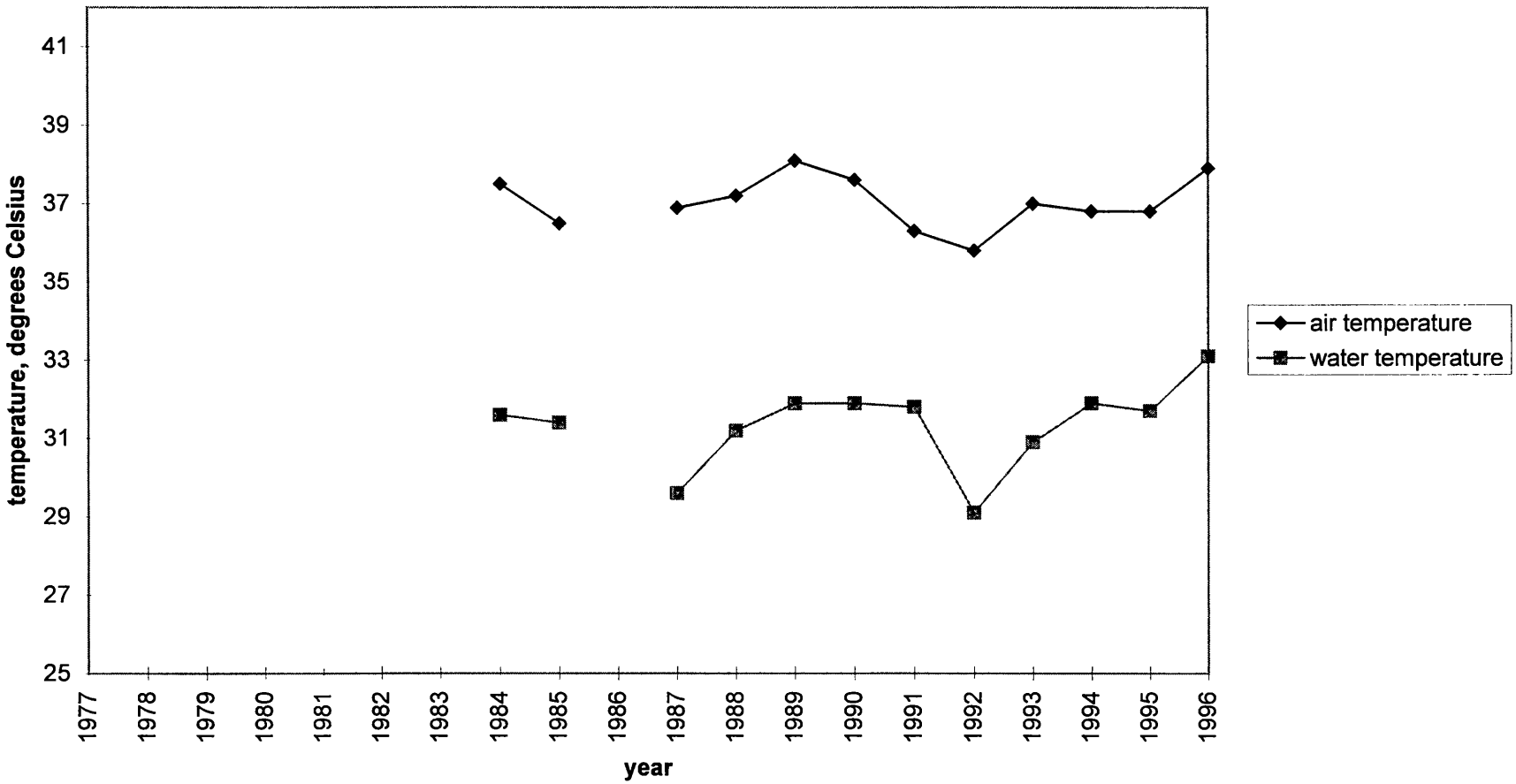

Figure D-23. Daily maximum water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, San Antonio River near Elmendorf, TX: 1977-1996

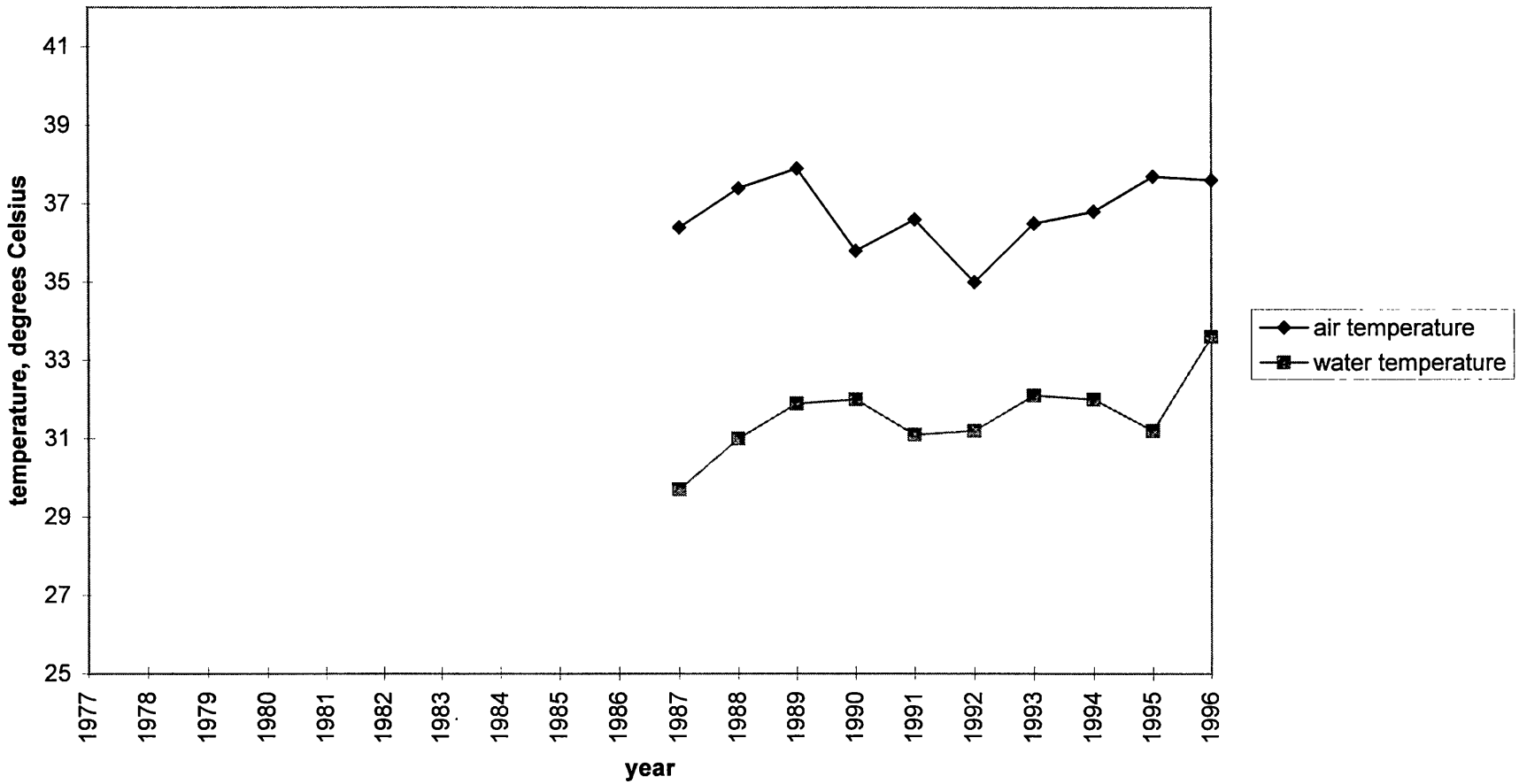

Figure D-24. Daily maximum water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, San Antonio River near Falls City, TX: 1977-1996

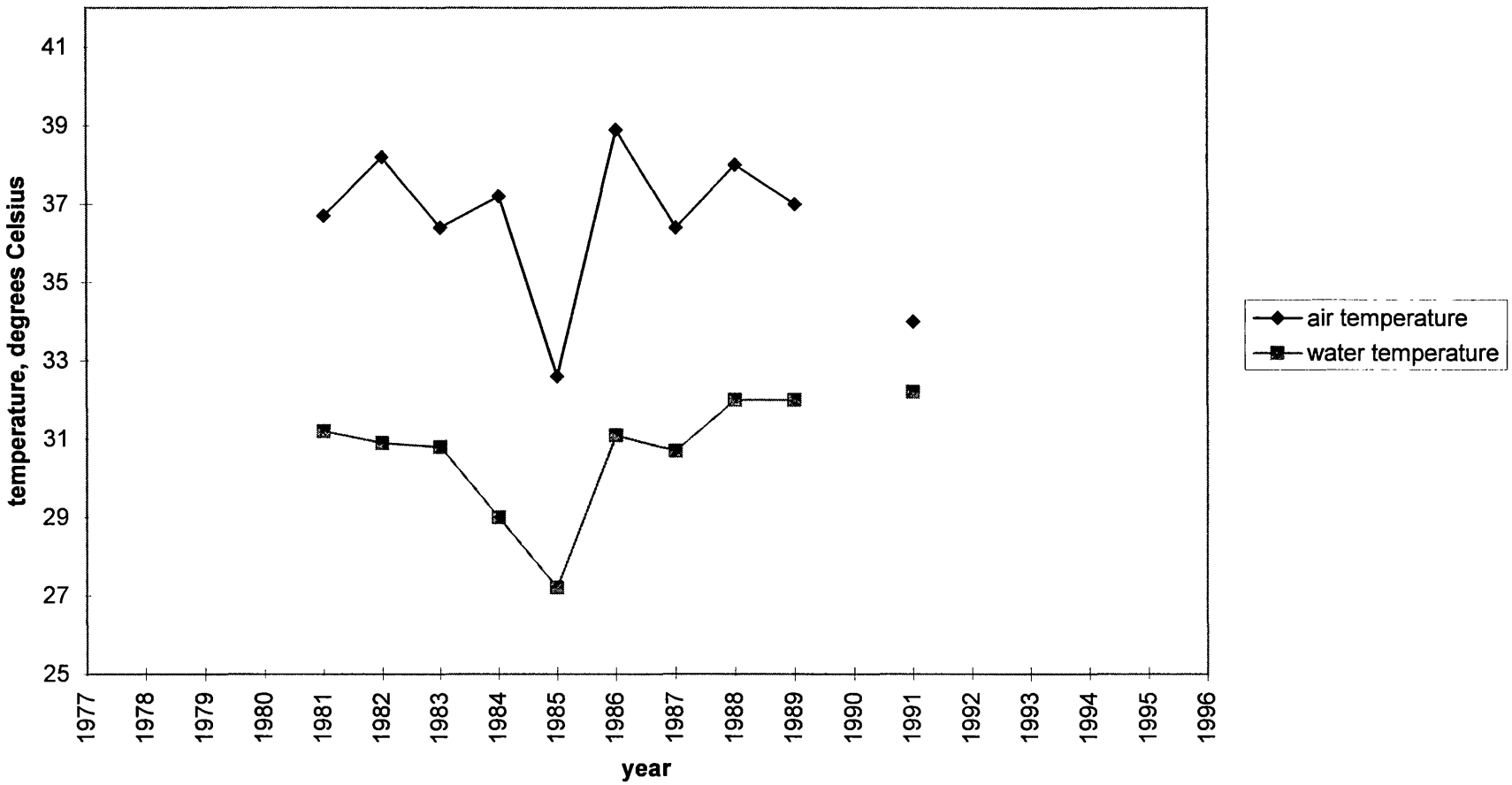

Figure D-25. Daily maximum water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, Cibolo Creek near Falls City, TX: 1977-1996

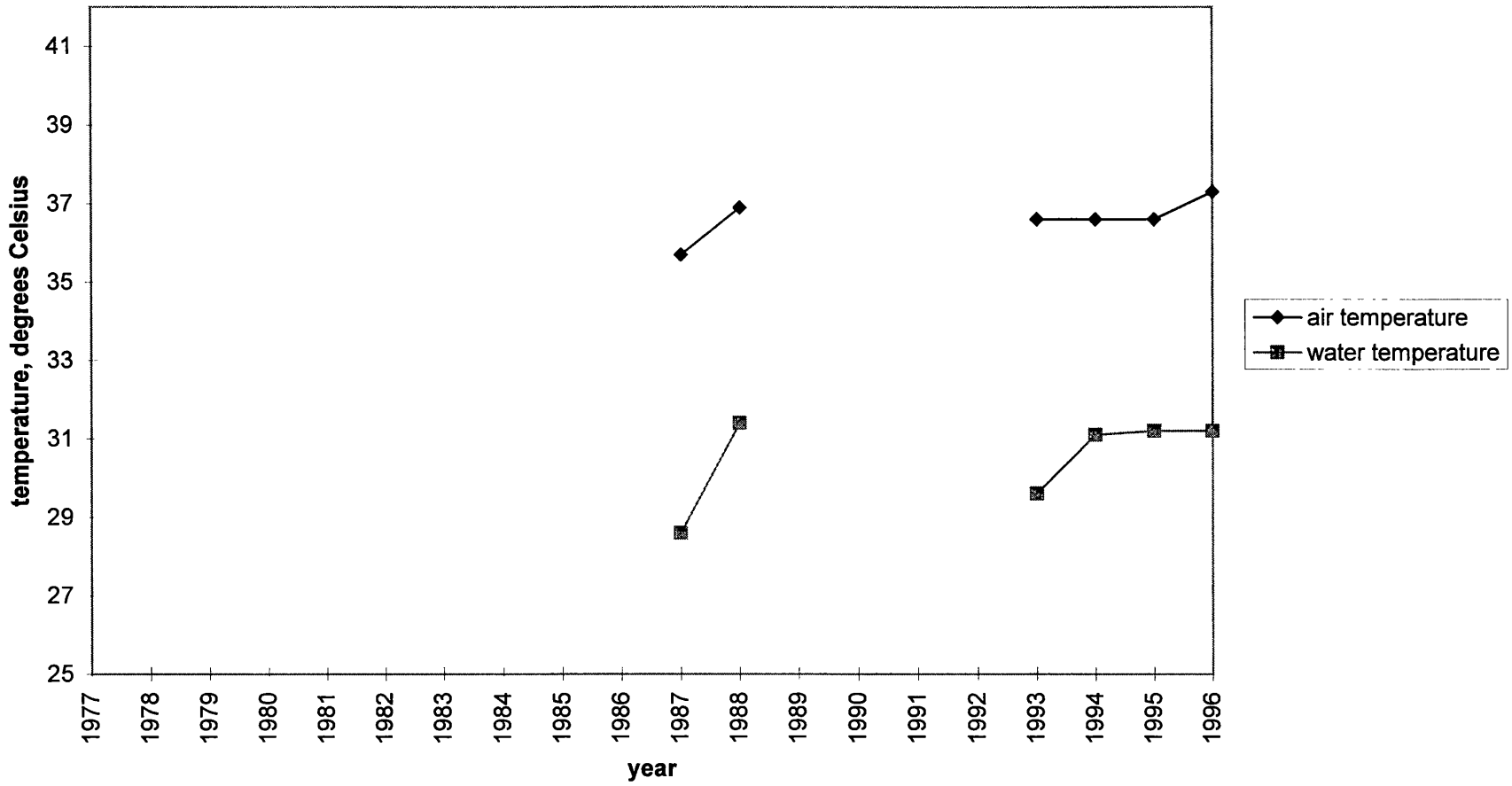

Figure D-26. Daily mean water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, San Antonio River at Loop 410, San Antonio, TX: 1977-1996

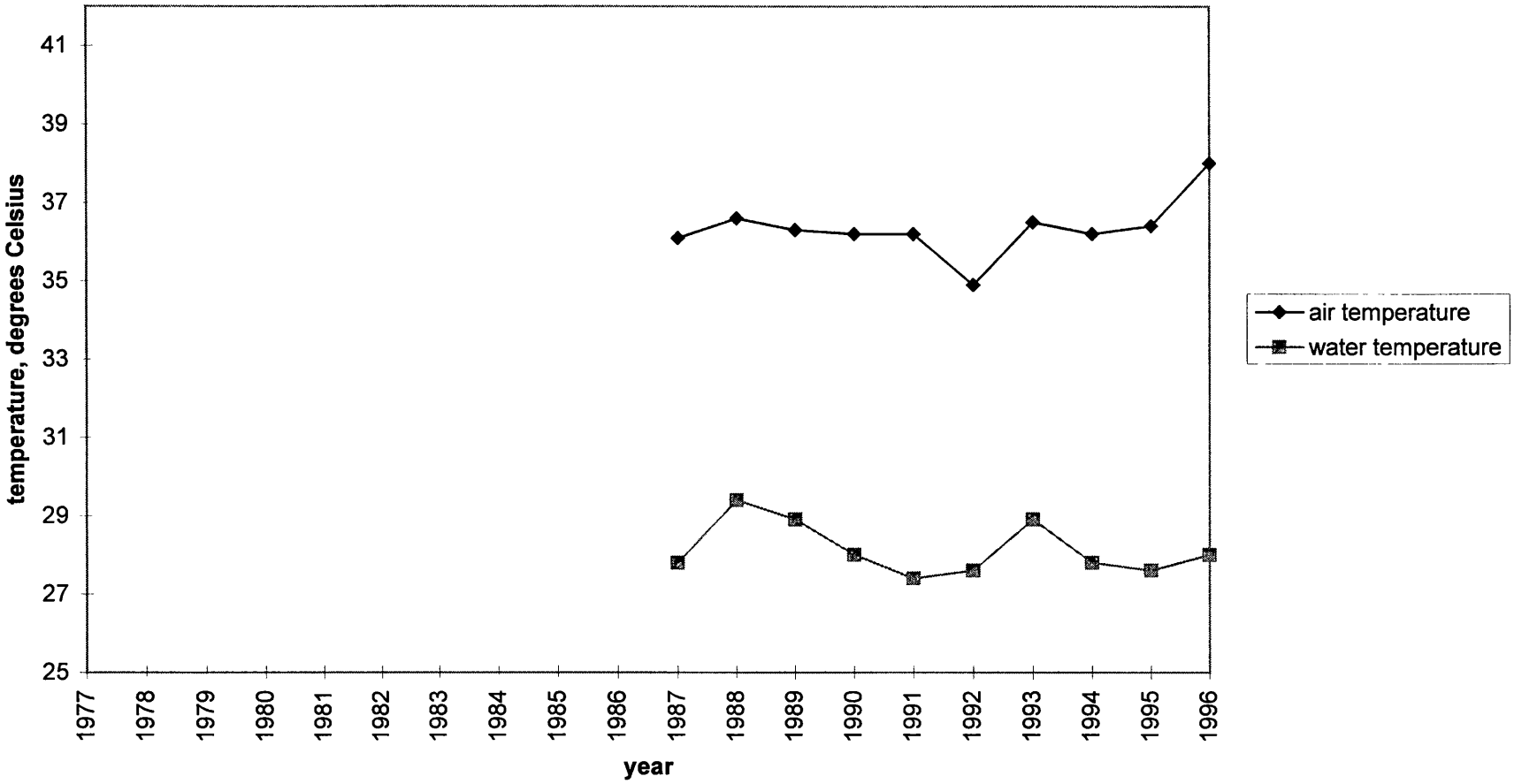

Figure D-27. Daily mean water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, Salado Creek (lower station) at San Antonio, TX: 1977-1996

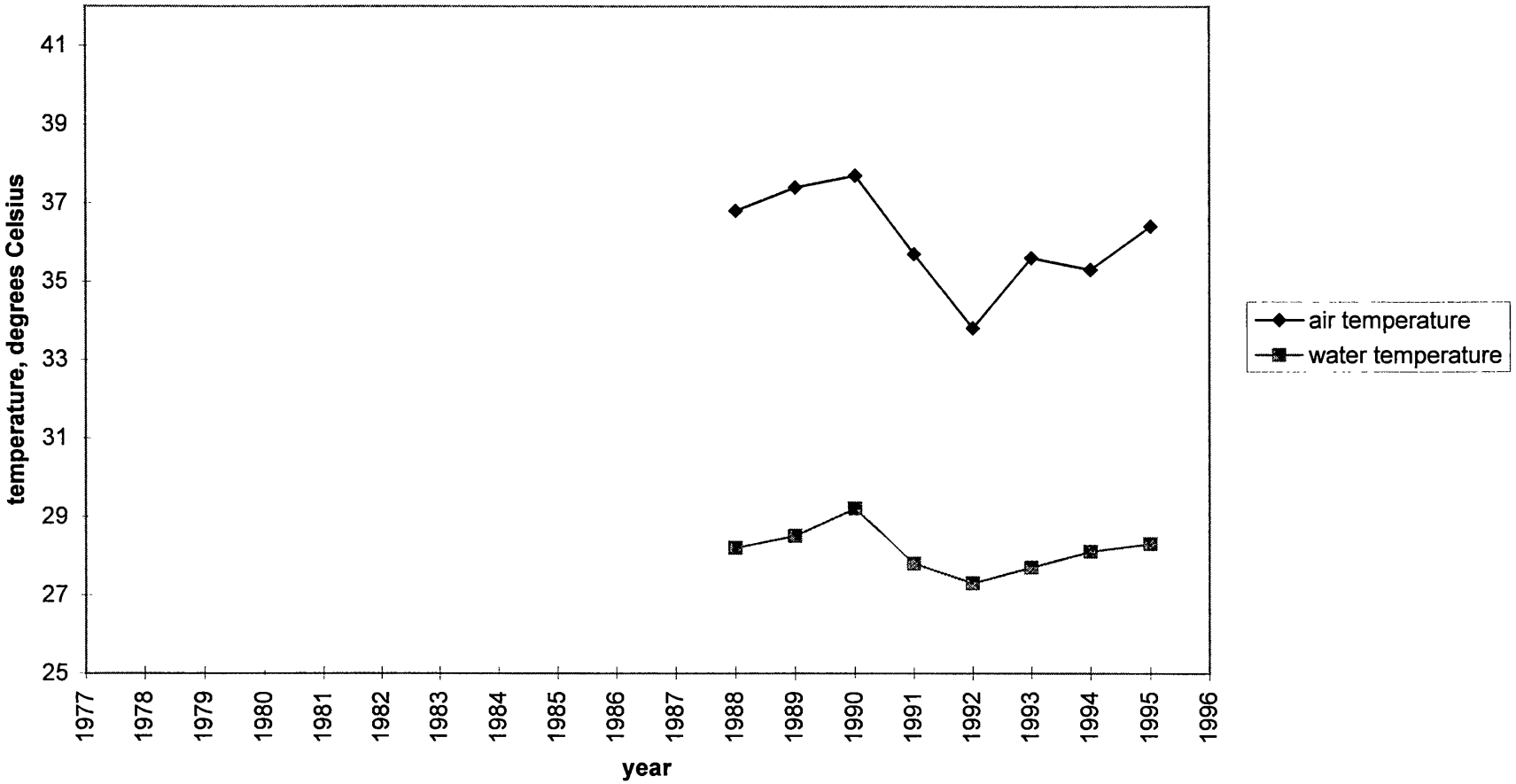

Figure D-28. Daily mean water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, Medina River at La Coste, TX: 1977-1996

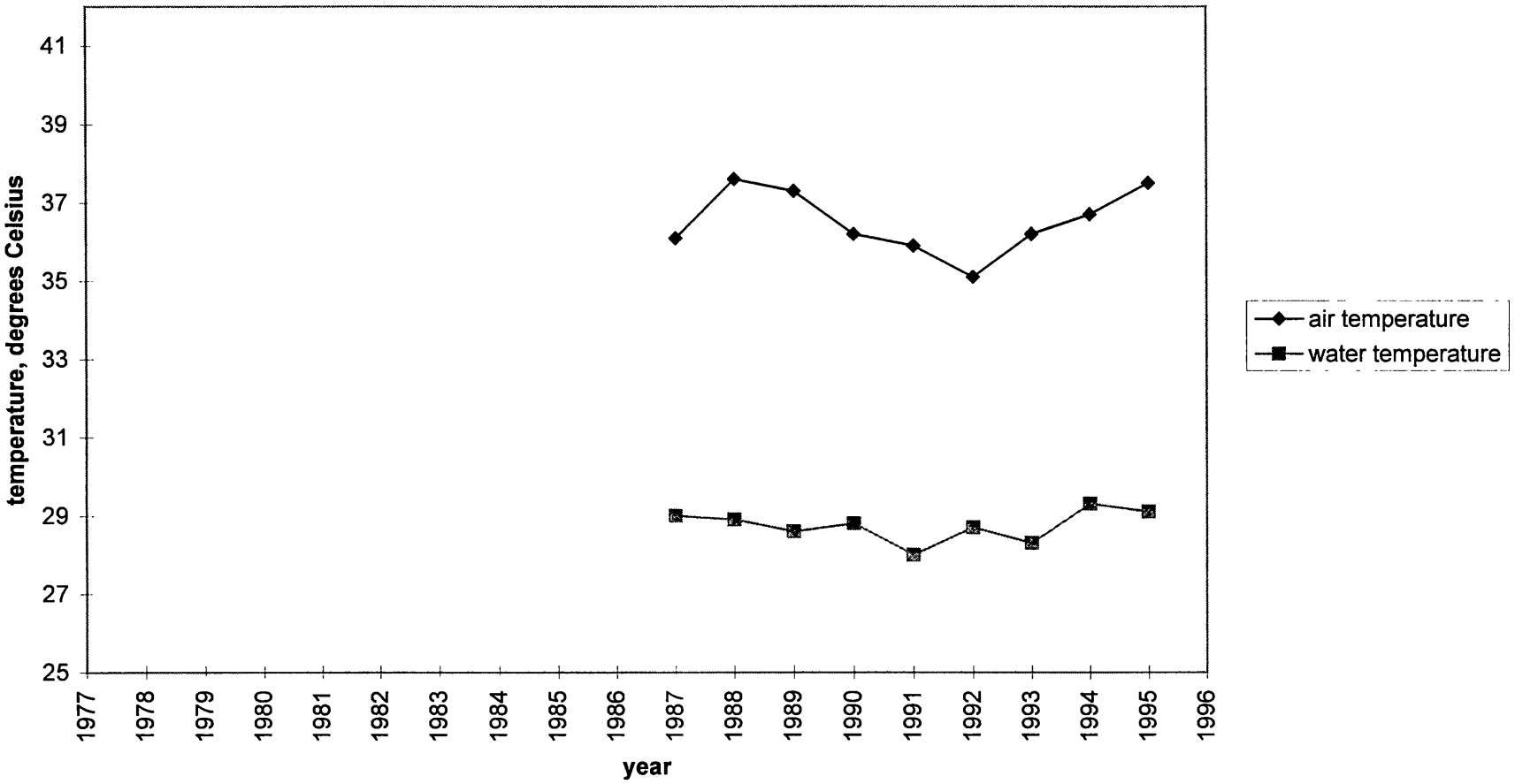

Figure D-29. Daily mean water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, Medio Creek at Pearsall Rd., San Antonio, TX: 1977-1996

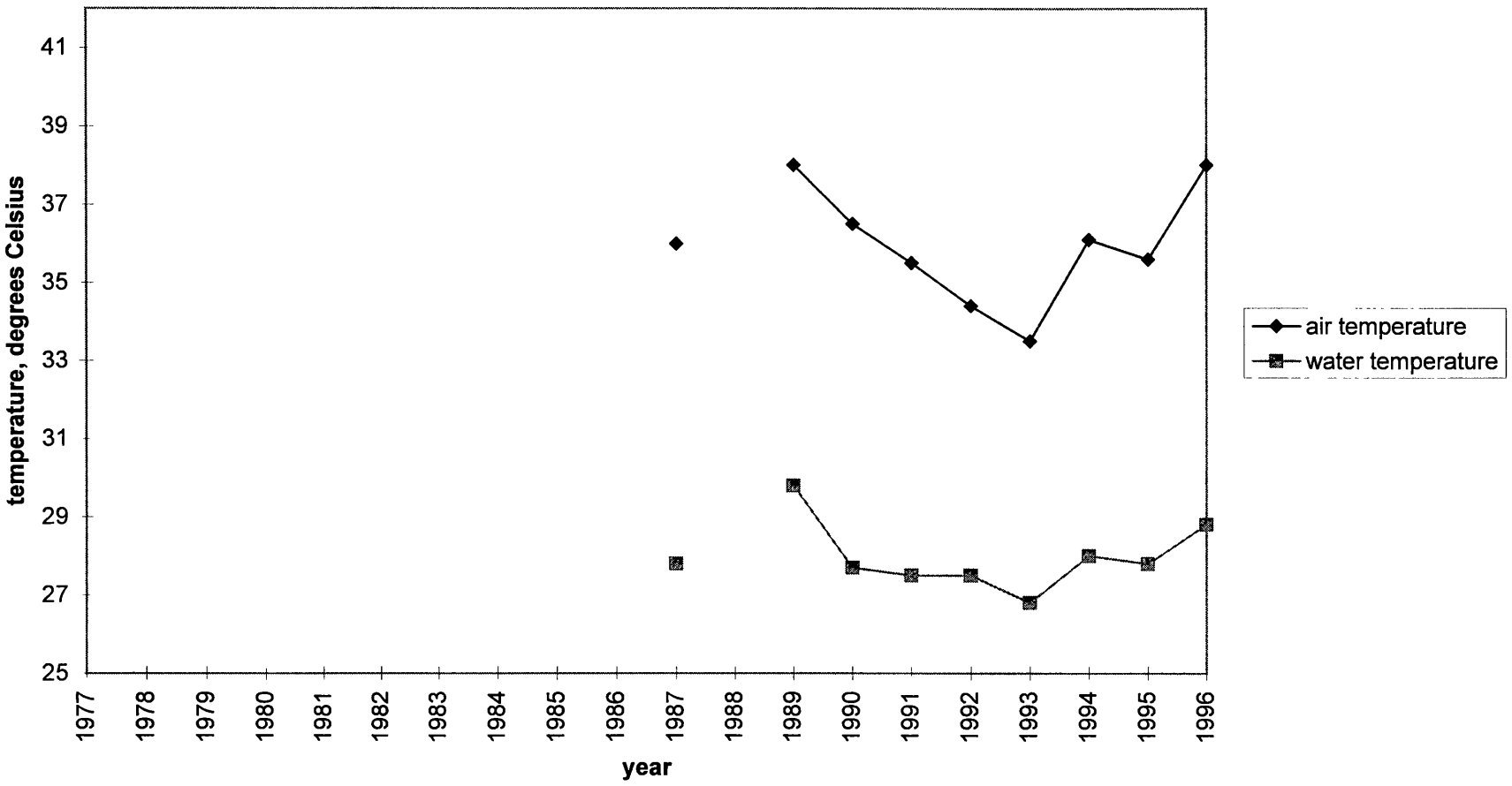

Figure D-30. Daily mean water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, Leon Creek at IH-35, San Antonio, TX: 1977-1996

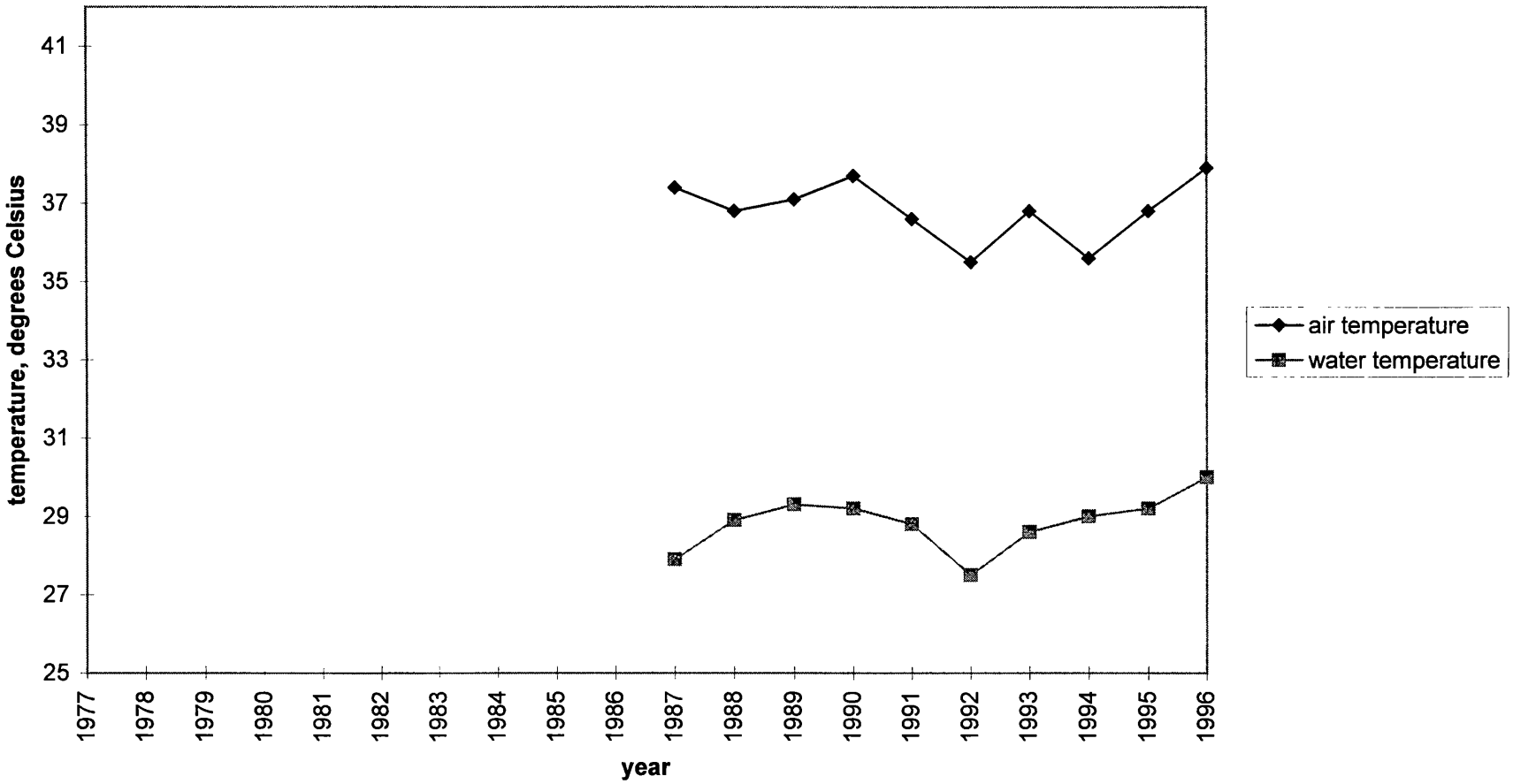

Figure D-31. Daily mean water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, Medina River at San Antonio, TX: 1977-1996

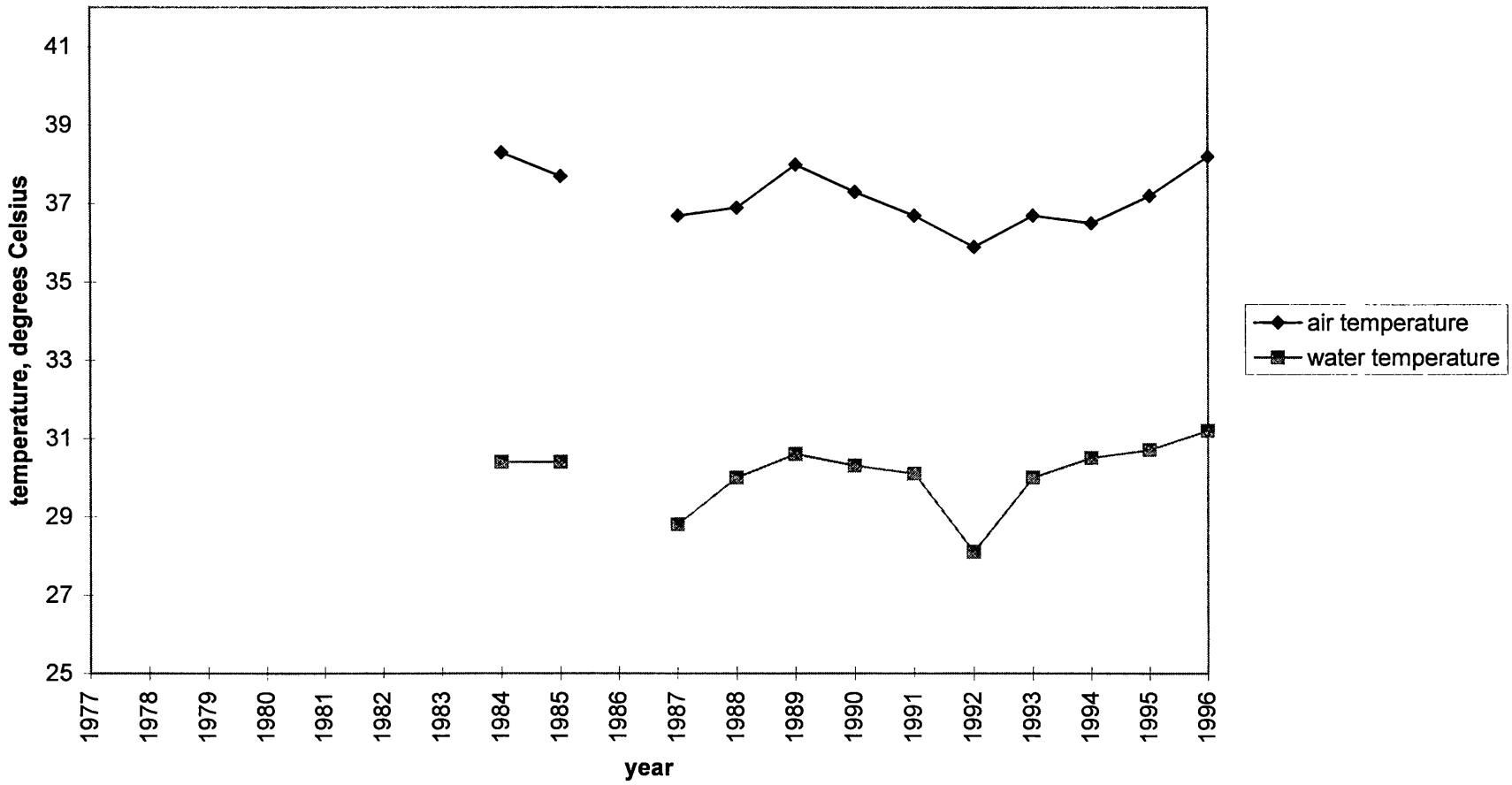

Figure D-32. Daily mean water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, San Antonio River near Elmendorf: 1977-1996

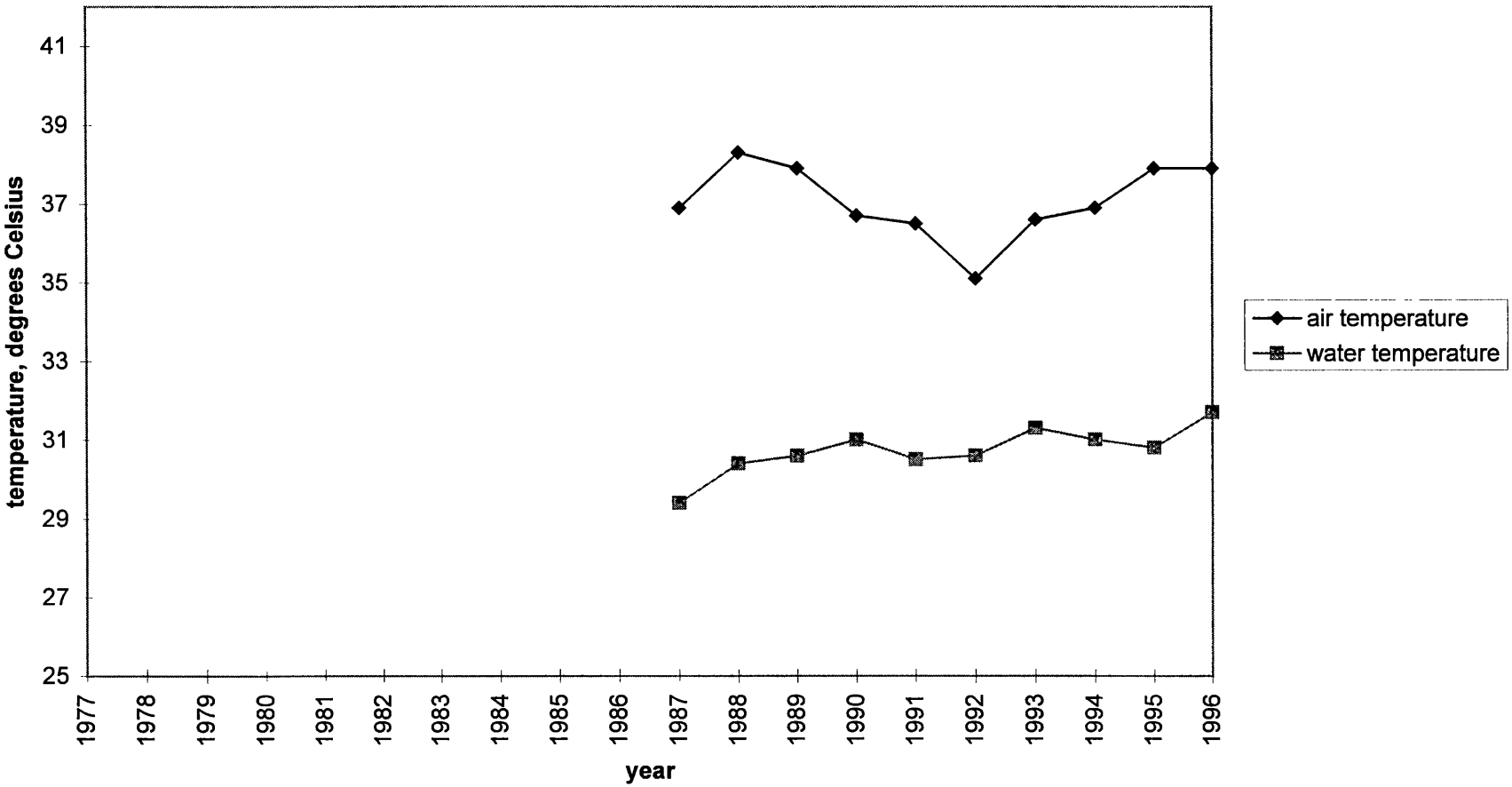

Figure D-33. Daily mean water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, San Antonio River near Falls City, TX: 1977-1996

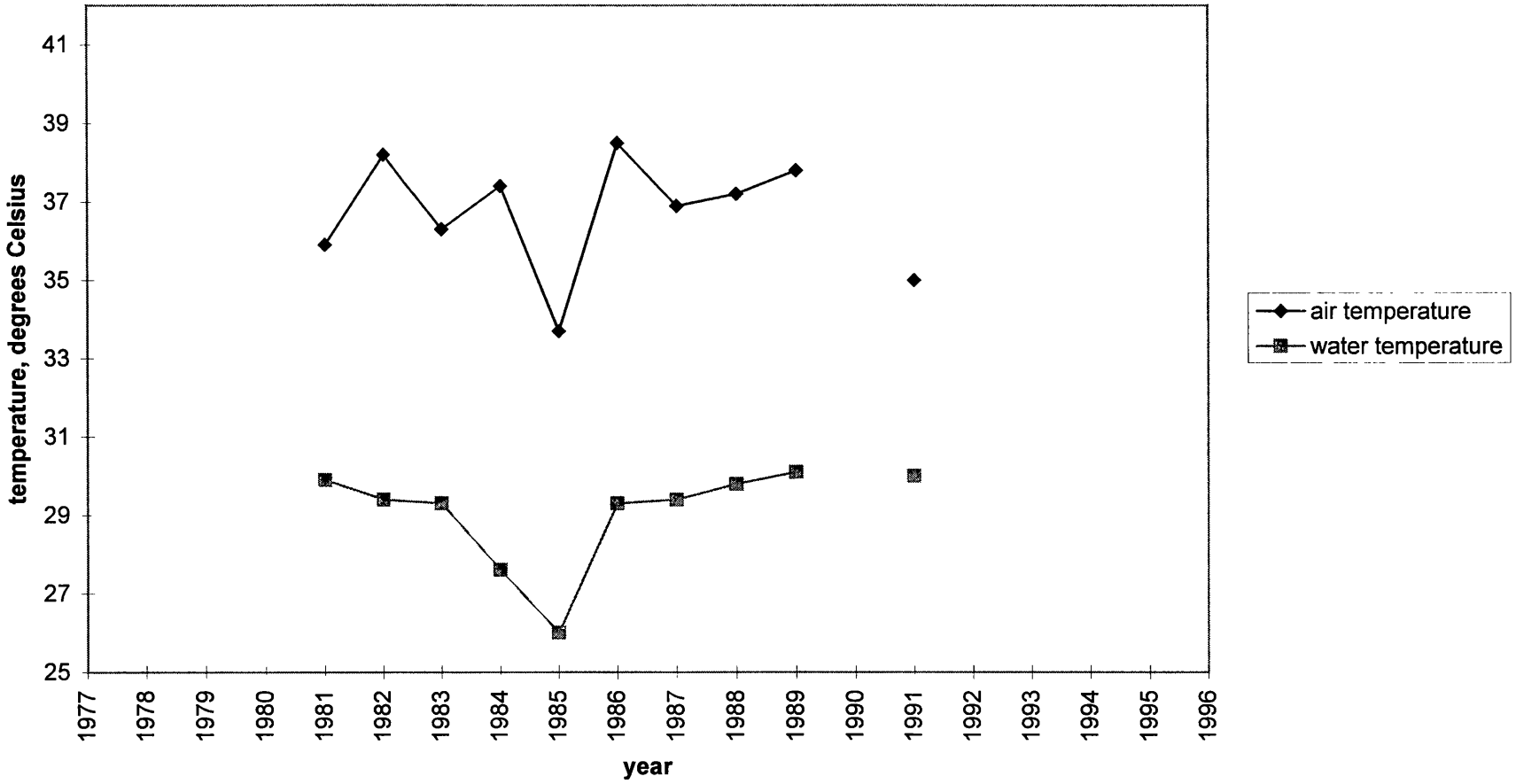

Figure D-34. Daily mean water temperatures, average of 5 summer observation dates annually, vs. corresponding days maximum air temperatures, Cibolo Creek near Falls City, TX. 1977-1996

APPENDIX E

Multiple Regression Analysis
Results

TABLE 32

MULTIPLE REGRESSION ANALYSIS RESULTS
Trinity River Basin Maximum Daily Water Temperatures vs. Year and Other Variables

PROCEDURE	**STATISTICS**	**REGRESSION EQUATION**	**ORDER OF VARIABLES ENTRY INTO REGRESSION EQUATION**	**VARIABLES NOT IN THE EQUATION**	**VARIABLES WITH SIG *T* < OR = .0500**	**VARIABLES WITH SIG *T* = .0000**
Trinity River Basin maximum water temperature vs. year	total cases: 540 cases used: 529 Adjusted R^2: .59 standard error: 1.11 F = 109.12 Sig F = .0000	H2O TEMP = 27.4648 - .0205 (YEAR) - .0060 (DATERANK) - .7056 (DISCHLN) + .0561 (AIRTEMP) + .0563 (AIR3TEMP) - .0038 (WIND) - .2831 (CLOUDS)	1. DISCHLN 2. AIRTEMP 3. AIR3TEMP 4. DATERANK 5. WIND 6. YEAR 7. CLOUDS	PRECIP DEWPT	Constant DISCHLN AIRTEMP AIR3TEMP DATERANK WIND YEAR CLOUDS	Constant DISCHLN
	EXPLAINED AND UNEXPLAINED SUM OF SQUARES	**INTER-CORRELATIONS > OR = (+/-) .500**	**INTER-CORRELATIONS: (+/-) .400 TO .499**	**PREDICTED MEAN WATER TEMPERATURE**	**OUTLIERS > OR = (+/-) 3.0 STANDARD DEVIATIONS**	**MEAN OF DISCHLN VARIABLE**
	explained: 947.28 unexplained: 646.13 <u>Degrees of Freedom</u> Regression: 7 Residual: 521	H2OTEMP / DISCHLN = (-) .726 AIRTEMP / AIR3TEMP = (+) .744	H2OTEMP / AIRTEMP (+) AIRTEMP / DEWPT(-) AIR3TEMP / PRECIP (-) AIR3TEMP / DEWPT (-)	32.05 °C standard deviation: 1.34	3.04 SD 3.10 3.68 4.29	5.34 standard deviation: 1.63

TABLE 33

MULTIPLE REGRESSION ANALYSIS RESULTS
Trinity River Basin Mean Daily Water Temperatures vs. Year and Other Variables

PROCEDURE	**STATISTICS**	**REGRESSION EQUATION**	**ORDER OF VARIABLES ENTRY INTO REGRESSION EQUATION**	**VARIABLES NOT IN THE EQUATION**	**VARIABLES WITH SIG *T* < OR = .0500**	**VARIABLES WITH SIG *T* = .0000**
Trinity River Basin mean water temperature vs. year	total cases: 545 cases used: 528 Adjusted R^2: .37 standard error: .79 F = 45.39 Sig F = .0000	H2O TEMP = 22.1076 - .0349 (YEAR) - .0078 (DATERANK) - .1883 (DISCHLN) + .0585 (AIRTEMP) + .0638 (AIR3TEMP) - .0055 (WIND) + .0252 (DEWPT)	1. AIR3TEMP 2. DISCHLN 3. YEAR 4. DATERANK 5. WIND 6. AIRTEMP 7. DEWPT	PRECIP CLOUDS	Constant AIR3TEMP DISCHLN YEAR DATERANK WIND AIRTEMP DEWPT	Constant AIR3TEMP DISCHLN YEAR DATERANK WIND
	EXPLAINED AND UNEXPLAINED SUM OF SQUARES	**INTER-CORRELATIONS > OR = (+/-) .500**	**INTER-CORRELATIONS: (+/-) .400 TO .499**	**PREDICTED MEAN WATER TEMPERATURE**	**OUTLIERS > OR = (+/-) 3.0 STANDARD DEVIATIONS**	**MEAN OF DISCHLN VARIABLE**
	explained: 200.28 unexplained: 327.77 <u>Degrees of Freedom</u> Regression: 7 Residual: 520	AIRTEMP / AIR3TEMP = (+) .783	H2OTEMP / AIRTEMP (+) H2OTEMP / AIR3TEMP (+) YEAR / DEWPT (+) AIRTEMP / DEWPT(-) AIR3TEMP / DEWPT (-)	30.72 °C standard deviation: .62	3.79 SD 6.40	5.33 standard deviation: 1.61

TABLE 34

MULTIPLE REGRESSION ANALYSIS RESULTS
San Antonio River Basin Maximum Daily Water Temperatures vs. Year and Other Variables

PROCEDURE	**STATISTICS**	**REGRESSION EQUATION**	**ORDER OF VARIABLES ENTRY INTO REGRESSION EQUATION**	**VARIABLES NOT IN THE EQUATION**	**VARIABLES WITH SIG *T* < OR = .0500**	**VARIABLES WITH SIG *T* = .0000**
San Antonio River Basin maximum water temperature vs. year	total cases: 420 cases used: 403 Adjusted R^2: .20 standard error: 1.53 F = 17.45 Sig F = .0000	H2O TEMP = 3.2741 + .0656 (YEAR) - .0089 (DATERANK) + .2289 (DISCHLN) + .1598 (AIRTEMP) + .0612 (AIR3TEMP) - .9523 (CLOUDS)	1. AIRTEMP 2. DISCHLN 3. CLOUDS 4. YEAR 5. DATERANK 6. AIR3TEMP	PRECIP WIND DEWPT	AIRTEMP DISCHLN CLOUDS YEAR DATERANK (not Constant; Constant's sig *t* = .4092)	DISCHLN (not Constant)
	EXPLAINED AND UNEXPLAINED SUM OF SQUARES	**INTER-CORRELATIONS > OR = (+/-) .500**	**INTER-CORRELATIONS: (+/-) .400 TO .499**	**PREDICTED MEAN WATER TEMPERATURE**	**OUTLIERS > OR = (+/-) 3.0 STANDARD DEVIATIONS**	**MEAN OF DISCHLN VARIABLE**
	explained: 244.15 unexplained: 923.46 <u>Degrees of Freedom</u> Regression: 6 Residual: 396	AIRTEMP / AIR3TEMP = (+) .816	AIRTEMP / PRECIP (-) AIR3TEMP / PRECIP (-)	30.31 °C standard deviation: .78	3.01 SD 3.20 3.27 3.54	3.59 standard deviation: 1.74

TABLE 35

MULTIPLE REGRESSION ANALYSIS RESULTS
San Antonio River Basin Mean Daily Water Temperatures vs. Year and Other Variables

PROCEDURE	**STATISTICS**	**REGRESSION EQUATION**	**ORDER OF VARIABLES ENTRY INTO REGRESSION EQUATION**	**VARIABLES NOT IN THE EQUATION**	**VARIABLES WITH SIG *T* < OR = .0500**	**VARIABLES WITH SIG *T* = .0000**
San Antonio River Basin mean water temperature vs. year	total cases: 420 cases used: 397 Adjusted R^2: .44 standard error: .96 F = 39.57 Sig F = .0000	H2O TEMP = - 6.7731 + .0472 (YEAR) - .0091 (DATERANK) + .2974 (DISCHLN) + .1941 (AIRTEMP) + .0713 (AIR3TEMP) - .0047 (WIND) - .8475 (CLOUDS) + .0858 (DEWPT)	1. AIRTEMP 2. DISCHLN 3. CLOUDS 4. DATERANK 5. YEAR 6. DEWPT 7. AIR3TEMP 8. WIND	PRECIP	Constant AIRTEMP DISCHLN CLOUDS DATERANK YEAR DEWPT AIR3TEMP	AIRTEMP DISCHLN CLOUDS DATERANK (not Constant; Constant's sig *t* = .0461)
	EXPLAINED AND UNEXPLAINED SUM OF SQUARES	**INTER-CORRELATIONS > OR = (+/-) .500**	**INTER-CORRELATIONS: (+/-) .400 TO .499**	**PREDICTED MEAN WATER TEMPERATURE**	**OUTLIERS > OR = (+/-) 3.0 STANDARD DEVIATIONS**	**MEAN OF DISCHLN VARIABLE**
	explained: 292.59 unexplained: 358.61 <u>Degrees of Freedom</u> Regression: 8 Residual: 388	AIRTEMP / AIR3TEMP = (+) .806	H2OTEMP / AIRTEMP (+) AIR3TEMP / PRECIP (-)	29.13 °C standard deviation: .86	- 3.21 SD	3.57 standard deviation: 1.74

TABLE 36

MULTIPLE REGRESSION ANALYSIS RESULTS
Trinity River Basin Maximum Daily Water Temperatures vs. Population Density and Other Variables

PROCEDURE	**STATISTICS**	**REGRESSION EQUATION**	**ORDER OF VARIABLES ENTRY INTO REGRESSION EQUATION**	**VARIABLES NOT IN THE EQUATION**	**VARIABLES WITH SIG *T* < OR = .0500**	**VARIABLES WITH SIG *T* = .0000**
Trinity River Basin maximum water temperature vs. population density (POPDENS variable)	total cases: 50 cases used: 50 Adjusted R^2: .76 standard error: .92 F = 31.68 Sig F = .0000	H2O TEMP = 27.8409 - .0128 (DATERANK) + .0006238 (POPDENS) - .4864 (DISCHLN) + .0741 (AIRTEMP) - .5817 (PRECIP)	1. POPDENS 2. DISCHLN 4. DATERANK * 5. PRECIP 6. AIRTEMP * AIR3TEMP entered equation 3rd; removed after inclusion of AIRTEMP	AIR3TEMP WIND CLOUDS DEWPT	Constant POPDENS DISCHLN DATERANK AIRTEMP	Constant
	EXPLAINED AND UNEXPLAINED SUM OF SQUARES	**INTER-CORRELATIONS > OR = (+/-) .500**	**INTER-CORRELATIONS: (+/-) .400 TO .499**	**PREDICTED MEAN WATER TEMPERATURE**	**OUTLIERS > OR = (+/-) 3.0 STANDARD DEVIATIONS**	**MEAN OF DISCHLN VARIABLE**
	explained: 135.24 unexplained: 37.56 <u>Degrees of Freedom</u> Regression: 5 Residual: 44	H2OTEMP / POPDENS = (+) .771 H2OTEMP / DISCHLN = (-) .771 POPDENS / DISCHLN = (-) .696 AIRTEMP / AIR3TEMP = (+) .771	H2OTEMP / DATERANK (-) H2OTEMP / AIRTEMP (+) H2OTEMP / AIR3TEMP (+) H2OTEMP / WIND (+) DATERANK / WIND (-) POPDENS / WIND (+) AIRTEMP / CLOUDS (-) AIR3TEMP / PRECIP (-) AIR3TEMP / CLOUDS (-)	32.17 °C standard deviation: 1.66	-0-	5.10 standard deviation: 1.70

TABLE 37

MULTIPLE REGRESSION ANALYSIS RESULTS
Trinity River Basin Mean Daily Water Temperatures vs. Population Density and Other Variables

PROCEDURE	**STATISTICS**	**REGRESSION EQUATION**	**ORDER OF VARIABLES ENTRY INTO REGRESSION EQUATION**	**VARIABLES NOT IN THE EQUATION**	**VARIABLES WITH SIG *T* < OR = .0500**	**VARIABLES WITH SIG *T* = .0000**
Trinity River Basin mean water temperature vs. population density (POPDENS variable)	total cases: 50 cases used: 50 Adjusted R^2: .67 standard error: .60 F = 20.81 Sig F = .0000	H2O TEMP = 20.2300 - .0077 (DATERANK) + .0003814 (POPDENS) + .1124 (AIR3TEMP) - .0037 (WIND) - .7220 (CLOUDS)	1. AIR3TEMP 2. POPDENS 3. CLOUDS 4. DATERANK 5. WIND	DISCHLN AIRTEMP PRECIP DEWPT	Constant AIR3TEMP POPDENS	Constant
	EXPLAINED AND UNEXPLAINED SUM OF SQUARES	**INTER-CORRELATIONS > OR = (+/-) .500**	**INTER-CORRELATIONS: (+/-) .400 TO .499**	**PREDICTED MEAN WATER TEMPERATURE**	**OUTLIERS > OR = (+/-) 3.0 STANDARD DEVIATIONS**	**MEAN OF DISCHLN VARIABLE**
	explained: 37.21 unexplained: 15.73 <u>Degrees of Freedom</u> Regression: 5 Residual: 44	H2OTEMP / POPDENS = (+) .576 H2OTEMP / AIRTEMP = (+) .672 H2OTEMP / AIR3TEMP = (+) .738 H2OTEMP / CLOUDS = (-) .586 DATERANK / AIR3TEMP = (-) .534 DATERANK / WIND = (-) .531 (continued next page)	H2OTEMP / DATERANK (-) H2OTEMP / DEWPT (-) DATERANK / AIRTEMP (-) POPDENS / AIRTEMP (+) POPDENS / WIND (+)	32.81 °C standard deviation: .87	-0-	5.01 standard deviation: 1.80

TABLE 37---Continued

Trinity River Basin mean water temperature vs. population density (POPDENS variable)		**INTER-CORRELATIONS > OR = (+/-) .500 (Continued)**				
		POPDENS / DISCHLN = (-) .732 AIRTEMP / AIR3TEMP = (+) .809 AIRTEMP / CLOUDS = (-) .613 AIRTEMP / DEWPT = (-) .645 AIR3TEMP / CLOUDS = (-) .604 AIR3TEMP / DEWPT = (-) .601				

TABLE 38

MULTIPLE REGRESSION ANALYSIS RESULTS
San Antonio River Basin Maximum Daily Water Temperatures vs. Population Density and Other Variables

PROCEDURE	**STATISTICS**	**REGRESSION EQUATION**	**ORDER OF VARIABLES ENTRY INTO REGRESSION EQUATION**	**VARIABLES NOT IN THE EQUATION**	**VARIABLES WITH SIG *T* < OR = .0500**	**VARIABLES WITH SIG *T* = .0000**
San Antonio River Basin maximum water temperature vs. population density (POPDENS variable)	total cases: 35 cases used: 34 Adjusted R^2: .80 standard error: .61 F = 27.64 Sig F = .0000	H2O TEMP = 16.6251 - .0007908 (POPDENS) + .3729 (DISCHLN) + .1281 (AIRTEMP) + 1.7012 (PRECIP) + .7230 (CLOUDS)	1. POPDENS 2. PRECIP 3. DISCHLN 4. AIRTEMP 5. CLOUDS 6. YEAR	DATERANK AIR3TEMP WIND DEWPT	Constant POPDENS PRECIP DISCHLN AIRTEMP	none (Constant's sig *t* = .0044)
	EXPLAINED AND UNEXPLAINED SUM OF SQUARES	**INTER-CORRELATIONS > OR = (+/-) .500**	**INTER-CORRELATIONS: (+/-) .400 TO .499**	**PREDICTED MEAN WATER TEMPERATURE**	**OUTLIERS > OR = (+/-) 3.0 STANDARD DEVIATIONS**	**MEAN OF DISCHLN VARIABLE**
	explained: 51.09 unexplained: 10.35 <u>Degrees of Freedom</u> Regression: 5 Residual: 28	H2OTEMP / POPDENS = (-) .836 H2OTEMP / DISCHLN = (+) .727 DATERANK / AIRTEMP = (-) .578 DATERANK / AIR3TEMP = (-) .629 DATERANK / WIND = (-) .598 (continued next page)	H2OTEMP / PRECIP (+) POPDENS / AIR3TEMP (-) AIR3TEMP / CLOUDS (-)	32.18 °C standard deviation: 1.24	-0-	3.02 standard deviation: 1.33

TABLE 38---Continued

San Antonio River Basin maximum water temperature vs. population density (POPDENS variable)		**INTER-CORRELATIONS > OR = (+/-) .500 (Continued)**				
		POPDENS / DISCHLN = (-) .659 AIRTEMP / AIR3TEMP = (+) .821 AIRTEMP / CLOUDS = (-) .558				

TABLE 39

MULTIPLE REGRESSION ANALYSIS RESULTS
San Antonio River Basin Mean Daily Water Temperatures vs. Population Density and Other Variables

PROCEDURE	**STATISTICS**	**REGRESSION EQUATION**	**ORDER OF VARIABLES ENTRY INTO REGRESSION EQUATION**	**VARIABLES NOT IN THE EQUATION**	**VARIABLES WITH SIG *T* < OR = .0500**	**VARIABLES WITH SIG *T* = .0000**
San Antonio River Basin mean water temperature vs. population density (POPDENS variable)	total cases: 35 cases used: 35 Adjusted R^2: .75 standard error: .57 F = 21.80 Sig F = .0000	H2O TEMP = 29.8626 - .0075 (DATERANK) - .0004890 (POPDENS) + .3648 (DISCHLN) - .0079 (WIND) - .6168 (CLOUDS)	1. POPDENS 2. DISCHLN 3. CLOUDS 4. DATERANK 5. WIND	AIRTEMP AIR3TEMP PRECIP DEWPT	Constant POPDENS DISCHLN	Constant
	EXPLAINED AND UNEXPLAINED SUM OF SQUARES	**INTER-CORRELATIONS > OR = (+/-) .500**	**INTER-CORRELATIONS: (+/-) .400 TO .499**	**PREDICTED MEAN WATER TEMPERATURE**	**OUTLIERS > OR = (+/-) 3.0 STANDARD DEVIATIONS**	**MEAN OF DISCHLN VARIABLE**
	explained: 35.52 unexplained: 9.45 <u>Degrees of Freedom</u> Regression: 5 Residual: 29	H2OTEMP / POPDENS = (-) .812 H2OTEMP / DISCHLN = (+) .765 DATERANK / POPDENS = (+) .503 DATERANK / AIR3TEMP = (-) .618 POPDENS / DISCHLN = (-) .707 AIRTEMP / AIR3TEMP = (+) .762	H2OTEMP / DATERANK (-) H2OTEMP / AIR3TEMP (+) DATERANK / DISCHLN (-) DATERANK / WIND (-) POPDENS / AIR3TEMP (-) WIND / CLOUDS (+)	29.17 °C standard deviation: 1.02	-0-	3.01 standard deviation: 1.27

TABLE 40

MULTIPLE REGRESSION ANALYSIS RESULTS
Trinity River Basin Maximum Daily Water Temperatures vs. Urbanization Status Categories and Other Variables

PROCEDURE	**STATISTICS**	**REGRESSION EQUATION**	**ORDER OF VARIABLES ENTRY INTO REGRESSION EQUATION**	**VARIABLES NOT IN THE EQUATION**	**VARIABLES WITH SIG *T* < OR = .0500**	**VARIABLES WITH SIG *T* = .0000**
Trinity River Basin maximum water temperature vs. Urbanization Status variables	total cases: 540 cases used: 529 Adjusted R^2: .75 standard error: .87 F = 195.51 Sig F = .0000	H2O TEMP = 27.8386 - .0083 (DATERANK) - 1.4659 (ACTIVURB) + .1729 (NONURB) - .8401 (DISCHLN) + .0549 (AIRTEMP) + .0391 (AIR3TEMP) - .0043 (WIND) - .1357 (CLOUDS)	1. DISCHLN 2. ACTIVURB 3. AIRTEMP 4. DATERANK 5. WIND 6. AIR3TEMP 7. NONURB 8. CLOUDS	PREVURB PRECIP DEWPT	Constant DISCHLN ACTIVURB AIRTEMP DATERANK WIND AIR3TEMP	Constant DISCHLN ACTIVURB DATERANK
	EXPLAINED AND UNEXPLAINED SUM OF SQUARES	**INTER-CORRELATIONS > OR = (+/-) .500**	**INTER-CORRELATIONS: (+/-) .400 TO .499**	**PREDICTED MEAN WATER TEMPERATURE**	**OUTLIERS > OR = (+/-) 3.0 STANDARD DEVIATIONS**	**MEAN OF DISCHLN VARIABLE**
	explained: 1195.84 unexplained: 397.57 <u>Degrees of Freedom</u> Regression: 8 Residual: 520	H2OTEMP / DISCHLN = (-) .726 PREVURB / ACTIVURB = (-) .596 NONURB / DISCHLN = (+) .569 AIRTEMP / AIR3TEMP = (+) .744	H2OTEMP / PREVURB (+) H2OTEMP / AIRTEMP (+) PREVURB / NONURB (-) ACTIVURB / NONURB (-) AIRTEMP / DEWPT(-) AIR3TEMP / PRECIP (-) AIR3TEMP / DEWPT (-)	32.05 °C standard deviation: 1.50	3.22 SD 3.43 3.60 3.61 3.87 5.20	5.34 standard deviation: 1.63

TABLE 41

MULTIPLE REGRESSION ANALYSIS RESULTS
Trinity River Basin Mean Daily Water Temperatures vs. Urbanization Status Categories and Other Variables

PROCEDURE	**STATISTICS**	**REGRESSION EQUATION**	**ORDER OF VARIABLES ENTRY INTO REGRESSION EQUATION**	**VARIABLES NOT IN THE EQUATION**	**VARIABLES WITH SIG *T* < OR = .0500**	**VARIABLES WITH SIG *T* = .0000**
Trinity River Basin mean water temperature vs. Urbanization Status variables	total cases: 545 cases used: 529 Adjusted R^2: .43 standard error: .75 F = 45.81 Sig F = .0000	H2O TEMP = 19.2985 - .0084 (DATERANK) - .1784 (PREVURB) - .7950 (ACTIVURB) - .2756 (DISCHLN) + .0536 (AIRTEMP) + .0807 (AIR3TEMP) + .0982 (PRECIP) - .0050 (WIND) + .0162 (DEWPT)	1. AIR3TEMP 2. DISCHLN 3. ACTIVURB 4. DATERANK 5. WIND 6. AIRTEMP 7. PREVURB 8. PRECIP 9. DEWPT	NONURB CLOUDS	Constant AIR3TEMP DISCHLN ACTIVURB DATERANK WIND AIRTEMP	Constant AIR3TEMP DISCHLN ACTIVURB DATERANK
	EXPLAINED AND UNEXPLAINED SUM OF SQUARES	**INTER-CORRELATIONS > OR = (+/-) .500**	**INTER-CORRELATIONS: (+/-) .400 TO .499**	**PREDICTED MEAN WATER TEMPERATURE**	**OUTLIERS > OR = (+/-) 3.0 STANDARD DEVIATIONS**	**MEAN OF DISCHLN VARIABLE**
	explained: 234.50 unexplained: 295.18 <u>Degrees of Freedom</u> Regression: 9 Residual: 519	PREVURB / ACTIVURB = (-) .606 NONURB / DISCHLN = (+) .576 AIRTEMP / AIR3TEMP = (+) .783	H2OTEMP / AIRTEMP (+) H2OTEMP / AIR3TEMP (+) PREVURB / NONURB (-) ACTIVURB / NONURB (-) AIRTEMP / DEWPT(-) AIR3TEMP / DEWPT (-)	30.72 °C standard deviation: .67	4.57 SD 6.98	5.32 standard deviation: 1.61

TABLE 42

MULTIPLE REGRESSION ANALYSIS RESULTS
San Antonio River Basin Maximum Daily Water Temperatures vs. Urbanization Status Categories and Other Variables

PROCEDURE	**STATISTICS**	**REGRESSION EQUATION**	**ORDER OF VARIABLES ENTRY INTO REGRESSION EQUATION**	**VARIABLES NOT IN THE EQUATION**	**VARIABLES WITH SIG *T* < OR = .0500**	**VARIABLES WITH SIG *T* = .0000**
San Antonio River Basin maximum water temperature vs. Urbanization Status variables	total cases: 420 cases used: 403 Adjusted R^2: .33 standard error: 1.39 F = 29.84 Sig F = .0000	H2O TEMP = 8.4041 - .0107 (DATERANK) + 1.4956 (PREVURB) + 1.5217 (ACTIVURB) + 1.9129 (NONURB) + .3000 (DISCHLN) + .2149 (AIRTEMP) - 1.0045 (CLOUDS)	1. AIRTEMP 2. NONURB 3. ACTIVURB 4. CLOUDS 5. PREVURB 6. DISCHLN 7. DATERANK	AIR3TEMP PRECIP WIND DEWPT	Constant AIRTEMP NONURB ACTIVURB CLOUDS PREVURB DISCHLN DATERANK	AIRTEMP NONURB ACTIVURB CLOUDS PREVURB DISCHLN (not Constant; Constant's sig *t* = .0035)
	EXPLAINED AND UNEXPLAINED SUM OF SQUARES	**INTER-CORRELATIONS > OR = (+/-) .500**	**INTER-CORRELATIONS: (+/-) .400 TO .499**	**PREDICTED MEAN WATER TEMPERATURE**	**OUTLIERS > OR = (+/-) 3.0 STANDARD DEVIATIONS**	**MEAN OF DISCHLN VARIABLE**
	explained: 403.85 unexplained: 763.76 <u>Degrees of Freedom</u> Regression: 7 Residual: 395	AIRTEMP / AIR3TEMP = (+) .816	PREVURB / DISCHLN (-) AIRTEMP / PRECIP (-) AIR3TEMP / PRECIP (-)	30.31 °C standard deviation: 1.00	3.05 SD 3.17 3.19 3.24 3.28 3.30 3.35 4.00	3.59 standard deviation: 1.74

TABLE 43

MULTIPLE REGRESSION ANALYSIS RESULTS
San Antonio River Basin Mean Daily Water Temperatures vs. Urbanization Status Categories and Other Variables

PROCEDURE	**STATISTICS**	**REGRESSION EQUATION**	**ORDER OF VARIABLES ENTRY INTO REGRESSION EQUATION**	**VARIABLES NOT IN THE EQUATION**	**VARIABLES WITH SIG *T* < OR = .0500**	**VARIABLES WITH SIG *T* = .0000**
San Antonio River Basin mean water temperature vs. Urbanization Status variables	total cases: 420 cases used: 397 Adjusted R^2: .52 standard error: .89 F = 43.86 Sig F = .0000	H2O TEMP = - 2.0291 - .0087 (DATERANK) + .7372 (PREVURB) + .9895 (ACTIVURB) + 1.1193 (NONURB) + .3035 (DISCHLN) + .1620 (AIRTEMP) + .0863 (AIR3TEMP) - .0044 (WIND) - .7743 (CLOUDS) + .0908 (DEWPT)	1. AIRTEMP 2. DISCHLN 3. NONURB 4. ACTIVURB 5. CLOUDS 6. PREVURB 7. DATERANK 8. DEWPT 9. AIR3TEMP 10. WIND	PRECIP	AIRTEMP DISCHLN NONURB ACTIVURB CLOUDS PREVURB DATERANK DEWPT AIR3TEMP (not Constant; Constant's sig *t* = .4771)	AIRTEMP DISCHLN NONURB ACTIVURB CLOUDS PREVURB DATERANK (not Constant)
	EXPLAINED AND UNEXPLAINED SUM OF SQUARES	**INTER-CORRELATIONS > OR = (+/-) .500**	**INTER-CORRELATIONS: (+/-) .400 TO .499**	**PREDICTED MEAN WATER TEMPERATURE**	**OUTLIERS > OR = (+/-) 3.0 STANDARD DEVIATIONS**	**MEAN OF DISCHLN VARIABLE**
	explained: 346.39 unexplained: 304.81 <u>Degrees of Freedom</u> Regression: 10 Residual: 386	AIRTEMP / AIR3TEMP = (+) .806	H2OTEMP / AIRTEMP (+) PREVURB / DISCHLN (-) AIR3TEMP / PRECIP (-)	29.13 °C standard deviation: .94	3.19 SD - 3.68 - 4.24	3.57 standard deviation: 1.74

APPENDIX F

Student's *t*-test
Results

TABLE 44

STUDENT'S *T*-TEST RESULTS
Maximum Water Temperature Study: Trinity River Basin

Test Variables	**Mean water temperatures (°C)**	**Standard deviation of mean water temperatures**	**Levene's test for equality of variances**	**Separate-variance *t*-test or pooled-variance *t*-test**	***t*-value**	**Two-tailed significance**
Previously Urbanized vs. Actively Urbanizing	Previously Urbanized 32.75 Actively Urbanizing 31.07	1.92 1.04	F = 76.55 P = .000	separate	8.68 degrees of freedom 189.84	.000
Previously Urbanized vs. Non-urban	Previously Urbanized 32.75 Non-urban 30.99	1.92 .96	F = 55.00 P = .000	separate	8.69 degrees of freedom 193.80	.000
Actively Urbanizing vs. Non-urban	Actively Urbanizing 31.07 Non-urban 30.99	1.04 .96	F = .528 P = .468	pooled	.50 degrees of freedom 208	.619

TABLE 45

STUDENT'S *T*-TEST RESULTS
Mean Water Temperature Study: Trinity River Basin

Test Variables	**Mean water temperatures (°C)**	**Standard deviation of mean water temperatures**	**Levene's test for equality of variances**	**Separate-variance *t*-test or pooled-variance *t*-test**	***t*-value**	**Two-tailed significance**
Previously Urbanized vs. Actively Urbanizing	Previously Urbanized 30.97 Actively Urbanizing 30.02	1.06 .92	F = 2.54 P = .112	pooled	7.64 degrees of freedom 253	.000
Previously Urbanized vs. Non-urban	Previously Urbanized 30.97 Non-urban 30.36	1.06 .89	F = .412 P = .522	pooled	4.29 degrees of freedom 203	.000
Actively Urbanizing vs. Non-urban	Actively Urbanizing 30.02 Non-urban 30.36	.92 .89	F = .863 P = .354	pooled	-2.60 degrees of freedom 208	.010

TABLE 46

STUDENT'S *T*-TEST RESULTS
Maximum Water Temperature Study: San Antonio River Basin

Test Variables	**Mean water temperatures (°C)**	**Standard deviation of mean water temperatures**	**Levene's test for equality of variances**	**Separate-variance *t*-test or pooled-variance *t*-test**	***t*-value**	**Two-tailed significance**
Previously Urbanized vs. Actively Urbanizing	Previously Urbanized 30.03 Actively Urbanizing 30.60	2.31 1.18	F = 26.86 P = .000	separate	-2.38 degrees of freedom 193.61	.018
Previously Urbanized vs. Non-urban	Previously Urbanized 30.03 Non-urban 31.58	2.31 1.05	F = 24.56 P =.000	separate	-6.10 degrees of freedom 170.30	.000
Previously Urbanized vs. Semi-urbanized	Previously Urbanized 30.03 Semi-urbanized 29.38	2.31 .92	F = 46.21 P = .000	separate	2.85 degrees of freedom 172.66	.005
Actively Urbanizing vs. Non-urban	Actively Urbanizing 30.60 Non-urban 31.58	1.18 1.05	F = 4.76 P = .031	separate *(values for pooled variance *t*-test given in parentheses)	-5.13 (-4.95)* degrees of freedom 110.46 (143)*	.000 (.000)*
Actively Urbanizing vs. Semi-urbanized	Actively Urbanizing 30.60 Semi-urbanized 29.38	1.18 .92	F = 10.27 P = .002	separate	7.87 degrees of freedom 176.36	.000
Non-urban vs. Semi-urbanized	Non-urban 31.58 Semi-urbanized 29.38	1.05 .92	F = .044 P = .834	pooled	12.92 degrees of freedom 138	.000

TABLE 47

STUDENT'S *T*-TEST RESULTS
Mean Water Temperature Study: San Antonio River Basin

Test Variables	**Mean water temperatures (°C)**	**Standard deviation of mean water temperatures**	**Levene's test for equality of variances**	**Separate-variance *t*-test or pooled-variance *t*-test**	***t*-value**	**Two-tailed significance**
Previously Urbanized vs. Actively Urbanizing	Previously Urbanized 28.65 Actively Urbanizing 29.42	1.38 .98	F = 9.17 P = .003	separate	-4.87 degrees of freedom 217.05	.000
Previously Urbanized vs. Non-urban	Previously Urbanized 28.65 Non-urban 30.73	1.38 .66	F = 27.20 P = .000	separate	-13.44 degrees of freedom 167.12	.000
Previously Urbanized vs. Semi-urbanized	Previously Urbanized 28.65 Semi-urbanized 28.53	1.38 .75	F = 32.42 P = .000	separate	.82 degrees of freedom 199.65	.412
Actively Urbanizing vs. Non-urban	Actively Urbanizing 29.42 Non-urban 30.73	.98 .66	F = 18.37 P = .000	separate	-9.53 degrees of freedom 133.73	.000
Actively Urbanizing vs. Semi-urbanized	Actively Urbanizing 29.42 Semi-urbanized 28.53	.98 .75	F = 13.74 P = .000	separate	7.01 degrees of freedom 175.34	.000
Non-urban vs. Semi-urbanized	Non-urban 30.73 Semi-urbanized 28.53	.66 .75	F = 1.50 P = .223	pooled	17.37 degrees of freedom 138	.000

APPENDIX G

Water Temperature Gaging Stations:

Observation Dates, Census Tracts/County Divisions,
Discharge and Meteorological Data Observation Sites

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1970	West Fork Trinity River at Beach Street at Fort Worth (08048543)	N/A	Fort Worth PMSA, tracts: 1.02 2.02 3 5.01 9 10 11 12.02 15 16 17 19 20 35 38 45.01 46.04 46.05 59 60.02	N/A	N/A	N/A	N/A	N/A
1970	West Fork Trinity River at Grand Prairie (08049500)	N/A	Fort Worth PMSA, tracts: 65.05 130 131 Dallas PMSA, tracts:	N/A	N/A	N/A	N/A	N/A

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
			153.01 154					
1970	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	N/A	Dallas PMSA, tracts: 20 32.02 34 41 43 89 100 101 102 105 106	N/A	N/A	N/A	N/A	N/A
1970	Trinity River below Dallas (08057410)	N/A	Dallas PMSA, tracts: 20 32.02 34 40 41 43 86 89 93.02 100 114.02 115	N/A	N/A	N/A	N/A	N/A

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1970	East Fork Trinity River at Seagoville (08061980)	N/A	Dallas PMSA, tracts: 170 173.02	N/A	N/A	N/A	N/A	N/A
1970	East Fork Trinity River near Crandall (08062000)	N/A	Dallas PMSA, tracts: 170 173.02 501 502	N/A	N/A	N/A	N/A	N/A
1970	Trinity River near Rosser (08062500)	N/A	Dallas PMSA, tracts: 508 601 617	N/A	N/A	N/A	N/A	N/A
1970	Trinity River at Trinidad (08062700)	N/A	Henderson County: Malakoff division, minus Trinidad town Henderson County: Trinidad town Navarro County: Kerens division	N/A	N/A	N/A	N/A	N/A

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1970	San Antonio River at Loop 410 at San Antonio (08178565)	N/A	San Antonio SMSA, tracts: 1104 1501 1502 1503 1507 1508 1518 1601	N/A	N/A	N/A	N/A	N/A
1970	Salado Creek (lower station) at San Antonio (08178800)	N/A	San Antonio SMSA, tracts: 1308 1309 1310 1311 1312 1413 1414	N/A	N/A	N/A	N/A	N/A
1970	Medina River at La Coste (08180640)	N/A	Medina County: Castroville - La Coste division, minus Castroville city Medina County: Castroville city	N/A	N/A	N/A	N/A	N/A

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1970	Medio Creek at Pearsall Rd. at San Antonio (08180750)	N/A	San Antonio SMSA, tracts: 1617 1618 1719 1720	N/A	N/A	N/A	N/A	N/A
1970	Leon Creek at IH-35 at San Antonio (08181480)	N/A	San Antonio SMSA, tracts: 1610 1613 1614 1616	N/A	N/A	N/A	N/A	N/A
1970	Medina River at San Antonio (08181500)	N/A	San Antonio SMSA, tracts: 1519 1520 1521	N/A	N/A	N/A	N/A	N/A
1970	San Antonio River near Elmendorf (08181800)	N/A	San Antonio SMSA, tracts: 1418 1522	N/A	N/A	N/A	N/A	N/A
1970	San Antonio River near Falls City (08183500)	N/A	Karnes County: Falls City division Karnes County: Gillette division	N/A	N/A	N/A	N/A	N/A

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
			Wilson County: Poth division					
1970	Cibolo Creek near Falls City (08186000)	N/A	Karnes County: Falls City division Karnes County: Gillette division Wilson County: Poth division Wilson County: Stockdale division	N/A	N/A	N/A	N/A	N/A
1977	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max: 7/23 7/24 7/15 7/18 8/17 Mean: 7/23 7/20 6/30 8/11	N/A	same as water temp gaging station	-Benbrook Dam -Dallas-Ft. Worth Regional WSMO AP -Waxahachie	-Arlington -Benbrook Dam -Burleson 2SSW -Aledo 4SE -Dallas-Ft. Worth Reg. WSMO AP -Roanoke -Kennedale 6SSW	-Benbrook Dam -Grapevine Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		8/17						
1977	West Fork Trinity River at Grand Prairie (08049500)	Max: 7/24 7/26 7/25 7/27 7/21 Mean: 7/26 7/27 7/31 8/11 8/8	N/A	same as water temp gaging station	-Dallas-Ft. Worth Reg. WSMO AP -Dallas FAA AP -Waxahachie -Benbrook Dam -Ferris (when available)	-Arlington -Dallas-Ft. Worth Reg. WSMO AP -Dallas FAA AP -Carrollton -Red Oak -Burleson 2SSW -Ferris -Frisco (when no Carrollton)	-Grapevine Dam -Benbrook Dam -Lavon Dam -Bardwell Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSMO AP)
1977	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	No data	N/A					
1977	Trinity River below Dallas (08057410)	Max: Too much data missing Mean: 7/23 8/24 7/8 7/11 7/16	N/A	same as water temp gaging station	-Dallas FAA AP -Ferris (when available) -Waxahachie -Kaufman 3SE	-Dallas FAA AP -Ferris -Red Oak -Arlington -Rosser -Crandall -Rockwall -Terrell -Richardson	-Grapevine Dam -Lavon Dam -Bardwell Dam -Benbrook Dam -Whitney Dam -Navarro Mills Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1977	East Fork Trinity River at Seagoville (08061980)	No data	N/A					
1977	East Fork Trinity River near Crandall (08062000)	Max: 7/25 7/9 7/15 7/18 7/23 Mean: 7/6 7/26 7/18 8/9 8/12	N/A	same as water temp gaging station	-Kaufman 3SE -Ferris (when available) -Dallas FAA AP -Bardwell Dam -Wills Point -Lavon Dam (when available)	-Crandall	-Lavon Dam -Bardwell Dam -Grapevine Dam -Benbrook Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSMO AP)
1977	Trinity River near Rosser (08062500)	Max: 7/26 7/9 7/20 7/22 8/11 Mean: 8/12 7/16 7/19	N/A	same as water temp gaging station	-Ferris (when available) -Kaufman 3SE -Bardwell Dam -Corsicana -Waxahachie	-Rosser	-Bardwell Dam -Lavon Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		7/21 8/13						
1977	Trinity River at Trinidad (08062700)	No data	N/A					
1977	San Antonio River at Loop 410 at San Antonio (08178565)	No data	N/A					
1977	Salado Creek (lower station) at San Antonio (08178800)	No data	N/A					
1977	Medina River at La Coste (08180640)	No data	N/A					
1977	Medio Creek at Pearsall Rd. at San Antonio (08180750)	No data	N/A					
1977	Leon Creek at IH-35 at San	No data	N/A					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	Antonio (08181480)							
1977	Medina River at San Antonio (08181500)	No data	N/A					
1977	San Antonio River near Elmendorf (08181800)	No data	N/A					
1977	San Antonio River near Falls City (08183500)	No data	N/A					
1977	Cibolo Creek near Falls City (08186000)	No data	N/A					
1978	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max: 7/16 7/7 7/9 7/19 7/20 Mean: 7/2	N/A	same as water temp gaging station	-Benbrook Dam -Dallas-Ft. Worth Reg. WSMO AP -Waxahachie (when available)	-Arlington -Benbrook Dam -Burleson 2SSW -Aledo 4 SE -Dallas-Ft. Worth Reg. WSMO AP -Roanoke -Kennedale 6SSW	-Benbrook Dam -Grapevine Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		7/5 7/6 7/8 7/20						
1978	West Fork Trinity River at Grand Prairie (08049500)	Max: 7/12 7/16 7/4 7/15 7/8 Mean: 7/15 7/4 7/9 7/12 7/18	N/A	same as water temp gaging station	-Dallas-Ft. Worth Reg. WSMO AP -Dallas FAA AP -Waxahachie -Benbrook -Ferris	-Arlington -Dallas/Ft. Worth Reg. WSMO AP -Dallas FAA AP -Red Oak -Burleson 2SSW -Ferris -Frisco	-Grapevine Dam -Benbrook Dam -Lavon Dam -Bardwell Dam (when available)	-Fort Worth (Dallas-Ft. Worth Reg. WSMO AP)
1978	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	No data	N/A					
1978	Trinity River below Dallas (08057410)	Max: 5/25 7/13 7/10 7/21 7/29	N/A	same as water temp gaging station	-Dallas FAA AP -Ferris -Waxahachie (when available) -Kaufman 3SE	-Dallas FAA AP -Ferris -Red Oak -Arlington -Rosser -Crandall -Lake Ray Hubbard	-Grapevine Dam -Lavon Dam -Bardwell Dam (when available) -Benbrook Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		Mean: 7/16 7/3 7/8 7/18 7/20				-Terrell -Richardson	-Whitney Dam -Navarro Mills Dam	
1978	East Fork Trinity River at Seagoville (08061980)	No data	N/A					
1978	East Fork Trinity River near Crandall (08062000)	No data	N/A					
1978	Trinity River near Rosser (08062500)	Max: 7/12 7/15 6/29 7/21 7/26 Mean: 7/15 7/16 7/12 7/21 7/5	N/A	same as water temp gaging station	-Ferris -Kaufman 3SE -Bardwell Dam -Corsicana -Waxahachie	-Rosser	-Bardwell Dam -Lavon Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1978	Trinity River at Trinidad (08062700)	No data	N/A					
1978	San Antonio River at Loop 410 at San Antonio (08178565)	No data	N/A					
1978	Salado Creek (lower station) at San Antonio (08178800)	No data	N/A					
1978	Medina River at La Coste (08180640)	No data	N/A					
1978	Medio Creek at Pearsall Rd. at San Antonio (08180750)	No data	N/A					
1978	Leon Creek at IH-35 at San Antonio (08181480)	No data	N/A					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1978	Medina River at San Antonio (08181500)	No data	N/A					
1978	San Antonio River near Elmendorf (08181800)	No data	N/A					
1978	San Antonio River near Falls City (08183500)	No data	N/A					
1978	Cibolo Creek near Falls City (08186000)	No data	N/A					
1979	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max: 7/29 7/12 7/16 7/13 8/6 Mean: 7/12 7/11 7/13 7/17	N/A	same as water temp gaging station	-Benbrook Dam -Dallas-Ft. Worth Reg. WSCMO -Waxahachie (when available)	-Arlington -Benbrook Dam -Burleson 2SSW -Aledo 4SE -Dallas-Ft. Worth Reg. WSCMO -Roanoke -Kennedale 6SSW	-Benbrook Dam -Grapevine Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		9/6						
1979	West Fork Trinity River at Grand Prairie (08049500)	Max: 6/30 7/8 7/9 7/13 7/14 Mean: 7/1 7/8 7/10 7/31 8/7	N/A	same as water temp gaging station	-Dallas-Ft. Worth Reg. WSCMO -Dallas FAA AP -Waxahachie -Benbrook Dam -Ferris	-Arlington -Dallas-Ft. Worth Reg. WSCMO -Dallas FAA AP -Carrollton -Red Oak -Burleson 2SSW -Ferris	-Grapevine Dam -Benbrook Dam -Lavon Dam -Bardwell Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO)
1979	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	No data	N/A					
1979	Trinity River below Dallas (08057410)	Max: 6/30 7/8 7/10 7/24 8/29 Mean: 8/31 7/9	N/A	same as water temp gaging station	-Dallas FAA AP -Ferris -Waxahachie (when available) -Kaufman 3SE	-Dallas FAA AP -Ferris -Red Oak -Arlington -Rosser -Crandall -Lake Ray Hubbard -Terrell -Richardson	-Grapevine Dam -Lavon Dam -Bardwell Dam -Benbrook Dam -Whitney Dam -Navarro Mills Dam (when available)	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		7/29 8/30 9/5						
1979	East Fork Trinity River at Seagoville (08061980)	No data	N/A					
1979	East Fork Trinity River near Crandall (08062000)	No data	N/A					
1979	Trinity River near Rosser (08062500)	Max: 6/30 7/13 8/7 7/2 8/9 Mean: 6/30 7/11 7/12 9/1 8/26	N/A	same as water temp gaging station	-Ferris -Kaufman 3SE -Bardwell Dam -Corsicana -Waxahachie (when available)	-Rosser	-Bardwell Dam -Lavon Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO)
1979	Trinity River at Trinidad (08062700)	No data	N/A					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1979	San Antonio River at Loop 410 at San Antonio (08178565)	No data	N/A					
1979	Salado Creek (lower station) at San Antonio (08178800)	No data	N/A					
1979	Medina River at La Coste (08180640)	No data	N/A					
1979	Medio Creek at Pearsall Rd. at San Antonio (08180750)	No data	N/A					
1979	Leon Creek at IH-35 at San Antonio (08181480)	No data	N/A					
1979	Medina River at San Antonio (08181500)	No data	N/A					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1979	San Antonio River near Elmendorf (08181800)	No data	N/A					
1979	San Antonio River near Falls City (08183500)	No data	N/A					
1979	Cibolo Creek near Falls City (08186000)	No data	N/A					
1980	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max: 7/18 7/5 7/9 7/10 7/15 Mean: 7/9 7/10 7/11 7/18 7/5	Fort Worth PMSA, tracts: 1001.02 1002.02 1003 1005.01 1009 1010 1011 1012.02 1015 1016 1017 1019 1020	same as water temp gaging station	-Benbrook Dam -Dallas-Ft. Worth Reg. WSCMO AP -Waxahachie	-Arlington -Benbrook Dam -Burleson 2SSW -Aledo 4SE -Dallas-Ft. Worth Reg. WSCMO AP -Roanoke -Kennedale 6SSW	-Benbrook Dam -Grapevine Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
			1035 1038 1045.01 1046.04 1046.05 1059					
1980	West Fork Trinity River at Grand Prairie (08049500)	Max: 6/27 7/16 7/8 7/18 7/30 Mean: 7/6 7/13 7/19 7/18 8/24	Fort Worth PMSA, tracts: 1065.05 1130 1131 Dallas PMSA, tracts: 153.01 154	same as water temp gaging station	-Dallas-Ft. Worth Reg. WSCMO AP -Dallas FAA AP -Waxahachie -Benbrook Dam -Ferris	-Arlington -Dallas-Ft. Worth Reg. WSCMO AP -Dallas FAA AP -Carrollton (when available) -Red Oak -Burleson 2SSW -Ferris -Frisco (when no Carrollton)	-Grapevine Dam -Benbrook Dam -Lavon Dam -Bardwell Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1980	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	no data	Dallas PMSA, tracts: 20 32.02 34 41 43 89 100 101					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
			102 105 106					
1980	Trinity River below Dallas (08057410)	Max: 7/6 7/8 7/14 7/18 7/31 Mean: 6/27 7/4 7/13 7/16 8/23	Dallas PMSA, tracts: 20 32.02 34 40 41 43 86.02 89 93.03 100 114.02 115	same as water temp gaging station	-Dallas FAA AP -Ferris -Waxahachie -Kaufman 3SE	-Dallas FAA AP -Ferris -Red Oak -Arlington -Rosser -Crandall -Lake Ray Hubbard -Terrell -Richardson	-Grapevine Dam -Lavon Dam -Bardwell Dam -Benbrook Dam -Whitney Dam -Navarro Mills Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1980	East Fork Trinity River at Seagoville (08061980)	no data	Dallas PMSA, tracts: 170 173.02					
1980	East Fork Trinity River near Crandall (08062000)	no data	Dallas PMSA, tracts: 170 173.02 502					
1980	Trinity River	Max:	Dallas PMSA,	same as	-Ferris	-Rosser	-Bardwell Dam	-Fort Worth

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	near Rosser (08062500)	7/4 7/6 7/8 7/12 6/26 Mean: 7/3 7/11 7/18 7/19 7/21	tracts: 508 601 617	water temp gaging station	-Kaufman 3SE -Bardwell Dam -Corsicana -Waxahachie		-Lavon Dam	(Dallas-Ft. Worth Reg. WSCMO AP)
1980	Trinity River at Trinidad (08062700)	no data	Henderson County: Eustace - Malakoff division, minus Trinidad city Henderson County: Trinidad city Navarro County: Kerens division					
1980	San Antonio	no data	San Antonio					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	River at Loop 410 at San Antonio (08178565)		SMSA, tracts: 1104 1501 1502 1503 1507 1508 1518 1601					
1980	Salado Creek (lower station) at San Antonio (08178800)	no data	San Antonio SMSA, tracts: 1308 1309 1310 1311 1312 1413 1414					
1980	Medina River at La Coste (08180640)	no data	Medina County: Castroville - La Coste division, minus Castroville city Medina County: Castroville city					
1980	Medio Creek at Pearsall Rd.	no data	San Antonio SMSA, tracts:					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	at San Antonio (08180750)		1617 1618 1719					
1980	Leon Creek at IH-35 at San Antonio (08181480)	no data	San Antonio SMSA, tracts: 1610 1613 1614.01 1614.02 1616					
1980	Medina River at San Antonio (08181500)	no data	San Antonio SMSA, tracts: 1519 1520 1521					
1980	San Antonio River near Elmendorf (08181800)	no data	San Antonio SMSA, tracts: 1418 1522					
1980	San Antonio River near Falls City (08183500)	no data	Karnes County: Falls City division Karnes County: Gillette division Wilson County:					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
			Poth division					
1980	Cibolo Creek near Falls City (08186000)	no data	Karnes County: Falls City division Karnes County: Gillette division Wilson County: Poth division Wilson County: Stockdale division					
1981	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max: 8/6 7/17 8/5 8/16 8/26 Mean: 8/15 7/14 7/25 7/17 8/14	N/A	same as water temp gaging station	-Benbrook Dam -Dallas-Ft. Worth Reg. WSCMO AP -Waxahachie	-Arlington -Benbrook Dam -Burleson 2SSW -Aledo 4SE -Dallas-Ft. Worth Reg. WSCMO AP -Roanoke -Lillian 3W	-Benbrook Dam -Grapevine Dam (when available)	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1981	West Fork Trinity River at Grand Prairie (08049500)	Max: 7/11 7/23 7/26 8/1 8/15 Mean: 7/21 7/24 7/25 7/2 7/15	N/A	same as water temp gaging station	-Dallas-Ft. Worth Reg. WSCMO AP -Dallas FAA AP -Waxahachie (when available) -Benbrook Dam -Ferris	-Arlington -Dallas-Ft. Worth Reg. WSCMO AP -Dallas FAA AP -Carrollton (when available) -Red Oak -Lillian 3W -Burleson 2SSW -Ferris -Frisco (when no Carrollton)	-Grapevine Dam (when available) -Benbrook Dam -Lavon Dam -Bardwell Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1981	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	no data	N/A					
1981	Trinity River below Dallas (08057410)	Max: 7/21 7/22 8/1 8/15 8/16 Mean: 7/21 7/26 8/1 8/5	N/A	same as water temp gaging station	-Dallas FAA AP -Ferris -Waxahachie (when available) -Kaufman	-Dallas FAA AP -Ferris -Red Oak -Arlington -Rosser -Crandall -Lake Ray Hubbard -Terrell -Richardson	-Grapevine Dam -Lavon Dam -Bardwell Dam -Benbrook Dam -Whitney Dam -Navarro Mills Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		8/14						
1981	East Fork Trinity River at Seagoville (08061980)	no data	N/A					
1981	East Fork Trinity River near Crandall (08062000)	no data	N/A					
1981	Trinity River near Rosser (08062500)	Max: 7/24 7/25 7/20 7/21 8/7 Mean: 7/23 7/25 7/18 7/26 8/1	N/A	same as water temp gaging station	-Ferris -Kaufman 3SE -Bardwell Dam -Corsicana -Waxahachie (when available)	-Rosser	-Bardwell Dam -Lavon Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1981	Trinity River at Trinidad (08062700)	no data	N/A					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1981	San Antonio River at Loop 410 at San Antonio (08178565)	no data	N/A					
1981	Salado Creek (lower station) at San Antonio (08178800)	no data	N/A					
1981	Medina River at La Coste (08180640)	no data	N/A					
1981	Medio Creek at Pearsall Rd. at San Antonio (08180750)	no data	N/A					
1981	Leon Creek at IH-35 at San Antonio (08181480)	no data	N/A					
1981	Medina River at San Antonio (08181500)	no data	N/A					
1981	San Antonio River near	no data	N/A					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	Elmendorf (08181800)							
1981	San Antonio River near Falls City (08183500)	no data	N/A					
1981	Cibolo Creek near Falls City (08186000)	Max: 7/20 7/16 6/10 8/16 8/15 Mean: 7/21 7/23 7/19 7/3 7/2	N/A	same as water temp gaging station	-Karnes City -Floresville -Nixon (when available)	-Cibolo Creek (when available) -Falls City 4WSW (when no Cibolo Creek) -Karnes City (when no Cibolo Creek) -Floresville (when no Cibolo Creek) -Runge (when no Cibolo Creek) -Stockdale 4N (when no Cibolo Creek) -Nixon (when no Cibolo Creek) -Yorktown (when no Cibolo Creek)	-Beevile 5NE (when available) -Canyon Dam (when available) -Dilley -Point Comfort	-San Antonio (San Antonio WSFO) -Corpus Christi (Corpus Christi WSO AP)
1982	West Fork Trinity River at Beach Street	Max: 7/28 8/20	N/A	same as water temp gaging	-Benbrook Dam -Dallas-Ft. Worth Reg. WSCMO AP	-Arlington -Benbrook Dam -Burleson 2SSW	-Benbrook Dam -Grapevine Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	at Fort Worth (08048543)	8/4 8/14 8/27 Mean: 7/28 8/7 8/5 8/12 8/22		station	-Waxahachie	-Aledo 4SE -Dallas-Ft. Worth Reg. WSCMO AP -Roanoke -Lillian 3W		AP)
1982	West Fork Trinity River at Grand Prairie (08049500)	Max: 7/24 8/14 8/4 8/13 8/20 Mean: 8/15 7/23 7/24 8/13 9/3	N/A	same as water temp gaging station	-Dallas-Ft. Worth Reg. WSCMO AP -Dallas FAA AP -Benbrook Dam -Waxahachie -Ferris	-Arlington -Dallas-Ft. Worth WSCMO AP -Dallas FAA AP -Carrollton (when available) -Frisco (when no Carrollton) -Red Oak -Lillian 3W -Burleson -Ferris	-Grapevine Dam -Benbrook Dam -Lavon Dam -Bardwell Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1982	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	no data	N/A					
1982	Trinity River	too much	N/A					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	below Dallas (08057410)	data missing						
1982	East Fork Trinity River at Seagoville (08061980)	no data	N/A					
1982	East Fork Trinity River near Crandall (08062000)	no data	N/A					
1982	Trinity River near Rosser (08062500)	Max: 7/20 7/12 8/16 8/27 8/31 Mean: 7/21 8/14 8/25 8/27 8/31	N/A	same as water temp gaging station	-Ferris -Kaufman 3SE -Bardwell Dam -Corsicana -Waxahachie	-Rosser	-Bardwell Dam -Lavon Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1982	Trinity River at Trinidad (08062700)	no data	N/A					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1982	San Antonio River at Loop 410 at San Antonio (08178565)	no data	N/A					
1982	Salado Creek (lower station) at San Antonio (08178800)	no data	N/A					
1982	Medina River at La Coste (08180640)	no data	N/A					
1982	Medio Creek at Pearsall Rd. at San Antonio (08180750)	no data	N/A					
1982	Leon Creek at IH-35 at San Antonio (08181480)	no data	N/A					
1982	Medina River at San Antonio (08181500)	no data	N/A					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1982	San Antonio River near Elmendorf (08181800)	no data	N/A					
1982	San Antonio River near Falls City (08183500)	no data	N/A					
1982	Cibolo Creek near Falls City (08186000)	Max: 8/1 8/2 8/14 8/15 8/4 Mean: 7/25 7/29 7/31 8/15 7/12	N/A	same as water temp gaging station	-Karnes City -Floresville -Nixon	-Cibolo Creek (when available) -Falls City 4WSW (when no Cibolo Creek) -Karnes City (when no Cibolo Creek) -Floresville (when no Cibolo Creek) -Runge (when no Cibolo Creek) -Stockdale 4N (when no Cibolo Creek) -Nixon (when no Cibolo Creek) -Yorktown (when no Cibolo Creek) (when available)	-Beeville 5NE (when available) -Canyon Dam -Point Comfort -Dilley	-San Antonio (San Antonio WSFO) -Corpus Christi (Corpus Christi WSO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1983	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max: 8/15 7/29 7/30 7/25 8/17 Mean: 7/31 8/12 8/31 7/26 7/29	N/A	same as water temp gaging station	-Benbrook Dam -Dallas-Ft. Worth Reg. WSCMO AP -Waxahachie	-Arlington -Benbrook Dam -Burleson 2SSW -Aledo 4SE -Dallas-Ft. Worth Reg. WSCMO AP -Roanoke -Lillian 3W	-Benbrook Dam -Grapevine Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1983	West Fork Trinity River at Grand Prairie (08049500)	Max: 7/24 7/29 8/2 8/26 8/28 Mean: 7/30 8/28 7/28 8/24 8/26	N/A	same as water temp gaging station	-Dallas-Ft. Worth WSCMO AP -Dallas FAA AP -Benbrook Dam -Waxahachie -Ferris	-Arlington -Dallas-Ft. Worth Reg. WSCMO AP -Dallas FAA AP -Carrollton -Red Oak -Lillian 3W -Burleson 2SSW -Ferris	-Grapevine Dam -Benbrook Dam -Lavon Dam -Bardwell Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1983	Trinity River at Cedar Crest Blvd. at Dallas	no data	N/A					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	(08057055)							
1983	Trinity River below Dallas (08057410)	Max: 8/17 8/27 8/30 7/27 8/6 Mean: 7/31 8/15 8/30 8/2 8/12	N/A	same as water temp gaging station	-Dallas FAA AP -Ferris -Waxahachie -Kaufman 3SE	-Dallas FAA AP -Ferris -Red Oak -Arlington -Rosser -Crandall -Rockwall -Terrell -Richardson	-Grapevine Dam -Lavon Dam -Bardwell Dam -Benbrook Dam -Whitney Dam -Navarro Mills Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1983	East Fork Trinity River at Seagoville (08061980)	no data	N/A					
1983	East Fork Trinity River near Crandall (08062000)	no data	N/A					
1983	Trinity River near Rosser (08062500)	Max: 7/25 8/3 8/26 8/28	N/A	same as water temp gaging station	-Ferris -Kaufman 3SE -Bardwell Dam -Corsicana -Waxahachie	-Rosser	-Bardwell Dam -Lavon Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		8/31 Mean: 7/29 7/24 7/26 7/31 9/1						
1983	Trinity River at Trinidad (08062700)	no data	N/A					
1983	San Antonio River at Loop 410 at San Antonio (08178565)	no data	N/A					
1983	Salado Creek (lower station) at San Antonio (08178800)	no data	N/A					
1983	Medina River at La Coste (08180640)	no data	N/A					
1983	Medio Creek at Pearsall Rd.	no data	N/A					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	at San Antonio (08180750)							
1983	Leon Creek at IH-35 at San Antonio (08181480)	no data	N/A					
1983	Medina River at San Antonio (08181500)	no data	N/A					
1983	San Antonio River near Elmendorf (08181800)	no data	N/A					
1983	San Antonio River near Falls City (08183500)	no data	N/A					
1983	Cibolo Creek near Falls City (08186000)	Max: 7/1 8/21 8/23 8/12 8/19 Mean: 7/28	N/A	same as water temp gaging station	-Karnes City -Floresville -Nixon	-Falls City 4WSW -Karnes City -Floresville -Runge -Stockdale 4N -Nixon -Yorktown (when available)	-Beeville 5NE -Canyon Dam -Point Comfort (when available) -Dilley (when available)	-San Antonio (San Antonio WSFO) -Corpus Christi (Corpus Christi WSO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		8/11 9/1 6/28 8/19						
1984	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max: 8/20 7/20 8/29 8/18 9/14 Mean: 8/19 6/23 8/28 7/20 7/22	N/A	same as water temp gaging station	-Benbrook Dam -Dallas-Ft. Worth Reg. WSCMO AP -Waxahachie	-Arlington -Benbrook Dam -Burleson 2SSW -Aledo 4SE -Dallas-Ft. Worth Reg. WSCMO AP -Roanoke -Lillian 3W -Joe Pool Lake	-Benbrook Dam -Grapevine Dam (when available)	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1984	West Fork Trinity River at Grand Prairie (08049500)	Max: 7/23 8/21 8/29 8/30 8/6 Mean: 7/17 6/24 7/18	N/A	same as water temp gaging station	-Dallas-Ft. Worth Reg. WSCMO AP -Dallas FAA AP -Waxahachie -Benbrook Dam -Ferris	-Arlington -Joe Pool Lake -Dallas-Ft. Worth Reg. WSCMO AP -Dallas FAA AP -Carrollton -Red Oak -Lillian 3W -Burleson 2SSW -Ferris	-Grapevine Dam (when available) -Benbrook Dam -Lavon Dam (when available) -Bardwell Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		8/9 8/27						
1984	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	Max: 7/6 7/9 7/18 8/21 8/27 Mean: 8/20 6/24 7/11 7/16 8/21	N/A	Trinity River at Dallas (08057000)	-Dallas FAA AP -Ferris	-Dallas FAA AP -Richardson -Carrollton -Joe Pool Lake -Red Oak -Ferris -Arlington -Rockwall -Lake Ray Hubbard -Crandall	-Grapevine Dam (when available) -Bardwell Dam -Benbrook Dam -Lavon Dam (when available) -Navarro Mills Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1984	Trinity River below Dallas (08057410)	Max: 7/7 7/21 6/23 7/14 8/9 Mean: 7/8 7/21 8/28 8/30 8/17	N/A	same as water temp gaging station	-Dallas FAA AP -Ferris -Waxahachie -Kaufman 3SE	-Dallas FAA AP -Ferris -Red Oak -Joe Pool Lake -Arlington -Rosser -Crandall -Lake Ray Hubbard -Terrell -Richardson	-Grapevine Dam (when available) -Lavon Dam (when available) -Bardwell Dam -Benbrook Dam -Whitney Dam (when available) -Navarro Mills Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1984	East Fork Trinity River at Seagoville (08061980)	no data	N/A					
1984	East Fork Trinity River near Crandall (08062000)	no data	N/A					
1984	Trinity River near Rosser (08062500)	Max: 7/8 7/9 7/13 6/30 8/19 Mean: 7/8 7/9 7/21 8/20 8/21	N/A	same as water temp gaging station	-Ferris -Kaufman 3SE -Bardwell Dam -Corsicana -Waxahachie	-Rosser	-Bardwell Dam -Lavon Dam (when available)	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1984	Trinity River at Trinidad (08062700)	no data	N/A					
1984	San Antonio River at Loop	no data	N/A					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	410 at San Antonio (08178565)							
1984	Salado Creek (lower station) at San Antonio (08178800)	no data	N/A					
1984	Medina River at La Coste (08180640)	no data	N/A					
1984	Medio Creek at Pearsall Rd. at San Antonio (08180750)	no data	N/A					
1984	Leon Creek at IH-35 at San Antonio (08181480)	no data	N/A					
1984	Medina River at San Antonio (08181500)	no data	N/A					
1984	San Antonio River near Elmendorf (08181800)	Max: 6/25 7/1 7/2	N/A	same as water temp gaging station	-Floresville -Poteet -San Antonio WSFO	-Floresville -Poteet -San Antonio WSFO	-Canyon Dam (when available) -Choke Canyon	-San Antonio (San Antonio WSFO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		7/5 7/23 <u>Mean</u>: 6/30 7/1 7/18 7/19 7/22			-Lytle 3W -New Braunfels	-Lytle 3W -Falls City 4WSW (when available) -Riomedina 2N -New Braunfels -Bulverde -Jourdanton -Karnes City (when no Falls City 4WSW)	Dam -Beeville 5NE -Austin (when no Canyon Dam) (when available)	
1984	San Antonio River near Falls City (08183500)	no data	N/A					
1984	Cibolo Creek near Falls City (08186000)	<u>Max</u>: 6/24 6/30 7/20 7/9 8/10 <u>Mean</u>: 7/5 8/11 8/23 8/24 8/29	N/A	same as water temp gaging station	-Karnes City -Floresville -Nixon (when available)	-Falls City 4WSW (when available) -Karnes City -Floresville -Stockdale 4N (when available) -Nixon (when available) -Yorktown	-Beeville 5NE -Choke Canyon Dam -Canyon Dam (when available) -Point Comfort -Dilley -Austin (when no Canyon Dam) (when available)	-San Antonio (San Antonio WSFO) -Corpus Christi (Corpus Christi WSO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1985	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max: 7/28 7/29 8/6 9/1 9/3 Mean: 7/9 7/10 8/6 9/1 7/6	N/A	same as water temp gaging station	-Benbrook Dam -Dallas-Ft. Worth Reg. WSCMO AP -Waxahachie	-Arlington -Benbrook Dam -Burleson 3SSE -Aledo 4SE -Dallas-Ft. Worth Reg. WSCMO AP -Roanoke -Lillian 3W -Joe Pool Lake	-Benbrook Dam -Grapevine Dam (when available)	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1985	West Fork Trinity River at Grand Prairie (08049500)	Max: 7/17 7/27 7/28 8/20 8/21 Mean: 8/4 8/17 8/22 8/24 9/2	N/A	same as water temp gaging station	-Dallas-Ft. Worth Reg. WSCMO AP -Dallas FAA AP -Waxahachie -Benbrook Dam -Ferris	-Arlington -Joe Pool Lake -Dallas-Ft. Worth Reg. WSCMO AP -Dallas FAA AP -Frisco -Red Oak -Lillian 3W -Burleson 3SSE -Ferris	-Grapevine Dam (when available) -Benbrook Dam -Lavon Dam -Bardwell Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1985	Trinity River at Cedar Crest Blvd. at Dallas	Max: 8/3 8/19	N/A	Trinity River at Dallas	-Dallas FAA AP -Ferris	-Dallas FAA AP -Richardson -Joe Pool Lake	-Grapevine Dam (when available)	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	(08057055)	8/5 8/6 8/20 <u>Mean</u>: 8/19 8/22 8/23 7/27 9/1		(08057000)		-Red Oak -Ferris -Arlington -Rockwall -Lake Ray Hubbard -Crandall	-Bardwell Dam -Benbrook Dam -Lavon Dam -Navarro Mills Dam	AP)
1985	Trinity River below Dallas (08057410)	too much data missing	N/A					
1985	East Fork Trinity River at Seagoville (08061980)	no data	N/A					
1985	East Fork Trinity River near Crandall (08062000)	no data	N/A					
1985	Trinity River near Rosser (08062500)	<u>Max</u>: 8/1 8/17 8/22 8/23 8/24	N/A	same as water temp gaging station	-Ferris -Kaufman 3SE -Bardwell Dam -Corsicana -Waxahachie	-Rosser	-Bardwell Dam -Lavon Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		Mean: 8/2 8/18 8/19 8/17 8/22						
1985	Trinity River at Trinidad (08062700)	no data	N/A					
1985	San Antonio River at Loop 410 at San Antonio (08178565)	no data	N/A					
1985	Salado Creek (lower station) at San Antonio (08178800)	no data	N/A					
1985	Medina River at La Coste (08180640)	no data	N/A					
1985	Medio Creek at Pearsall Rd. at San Antonio	no data	N/A					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	(08180750)							
1985	Leon Creek at IH-35 at San Antonio (08181480)	no data	N/A					
1985	Medina River at San Antonio (08181500)	no data	N/A					
1985	San Antonio River near Elmendorf (08181800)	Max: 7/26 7/28 7/29 8/24 7/25 Mean: 8/1 8/18 8/19 8/21 7/30	N/A	same as water temp gaging station	-Floresville -Poteet -San Antonio WSFO -Lytle 3W -New Braunfels	-Floresville -Poteet -San Antonio WSFO -Lytle 3W -Falls City 4WSW -Riomedina 2N -New Braunfels -Bulverde -Jourdanton	-Canyon Dam -Choke Canyon Dam -Beeville 5NE	-San Antonio (San Antonio WSFO)
1985	San Antonio River near Falls City (08183500)	no data	N/A					
1985	Cibolo Creek	Max:	N/A	same as	-Karnes City	-Falls City 4WSW	-Beeville 5NE	-San Antonio (San

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	near Falls City (08186000)	6/1 6/6 7/2 5/9 6/24 Mean: 6/2 6/6 6/7 6/27 6/12		water temp gaging station	-Floresville -Nixon (when available)	-Karnes City -Floresville -Runge -Stockdale -Nixon (when available) -Yorktown (when available)	-Choke Canyon Dam -Canyon Dam -Point Comfort -Dilley (when available)	Antonio WSFO) -Corpus Christi (Corpus Christi WSO AP)
1986	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max: 7/31 8/19 7/23 7/24 7/9 Mean: 8/1 7/31 8/2 8/8 8/13	N/A	same as water temp gaging station	-Benbrook Dam -Burleson 3SSE -Dallas-Ft. Worth Reg. WSCMO AP -Waxahachie	-Arlington -Benbrook Dam -Burleson 3SSE -Aledo 4SE -Dallas-Ft. Worth Reg. WSCMO AP -Roanoke -Lillian 3W -Joe Pool Lake	-Benbrook Dam -Grapevine Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1986	West Fork Trinity River at Grand	Max: 8/1 7/29	N/A	same as water temp gaging	-Dallas-Ft. Worth Reg. WSCMO AP -Dallas FAA AP	-Arlington -Joe Pool Lake -Dallas-Ft. Worth	-Grapevine Dam (when available)	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	Prairie (08049500)	7/30 8/18 7/20 Mean: 5/13 7/26 7/28 7/29 8/18		station	-Burleson 3SSE (when available) -Waxahachie -Ferris	Reg. WSCMO AP -Dallas FAA AP -Carrollton -Red Oak -Lillian 3W -Burleson 3SSE -Ferris	-Benbrook Dam -Lavon Dam (when available) -Bardwell Dam	AP)
1986	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	Max: 8/19 8/18 8/9 8/16 8/20 Mean: 8/1 7/25 8/9 8/16 8/21	N/A	Trinity River at Dallas (08057000)	-Dallas FAA AP -Ferris	-Dallas FAA AP -Richardson -Carrollton -Joe Pool Lake -Red Oak -Ferris -Arlington -Rockwall -Lake Ray Hubbard -Crandall	-Grapevine Dam -Bardwell Dam -Benbrook Dam -Lavon Dam -Navarro Mills Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1986	Trinity River below Dallas (08057410)	too much data missing	N/A					
1986	East Fork Trinity River	no data	N/A					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	at Seagoville (08061980)							
1986	East Fork Trinity River near Crandall (08062000)	no data	N/A					
1986	Trinity River near Rosser (08062500)	Max: 7/28 8/3 7/22 7/24 7/25 Mean: 7/26 7/21 8/18 8/19 7/22	N/A	same as water temp gaging station	-Ferris -Kaufman 3SE -Bardwell Dam -Corsicana -Waxahachie	-Rosser	-Bardwell Dam -Lavon Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1986	Trinity River at Trinidad (08062700)	Max: 7/31 8/1 8/2 8/18 8/16 Mean: 7/25	N/A	same as water temp gaging station	-Athens 3SSE -Corsicana -Fairfield 4E -Kaufman 3SE -Bardwell Dam -Palestine 2NE -Mexia -Wills Point -Ferris	-Trinidad Power Plant	-Bardwell Dam -Navarro Mills Dam -Lavon Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP) -Waco (Waco WSO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		7/26 7/28 7/29 7/10						
1986	San Antonio River at Loop 410 at San Antonio (08178565)	no data	N/A					
1986	Salado Creek (lower station) at San Antonio (08178800)	no data	N/A					
1986	Medina River at La Coste (08180640)	no data	N/A					
1986	Medio Creek at Pearsall Rd. at San Antonio (08180750)	no data	N/A					
1986	Leon Creek at IH-35 at San Antonio (08181480)	too much data missing	N/A					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1986	Medina River at San Antonio (08181500)	no data	N/A					
1986	San Antonio River near Elmendorf (08181800)	too much data missing	N/A					
1986	San Antonio River near Falls City (08183500)	no data	N/A					
1986	Cibolo Creek near Falls City (08186000)	Max: 7/30 7/25 7/27 7/29 7/31 Mean: 7/30 7/31 8/2 7/21 7/24	N/A	same as water temp gaging station	-Karnes City (when available) -Floresville -Nixon -Beeville 5NE (when no Karnes City) -Poteet (when no Karnes City)	-Falls City 4WSW -Karnes City (when available) -Floresville -Runge -Stockdale -Nixon -Yorktown	-Beeville 5NE -Choke Canyon Dam -Canyon Dam -Point Comfort -Dilley	-San Antonio (San Antonio WSFO) -Corpus Christi (Corpus Christi WSO AP)
1987	West Fork Trinity River	Max: 8/6	N/A	same as water temp	-Benbrook Dam -Burleson 3SSE	-Arlington (when available)	-Benbrook Dam -Grapevine	-Fort Worth (Dallas-Ft. Worth

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	at Beach Street at Fort Worth (08048543)	8/8 8/4 8/10 8/11 Mean: 7/29 8/4 7/24 7/25 7/27		gaging station	-Dallas-Ft. Worth Reg. WSCMO AP -Waxahachie	-Benbrook Dam -Burleson 3SSE -Aledo 4SE (when available) -Dallas-Ft. Worth WSCMO AP -Roanoke (when available) -Lillian 3W -Joe Pool Lake	Dam	Reg. WSCMO AP)
1987	West Fork Trinity River at Grand Prairie (08049500)	Max: 8/9 8/3 8/10 8/15 8/21 Mean: 8/9 8/8 8/11 8/12 8/14	N/A	same as water temp gaging station	-Dallas-Ft. Worth WSCMO AP -Dallas FAA AP -Burleson 3SSE -Waxahachie -Ferris (when available)	-Arlington (when available) -Joe Pool Lake -Dallas-Ft. Worth WSCMO AP -Dallas FAA AP -Carrollton -Red Oak -Lillian 3W -Burleson 3SSE -Ferris (when available)	-Grapevine Dam -Benbrook Dam -Lavon Dam -Bardwell Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1987	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	Max: 8/2 7/30 7/31 8/25	N/A	Trinity River at Dallas (08057000)	-Dallas FAA AP -Ferris (when available)	-Dallas FAA AP -Richardson -Carrollton -Joe Pool Lake -Red Oak	-Grapevine Dam -Bardwell Dam -Benbrook Dam -Lavon Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		8/19 Mean: 8/9 8/10 8/3 8/20 8/22				-Ferris (when available) -Arlington (when available) -Lake Ray Hubbard -Crandall	-Navarro Mills Dam	
1987	Trinity River below Dallas (08057410)	Max: 7/26 7/19 7/16 8/14 8/22 Mean: 6/30 7/19 7/23 8/6 7/18	N/A	same as water temp gaging station	-Dallas FAA AP -Ferris (when available) -Waxahachie -Kaufman 3SE -Bardwell Dam (when no Ferris)	-Dallas FAA AP -Ferris (when available) -Red Oak -Joe Pool Lake -Arlington (when available) -Rosser -Crandall -Lake Ray Hubbard -Terrell -Richardson -Ennis (when no Ferris)	-Grapevine Dam -Lavon Dam -Bardwell Dam (when available) -Benbrook Dam -Whitney Dam -Navarro Mills Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1987	East Fork Trinity River at Seagoville (08061980)	Max: 8/1 8/7 7/30 8/15 8/18	N/A	East Fork Trinity River near Crandall (08062000)	-Ferris (when available) -Kaufman 3SE -Dallas FAA AP -Lavon Dam -Bardwell Dam -Wills Point	-Crandall -Lake Ray Hubbard -Ferris (when available) -Terrell	-Bardwell Dam -Grapevine Dam -Lavon Dam -Benbrook Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		Mean: 8/7 8/1 8/2 8/5 8/16			-Waxahachie (when no Ferris)			
1987	East Fork Trinity River near Crandall (08062000)	Max: 8/15 8/21 8/26 8/14 8/25 Mean: 7/27 7/28 8/16 7/26 8/15	N/A	same as water temp gaging station	-Kaufman 3SE -Ferris (when available) -Dallas FAA AP -Bardwell Dam -Wills Point -Lavon Dam -Waxahachie (when no Ferris)	-Crandall	-Bardwell Dam -Grapevine Dam -Lavon Dam -Benbrook Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1987	Trinity River near Rosser (08062500)	Max: 8/2 8/5 8/8 8/15 7/24 Mean: 8/3 8/5	N/A	same as water temp gaging station	-Ferris (when available) -Kaufman 3SE -Bardwell Dam -Corsicana -Waxahachie -Dallas FAA AP (when no Ferris)	-Rosser	-Bardwell Dam -Lavon Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		8/6 8/8 8/14						
1987	Trinity River at Trinidad (08062700)	too much data missing	N/A					
1987	San Antonio River at Loop 410 at San Antonio (08178565)	Max: 8/19 8/21 8/25 9/12 9/13 Mean: 8/25 8/17 9/12 9/14 9/15	N/A	same as water temp gaging station	-San Antonio WSFO -Lytle 3W -Charlotte 5NNW -Floresville -New Braunfels -Boerne -Nixon -Hondo WSMO AP	-San Antonio WSFO -Lytle 3W -Charlotte 5NNW -Floresville -Jourdanton -Riomedina 2N -Stockdale 4N -New Braunfels -Boerne -Hondo WSMO AP	-Choke Canyon Dam -Beeville 5NE -Austin	-San Antonio (San Antonio WSFO)
1987	Salado Creek (lower station) at San Antonio (08178800)	Max: 8/6 8/10 8/15 8/16 8/4 Mean:	N/A	same as water temp gaging station	-San Antonio WSFO -Floresville -Lytle 3W -Charlotte 5NNW -New Braunfels (when available) -Boerne	-San Antonio WSFO -Floresville -Lytle 3W -Jourdanton -Stockdale 4N -New Braunfels (when available)	-Choke Canyon Dam -Beeville 5NE -Austin	-San Antonio (San Antonio WSFO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		8/12 8/16 8/17 6/20 8/2				-Boerne -Riomedina 2N		
1987	Medina River at La Coste (08180640)	too much data missing	N/A					
1987	Medio Creek at Pearsall Rd. at San Antonio (08180750)	Max: 8/14 7/5 8/3 8/5 8/18 Mean: 7/5 8/4 8/9 8/12 8/17	N/A	same as water temp gaging station	-Lytle 3W -San Antonio WSFO -Charlotte 5NNW	-Lytle 3W -San Antonio WSFO -Riomedina 2N -Charlotte 5NNW	-Choke Canyon Dam -Beeville 5NE -Austin	-San Antonio (San Antonio WSFO)
1987	Leon Creek at IH-35 at San Antonio (08181480)	Max: 6/17 8/9 8/12 8/18 8/28	N/A	same as water temp gaging station	-Lytle 3W -San Antonio WSFO -Charlotte 5NNW -Floresville -Boerne	-Lytle 3W -San Antonio WSFO -Riomedina 2N -Charlotte 5NNW -Floresville -Boerne	-Choke Canyon Dam -Beeville 5NE -Austin	-San Antonio (San Antonio WSFO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		Mean: 6/19 8/17 8/18 8/10 8/23				-Jourdanton		
1987	Medina River at San Antonio (08181500)	Max: 8/17 7/5 8/6 8/20 8/25 Mean: 8/13 8/16 8/17 8/18 8/26	N/A	same as water temp gaging station	-Charlotte 5NNW -Lytle 3W -San Antonio WSFO -Floresville -New Braunfels (when available) -Boerne -Nixon	-Charlotte 5NNW -Lytle 3W -Riomedina 2N -San Antonio WSFO -Floresville -Stockdale 4N -Falls City 4WSW -New Braunfels (when available) -Boerne -Jourdanton	-Choke Canyon Dam -Beeville 5NE -Austin	-San Antonio (San Antonio WSFO)
1987	San Antonio River near Elmendorf (08181800)	Max: 8/16 8/7 8/14 8/21 9/13 Mean: 8/11 8/22	N/A	same as water temp gaging station	-Floresville -Charlotte 5NNW -San Antonio WSFO -Lytle 3W -New Braunfels	-Floresville -Charlotte 5NNW -San Antonio WSFO -Lytle 3W -Falls City 4WSW -Riomedina 2N -New Braunfels -Bulverde -Jourdanton	-Choke Canyon Dam -Beeville 5NE -Austin	-San Antonio (San Antonio WSFO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		9/16 8/9 8/14						
1987	San Antonio River near Falls City (08183500)	Max: 8/12 8/21 8/5 8/10 9/15 Mean: 8/11 8/18 8/22 8/23 8/5	N/A	same as water temp gaging station	-Karnes City -Floresville -Nixon -Choke Canyon Dam	-Falls City 4WSW	-Choke Canyon Dam -Beeville 5NE -Austin	-San Antonio (San Antonio WSFO) -Corpus Christi (Corpus Christi WSO AP)
1987	Cibolo Creek near Falls City (08186000)	Max: 8/12 8/19 8/5 8/8 8/10 Mean: 8/12 8/13 8/17 8/19 8/23	N/A	same as water temp gaging station	-Karnes City -Floresville -Nixon	-Falls City 4WSW -Karnes City -Floresville -Runge -Stockdale 4N -Nixon	-Beeville 5NE -Choke Canyon Dam -Austin	-San Antonio (San Antonio WSFO) -Corpus Christi (Corpus Christi WSO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1988	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max: 7/1 7/2 7/26 8/18 7/15 Mean: 8/8 8/9 8/10 8/24 8/15	N/A	same as water temp gaging station	-Benbrook Dam -Burleson 3SSE (when available) -Dallas-Ft. Worth Reg. WSCMO AP -Waxahachie	-Arlington -Benbrook Dam -Burleson 3SSE -Aledo 4SE -Dallas-Ft. Worth Reg. WSCMO AP -Roanoke -Lillian 3W -Joe Pool Lake	-Benbrook Dam -Grapevine Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1988	West Fork Trinity River at Grand Prairie (08049500)	Max: 8/9 7/26 8/11 8/24 8/17 Mean: 8/9 8/7 8/25 7/16 8/23	N/A	same as water temp gaging station	-Dallas-Ft. Worth Reg. WSCMO AP -Dallas FAA AP -Burleson 3SSE (when available) -Waxahachie -Ferris	-Arlington -Joe Pool Lake -Dallas-Ft. Worth Reg. WSCMO AP -Dallas FAA AP -Carrollton -Red Oak -Lillian 3W -Burleson 3SSE -Ferris	-Grapevine Dam -Benbrook Dam -Lavon Dam -Bardwell Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1988	Trinity River	Max:	N/A	Trinity	-Dallas FAA AP	-Dallas FAA AP	-Grapevine	-Fort Worth

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	at Cedar Crest Blvd. at Dallas (08057055)	8/7 8/10 7/31 8/12 8/22 Mean: 8/8 7/17 8/1 8/11 8/26		River at Dallas (08057000)	-Ferris	-Richardson (when available) -Carrollton -Joe Pool Lake -Red Oak -Ferris -Arlington -Rockwall -Lake Ray Hubbard -Crandall	Dam -Bardwell Dam -Benbrook Dam -Lavon Dam -Navarro Mills Dam	(Dallas-Ft. Worth Reg. WSCMO AP)
1988	Trinity River below Dallas (08057410)	Max: 8/5 8/13 8/16 8/17 8/18 Mean: 8/6 8/11 8/18 8/25 7/17	N/A	same as water temp gaging station	-Dallas FAA AP -Ferris -Waxahachie -Kaufman 3SE	-Dallas FAA AP -Ferris -Red Oak -Joe Pool Lake -Arlington -Rosser -Crandall -Lake Ray Hubbard -Terrell -Richardson (when available)	-Grapevine Dam -Lavon Dam -Bardwell Dam -Benbrook Dam -Whitney Dam -Navarro Mills Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1988	East Fork Trinity River at Seagoville (08061980)	Max: 6/29 7/16 8/14	N/A	East Fork Trinity River near Crandall	-Ferris -Kaufman 3SE -Dallas FAA AP -Lavon Dam (when	-Crandall -Lake Ray Hubbard -Ferris -Terrell	-Bardwell Dam -Grapevine Dam -Lavon Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		8/15 8/22 Mean: 8/8 8/9 6/28 7/17 8/16		(08062000)	available) -Bardwell Dam -Wills Point		(when available) -Benbrook Dam	
1988	East Fork Trinity River near Crandall (08062000)	Max: 7/17 8/6 6/28 8/2 8/18 Mean: 8/9 6/29 8/6 8/14 8/17	N/A	same as water temp gaging station	-Kaufman 3SE -Ferris -Dallas FAA AP -Bardwell Dam -Wills Point -Lavon Dam (when available)	-Crandall	-Bardwell Dam -Grapevine Dam -Lavon Dam (when available) -Benbrook Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1988	Trinity River near Rosser (08062500)	Max: 8/9 8/10 7/19 7/1 8/17	N/A	same as water temp gaging station	-Ferris -Kaufman 3SE -Bardwell Dam -Corsicana -Waxahachie	-Rosser	-Bardwell Dam -Lavon Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		Mean: 8/8 7/17 8/15 8/19 8/25						
1988	Trinity River at Trinidad (08062700)	too much data missing	N/A					
1988	San Antonio River at Loop 410 at San Antonio (08178565)	Max: 8/10 7/2 7/5 8/26 8/13 Mean: 8/10 8/11 7/5 7/6 8/13	N/A	same as water temp gaging station	-San Antonio WSFO -San Antonio / Seaworld (when available) -Lytle 3W -Poteet (when avaialble) -Floresville (when available) -New Braunfels (when available) -Boerne (when available) -Canyon Dam (when available) -Nixon (when available) -Hondo WSMO AP	-San Antonio WSFO -San Antonio / Seaworld (when available) -Lytle 3W -Poteet (when available) -Floresville (when available) -Jourdanton -Riomedina 2N -Stockdale 4N -New Braunfels (when available) -Boerne (when available) -Canyon Dam (when available)	-San Antonio / Seaworld -Canyon Dam	-San Antonio (San Antonio WSFO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
					(when available) -Charlotte 5NNW (when no Poteet)	-Hondo WSMO AP (when available) -Charlotte 5NNW (when no Poteet) -Falls City 4WSW (when no Floresville)		
1988	Salado Creek (lower station) at San Antonio (08178800)	Max: 7/18 8/9 8/11 7/13 8/15 Mean: 7/17 7/15 7/16 8/12 8/16	N/A	same as water temp gaging station	-San Antonio WSFO -San Antonio / Seaworld -Floresville (when available) -Lytle 3W -Poteet (when available) -New Braunfels -Boerne -Canyon Dam -Charlotte 5NNW (when no Poteet)	-San Antonio WSFO -San Antonio / Seaworld -Floresville (when available) -Lytle 3W -Poteet (when available) -Stockdale 4N -New Braunfels -Boerne -Canyon Dam -Jourdanton -Falls City 4WSW (when no Floresville)	-San Antonio / Seaworld -Canyon Dam	-San Antonio (San Antonio WSFO)
1988	Medina River at La Coste (08180640)	Max: 7/2 8/9 8/10	N/A	same as water temp gaging station	-Lytle 3W -San Antonio / Seaworld (when available)	-Lytle 3W -San Antonio / Seaworld (when available)	-San Antonio / Seaworld	-San Antonio (San Antonio WSFO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		8/15 8/25 Mean: 8/12 8/25 7/7 7/17 8/23				-Riomedina 2N		
1988	Medio Creek at Pearsall Rd. at San Antonio (08180750)	Max: 6/30 7/15 8/9 8/10 8/15 Mean: 7/3 7/19 8/10 8/23 8/12	N/A	same as water temp gaging station	-San Antonio / Seaworld (when available) -Lytle 3W -San Antonio WSFO -Poteet (when available) -Charlotte 5NNW	-San Antonio / Seaworld (when available) -Lytle 3W -San Antonio WSFO -Riomedina 2N -Poteet (when available) -Charlotte 5NNW	-San Antonio / Seaworld (when available)	-San Antonio (San Antonio WSFO)
1988	Leon Creek at IH-35 at San Antonio (08181480)	too much data missing	N/A					
1988	Medina River at San Antonio	Max: 7/14	N/A	same as water temp	-Poteet (when available)	-Poteet (when available)	-San Antonio / Seaworld	-San Antonio (San Antonio WSFO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	(08181500)	7/18 8/10 8/24 8/9 Mean: 7/15 8/9 8/17 8/22 7/1		gaging station	-Lytle 3W -San Antonio / Seaworld (when available) -San Antonio WSFO -Floresville (when available) -New Braunfels (when available) -Boerne (when available) -Canyon Dam (when available) -Nixon (when available) -Charlotte 5NNW (when no Poteet)	-Lytle 3W -San Antonio / Seaworld (when available) -San Antonio WSFO -Floresville (when available) -Stockdale 4N -Falls City 4WSW -New Braunfels (when available) -Boerne (when available) -Canyon Dam (when available) -Jourdanton -Charlotte 5NNW (when no Poteet)	-Canyon Dam -Choke Canyon Dam (when available)	
1988	San Antonio River near Elmendorf (08181800)	Max: 7/19 8/24 7/3 7/15 8/27 Mean: 7/3 7/19 7/27	N/A	same as water temp gaging station	-Floresville (when available) -Poteet (when available) -San Antonio WSFO -Lytle 3W -San Antonio / Seaworld (when available) -New Braunfels	-Floresville (when available) -Poteet (when available) -San Antonio WSFO -Lytle 3W -Falls City 4WSW -San Antonio / Seaworld (when available)	-San Antonio / Seaworld -Canyon Dam -Choke Canyon Dam (when available) -Beeville 5NE	-San Antonio (San Antonio WSFO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		8/21 8/23			(when available) -Charlotte 5NNW (when no Poteet) -Karnes City (when no Floresville) (when available) -Canyon Dam (when no Floresville) (when available)	-New Braunfels (when available) -Bulverde -Jourdanton -Riomedina 2N (when no San Antonio Seaworld) -Charlotte 5NNW (when no Poteet) -Canyon Dam (when no Floresville) (when available) -Stockdale 4N (when no Floresville)		
1988	San Antonio River near Falls City (08183500)	Max: 8/24 8/14 8/16 8/22 7/4 Mean: 8/10 8/11 8/24 7/2 7/18	N/A	same as water temp gaging station	-Karnes City (when available) -Floresville (when available) -Nixon (when available) -Choke Canyon Dam (when available)	-Falls City 4WSW	-Choke Canyon Dam (when available) -Beeville 5NE -San Antonio / Seaworld -Canyon Dam -Point Comfort	-San Antonio (San Antonio WSFO) -Corpus Christi (Corpus Christi WSO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1988	Cibolo Creek near Falls City (08186000)	Max: 8/10 8/7 8/23 8/26 8/27 Mean: 8/6 8/12 8/14 8/16 8/20	N/A	same as water temp gaging station	-Karnes City -Floresville -Nixon	-Falls City 4WSW -Karnes City -Floresville (when available) -Runge -Stockdale 4N -Nixon -Yorktown	-Beeville 5NE -San Antonio / Seaworld -Canyon Dam -Point Comfort	-San Antonio (San Antonio WSFO) -Corpus Christi (Corpus Christi WSO AP)
1989	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max: 8/31 7/15 7/9 7/16 8/24 Mean: 8/29 9/2 7/31 8/26 9/7	N/A	same as water temp gaging station	-Benbrook Dam -Burleson 3SSE -Dallas-Ft. Worth Reg. WSCMO AP -Dallas Arboretum-White Lake -Waxahachie	-Arlington -Benbrook Dam -Burleson 3SSE -Aledo 4SE (when available) -Dallas-Ft. Worth Reg. WSCMO AP -Roanoke (when available) -Lillian 3W -Joe Pool Lake	-Benbrook Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1989	West Fork Trinity River	too much data missing	N/A					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	at Grand Prairie (08049500)							
1989	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	no data	N/A					
1989	Trinity River below Dallas (08057410)	Max: 9/8 9/7 8/31 8/24 9/10 Mean: 9/5 9/1 9/6 8/22 8/23	N/A	same as water temp gaging station	-Dallas FAA AP -Ferris -Waxahachie -Kaufman 3SE -Dallas Arboretum-White Lake	-Dallas FAA AP -Ferris -Red Oak -Joe Pool Lake -Arlington -Rosser -Crandall -Lake Ray Hubbard -Terrell -Dallas Arboretum-White Lake	-Lavon Dam -Bardwell Dam -Benbrook Dam -Whitney Dam -Navarro Mills Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1989	East Fork Trinity River at Seagoville (08061980)	Max: 7/4 7/6 7/7 8/4 9/4 Mean:	N/A	East Fork Trinity River near Crandall (08062000)	-Ferris -Kaufman 3SE -Dallas Arboretum-White Lake -Lavon Dam -Bardwell Dam -Wills Point	-Crandall -Lake Ray Hubbard -Ferris -Terrell	-Bardwell Dam -Lavon Dam -Benbrook Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		7/17 7/19 8/31 9/4 7/8						
1989	East Fork Trinity River near Crandall (08062000)	Max: 7/29 7/28 7/31 8/4 8/5 Mean: 7/17 7/19 7/30 9/6 9/7	N/A	same as water temp gaging station	-Kaufman 3SE -Ferris -Dallas Arboretum-White Lake -Bardwell Dam -Wills Point -Lavon Dam	-Crandall	-Bardwell Dam -Lavon Dam (when available) -Benbrook Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1989	Trinity River near Rosser (08062500)	Max: 8/27 9/5 9/6 9/8 7/29 Mean: 8/29 9/4 9/5	N/A	same as water temp gaging station	-Ferris -Kaufman 3SE -Bardwell Dam -Corsicana -Waxahachie -Dallas Arboretum-White Lake	-Rosser	-Bardwell Dam -Lavon Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		8/25 9/8						
1989	Trinity River at Trinidad (08062700)	Max: 8/30 8/28 8/25 9/8 8/23 Mean: 8/28 9/4 9/5 7/6 8/23	N/A	same as water temp gaging station	-Athens 3SSE -Corsicana -Fairfield 4E -Kaufman 3SE -Bardwell Dam -Palestine 2NE -Mexia -Wills Point -Ferris	-Corsicana Athens 3SSE -Fairfield 4E -Rosser -Kaufman 3SE -Bardwell Dam -Canton (when available) -Edom 3NNW -Palestine 2NE -Ennis -Wills Point -Ferris	-Bardwell Dam -Navarro Mills Dam -Lavon Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP) -Waco (Waco WSO AP)
1989	San Antonio River at Loop 410 at San Antonio (08178565)	no data	N/A					
1989	Salado Creek (lower station) at San Antonio (08178800)	Max: 7/5 7/19 8/27 7/15 8/5	N/A	same as water temp gaging station	-San Antonio WSFO -San Antonio / Seaworld -Floresville -Lytle 3W -Poteet	-San Antonio WSFO -San Antonio / Seaworld -Floresville (when available) -Lytle 3W	-San Antonio / Seaworld -Canyon Dam	-San Antonio (San Antonio WSFO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		Mean: 8/29 7/8 8/24 8/7 8/25			-New Braunfels -Boerne -Canyon Dam	-Poteet -Stockdale 4N -New Braunfels (when available) -Boerne -Canyon Dam -Jourdanton		
1989	Medina River at La Coste (08180640)	Max: 7/17 7/18 7/16 9/2 7/7 Mean: 7/10 8/31 9/1 9/4 9/5	N/A	same as water temp gaging station	-Lytle 3W -San Antonio / Seaworld	-Lytle 3W -San Antonio / Seaworld -Riomedina 2N	-San Antonio / Seaworld	-San Antonio (San Antonio WSFO)
1989	Medio Creek at Pearsall Rd. at San Antonio (08180750)	Max: 7/19 6/20 7/15 6/21 7/7 Mean: 8/6	N/A	same as water temp gaging station	-San Antonio / Seaworld -Lytle 3W -San Antonio WSFO -Poteet -Charlotte 5NNW	-San Antonio / Seaworld -Lytle 3W -San Antonio WSFO -Riomedina 2N -Poteet -Charlotte 5NNW	-San Antonio / Seaworld	-San Antonio (San Antonio WSFO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		5/23 5/26 7/11 8/23						
1989	Leon Creek at IH-35 at San Antonio (08181480)	Max: 7/17 7/7 7/2 7/4 7/11 Mean: 7/18 7/19 7/4 7/7 7/2	N/A	same as water temp gaging station	-San Antonio / Seaworld -Lytle 3W -San Antonio WSFO -Poteet -Charlotte 5NNW -Floresville -Boerne	-San Antonio / Seaworld -Lytle 3W -San Antonio WSFO -Poteet -Riomedina 2N -Charlotte 5NNW -Floresville -Boerne -Jourdanton	-San Antonio / Seaworld	-San Antonio (San Antonio WSFO)
1989	Medina River at San Antonio (08181500)	Max: 6/11 8/6 7/2 7/11 7/30 Mean: 8/28 8/29 9/1 7/3	N/A	same as water temp gaging station	-Poteet -Lytle 3W -San Antonio / Seaworld -San Antonio WSFO -Floresville -New Braunfels -Boerne -Canyon Dam -Nixon	-Poteet -Lytle 3W -San Antonio / Seaworld -San Antonio WSFO -Floresville (when available) -Stockdale 4N -Falls City 4WSW -New Braunfels (when available)	-San Antonio / Seaworld -Canyon Dam -Choke Canyon Dam	-San Antonio (San Antonio WSFO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		8/24				-Boerne -Canyon Dam -Jourdanton		
1989	San Antonio River near Elmendorf (08181800)	Max: 7/18 8/5 8/6 9/4 5/26 Mean: 9/3 7/19 8/5 8/30 9/4	N/A	same as water temp gaging station	-Floresville -Poteet -San Antonio WSFO -Lytle 3W -San Antonio / Seaworld -New Braunfels	-Floresville (when available) -Poteet -San Antonio WSFO -Lytle 3W -Falls City 4WSW -San Antonio / Seaworld -New Braunfels -Bulverde (when available) -Jourdanton	-San Antonio / Seaworld -Canyon Dam -Choke Canyon Dam -Beeville 5NE	-San Antonio (San Antonio WSFO)
1989	San Antonio River near Falls City (08183500)	Max: 6/6 7/18 9/2 9/4 7/7 Mean: 7/6 7/14 8/30 9/1 9/2	N/A	same as water temp gaging station	-Karnes City -Floresville -Nixon -Choke Canyon Dam	-Falls City 4WSW	-Choke Canyon Dam -Beeville 5NE -San Antonio / Seaworld -Canyon Dam	-San Antonio (San Antonio WSFO) -Corpus Christi (Corpus Christi WSO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1989	Cibolo Creek near Falls City (08186000)	Max: 7/15 5/19 5/26 7/13 6/20 Mean: 7/16 7/17 6/6 7/14 7/31	N/A	same as water temp gaging station	-Karnes City -Floresville -Nixon	-Falls City 4WSW -Karnes City -Floresville -Runge -Stockdale 4N -Nixon -Yorktown	-Beeville 5NE -Choke Canyon Dam -San Antonio / Seaworld -Canyon Dam -Point Comfort (when available)	-San Antonio (San Antonio WSFO) -Corpus Christi (Corpus Christi WSO AP)
1990	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max: 8/31 7/1 8/28 6/27 7/9 Mean: 8/28 8/26 9/1 7/11 9/5	Fort Worth PMSA, tracts: 1001.02 1002.02 1003 1005.01 1009 1010 1011 1012.02 1015 1016 1017 1019 1020	same as water temp gaging station	-Benbrook Dam -Burleson 3SSE -Dallas-Ft. Worth Reg. WSCMO AP -Dallas Arboretum-White Lake (when available) -Waxahachie (when available)	-Arlington -Benbrook Dam -Burleson 3SSE -Aledo 4SE -Dallas-Ft. Worth Reg. WSCMO AP -Roanoke -Lillian 3W -Joe Pool Lake	-Benbrook Dam -Joe Pool Lake (when available) -Grapevine Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
			1035 1038 1045.01 1046.04 1046.05 1059					
1990	West Fork Trinity River at Grand Prairie (08049500)	Max: 7/2 7/30 8/20 8/10 8/12 Mean: 8/22 7/5 7/30 7/1 8/15	Fort Worth PMSA, tracts: 1065.08 1130.01 1131.01 Dallas PMSA, tracts: 153.01 154.01	same as water temp gaging station	-Joe Pool Lake -Dallas-Ft. Worth Reg. WSCMO AP -Dallas FAA AP -Burleson 3SSE -Waxahachie -Dallas Arboretum-White Lake (when available) -Ferris	-Arlington -Joe Pool Lake -Dallas-Ft. Worth Reg. WSCMO AP -Dallas FAA AP -Carrollton -Red Oak -Lillian 3W -Burleson 3SSE -Dallas Arboretum-White Lake (when available) -Ferris (when available)	-Joe Pool Lake (when available) -Grapevine Dam -Benbrook Dam (when no Joe Pool Lake) -Lavon Dam (when no Joe Pool Lake) -Bardwell Dam (when no Joe Pool Lake)	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1990	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	too much data missing	Dallas PMSA, tracts: 20 33 34 41 43 89 100					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
			101.01 101.02 102 105 106					
1990	Trinity River below Dallas (08057410)	too much data missing	Dallas PMSA, tracts: 20 33 34 40 41 43 86.02 89 93.03 100 114.02 115					
1990	East Fork Trinity River at Seagoville (08061980)	Max: 8/29 7/29 9/1 9/3 7/12 Mean: 7/11 8/22	Dallas PMSA, tracts: 170.02 173.02	East Fork Trinity River near Crandall (08062000)	-Ferris -Kaufman 3SE -Dallas Arboretum-White Lake (when available) -Lavon Dam (when available) -Joe Pool Lake (when available) -Bardwell Dam	-Crandall -Lake Ray Hubbard (when available) -Ferris (when available) -Terrell	-Joe Pool Lake (when available) -Bardwell Dam -Grapevine Dam -Lavon Dam (when available) -Benbrook Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		9/6 8/21 9/5			(when available) -Wills Point -Dallas FAA AP (when available)		(when no Joe Pool Lake)	
1990	East Fork Trinity River near Crandall (08062000)	Max: 8/20 8/28 8/16 8/18 8/23 Mean: 8/20 8/22 7/30 8/19 9/4	Dallas PMSA, tracts: 170.02 173.02 502	same as water temp gaging station	-Kaufman 3SE -Ferris -Dallas Arboretum-White Lake (when available) -Bardwell Dam (when available) -Wills Point -Lavon Dam (when available) -Joe Pool Lake (when available) -Dallas FAA AP (when no Dallas Arboretum-White Lake)	-Crandall	-Bardwell Dam -Joe Pool Lake (when available) -Grapevine Dam -Lavon Dam (when available) -Benbrook Dam (when no Joe Pool Lake)	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1990	Trinity River near Rosser (08062500)	Max: 9/8 8/22 7/13 8/18 9/19 Mean: 8/23	Dallas PMSA, tracts: 508 601 617	same as water temp gaging station	-Ferris -Kaufman 3SE -Bardwell Dam (when available) -Corsicana -Waxahachie -Joe Pool Lake (when available) -Dallas Arboretum-	-Rosser	-Bardwell Dam -Joe Pool Lake (when available) -Lavon Dam (when available)	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		8/20 9/19 8/14 9/21			White Lake (when available)			
1990	Trinity River at Trinidad (08062700)	Max: 8/27 8/30 9/3 9/7 8/23 Mean: 8/29 9/6 7/12 8/21 8/23	Henderson County: (BNA # 9508 (Eustace - Malakoff division (part)), minus Trinidad city Henderson County: Trinidad city Navarro County: BNA # 9706 (Kerens division)	same as water temp gaging station	-Athens 3SSE -Corsicana -Fairfield 4E -Kaufman 3SE -Bardwell Dam (when available) -Palestine 2NE -Mexia -Wills Point -Ferris	-Corsicana -Athens 3SSE -Fairfield 4E -Rosser -Kaufman 3SE -Bardwell Dam -Canton -Edom 3NNW -Palestine 2NE -Ennis -Wills Point -Ferris	-Bardwell Dam -Navarro Mills Dam -Lavon Dam (when available)	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP) -Waco (Waco WSO AP)
1990	San Antonio River at Loop 410 at San Antonio (08178565)	no data	San Antonio SMSA, tracts: 1104 1501 1502 1503 1507 1508 1518					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
			1601					
1990	Salado Creek (lower station) at San Antonio (08178800)	Max: 6/2 8/16 8/17 8/12 8/14 Mean: 6/3 6/7 8/20 8/23 8/25	San Antonio SMSA, tracts: 1308 1309 1310 1311 1312 1413 1414	same as water temp gaging station	--San Antonio WSFO -San Antonio Seaworld -Floresville -Lytle 3W -Poteet -New Braunfels (when available) -Boerne -Canyon Dam (when available)	-San Antonio WSFO -San Antonio Seaworld -Floresville -Lytle 3W -Poteet -Stockdale 4N -New Braunfels (when available) -Boerne -Canyon Dam (when available) -Jourdanton	-San Antonio Seaworld -Canyon Dam	-San Antonio (San Antonio WSFO)
1990	Medina River at La Coste (08180640)	Max: 6/26 6/18 6/25 6/8 6/30 Mean: 6/24 6/25 6/17 6/20 6/30	Medina County: BNA # 9901 (Castroville - La Coste division), minus Castroville city Medina County: Castroville city	same as water temp gaging station	-Lytle 3W -San Antonio Seaworld	-Lytle 3W -San Antonio Seaworld -Riomedina 2N	-San Antonio Seaworld	-San Antonio (San Antonio WSFO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1990	Medio Creek at Pearsall Rd. at San Antonio (08180750)	Max: 6/17 6/25 6/27 8/5 8/17 Mean: 6/27 8/26 8/31 6/22 8/2	San Antonio SMSA, tracts: 1617 1618 1719.04	same as water temp gaging station	-San Antonio Seaworld -Lytle 3W -San Antonio WSFO -Poteet -Charlotte 5NNW	-San Antonio Seaworld -Lytle 3W -San Antonio WSFO -Riomedina 2N -Poteet -Charlotte 5NNW	-San Antonio Seaworld	-San Antonio (San Antonio WSFO)
1990	Leon Creek at IH-35 at San Antonio (08181480)	Max: 6/8 6/25 6/27 6/21 8/22 Mean: 8/19 8/31 6/26 8/15 8/27	San Antonio SMSA, tracts: 1610.85 1613 1614.01 1614.85 1616	same as water temp gaging station	-San Antonio Seaworld -Lytle 3W -San Antonio WSFO -Poteet -Charlotte 5NNW -Floresville -Boerne	-San Antonio Seaworld -Lytle 3W -San Antonio WSFO -Poteet -Riomedina 2N -Charlotte 5NNW -Floresville -Boerne -Jourdanton	-San Antonio Seaworld	-San Antonio (San Antonio WSFO)
1990	Medina River at San Antonio (08181500)	Max: 6/22 6/25	San Antonio SMSA, tracts: 1519	same as water temp gaging	-Poteet -Lytle 3W -San Antonio	-Poteet -Lytle 3W -San Antonio	-San Antonio Seaworld -Canyon Dam	-San Antonio (San Antonio WSFO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		6/18 7/4 8/26 Mean: 6/23 6/25 6/3 6/16 6/29	1520 1521	station	Seaworld -San Antonio WSFO -Floresville -New Braunfels (when available) -Boerne -Canyon Dam (when available) -Nixon	Seaworld -San Antonio WSFO -Floresville -Stockdale 4N -Falls City 4WSW -New Braunfels (when available) -Boerne -Canyon Dam (when available) Jourdanton	-Choke Canyon Dam	
1990	San Antonio River near Elmendorf (08181800)	Max: 6/23 6/18 6/25 7/12 8/30 Mean: 6/24 6/28 6/19 7/12 8/26	San Antonio SMSA, tracts: 1418 1522	same as water temp gaging station	-Floresville -Poteet -San Antonio WSFO -Lytle 3W -San Antonio Seaworld -New Braunfels (when available)	-Floresville -Poteet -San Antonio WSFO -Lytle 3W -Falls City 4WSW -San Antonio Seaworld -New Braunfels (when available) -Bulverde -Jourdanton	-San Antonio Seaworld -Canyon Dam -Choke Canyon Dam -Beeville 5NE	-San Antonio (San Antonio WSFO)
1990	San Antonio River near Falls City (08183500)	Max: 7/12 6/9 6/29	Karnes County: BNA # 9701 (Falls City division +	same as water temp gaging station	-Karnes City -Floresville -Nixon -Choke Canyon	-Falls City 4WSW	-Choke Canyon Dam -Beeville 5NE -San Antonio	-San Antonio (San Antonio WSFO) -Corpus Christi (Corpus Christi

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		7/6 7/8 Mean: 6/24 6/20 6/21 6/4 6/30	Gillette division) Wilson County: BNA # 9806 (Poth division)		Dam		Seaworld -Canyon Dam -Point Comfort	WSO AP)
1990	Cibolo Creek near Falls City (08186000)	too much data missing	Karnes County: BNA # 9701 (Falls City division + Gillette division) Wilson County: BNA # 9806 (Poth division) Wilson County: BNA # 9805 (Stockdale division)					
1991	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max: 8/8 8/4 8/7 7/6	N/A	same as water temp gaging station	-Arlington -Benbrook Dam -Burleson -Dallas-Ft. Worth Reg. WSCMO AP	-Arlington -Benbrook Dam -Burleson -Aledo 4SE (when available)	-Benbrook Dam -Joe Pool Lake (when available) -Grapevine	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		8/3 Mean: 7/7 6/25 8/23 8/2 8/26				-Dallas-Ft. Worth Reg. WSCMO AP -Roanoke -Lillian 3W -Joe Pool Lake (when available)	Dam	
1991	West Fork Trinity River at Grand Prairie (08049500)	Max: 7/2 7/14 7/17 7/22 8/9 Mean: 8/8 7/14 8/3 7/19 7/21	N/A	same as water temp gaging station	-Arlington -Joe Pool Lake (when available) -Dallas-Ft. Worth Reg. WSCMO AP -Dallas FAA AP -Burleson -Waxahachie -Ferris	-Arlington -Joe Pool Lake (when available) -Dallas-Ft. Worth Reg. WSCMO AP -Dallas FAA AP -Carrollton -Red Oak -Lillian 3W -Burleson -Ferris	-Joe Pool Lake (when available) -Grapevine Dam -Benbrook Dam (when no Joe Pool Lake) -Lavon Dam (when no Joe Pool Lake) -Bardwell Dam (when no Joe Pool Lake)	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1991	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	too much data missing	N/A					
1991	Trinity River below Dallas	Max: 8/6	N/A	same as water temp	-Dallas FAA AP -Ferris	-Dallas FAA AP -Ferris	-Joe Pool Lake (when	-Fort Worth (Dallas-Ft. Worth

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	(08057410)	8/1 8/8 7/16 7/18 Mean: 8/6 8/9 8/2 8/29 7/17		gaging station	-Joe Pool Lake (when available) -Arlington -Waxahachie -Kaufman 3 SE	-Red Oak -Joe Pool Lake (when available) -Arlington -Rosser -Crandall -Lake Ray Hubbard (when available) -Rockwall (when no Lake Ray Hubbard) -Terrell -Richardson	available) -Grapevine Dam -Bardwell Dam -Benbrook Dam -Lavon Dam -Whitney Dam (when no Joe Pool Lake) -Navarro Mills Dam (when no Joe Pool Lake)	Reg. WSCMO AP)
1991	East Fork Trinity River at Seagoville (08061980)	Max: 8/8 6/27 6/28 7/5 8/7 Mean: 8/6 8/7 6/28 7/14 7/23	N/A	East Fork Trinity River near Crandall (08062000)	-Ferris -Kaufman 3SE -Dallas FAA AP -Lavon Dam -Joe Pool Lake (when available) -Bardwell Dam -Wills Point	-Crandall -Lake Ray Hubbard (when available) -Ferris -Terrell	-Joe Pool Lake (when available) -Bardwell Dam -Grapevine Dam -Lavon Dam -Benbrook Dam (when no Joe Pool Lake)	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1991	East Fork Trinity River near Crandall	too much data missing	N/A					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	(08062000)							
1991	Trinity River near Rosser (08062500)	Max: 7/6 8/4 8/5 7/1 7/18 Mean: 6/22 7/15 8/4 8/5 6/20	N/A	same as water temp gaging station	-Ferris -Kaufman 3SE -Bardwell Dam -Corsicana -Waxahachie -Joe Pool Lake (when available)	-Rosser	-Bardwell Dam -Joe Pool Lake (when available) -Lavon Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1991	Trinity River at Trinidad (08062700)	too much data missing	N/A					
1991	San Antonio River at Loop 410 at San Antonio (08178565)	no data	N/A					
1991	Salado Creek (lower station) at San Antonio (08178800)	Max: 6/22 7/31 8/12	N/A	same as water temp gaging station	-San Antonio WSFO -San Antonio Seaworld	-San Antonio WSFO -San Antonio Seaworld	-San Antonio Seaworld -Canyon Dam	-San Antonio (San Antonio WSFO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		8/16 8/17 Mean: 8/13 8/19 8/30 6/28 7/26			-Floresville -Lytle 3W -Poteet -Pleasanton -New Braunfels -Boerne -Canyon Dam	-Floresville -Lytle 3W -Poteet -Pleasanton -Stockdale 4N -New Braunfels -Boerne -Canyon Dam		
1991	Medina River at La Coste (08180640)	Max: 6/18 6/19 6/20 7/15 8/19 Mean: 6/19 7/19 8/2 7/14 8/10	N/A	same as water temp gaging station	-Lytle 3W -San Antonio Seaworld	-Lytle 3W -San Antonio Seaworld -Riomedina 2N	-San Antonio Seaworld	-San Antonio (San Antonio WSFO)
1991	Medio Creek at Pearsall Rd. at San Antonio (08180750)	Max: 6/22 6/15 7/21 7/31 8/21	N/A	same as water temp gaging station	-San Antonio Seaworld -Lytle 3W -San Antonio WSFO -Poteet -Charlotte 5NNW	-San Antonio Seaworld -Lytle 3W -San Antonio WSFO -Riomedina 2N (when available)	-San Antonio Seaworld	-San Antonio (San Antonio WSFO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		Mean: 6/5 6/27 7/17 7/21 8/21				-Poteet -Charlotte 5NNW		
1991	Leon Creek at IH-35 at San Antonio (08181480)	Max: 7/21 7/27 7/31 8/10 8/18 Mean: 7/7 7/19 7/22 8/4 8/30	N/A	same as water temp gaging station	-San Antonio Seaworld -Lytle 3W -San Antonio WSFO -Poteet -Pleasanton -Charlotte 5NNW -Floresville -Boerne	-San Antonio Seaworld -Lytle 3W -San Antonio WSFO -Poteet -Riomedina 2N (when available) -Pleasanton -Charlotte 5NNW -Floresville -Boerne	-San Antonio Seaworld	-San Antonio (San Antonio WSFO)
1991	Medina River at San Antonio (08181500)	Max: 8/12 7/18 7/31 8/16 8/22 Mean: 8/11 8/12	N/A	same as water temp gaging station	-Poteet -Lytle 3W -San Antonio Seaworld -San Antonio WSFO -Pleasanton -Floresville -New Braunfels -Boerne	-Poteet -Lytle 3W -San Antonio Seaworld -San Antonio WSFO -Pleasanton -Floresville -Stockdale 4N -Falls City 4WSW	-San Antonio Seaworld -Canyon Dam -Choke Canyon Dam	-San Antonio (San Antonio WSFO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		8/18 7/22 8/3			-Canyon Dam -Nixon	-New Braunfels -Boerne -Canyon Dam		
1991	San Antonio River near Elmendorf (08181800)	Max: 7/19 7/29 8/18 7/16 7/17 Mean: 7/31 7/18 7/19 8/14 8/29	N/A	same as water temp gaging station	-Floresville -Poteet -Pleasanton -San Antonio WSFO -Lytle 3W -San Antonio Seaworld -New Braunfels	-Floresville -Poteet -Pleasanton -San Antonio WSFO -Lytle 3W -Falls City 4WSW -San Antonio Seaworld -New Braunfels -Bulverde	-San Antonio Seaworld -Canyon Dam -Choke Canyon Dam -Beeville 5NE	-San Antonio (San Antonio WSFO)
1991	San Antonio River near Falls City (08183500)	Max: 8/20 8/1 8/2 8/3 8/21 Mean: 7/17 7/21 7/31 8/18 8/21	N/A	same as water temp gaging station	-Karnes City -Floresville -Pleasanton -Nixon -Choke Canyon Dam	-Falls City 4WSW	-Choke Canyon Dam -Beeville 5NE -San Antonio Seaworld (when available) -Canyon Dam -Point Comfort	-San Antonio (San Antonio WSFO) -Corpus Christi (Corpus Christi WSO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1991	Cibolo Creek near Falls City (08186000)	Max: 7/18 7/21 6/16 7/5 7/16 Mean: 6/22 6/16 7/6 7/19 7/31	N/A	same as water temp gaging station	-Karnes City -Floresville -Nixon	-Falls City 4WSW -Karnes City (when available) -Floresville -Runge -Stockdale 4N -Nixon -Yorktown	-Beeville 5NE - ChokemCanyon Dam -San Antonio Seaworld -Canyon Dam -Point Comfort	-San Antonio (San Antonio WSFO) -Corpus Christi (Corpus Christi WSO AP)
1992	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max: 10/3/91 8/11 7/24 9/21 7/23 Mean: 8/10 8/9 7/23 7/2 7/8	N/A	same as water temp gaging station	-Fort Worth Meacham Field (when available) -Arlington -Benbrook Dam -Burleson -Dallas-Ft. Worth Reg. WSCMO AP -Joe Pool Lake	-Fort Worth Meacham Field (when available) -Arlington -Benbrook Dam -Burleson -Aledo 4SE -Dallas-Ft. Worth Reg. WSCMO AP -Roanoke -Lillian 3W -Joe Pool Lake	-Benbrook Dam -Joe Pool Lake -Grapevine Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1992	West Fork	Max:	N/A	same as	-Arlington	-Arlington	-Joe Pool Lake	-Fort Worth

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	Trinity River at Grand Prairie (08049500)	7/26 7/23 7/30 8/6 7/31 Mean: 7/26 7/27 8/6 7/23 9/8		water temp gaging station	-Joe Pool Lake -Dallas-Ft. Worth Reg. WSCMO AP -Dallas FAA AP -Fort Worth Meacham Field -Burleson -Waxahachie -Ferris	-Joe Pool Lake -Dallas-Ft. Worth Reg. WSCMO AP -Dallas FAA AP -Carrollton -Red Oak -Lillian 3W -Fort Worth Meacham Field -Burleson -Ferris	-Grapevine Dam	(Dallas-Ft. Worth Reg. WSCMO AP)
1992	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	Max: 7/25 7/10 7/11 8/12 6/19 Mean: 7/15 7/12 7/14 7/28 9/8	N/A	Trinity River at Dallas (08057000)	-Dallas FAA AP -Joe Pool Lake -Ferris -Arlington	-Dallas FAA AP -Richardson -Carrollton -Joe Pool Lake -Red Oak -Ferris -Arlington -Rockwall -Lake Ray Hubbard (when available) -Crandall (when available)	-Joe Pool Lake -Grapevine Dam -Bardwell Dam -Benbrook Dam -Lavon Dam (when available)	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1992	Trinity River below Dallas (08057410)	Max: 7/26 8/10 8/5	N/A	same as water temp gaging station	-Dallas FAA AP -Ferris -Joe Pool Lake -Arlington	-Dallas FAA AP -Ferris -Red Oak -Joe Pool Lake	-Joe Pool Lake -Grapevine Dam -Bardwell Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		8/6 7/28 Mean: 8/9 8/11 8/6 8/12 9/8			-Waxahachie -Kaufman 3SE	-Arlington -Rosser -Kaufman 3SE -Lake Ray Hubbard (when available) -Rockwall (when no Lake Ray Hubbard) -Terrell -Richardson	-Benbrook Dam (when available) -Lavon Dam	
1992	East Fork Trinity River at Seagoville (08061980)	Max: 7/25 7/27 8/10 7/2 7/23 Mean: 7/25 7/26 8/10 7/19 7/24	N/A	East Fork Trinity River near Crandall (08062000)	-Ferris -Kaufman 3SE -Dallas FAA AP -Lavon Dam -Joe Pool Lake -Bardwell Dam -Wills Point	-Ferris -Terrell -Kaufman 3SE -Rosser -Rockwall -Dallas FAA AP -Richardson -Joe Pool Lake -Bardwell Dam -Wills Point	-Joe Pool Lake -Bardwell Dam -Grapevine Dam -Lavon Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1992	East Fork Trinity River near Crandall (08062000)	Max: 7/27 8/11 6/19 7/2 7/13	N/A	same as water temp gaging station	-Kaufman 3SE -Ferris -Dallas FAA AP -Bardwell Dam -Wills Point -Lavon Dam	-Kaufman 3SE -Ferris -Terrell -Rosser -Lake Ray Hubbard (when available)	-Bardwell Dam -Joe Pool Lake -Grapevine Dam -Lavon Dam (when	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		Mean: 8/10 7/28 7/10 7/11 7/23			-Joe Pool Lake	-Rockwall (when no Lake Ray Hubbard) -Dallas FAA AP -Richardson -Bardwell Dam -Wills Point -Joe Pool Lake	available)	
1992	Trinity River near Rosser (08062500)	Max: 8/9 8/7 8/12 7/24 6/21 Mean: 8/10 8/7 7/10 7/31 8/13	N/A	same as water temp gaging station	-Ferris -Kaufman 3SE -Bardwell Dam -Corsicana -Waxahachie -Joe Pool Lake	-Rosser	-Bardwell Dam -Joe Pool Lake -Lavon Dam (when available)	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1992	Trinity River at Trinidad (08062700)	Max: 8/10 8/11 7/28 7/14 7/12 Mean:	N/A	same as water temp gaging station	-Athens 3SSE -Corsicana -Fairfield -Kaufman 3SE -Bardwell Dam -Palestine 2NE -Mexia -Wills Point	-Corsicana 8E -Athens 3SSE -Fairfield (when available) -Rosser -Kaufman 3SE -Bardwell Dam -Canton	-Bardwell Dam -Navarro Mills Dam -Lavon Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP) -Waco (Waco WSO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		8/13 7/30 7/13 7/31 8/6			-Ferris	-Wortham -Edom 3NW (when available) -Palestine 2NE		
1992	San Antonio River at Loop 410 at San Antonio (08178565)	no data	N/A					
1992	Salado Creek (lower station) at San Antonio (08178800)	Max: 8/3 7/24 7/28 7/31 8/9 Mean: 7/26 7/9 7/13 7/18 9/8	N/A	same as water temp gaging station	-San Antonio WSFO -San Antonio Seaworld -Floresville -Lytle 3W -Poteet -Pleasanton -New Braunfels (when available) -Boerne -Canyon Dam	-San Antonio WSFO -San Antonio Seaworld -Floresville -Lytle 3W -Poteet -Pleasanton -Stockdale 4N -New Braunfels (when available) -Boerne -Canyon Dam	-San Antonio Seaworld -Canyon Dam	-San Antonio (San Antonio WSFO)
1992	Medina River at La Coste (08180640)	Max: 6/24 6/30 6/23	N/A	same as water temp gaging station	-Lytle 3W -San Antonio Seaworld	-Lytle 3W -San Antonio Seaworld -Riomedina 2N	-San Antonio Seaworld (when available)	-San Antonio (San Antonio WSFO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		8/5 8/8 Mean: 6/26 6/27 6/30 7/16 8/12						
1992	Medio Creek at Pearsall Rd. at San Antonio (08180750)	Max: 7/2 7/15 7/26 8/8 8/9 Mean: 8/7 8/11 6/17 7/17 9/8	N/A	same as water temp gaging station	-San Antonio Seaworld -Lytle 3W -San Antonio WSFO -Poteet -Charlotte 5NNW	-San Antonio Seaworld -Lytle 3W -San Antonio WSFO -Riomedina 2N -Poteet -Charlotte 5NNW	-San Antonio Seaworld	-San Antonio (San Antonio WSFO)
1992	Leon Creek at IH-35 at San Antonio (08181480)	Max: 7/26 7/27 9/4 6/15 7/15	N/A	same as water temp gaging station	-San Antonio Seaworld -Lytle 3W -San Antonio WSFO -Poteet -Pleasanton	-San Antonio Seaworld -Lytle 3W -San Antonio WSFO -Poteet -Riomedina 2N	-San Antonio Seaworld	-San Antonio (San Antonio WSFO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		Mean: 6/16 8/5 8/9 8/10 8/13			-Charlotte 5NNW -Floresville -Boerne	-Pleasanton -Charlotte 5NNW -Floresville -Boerne		
1992	Medina River at San Antonio (08181500)	Max: 7/2 7/28 8/5 8/6 8/9 Mean: 7/2 8/7 8/11 9/8 7/29	N/A	same as water temp gaging station	-Poteet -Lytle 3W -San Antonio Seaworld -San Antonio WSFO -Pleasanton -Floresville -New Braunfels (when available) -Boerne -Canyon Dam -Nixon	-Poteet -Lytle 3W -San Antonio Seaworld -San Antonio WSFO -Pleasanton -Floresville -Stockdale 4N -Falls City 4WSW -New Braunfels (when available) -Boerne -Canyon Dam	-San Antonio Seaworld -Canyon Dam -Choke Canyon Dam	-San Antonio (San Antonio WSFO)
1992	San Antonio River near Elmendorf (08181800)	Max: 9/5 7/2 7/16 7/30 9/7 Mean: 8/7	N/A	same as water temp gaging station	-Floresville -Poteet -Pleasanton -San Antonio WSFO -Lytle 3W -San Antonio Seaworld -New Braunfels	-Floresville -Poteet -Pleasanton -San Antonio WSFO -Lytle 3W -Falls City 4WSW -San Antonio Seaworld	-San Antonio Seaworld -Canyon Dam -Choke Canyon Dam -Beeville 5NE (when available)	-San Antonio (San Antonio WSFO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		7/18 7/29 9/2 9/4			(when available)	-New Braunfels (when available) -Bulverde		
1992	San Antonio River near Falls City (08183500)	Max: 8/7 6/18 8/4 8/12 9/4 Mean: 8/7 8/14 9/3 9/5 6/27	N/A	same as water temp gaging station	-Karnes City -Floresville -Pleasanton -Nixon -Choke Canyon Dam	-Falls City 4WSW	-Choke Canyon Dam -Beeville 5NE (when available) -San Antonio Seaworld -Canyon Dam -Point Comfort (when available)	-San Antonio (San Antonio WSFO) -Corpus Christi (Corpus Christi WSO AP)
1992	Cibolo Creek near Falls City (08186000)	no data	N/A					
1993	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max: 7/20 7/19 8/19 8/16 6/3	N/A	same as water temp gaging station	-Fort Worth Meacham Field -Arlington -Benbrook Dam -Burleson -Dallas-Ft. Worth Reg. WSCMO AP	-Fort Worth Meacham Field -Arlington -Benbrook Dam -Burleson -Aledo 4SE -Dallas-Ft. Worth	-Benbrook Dam (when available) -Joe Pool Lake -Grapevine Dam (when avialable)	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		Mean: 8/15 8/16 8/19 6/4 8/2			-Joe Pool Lake	Reg. WSCMO AP -Roanoke -Lillian 3W -Joe Pool Lake		
1993	West Fork Trinity River at Grand Prairie (08049500)	too much data missing	N/A					
1993	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	Max: 7/31 8/11 8/19 8/20 8/21 Mean: 7/30 8/21 8/10 8/16 8/2	N/A	Trinity River at Dallas (08057000)	-Dallas FAA AP -Joe Pool Lake -Ferris -Arlington	-Dallas FAA AP -Richardson -Carrollton -Joe Pool Lake -Red Oak (when available) -Ferris -Arlington -Rockwall -Lake Ray Hubbard (when available) -Crandall	-Joe Pool Lake -Grapevine Dam (when available) -Bardwell Dam -Benbrook Dam -Lavon Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1993	Trinity River below Dallas (08057410)	Max: 8/12 8/14 8/22	N/A	same as water temp gaging station	-Dallas FAA AP -Ferris -Joe Pool Lake -Arlington	-Dallas FAA AP -Ferris -Red Oak (when available)	-Joe Pool Lake -Grapevine Dam (when available)	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		8/23 8/25 Mean: 7/31 8/11 8/15 8/22 8/28			-Waxahachie -Kaufman 3SE	-Joe Pool Lake -Arlington -Rosser -Crandall -Rockwall -Terrell -Richardson	-Bardwell Dam -Benbrook Dam -Lavon Dam (when available)	
1993	East Fork Trinity River at Seagoville (08061980)	Max: 7/29 7/20 7/28 8/10 8/13 Mean: 7/20 7/22 7/26 7/27 7/14	N/A	East Fork Trinity River near Crandall (08062000)	-Ferris -Kaufman 3SE -Dallas FAA AP -Lavon Dam -Joe Pool Lake -Bardwell Dam -Wills Point	-Ferris -Terrell -Crandall -Lake Ray Hubbard (when available)	-Joe Pool Lake -Bardwell Dam -Grapevine Dam (when available) -Lavon Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1993	East Fork Trinity River near Crandall (08062000)	too much data missing	N/A					
1993	Trinity River near Rosser	Max: 8/10	N/A	same as water temp	-Ferris -Kaufman 3SE	-Rosser	-Bardwell Dam -Joe Pool Lake	-Fort Worth (Dallas-Ft. Worth

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	(08062500)	7/16 7/21 7/27 8/6 Mean: 8/10 9/1 9/2 7/22 7/23		gaging station	-Bardwell Dam -Corsicana -Waxahachie -Joe Pool Lake		-Lavon Dam	Reg. WSCMO AP)
1993	Trinity River at Trinidad (08062700)	Max: 8/2 8/19 7/30 8/22 8/4 Mean: 8/18 8/21 7/30 7/31 8/13	N/A	same as water temp gaging station	-Athens 3SSE -Corsicana -Kaufman 3SE -Bardwell Dam -Palestine 2NE -Mexia -Wills Point -Ferris	-Corsicana 8E -Athens 3SSE -Rosser -Kaufman 3SE -Bardwell Dam -Canton (when available) -Wortham -Edom -Palestine 2NE	-Bardwell Dam -Navarro Mills Dam (when available) -Lavon Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP) -Waco (Waco WSO AP)
1993	San Antonio River at Loop 410 at San Antonio	Max: 8/14 8/4 8/7	N/A	same as water temp gaging station	-San Antonio WSFO -San Antonio Seaworld	-San Antonio WSFO -San Antonio Seaworld	-San Antonio Seaworld -Canyon Dam	-San Antonio (San Antonio WSFO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	(08178565)	8/21 8/29 Mean: 8/14 7/28 8/3 8/4 8/6			-Lytle 3W -Poteet (when available) -Floresville -Pleasanton (when available) -New Braunfels (when available) -Boerne -Canyon Dam -Nixon -Hondo WSMO AP	-Lytle 3W -Poteet -Floresville -Pleasanton (when available) -Riomedina 2N -Stockdale 4N -New Braunfels (when available) -Boerne -Canyon Dam -Hondo WSMO AP		
1993	Salado Creek (lower station) at San Antonio (08178800)	Max: 7/30 7/28 8/5 8/7 7/26 Mean: 8/3 7/31 8/10 7/25 8/17	N/A	same as water temp gaging station	-San Antonio WSFO -San Antonio Seaworld -Floresville -Lytle 3W -Poteet (when available) -Pleasanton (when available) -New Braunfels (when available) -Boerne -Canyon Dam	-San Antonio WSFO -San Antonio Seaworld -Floresville -Lytle 3W -Poteet -Pleasanton (when available) -Stockdale 4N -New Braunfels (when available) -Boerne -Canyon Dam	-San Antonio Seaworld -Canyon Dam	-San Antonio (San Antonio WSFO)
1993	Medina River at La Coste	Max: 7/27	N/A	same as water temp	-Lytle 3W -San Antonio	-Lytle 3W -San Antonio	-San Antonio Seaworld	-San Antonio (San Antonio WSFO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	(08180640)	8/6 8/7 7/20 8/18 <u>Mean</u>: 8/6 8/13 7/15 8/8 8/24		gaging station	Seaworld	Seaworld -Riomedina 2N		
1993	Medio Creek at Pearsall Rd. at San Antonio (08180750)	<u>Max</u>: 8/1 7/20 7/27 8/14 8/18 <u>Mean</u>: 7/29 8/1 8/4 8/8 8/13	N/A	same as water temp gaging station	-San Antonio Seaworld -Lytle 3W -San Antonio WSFO -Poteet (when available) -Charlotte 5NNW	-San Antonio Seaworld -Lytle 3W -San Antonio WSFO -Riomedina 2N -Poteet -Charlotte 5NNW	-San Antonio Seaworld	-San Antonio (San Antonio WSFO)
1993	Leon Creek at IH-35 at San Antonio (08181480)	<u>Max</u>: 7/13 7/9 7/17 7/3	N/A	same as water temp gaging station	-San Antonio Seaworld -Lytle 3W -San Antonio WSFO	-San Antonio Seaworld -Lytle 3W -San Antonio WSFO	-San Antonio Seaworld	-San Antonio (San Antonio WSFO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		7/27 Mean: 7/14 7/2 7/8 7/16 7/27			-Poteet -Charlotte 5NNW -Floresville -Boerne	-Poteet -Riomedina 2N -Charlotte 5NNW -Floresville -Boerne		
1993	Medina River at San Antonio (08181500)	Max: 8/2 9/20 8/7 8/13 8/15 Mean: 9/20 8/8 8/10 8/15 8/24	N/A	same as water temp gaging station	-Poteet (when available) -Lytle 3W -San Antonio Seaworld -San Antonio WSFO -Pleasanton (when available) -Floresville -New Braunfels (when available) -Boerne -Canyon Dam -Nixon	-Poteet -Lytle 3W -San Antonio Seaworld -San Antonio WSFO -Pleasanton -Floresville -Stockdale 4N -Falls City 4WSW -New Braunfels (when available) -Boerne -Canyon Dam	-San Antonio Seaworld -Canyon Dam -Choke Canyon Dam	-San Antonio (San Antonio WSFO)
1993	San Antonio River near Elmendorf (08181800)	Max: 7/31 7/28 8/15 8/19 8/25	N/A	same as water temp gaging station	-Floresville -Poteet (when available) -Pleasanton (when available) -San Antonio	-Floresville -Poteet -Pleasanton (when available) -San Antonio WSFO	-San Antonio Seaworld -Canyon Dam -Choke Canyon Dam -Beeville 5NE	-San Antonio (San Antonio WSFO)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		Mean: 7/30 7/31 8/16 8/20 8/31			WSFO -Lytle 3W -San Antonio Seaworld -New Braunfels (when available)	-Lytle 3W -Falls City 4WSW -San Antonio Seaworld -New Braunfels (when available) -Bulverde		
1993	San Antonio River near Falls City (08183500)	Max: 8/31 7/30 8/2 8/7 8/11 Mean: 7/29 8/10 8/11 8/17 8/19	N/A	same as water temp gaging station	-Karnes City -Floresville -Pleasanton (when available) -Nixon -Choke Canyon Dam	-Falls City 4WSW	-Choke Canyon Dam -Beeville 5NE -San Antonio Seaworld -Canyon Dam -Point Comfort	-San Antonio (San Antonio WSFO) -Corpus Christi (Corpus Christi WSO AP)
1993	Cibolo Creek near Falls City (08186000)	no data	N/A					
1994	West Fork Trinity River at Beach Street at Fort Worth	Max: 8/14 6/20 7/21	N/A	same as water temp gaging station	-Fort Worth WSFO -Fort Worth Meacham Field -Arlington	-Fort Worth WSFO -Fort Worth Meacham Field -Arlington	-Benbrook Dam (when available) -Joe Pool Lake	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	(08048543)	8/6 8/26 Mean: 6/20 7/18 6/21 7/17 6/26			-Benbrook Dam -Burleson -Dallas-Ft. Worth Reg. WSCMO AP -Joe Pool Lake	-Benbrook Dam -Burleson -Aledo 4SE -Dallas-Ft. Worth Reg. WSCMO AP -Roanoke -Lillian 3W -Joe Pool Lake	-Grapevine Dam	
1994	West Fork Trinity River at Grand Prairie (08049500)	Max: 7/22 7/24 6/25 7/20 6/23 Mean: 7/24 6/24 7/20 7/21 8/19	N/A	same as water temp gaging station	-Arlington -Joe Pool Lake -Dallas-Ft. Worth Reg. WSCMO AP -Dallas FAA AP -Fort Worth WSFO -Fort Worth Meacham Field -Burleson -Ferris -Waxahachie	-Arlington -Joe Pool Lake -Dallas-Ft. Worth Reg. WSCMO AP -Dallas FAA AP -Fort Worth WSFO -Carrollton -Red Oak -Lillian 3W -Fort Worth Meacham Field -Burleson -Ferris	-Joe Pool Lake -Grapevine Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1994	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	Max: 6/26 8/25 8/30 6/24 7/5	N/A	Trinity River at Dallas (08057000)	-Dallas FAA AP -Joe Pool Lake -Ferris -Arlington (when available)	-Dallas FAA AP -Richardson -Carrollton -Joe Pool Lake -Red Oak -Ferris -Arlington (when	-Joe Pool Lake -Grapevine Dam -Lavon Dam -Bardwell Dam -Benbrook Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		Mean: 8/26 6/25 6/29 7/2 8/24				available) -Rockwall		
1994	Trinity River below Dallas (08057410)	Max: 8/19 8/26 8/30 6/24 8/15 Mean: 6/25 6/26 8/12 8/18 8/27	N/A	same as water temp gaging station	-Dallas FAA AP -Ferris -Joe Pool Lake -Arlington -Waxahachie -Kaufman 3SE	-Dallas FAA AP -Ferris -Red Oak -Joe Pool Lake -Richardson -Arlington -Rosser -Rockwall -Terrell -Kaufman 3SE	-Joe Pool Lake -Grapevine Dam -Lavon Dam -Bardwell Dam -Benbrook Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1994	East Fork Trinity River at Seagoville (08061980)	Max: 6/26 6/27 9/6 6/25 9/7 Mean: 6/28 6/25	N/A	East Fork Trinity River near Crandall (08062000)	-Ferris -Kaufman 3SE -Dallas FAA AP -Lavon Dam -Joe Pool Lake -Bardwell Dam -Wills Point	-Ferris -Terrell -Kaufman 3SE -Rosser -Rockwall -Dallas FAA AP -Richardson -Joe Pool Lake -Bardwell Dam -Wills Point	-Joe Pool Lake -Bardwell Dam -Lavon Dam -Grapevine Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		6/23 6/24 7/24						
1994	East Fork Trinity River near Crandall (08062000)	Max: 6/26 6/27 7/4 7/6 8/24 Mean: 8/19 8/27 7/6 7/8 8/25	N/A	same as water temp gaging station	-Kaufman 3SE -Ferris -Dallas FAA AP -Bardwell Dam -Wills Point -Lavon Dam -Joe Pool Lake	-Kaufman 3SE -Ferris -Terrell -Rosser -Rockwall -Dallas FAA AP -Richardson -Bardwell Dam -Wills Point -Joe Pool Lake	-Lavon Dam -Bardwell Dam -Joe Pool Lake -Grapevine Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1994	Trinity River near Rosser (08062500)	Max: 6/27 8/26 6/29 7/8 8/18 Mean: 8/14 8/19 6/23 8/12 8/26	N/A	same as water temp gaging station	-Ferris -Kaufman 3SE -Bardwell Dam -Corsicana -Waxahachie -Joe Pool Lake	-Rosser	-Bardwell Dam -Joe Pool Lake -Lavon Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1994	Trinity River at Trinidad (08062700)	too much data missing	N/A					
1994	San Antonio River at Loop 410 at San Antonio (08178565)	Max: 6/25 6/7 6/30 7/11 8/17 Mean: 6/25 6/24 6/28 7/27 8/23	N/A	same as water temp gaging station	-San Antonio International AP -San Antonio Seaworld -Lytle 3W -Poteet -Floresville -Pleasanton -New Braunfels -Boerne -Canyon Dam -Nixon -Hondo WSMO AP	-San Antonio International AP -San Antonio Seaworld -Lytle 3W -Poteet -Floresville -Pleasanton (when available) -Rio Medina 2N -Stockdale 4N -New Braunfels -Boerne -Canyon Dam -Hondo WSMO AP	-San Antonio Seaworld -Canyon Dam	-San Antonio (San Antonio International AP)
1994	Salado Creek (lower station) at San Antonio (08178800)	Max: 6/7 8/20 6/10 6/25 7/27 Mean: 7/21	N/A	same as water temp gaging station	-San Antonio International AP -San Antonio Seaworld -Floresville -Lytle 3W -Poteet -Pleasanton (when available)	-San Antonio International AP -San Antonio Seaworld -Floresville -Lytle 3W -Poteet -Pleasanton (when available)	-San Antonio Seaworld -Canyon Dam	-San Antonio (San Antonio International AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		8/19 8/21 6/10 8/24			-New Braunfels -Boerne -Canyon Dam	-Stockdale 4N -New Braunfels -Boerne -Canyon Dam		
1994	Medina River at La Coste (08180640)	Max: 6/27 7/3 7/7 7/8 7/11 Mean: 7/13 6/8 7/4 7/14 7/15	N/A	same as water temp gaging station	-Lytle 3W -San Antonio Seaworld	-Lytle 3W -San Antonio Seaworld -Rio Medina 2N	-San Antonio Seaworld	-San Antonio (San Antonio International AP)
1994	Medio Creek at Pearsall Rd. at San Antonio (08180750)	Max: 7/9 7/16 7/20 7/21 7/19 Mean: 6/25 7/12 7/25 7/1	N/A	same as water temp gaging station	-San Antonio Seaworld -Lytle 3W -San Antonio International AP -Poteet -Charlotte 5NNW	-San Antonio Seaworld -Lytle 3W -San Antonio International AP -Rio Medina 2N -Poteet -Charlotte 5NNW	-San Antonio Seaworld	-San Antonio (San Antonio International AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		7/16						
1994	Leon Creek at IH-35 at San Antonio (08181480)	Max: 6/25 7/6 7/16 7/22 7/27 Mean: 6/11 7/1 7/7 7/13 7/23	N/A	same as water temp gaging station	-San Antonio Seaworld -Lytle 3W -San Antonio International AP -Poteet -Pleasanton -Charlotte 5NNW -Floresville -Boerne	-San Antonio Seaworld -Lytle 3W -San Antonio International AP -Poteet -Rio Medina 2N -Pleasanton -Charlotte 5NNW -Floresville -Boerne	-San Antonio Seaworld	-San Antonio (San Antonio International AP)
1994	Medina River at San Antonio (08181500)	Max: 7/23 7/1 7/15 7/25 8/24 Mean: 6/26 7/3 8/21 8/22 8/25	N/A	same as water temp gaging station	-Poteet -Lytle 3W -San Antonio Seaworld -San Antonio International AP -Pleasanton (when available) -Floresville -New Braunfels -Boerne -Canyon Dam -Nixon	-Poteet -Lytle 3W -San Antonio Seaworld -San Antonio International AP -Pleasanton (when available) -Floresville -Stockdale 4N -Falls City 4WSW -New Braunfels -Boerne -Canyon Dam	-San Antonio Seaworld -Canyon Dam -Choke Canyon Dam	-San Antonio (San Antonio International AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1994	San Antonio River near Elmendorf (08181800)	Max: 7/23 7/9 7/12 6/8 8/21 Mean: 7/2 7/8 7/20 8/22 8/23	N/A	same as water temp gaging station	-Floresville -Poteet -Pleasanton (when available) -San Antonio International AP -Lytle 3W -San Antonio Seaworld -New Braunfels	-Floresville -Poteet -Pleasanton (when available) -San Antonio International AP -Lytle 3W -Falls City 4WSW -San Antonio Seaworld -New Braunfels -Bulverde (when available)	-San Antonio Seaworld -Canyon Dam -Choke Canyon Dam -Beeville 5NE	-San Antonio (San Antonio International AP)
1994	San Antonio River near Falls City (08183500)	Max: 7/25 7/17 7/18 7/27 7/14 Mean: 6/26 6/30 7/17 7/23 7/24	N/A	same as water temp gaging station	-Karnes City -Floresville -Pleasanton -Nixon -Choke Canyon Dam	-Falls City 4WSW	-Choke Canyon Dam -Beeville 5NE -San Antonio Seaworld -Canyon Dam -Point Comfort (when available)	-San Antonio (San Antonio International AP) -Corpus Christi (Corpus Christi WSO AP)
1994	Cibolo Creek near Falls City (08186000)	no data	N/A					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1995	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max: 7/13 7/14 8/19 8/26 7/9 Mean: 7/29 8/27 7/8 7/9 9/2	N/A	same as water temp gaging station	-Fort Worth WSFO -Fort Worth Meacham Field -Arlington -Benbrook Dam -Burleson -Dallas-Ft. Worth Reg. WSCMO AP -Joe Pool Lake	-Fort Worth WSFO -Fort Worth Meacham Field -Arlington -Benbrook Dam -Burleson -Aledo 4SE -Dallas-Ft. Worth Reg. WSCMO AP -Roanoke -Lillian 3W -Joe Pool Lake	-Benbrook Dam -Joe Pool Lake -Grapevine Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1995	West Fork Trinity River at Grand Prairie (08049500)	Max: 7/28 7/13 7/22 7/26 8/23 Mean: 7/27 8/18 8/28 7/21 8/22	N/A	same as water temp gaging station	-Arlington -Joe Pool Lake -Dallas-Ft. Worth Reg. WSCMO AP -Dallas FAA AP -Fort Worth WSFO -Fort Worth Meacham Field -Burleson -Ferris -Waxahachie	-Arlington -Joe Pool Lake -Dallas-Ft. Worth Reg. WSCMO AP -Dallas FAA AP -Fort Worth WSFO -Carrollton -Lillian 3W -Fort Worth Meacham Field -Burleson -Ferris	-Joe Pool Lake -Grapevine Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1995	Trinity River	too much	N/A					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	at Cedar Crest Blvd. at Dallas (08057055)	data missing						
1995	Trinity River below Dallas (08057410)	Max: 7/13 7/28 8/19 8/28 9/2 Mean: 7/14 7/28 8/20 7/11 8/18	N/A	same as water temp gaging station	-Dallas FAA AP -Ferris -Joe Pool Lake -Arlington -Waxahachie -Kaufman 3SE	-Dallas FAA AP -Ferris -Joe Pool Lake -Arlington -Rosser -Kaufman 3SE (when available) -Rockwall -Terrell -Richardson	-Joe Pool Lake -Grapevine Dam -Lavon Dam -Bardwell Dam -Benbrook Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1995	East Fork Trinity River at Seagoville (08061980)	Max: 8/6 8/9 8/18 9/3 8/14 Mean: 7/28 8/19 8/20 8/21 9/2	N/A	East Fork Trinity River near Crandall (08062000)	-Ferris -Kaufman 3SE -Dallas FAA AP -Lavon Dam -Joe Pool Lake Bardwell Dam -Wills Point	-Ferris -Terrell -Kaufman 3SE -Rosser -Rockwall -Dallas FAA AP -Richardson -Joe Pool Lake -Bardwell Dam -Wills Point	-Lavon Dam -Joe Pool Lake -Bardwell Dam -Grapevine Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1995	East Fork Trinity River near Crandall (08062000)	Max: 7/26 8/12 7/22 8/16 8/23 Mean: 7/26 8/7 8/9 8/12 8/13	N/A	same as water temp gaging station	-Kaufman 3SE -Ferris -Dallas FAA AP -Bardwell Dam -Wills Point -Lavon Dam -Joe Pool Lake	-Kaufman 3SE -Ferris -Terrell -Rosser -Rockwall -Dallas FAA AP -Richardson -Bardwell Dam -Wills Point -Joe Pool Lake	-Lavon Dam -Bardwell Dam -Joe Pool Lake -Grapevine Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1995	Trinity River near Rosser (08062500)	Max: 8/28 8/29 8/14 8/22 8/30 Mean: 8/19 8/18 8/27 8/30 7/14	N/A	same as water temp gaging station	-Ferris -Kaufman 3SE -Bardwell Dam -Corsicana -Waxahachie -Joe Pool Lake	-Rosser	-Bardwell Dam -Joe Pool Lake -Lavon Dam	-Fort Worth (Dallas-Ft. Worth Reg. WSCMO AP)
1995	Trinity River at Trinidad	Max: 8/22	N/A	same as water temp	-Athens 3SSE (when available)	-Corsicana 8E -Athens 3SSE	-Bardwell Dam -Navarro Mills	-Fort Worth (Dallas-Ft. Worth

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	(08062700)	8/23 8/12 8/25 9/3 Mean: 8/22 8/29 8/28 8/30 9/4		gaging station	-Corsicana -Fairfield 3W -Kaufman 3SE -Bardwell Dam -Palestine 2NE -Mexia (when available) -Wills Point -Ferris	-Fairfield 3W -Rosser -Kaufman 3SE -Bardwell Dam -Canton -Wortham -Edom -Palestine 2NE	Dam -Lavon Dam	Reg. WSCMO AP) -Waco (Waco WSO AP)
1995	San Antonio River at Loop 410 at San Antonio (08178565)	Max: 7/19 7/11 6/23 6/28 8/28 Mean: 7/12 7/26 7/21 8/6 8/28	N/A	same as water temp gaging station	-San Antonio International AP -San Antonio Seaworld -Lytle 3W -Poteet -Floresville -Pleasanton -New Braunfels -Boerne -Canyon Dam -Nixon -Hondo WSMO Airport (when available)	-San Antonio International AP -San Antonio Seaworld -Lytle 3W -Poteet -Floresville -Pleasanton -Stockdale 4N -New Braunfels -Boerne -Canyon Dam -Hondo WSMO Airport (when available)	-San Antonio Seaworld -Canyon Dam	-San Antonio (San Antonio International AP)
1995	Salado Creek (lower station)	Max: 7/30	N/A	same as water temp	-San Antonio International AP	-San Antonio International AP	-San Antonio Seaworld	-San Antonio (San Antonio

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	at San Antonio (08178800)	8/7 8/8 8/10 8/18 Mean: 7/25 8/5 8/15 8/17 8/24		gaging station	-San Antonio Seaworld -Floresville -Lytle 3W -Poteet -Pleasanton -New Braunfels -Boerne -Canyon Dam	-San Antonio Seaworld -Floresville -Lytle 3W -Poteet -Pleasanton -Stockdale 4N -New Braunfels -Boerne -Canyon Dam	-Canyon Dam	International AP)
1995	Medina River at La Coste (08180640)	Max: 7/24 7/29 7/19 7/25 8/3 Mean: 7/23 7/25 7/28 8/7 8/10	N/A	same as water temp gaging station	-Lytle 3W -San Antonio Seaworld	-Lytle 3W -San Antonio Seaworld	-San Antonio Seaworld	-San Antonio (San Antonio International AP)
1995	Medio Creek at Pearsall Rd. at San Antonio (08180750)	Max: 7/24 7/29 7/3 7/19	N/A	same as water temp gaging station	-San Antonio Seaworld -Lytle 3W -San Antonio International AP	-San Antonio Seaworld -Lytle 3W -San Antonio International AP	-San Antonio Seaworld	-San Antonio (San Antonio International AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		8/14 Mean: 7/26 7/27 7/22 7/24 8/9			-Poteet -Charlotte 5NNW	-Poteet -Charlotte 5NNW		
1995	Leon Creek at IH-35 at San Antonio (08181480)	Max: 7/23 7/22 7/29 8/3 8/16 Mean: 7/22 8/5 8/15 7/6 8/24	N/A	same as water temp gaging station	-San Antonio Seaworld -Lytle 3W -San Antonio International AP -Poteet -Pleasanton -Charlotte 5NNW -Floresville -Boerne	-San Antonio Seaworld -Lytle 3W -San Antonio International AP -Poteet -Pleasanton -Charlotte 5NNW -Floresville -Boerne	-San Antonio Seaworld	-San Antonio (San Antonio International AP)
1995	Medina River at San Antonio (08181500)	Max: 7/22 8/5 8/25 8/26 8/27 Mean:	N/A	same as water temp gaging station	-Poteet -Lytle 3W -San Antonio Seaworld -San Antonio International AP -Pleasanton -Floresville	-Poteet -Lytle 3W -San Antonio Seaworld -San Antonio International AP -Pleasanton -Floresville	-San Antonio Seaworld -Canyon Dam -Choke Canyon Dam	-San Antonio (San Antonio International AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		7/23 7/28 8/3 8/8 9/6			-New Braunfels -Boerne -Canyon Dam -Nixon	-Stockdale 4N -Falls City 4WSW -New Braunfels -Boerne -Canyon Dam		
1995	San Antonio River near Elmendorf (08181800)	Max: 7/22 7/26 7/13 8/26 9/4 Mean: 7/20 7/23 8/21 8/27 9/17	N/A	same as water temp gaging station	-Floresville -Poteet -Pleasanton -San Antonio International AP -Lytle 3W -San Antonio Seaworld -New Braunfels	-Floresville -Poteet -Pleasanton -San Antonio International AP -Lytle 3W -Falls City 4WSW -San Antonio Seaworld -New Braunfels -Bulverde	-San Antonio Seaworld -Canyon Dam -Choke Canyon Dam -Beeville 5NE	-San Antonio (San Antonio International AP)
1995	San Antonio River near Falls City (08183500)	Max: 7/19 7/26 7/24 8/14 8/28 Mean: 7/21 7/23 7/24	N/A	same as water temp gaging station	-Karnes City 2N (when available) -Floresville -Pleasanton -Nixon -Choke Canyon Dam	-Falls City 4WSW	-Choke Canyon Dam -Beeville 5NE -San Antonio Seaworld -Canyon Dam -Point Comfort	-San Antonio (San Antonio International AP) -Corpus Christi (Corpus Christi WSO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		6/25 7/17						
1995	Cibolo Creek near Falls City (08186000)	no data	N/A					
1996	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max: 7/4 7/7 6/30 6/21 6/22 Mean: 7/20 6/16 6/27 6/22 7/28	N/A	same as water temp gaging station	-Fort Worth WSFO -Fort Worth Meacham Field -Arlington -Benbrook Dam -Burleson -Dallas-Ft. Worth WSCMO AP -Joe Pool Lake	-Fort Worth WSFO -Fort Worth Meacham Field -Arlington -Benbrook Dam -Burleson -Aledo 4SE -Dallas-Ft. Worth WSCMO AP -Roanoke -Lillian 3W -Joe Pool Lake	-Benbrook Dam (when available) -Joe Pool Lake -Grapevine Dam -Lavon Dam (when no Benbrook Dam)	-Fort Worth (Dallas-Ft. Worth WSCMO AP)
1996	West Fork Trinity River at Grand Prairie (08049500)	Max: 7/3 7/6 7/22 6/19 7/2 Mean: 7/7	N/A	same as water temp gaging station	-Arlington -Joe Pool Lake -Dallas-Ft. Worth WSCMO AP -Dallas FAA AP -Fort Worth WSFO -Fort Worth Meacham Field -Burleson	-Arlington -Joe Pool Lake -Dallas-Ft. Worth WSCMO AP -Dallas FAA AP -Fort Worth WSFO Carrollton -Red Oak (when available)	-Joe Pool Lake -Grapevine Dam	-Fort Worth (Dallas-Ft. Worth WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		7/8 7/2 7/6 6/30			-Ferris -Waxahachie	-Lillian 3W -Fort Worth Meacham Field -Burleson -Ferris		
1996	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	Max: 7/2 7/4 7/9 7/23 7/29 Mean: 7/3 6/30 7/5 7/6 8/6	N/A	Trinity River at Dallas (08057000)	-Dallas FAA AP -Joe Pool Lake -Ferris -Arlington	-Dallas FAA AP -Richardson -Carrollton -Joe Pol Lake -Red Oak (when available) -Ferris -Arlington -Rockwall	-Joe Pool Lake -Grapevine Dam -Lavon Dam -Bardwell Dam -Benbrook Dam	-Fort Worth (Dallas-Ft. Worth WSCMO AP)
1996	Trinity River below Dallas (08057410)	Max: 7/7 7/20 6/22 6/29 6/30 Mean: 7/5 7/23 6/23	N/A	same as water temp gaging station	-Dallas FAA AP -Ferris -Joe Pool Lake -Arlington -Waxahachie -Kaufman 3SE	-Dallas FAA AP -Ferris -Red Oak (when available) -Joe Pool Lake -Arlington -Rosser -Kaufman 3SE -Rockwall -Terrell -Richardson	-Joe Pool Lake -Grapevine Dam -Lavon Dam -Bardwell Dam -Benbrook Dam (when available)	-Fort Worth (Dallas-Ft. Worth WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
		6/28 7/27						
1996	East Fork Trinity River at Seagoville (08061980)	Max: 8/4 8/5 6/30 6/22 7/1 Mean: 7/20 8/7 6/21 7/17 7/30	N/A	East Fork Trinity River near Crandall (08062000)	-Ferris -Kaufman 3SE -Dallas FAA AP -Lavon Dam -Joe Pool Lake -Bardwell Dam -Wills Point	-Ferris -Terrell -Kaufman 3SE -Rosser -Rockwall -Dallas FAA AP -Richardson (when available) -Joe Pool Lake -Bardwell Dam -Wills Point	-Lavon Dam -Joe Pool Lake -Bardwell Dam -Grapevine Dam	-Fort Worth (Dallas-Ft. Worth WSCMO AP)
1996	East Fork Trinity River near Crandall (08062000)	Max: 7/7 7/19 7/22 6/20 8/3 Mean: 7/23 7/7 7/21 8/5 6/20	N/A	same as water temp gaging station	-Kaufman 3SE -Ferris -Dallas FAA AP -Bardwell Dam -Wills Point -Lavon Dam -Joe Pool Lake	-Kaufman 3SE -Ferris -Terrell -Rosser -Rockwall -Dallas FAA AP -Richardson (when available) -Bardwell Dam -Wills Point -Joe Pool Lake	-Lavon Dam -Bardwell Dam -Joe Pool Lake -Grapevine Dam	-Fort Worth (Dallas-Ft. Worth WSCMO AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1996	Trinity River near Rosser (08062500)	Max: 7/7 7/23 6/30 7/11 8/8 Mean: 7/8 7/6 7/10 7/21 8/3	N/A	same as water temp gaging station	-Ferris -Kaufman 3SE -Bardwell Dam -Corsicana -Waxahachie -Joe Pool Lake	-Rosser	-Bardwell Dam -Joe Pool Lake -Lavon Dam	-Fort Worth (Dallas-Ft. Worth WSCMO AP)
1996	Trinity River at Trinidad (08062700)	Max: 7/8 7/3 7/1 7/11 7/21 Mean: 7/9 7/1 7/2 7/11 8/5	N/A	same as water temp gaging station	-Athens 3SSE -Corsicana -Fairfield 3W -Kaufman 3SE -Bardwell Dam -Palestine 2NE -Mexia -Wills Point -Ferris	-Corsicana 8E -Athens 3SSE -Fairfield 3W -Rosser -Kaufman 3SE -Bardwell Dam -Canton -Edom -Palestine 2NE -Mexia	-Bardwell Dam -Navarro Mills Dam -Lavon Dam	-Fort Worth (Dallas-Ft. Worth WSCMO AP) -Waco (Waco WSO AP)
1996	San Antonio River at Loop	Max: 8/12	N/A	same as water temp	-San Antonio International	-San Antonio International	-San Antonio Seaworld (when	-San Antonio (San Antonio

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	410 at San Antonio (08178565)	8/2 7/2 7/14 8/7 Mean: 6/17 8/13 6/14 7/7 8/2		gaging station	Airport -San Antonio Seaworld -Lytle 3W -Poteet -Floresville -Pleasanton -New Braunfels -Boerne -Canyon Dam -Nixon -Hondo AP	Airport -San Antonio Seaworld -Lytle 3W -Poteet -Floresville -Pleasanton -Rio Medina -Stockdale 4N -New Braunfels -Boerne -Canyon Dam -Hondo AP	available) -Canyon Dam	International AP)
1996	Salado Creek (lower station) at San Antonio (08178800)	Max: 7/17 6/17 6/21 8/2 8/3 Mean: 6/20 7/13 7/22 7/24 8/7	N/A	same as water temp gaging station	-San Antonio International Airport -San Antonio Seaworld -Floresville -Lytle 3W -Poteet -Pleasanton -New Braunfels -Boerne -Canyon Dam	-San Antonio International Airport -San Antonio Seaworld -Floresville -Lytle 3W -Poteet -Pleasanton -Stockdale 4N -New Braunfels -Boerne -Canyon Dam	-San Antonio Seaworld -Canyon Dam	-San Antonio (San Antonio International AP)
1996	Medina River at La Coste (08180640)	no data	N/A					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
1996	Medio Creek at Pearsall Rd. at San Antonio (08180750)	no data	N/A					
1996	Leon Creek at IH-35 at San Antonio (08181480)	Max: 6/20 6/18 7/13 7/20 7/28 Mean: 8/4 8/6 8/7 7/31 8/12	N/A	same as water temp gaging station	-San Antonio Seaworld -Lytle 3W -San Antonio International Airport -Poteet -Pleasanton -Charlotte 5NNW -Floresville -Boerne	-San Antonio Seaworld -Lytle 3W -San Antonio International Airport -Poteet -Rio Medina -Pleasanton -Charlotte 5NNW -Floresville -Boerne	-San Antonio Seaworld	-San Antonio (San Antonio International AP)
1996	Medina River at San Antonio (08181500)	Max: 6/19 8/2 8/3 8/13 6/21 Mean: 6/21 7/19 7/24 7/31 8/6	N/A	same as water temp gaging station	-Poteet -Lytle 3W -San Antonio Seaworld -San Antonio International Airport -Pleasanton -Floresville -New Braunfels -Boerne -Canyon Dam -Nixon	-Poteet -Lytle 3W -San Antonio Seaworld -San Antonio International Airport -Pleasanton -Floresville -Stockdale 4N -Falls City 4WSW -New Braunfels -Boerne	-San Antonio Seaworld -Canyon Dam -Choke Canyon Dam	-San Antonio (San Antonio International AP)

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
						-Canyon Dam		
1996	San Antonio River near Elmendorf (08181800)	Max: 6/19 6/17 7/2 8/12 8/14 Mean: 6/20 8/2 7/14 7/31 8/12	N/A	same as water temp gaging station	-Floresville -Poteet -Pleasanton -San Antonio International Airport -Lytle 3W -San Antonio Seaworld -New Braunfels	-Floresville -Poteet -Pleasanton -San Antonio International Airport -Lytle 3W -Falls City 4WSW -San Antonio Seaworld -New Braunfels -Bulverde	-San Antonio Seaworld (when available) -Canyon Dam -Choke Canyon Dam -Beeville 5NE (when available)	-San Antonio (San Antonio International AP)
1996	San Antonio River near Falls City (08183500)	Max: 7/6 8/13 7/4 7/25 7/23 Mean: 6/20 8/12 6/17 7/4 7/9	N/A	same as water temp gaging station	-Karnes City 2N -Floresville -Pleasanton -Nixon -Choke Canyon Dam	-Falls City 4WSW	-Choke Canyon Dam -Beeville 5NE (when available) -San Antonio Seaworld -Canyon Dam -Point Comfoort	-San Antonio (San Antonio International AP) -Corpus Christi (Corpus Christi WSFO AP)
1996	Cibolo Creek	no data	N/A					

Water Year	Water temperature gaging station	Observation dates	Census tracts / County divisions for population density	Discharge observation site	Air temperature observation sites	Precipitation observation site(s)	Wind observation site(s)	Cloudcover / dew point temperature observation site(s)
	near Falls City (08186000)							

APPENDIX H

Water Temperature Gaging Stations:

Dependent and Independent Variable Values

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1970	West Fork Trinity River at Beach Street at Fort Worth (08048543)	N/A			2646							
1970	West Fork Trinity River at Grand Prairie (08049500)	N/A			620							
1970	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	N/A			3077							
1970	Trinity River below Dallas (08057410)	N/A			2437							
1970	East Fork Trinity River at Seagoville (08061980)	N/A			138							
1970	East Fork Trinity River near Crandall (08062000)	N/A			98							
1970	Trinity River near Rosser	N/A			20							

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	(08062500)											
1970	Trinity River at Trinidad (08062700)	N/A			36							
1970	San Antonio River at Loop 410 at San Antonio (08178565)	N/A			3286							
1970	Salado Creek (lower station) at San Antonio (08178800)	N/A			1928							
1970	Medina River at La Coste (08180640)	N/A			215							
1970	Medio Creek at Pearsall Rd. at San Antonio (08180750)	N/A			204							
1970	Leon Creek at IH-35 at San Antonio (08181480)	N/A			1397							

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1970	Medina River at San Antonio (08181500)	N/A			95							
1970	San Antonio River near Elmendorf (08181800)	N/A			49							
1970	San Antonio River near Falls City (08183500)	N/A			12							
1970	Cibolo Creek near Falls City (08186000)	N/A			12							
1977	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max:			N/A							
		7/23	84	37.5		2.6	102.1	99.4	.01	36.4	.5	70
		7/24	85	37.0		3.1	106.1	100.4	.01	55.3	.4	70
		7/15	76	36.0		3.0	99.1	99.5	.01	82.1	.75	68
		7/18	79	35.0		2.9	97.8	98.7	0	85.4	.1	66
		8/17	109	35.0		18	101.4	98.4	.50	110.8	.1	72
		Mean:										
		7/23	84	32.5		2.6	102.1	99.4	.01	36.4	.5	70
		7/20	81	32.0		2.6	99.3	97.9	0	100.8	.1	70
		6/30	61	31.5		4.2	95.9	96.9	.36	138.3	.5	70
		8/11	103	31.5		2.4	99.0	99	0	99.1	.25	70
		8/17	109	31.5		18	101.4	98.4	.5	110.8	.1	72

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1977	West Fork Trinity River at Grand Prairie (08049500)	Max:			N/A							
		7/24	85	33.5		109	108	101.4	.02	46.2	.4	70
		7/26	87	33.0		116	104.7	105.6	.13	70.3	.25	64
		7/25	86	32.5		101	104.7	104.1	.02	81.2	1.0	66
		7/27	88	32.5		114	101.6	105.7	.75	72.5	.4	72
		7/21	82	32.0		105	99.6	99.4	.02	111.7	.25	72
		Mean:										
		7/26	87	32.0		116	104.7	105.6	.13	70.3	.25	64
		7/27	88	31.5		114	101.6	105.7	.75	72.5	.4	72
		7/31	92	31.5		130	102.6	97.7	1.36	108.8	.75	70
		8/11	103	31.5		72	100.3	100	0	86.3	.25	70
		8/8	100	31.0		68	99.7	98.5	.01	119.7	0	72
1977	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	No data										
1977	Trinity River below Dallas (08057410)	Max: Too much data missing			N/A							
		Mean:										
		7/23	84	32.0		423	104.4	100.3	.06	41	.5	70
		8/24	116	31.5		826	100.3	95.3	2.06	84.5	.75	73
		7/8	69	31.0		456	100.2	99.4	0	77.8	0	68
		7/11	72	31.0		474	99.1	100.3	.28	105.4	0	70
		7/16	77	31.0		424	99.8	100.4	.27	62.5	.25	64
1977	East Fork Trinity River at Seagoville (08061980)	No data										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1977	East Fork Trinity River near Crandall (08062000)	Max:			N/A							
		7/25	86	33.0		33	105.2	100.3	0	84.2	1.0	66
		7/9	70	32.5		50	99.9	97.9	0	68.4	.6	70
		7/15	76	32.5		41	98.4	99.2	0	61.3	.75	66
		7/18	79	32.5		38	97	98.2	.12	72.4	.1	66
		7/23	84	32.5		32	101	97.6	.12	39.6	.5	70
		Mean:										
		7/6	67	32.0		46	97.7	98.1	0	87.7	.1	68
		7/26	87	32.0		35	103.1	103	0	70.2	.25	64
		7/18	79	31.5		38	97	98.2	.12	72.4	.1	66
		8/9	101	31.5		33	98.9	98.5	0	115.1	0	70
		8/12	104	31.5		37	99.5	99.7	0	57.2	.75	72
1977	Trinity River near Rosser (08062500)	Max:			N/A							
		7/26	87	33.0		525	103.6	103.2	0	67.2	.25	64
		7/9	70	32.0		553	99.7	97.6	0	71.3	.6	70
		7/20	81	32.0		491	97.4	97	0	79.3	.1	70
		7/22	83	32.0		593	98.4	97.7	0	80.2	.25	70
		8/11	103	32.0		547	100.1	99.8	0	79.2	.25	70
		Mean:										
		8/12	104	32.0		554	100	100	.45	55.6	.75	72
		7/16	77	31.5		500	98.5	98.8	.07	56.2	.25	64
		7/19	80	31.5		488	97.5	97.3	0	78.4	0	67
		7/21	82	31.5		493	98.2	97	0	115.2	.25	72
		8/13	105	31.5		561	99	100.2	.45	57.1	.5	70
1977	Trinity River at Trinidad (08062700)	No data										
1977	San Antonio	No data										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	River at Loop 410 at San Antonio (08178565)											
1977	Salado Creek (lower station) at San Antonio (08178800)	No data										
1977	Medina River at La Coste (08180640)	No data										
1977	Medio Creek at Pearsall Rd. at San Antonio (08180750)	No data										
1977	Leon Creek at IH-35 at San Antonio (08181480)	No data										
1977	Medina River at San Antonio (08181500)	No data										
1977	San Antonio River near Elmendorf (08181800)	No data										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1977	San Antonio River near Falls City (08183500)	No data										
1977	Cibolo Creek near Falls City (08186000)	No data										
1978	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max:			N/A							
		7/16	77	38.0		5.1	105.3	102.8	0	67.4	.25	66
		7/7	68	37.0		3.7	101.2	101.1	.07	143.1	0	77
		7/9	70	36.5		2.3	104.1	101.7	.07	93	0	57
		7/19	80	36.0		2.8	101.4	103.5	0	129.1	.1	63
		7/20	81	36.0		2.7	100	102.2	0	112.6	0	64
		Mean:										
		7/2	63	32.0		3.3	100.4	98.5	0	114.6	0	70
		7/5	66	32.0		4.0	101	101	.07	110.5	0	66
		7/6	67	32.0		4.5	101.6	101.2	.07	120.5	0	64
		7/8	69	32.0		2.8	102.2	101.3	.07	109	0	63
		7/20	81	32.0		2.7	100	102.2	0	112.6	0	64
1978	West Fork Trinity River at Grand Prairie (08049500)	Max:			N/A							
		7/12	73	34.0		123	101.2	103.1	0	86.4	0	68
		7/16	77	34.0		130	103.8	104.4	0	55.3	.25	66
		7/4	65	33.5		118	101.4	101.3	0	81.7	0	66
		7/15	76	33.5		129	107.5	102.2	0	70.5	.75	64
		7/8	69	33.0		117	103.4	101.3	0	88.8	0	63
		Mean:										
		7/15	76	32.5		129	107.5	102.2	0	70.5	.75	64

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/4	65	32.0		118	101.4	101.3	0	81.7	0	66
		7/9	70	32.0		113	104.4	102	0	73.2	0	57
		7/12	73	32.0		123	101.2	103.1	0	86.4	0	68
		7/18	79	32.0		134	102.9	104.6	0	133	.1	66
1978	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	No data										
1978	Trinity River below Dallas (08057410)	Max:			N/A							
		5/25	25	32.5		1210	89.3	86.9	2.37	101.8	.6	68
		7/13	74	32.5		368	103	103	0	88.6	0	66
		7/10	71	32.0		356	103.8	103.6	0	70.1	0	64
		7/21	82	32.0		380	99.8	102	0	74.3	0	68
		7/29	90	31.5		438	101.7	100.8	.67	94.2	.1	64
		Mean:										
		7/16	77	32.0		351	105.8	105	0	55.6	.25	66
		7/3	64	31.5		344	102.6	101.4	0	67.3	0	70
		7/8	69	31.5		352	104	102.1	0	84.2	0	63
		7/18	79	31.5		371	103.2	105.4	0	120.4	.1	66
		7/20	81	31.0		378	100.6	102.7	0	82.5	0	64
1978	East Fork Trinity River at Seagoville (08061980)	No data										
1978	East Fork Trinity River near Crandall (08062000)	No data										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1978	Trinity River near Rosser (08062500)	Max:			N/A							
		7/12	73	33.5		428	101.9	103.2	0	39.5	0	68
		7/15	76	33.5		425	104.1	102.1	0	31	.75	64
		6/29	60	32.5		465	98.9	99	0	26.9	0	64
		7/21	82	32.5		437	99.9	101.6	0	38.9	0	68
		7/26	87	32.0		526	99.9	92.7	1.28	47.3	.75	68
		Mean:										
		7/15	76	33.0		425	104.1	102.1	0	31	.75	64
		7/16	77	33.0		412	107.9	102.8	0	31.1	.25	66
		7/12	73	32.5		428	101.9	103.2	0	39.5	0	68
		7/21	82	32.0		437	99.9	101.6	0	38.9	0	68
		7/5	66	31.5		400	102	101.6	0	38.7	0	66
1978	Trinity River at Trinidad (08062700)	No data										
1978	San Antonio River at Loop 410 at San Antonio (08178565)	No data										
1978	Salado Creek (lower station) at San Antonio (08178800)	No data										
1978	Medina River at La Coste (08180640)	No data										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1978	Medio Creek at Pearsall Rd. at San Antonio (08180750)	No data										
1978	Leon Creek at IH-35 at San Antonio (08181480)	No data										
1978	Medina River at San Antonio (08181500)	No data										
1978	San Antonio River near Elmendorf (08181800)	No data										
1978	San Antonio River near Falls City (08183500)	No data										
1978	Cibolo Creek near Falls City (08186000)	No data										
1979	West Fork Trinity River at Beach	Max: 7/29 7/12	 90 73	 34.0 33.5	N/A	 12 47	 97.4 96.9	 89.7 97.2	 .13 .21	 119.4 44.6	 .6 0	 72 66

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	Street at Fort Worth (08048543)	7/16	77	33.5		50	98.1	97.4	.13	94.6	1.0	73
		7/13	74	33.0		42	97.2	96.6	.18	88.4	0	72
		8/6	98	32.5		51	94.6	91.5	3.29	54.5	0	70
		Mean:										
		7/12	73	31.5		47	96.9	97.2	.21	44.6	0	66
		7/11	72	31.0		55	95.7	96.9	.27	41.4	.25	66
		7/13	74	31.0		42	97.2	96.6	.18	88.4	0	72
		7/17	78	30.5		51	97.7	97.7	.09	54.5	.9	68
		9/6	129	30.5		21	94.7	92.8	.07	48.3	.1	68
1979	West Fork Trinity River at Grand Prairie (08049500)	Max:			N/A							
		6/30	61	32.0		174	102.2	95.9	.32	57.1	.9	70
		7/8	69	32.0		152	94.8	93.2	.87	41.2	.75	70
		7/9	70	31.5		151	97.4	93.3	.90	58.6	.25	72
		7/13	74	31.5		167	97.1	95.7	.64	73.3	0	72
		7/14	75	31.5		162	97	96.3	.20	98.5	.6	73
		Mean:										
		7/1	62	30.5		160	100.3	99.8	.32	98.5	.1	68
		7/8	69	30.5		152	94.8	93.2	.87	41.2	.75	70
		7/10	71	30.5		169	95.3	95.4	.99	64.5	1.0	68
		7/31	92	30.5		114	98.3	97.5	.36	141.7	.9	73
		8/7	99	30.5		458	96.5	94.6	2.63	37.2	0	72
1979	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	No data										
1979	Trinity River below Dallas (08057410)	Max:			N/A							
		6/30	61	30.5		531	101.4	94.5	.52	57.5	.9	70
		7/8	69	30.0		580	93.6	92.6	1.26	40.6	.75	70
		7/10	71	30.0		534	93.5	93.7	1.40	60.5	1.0	68

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/24	85	30.0		505	94.1	93.4	.58	44.7	.9	72
		8/29	121	30.0		763	95.2	94.4	.51	65.2	.25	70
		Mean:										
		8/31	123	30.0		593	95.6	95.4	.01	45	.75	72
		7/9	70	29.5		527	95.3	92.5	1.26	54.8	.25	72
		7/29	90	29.5		473	95.6	88.8	.28	93.6	.6	72
		8/30	122	29.5		637	95.2	95.2	.01	63.1	.1	68
		9/5	128	29.5		563	94.4	93.2	.34	37.7	.5	70
1979	East Fork Trinity River at Seagoville (08061980)	No data										
1979	East Fork Trinity River near Crandall (08062000)	No data										
1979	Trinity River near Rosser (08062500)	Max:			N/A							
		6/30	61	31.5		656	99.7	91	1.54	41	.9	70
		7/13	74	31.0		604	94.9	93.3	.43	47.8	0	72
		8/7	99	31.0		1210	95.1	92.4	3.12	15.8	0	72
		7/2	63	30.5		573	94.5	97.8	1.28	83	.1	70
		8/9	101	30.5		1080	92.2	94.5	1.09	24	.25	66
		Mean:										
		6/30	61	30.5		656	99.7	91	1.54	41	.9	70
		7/11	72	30.5		670	92.4	92.8	.47	18.3	.25	66
		7/12	73	30.5		634	94.1	93	.47	18.5	0	66
		9/1	124	30.5		659	94.7	94.2	0	29.2	0	72
		8/26	118	30.0		805	91.5	91.8	.61	6.1	0	68
1979	Trinity River	No data										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	at Trinidad (08062700)											
1979	San Antonio River at Loop 410 at San Antonio (08178565)	No data										
1979	Salado Creek (lower station) at San Antonio (08178800)	No data										
1979	Medina River at La Coste (08180640)	No data										
1979	Medio Creek at Pearsall Rd. at San Antonio (08180750)	No data										
1979	Leon Creek at IH-35 at San Antonio (08181480)	No data										
1979	Medina River at San Antonio (08181500)	No data										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1979	San Antonio River near Elmendorf (08181800)	No data										
1979	San Antonio River near Falls City (08183500)	No data										
1979	Cibolo Creek near Falls City (08186000)	No data										
1980	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max:			2646							
		7/18	79	37.0		2.7	107	105.1	0	77.9	0	57
		7/5	66	36.5		5.6	101.9	106.4	0	119.3	0	70
		7/9	70	36.5		7.1	103.8	101.9	0	104.5	0	66
		7/10	71	36.5		6.3	103.8	102.4	0	100.8	0	68
		7/15	76	36.0		2.3	103.9	104.5	0	135.6	.25	70
		Mean:										
		7/9	70	32.5		7.1	103.8	101.9	0	104.5	0	66
		7/10	71	32.5		6.3	103.8	102.4	0	100.8	0	68
		7/11	72	32.5		4.6	104.1	103.2	0	94.3	0	66
		7/18	79	32.0		2.7	107	105.1	0	77.9	0	57
		7/5	66	31.5		5.6	101.9	106.4	0	119.3	0	70
1980	West Fork Trinity River at Grand Prairie	Max:			772							
		6/27	58	32.5		132	111.7	107.5	.35	71.6	.25	66
		7/16	77	32.5		118	107.1	105	0	118.8	0	66
		7/8	69	32.0		129	103	102.1	0	92.7	.25	70

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	(08049500)	7/18	79	32.0		122	107.4	106.3	0	57	0	57
		7/30	91	32.0		149	104.4	100.9	.34	58.7	0	66
		Mean:										
		7/6	67	31.5		109	102.7	104.1	0	86	0	70
		7/13	74	31.5		122	105.6	104.4	0	88.3	0	66
		7/19	80	31.5		119	103	107.4	0	73.8	0	64
		7/18	79	31.0		122	107.4	106.3	0	57	0	57
		8/24	116	31.0		177	103.2	105	0	43	.1	57
1980	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	no data			2997							
1980	Trinity River below Dallas (08057410)	Max:			2086							
		7/6	67	32.0		404	101.5	103.2	0	75.5	0	70
		7/8	69	32.0		433	102.1	101.3	0	81.5	.25	70
		7/14	75	32.0		426	104.4	104.5	0	86.3	0	66
		7/18	79	32.0		430	106.5	105.9	0	45.8	0	57
		7/31	92	32.0		442	103.6	101.2	.31	78.3	0	66
		Mean:										
		6/27	58	31.5		466	110.8	105.7	1.32	63.6	.25	66
		7/4	65	31.5		434	101.9	106.6	0	90.1	.1	68
		7/13	74	31.5		411	105	103.7	0	75	0	66
		7/16	77	31.5		432	106.8	104.3	0	107.8	0	66
		8/23	115	31.5		435	105.7	104.7	0	41.6	0	63
1980	East Fork Trinity River at Seagoville (08061980)	no data			286							

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1980	East Fork Trinity River near Crandall (08062000)	no data			186							
1980	Trinity River near Rosser (08062500)	Max:			30							
		7/4	65	32.5		545	102.1	104.6	0	52.1	.1	68
		7/6	67	32.5		495	100.5	102.6	0	37.4	0	70
		7/8	69	32.5		505	100.8	100.2	0	42	.25	70
		7/12	73	32.5		523	102.8	102.2	0	38.5	.4	64
		6/26	57	32.0		604	104.5	98.2	.99	61	.1	66
		Mean:										
		7/3	64	32.0		548	105.7	103.7	0	42.9	0	64
		7/11	72	32.0		526	102.1	101.7	0	28.9	0	66
		7/18	79	31.5		511	105.7	104.2	0	15.3	0	57
		7/19	80	31.5		511	103.5	105.1	0	35.4	0	64
		7/21	82	31.5		486	100	103.4	0	27.4	.25	64
1980	Trinity River at Trinidad (08062700)	no data			42							
1980	San Antonio River at Loop 410 at San Antonio (08178565)	no data			3491							
1980	Salado Creek (lower station) at	no data			2165							

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	San Antonio (08178800)											
1980	Medina River at La Coste (08180640)	no data			218							
1980	Medio Creek at Pearsall Rd. at San Antonio (08180750)	no data			428							
1980	Leon Creek at IH-35 at San Antonio (08181480)	no data			1651							
1980	Medina River at San Antonio (08181500)	no data			100							
1980	San Antonio River near Elmendorf (08181800)	no data			67							
1980	San Antonio River near Falls City (08183500)	no data			14							
1980	Cibolo Creek near Falls	no data			14							

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	City (08186000)											
1981	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max:			N/A							
		8/6	98	34.0		17	100.6	98.9	0	106	0	72
		7/17	78	33.5		36	97.1	96.2	0	101.5	0	72
		8/5	97	33.5		17	99.9	98.6	0	125	0	72
		8/16	108	33.5		11	98.6	98.6	0	107	.75	70
		8/26	118	33.5		14	96.4	94.3	0	64	0	70
		Mean:										
		8/15	107	32.0		8.6	100.6	97	0	102	.25	72
		7/14	75	31.5		40	95.1	95.8	0	97.1	0	72
		7/25	86	31.5		29	99.2	100.7	0	87.6	0	72
		7/17	78	31.0		36	97.1	96.2	0	101.5	0	72
		8/14	106	31.0		9.2	97.9	96.9	.04	112	0	72
1981	West Fork Trinity River at Grand Prairie (08049500)	Max:			N/A							
		7/11	72	32.0		209	97.8	95.2	.28	30.7	0	72
		7/23	84	32.0		170	101	100.9	0	101.7	missing	missing
		7/26	87	32.0		161	98.3	100.4	0	87.6	1.0	73
		8/1	93	32.0		161	98.8	99	.18	83.6	.9	73
		8/15	107	32.0		140	103	98.2	0	75.4	.25	72
		Mean:										
		7/21	82	31.5		179	100.9	99	0	79.5	0	70
		7/24	85	31.5		170	101.8	101	0	86.2	0	68
		7/25	86	31.5		161	98.3	101.3	0	67.6	0	72
		7/2	63	31.0		184	98	95.2	0	44.2	.75	72
		7/15	76	31.0		188	97.6	96.2	0	92.4	.1	72
1981	Trinity River at Cedar Crest Blvd. at	no data										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	Dallas (08057055)											
1981	Trinity River below Dallas (08057410)	Max:			N/A							
		7/21	82	32.0		532	100	98.2	0	78	0	70
		7/22	83	32.0		532	100.3	99.2	0	76.8	.1	70
		8/1	93	32.0		481	98.2	98.4	.14	75	.9	73
		8/15	107	32.0		452	102.5	98.4	0	67.4	.25	72
		8/16	108	31.5		449	99	100.3	0	74.2	.75	70
		Mean:										
		7/21	82	31.5		532	100	98.2	0	78	0	70
		7/26	87	31.0		498	97.9	99.4	0	79.6	1.0	73
		8/1	93	31.0		481	98.2	98.4	.14	75	.9	73
		8/5	97	31.0		482	99.7	99.4	0	80.6	0	72
		8/14	106	31.0		460	99.4	98.2	.04	63.6	0	72
1981	East Fork Trinity River at Seagoville (08061980)	no data										
1981	East Fork Trinity River near Crandall (08062000)	no data										
1981	Trinity River near Rosser (08062500)	Max:			N/A							
		7/24	85	32.0		613	98	97.8	0	42.3	0	68
		7/25	86	32.0		616	97.7	98	0	32.2	0	72
		7/20	81	31.5		733	96.6	95.2	0	52.2	.25	72
		7/21	82	31.5		706	97.4	95.9	0	48.4	0	70
		8/7	99	31.5		552	99	98.3	0	40.3	1.0	70
		Mean:										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/23 7/25 7/18 7/26 8/1	84 86 79 87 93	31.5 31.5 31.0 31.0 31.0		652 616 801 609 611	98.1 97.7 95.4 96.3 96.8	97.3 98 94.4 97.9 97	0 0 0 0 .02	51.1 32.2 48.3 46.9 42.6	missing 0 missing 1.0 .9	missing 72 missing 73 73
1981	Trinity River at Trinidad (08062700)	no data										
1981	San Antonio River at Loop 410 at San Antonio (08178565)	no data										
1981	Salado Creek (lower station) at San Antonio (08178800)	no data										
1981	Medina River at La Coste (08180640)	no data										
1981	Medio Creek at Pearsall Rd. at San Antonio (08180750)	no data										
1981	Leon Creek at IH-35 at San	no data										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	Antonio (08181480)											
1981	Medina River at San Antonio (08181500)	no data										
1981	San Antonio River near Elmendorf (08181800)	no data										
1981	San Antonio River near Falls City (08183500)	no data										
1981	Cibolo Creek near Falls City (08186000)	Max:			N/A							
		7/20	81	32.0		54	95.5	98.3	0	59.4	.72	73.4
		7/16	77	31.5		63	100.4	97.1	0	59.6	.48	72
		6/10	41	31.0		172	94.9	95.1	.85	82.1	.74	75.7
		8/16	108	31.0		38	100.4	97.1	0	72.2	.15	73
		8/15	107	30.5		39	98.8	96.7	0	52.8	.48	73.7
		Mean:										
		7/21	82	30.5		54	97.2	97	0	46	.56	73
		7/23	84	30.5		51	95.2	96.2	0	62.1	missing	missing
		7/19	80	30.0		55	96.5	99.6	0	60.9	.62	74.3
		7/3	64	29.5		111	97.3	94.8	.65	51.4	.75	74.3
		7/2	63	29.0		126	96.8	92.3	.65	28.3	.72	74.6
1982	West Fork Trinity River	Max:			N/A							
		7/28	89	35.0		35	97.4	96.8	.31	57.8	.75	66

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	at Beach Street at Fort Worth (08048543)	8/20	112	34.0		13	95.3	94.7	.01	45.4	.9	65
		8/4	96	33.5		36	97.4	95.4	1.06	113.5	0	68
		8/14	106	33.5		22	100.4	95.9	.14	102.4	.1	63
		8/27	119	33.5		15	100.4	100.4	0	136	0	66
		Mean:										
		7/28	89	31.0		35	97.4	96.8	.31	57.8	.75	66
		8/7	99	31.0		24	100.2	99.1	.43	51.5	.75	64
		8/5	97	30.5		32	98.8	96.5	.98	99.6	0	65
		8/12	104	30.5		28	96.5	94	.14	90.1	.25	66
		8/22	114	30.5		12	98.1	95.4	.01	43.3	0	63
1982	West Fork Trinity River at Grand Prairie (08049500)	Max:			N/A							
		7/24	85	32.0		411	100	99.9	0	35.6	.25	69
		8/14	106	32.0		171	102.2	97.5	.23	91.9	.1	63
		8/4	96	31.5		203	98.8	97	.77	99.3	0	68
		8/13	105	31.5		180	99.5	95.7	.26	93.5	.25	65
		8/20	112	31.5		149	97.9	95.2	.01	40.6	.9	65
		Mean:										
		8/15	107	31.0		156	102.1	100	.14	84.2	0	62
		7/23	84	30.5		518	99.8	99.3	0	27.4	.4	69
		7/24	85	30.5		411	100	99.9	0	35.6	.25	69
		8/13	105	30.5		180	99.5	95.7	.26	93.5	.25	65
		9/3	126	30.5		128	93.8	99.2	.46	53.8	.75	65
1982	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	no data										
1982	Trinity River below Dallas (08057410)	too much data missing										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1982	East Fork Trinity River at Seagoville (08061980)	no data										
1982	East Fork Trinity River near Crandall (08062000)	no data										
1982	Trinity River near Rosser (08062500)	Max:			N/A							
		7/20	81	30.0		7470	97.1	95.3	0	48.9	.1	64
		7/12	73	29.5		11400	95.9	94.7	.20	28.8	.75	68
		8/16	108	29.5		7500	99.6	98.7	0	40.7	.1	60
		8/27	119	29.5		5250	100.2	100	0	92.7	0	66
		8/31	123	29.5		5340	96.5	96.3	3.05	40.3	0	67
		Mean:										
		7/21	82	29.5		4050	98.5	96.1	0	28.1	0	64
		8/14	106	29.0		7680	98.5	95.9	.04	71.1	.1	63
		8/25	117	29.0		5440	100	99.2	0	96.4	0	62
		8/27	119	29.0		5250	100.2	100	0	92.7	0	66
		8/31	123	29.0		5340	96.5	96.3	3.05	40.3	0	67
1982	Trinity River at Trinidad (08062700)	no data										
1982	San Antonio River at Loop 410 at San Antonio (08178565)	no data										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1982	Salado Creek (lower station) at San Antonio (08178800)	no data										
1982	Medina River at La Coste (08180640)	no data										
1982	Medio Creek at Pearsall Rd. at San Antonio (08180750)	no data										
1982	Leon Creek at IH-35 at San Antonio (08181480)	no data										
1982	Medina River at San Antonio (08181500)	no data										
1982	San Antonio River near Elmendorf (08181800)	no data										
1982	San Antonio River near Falls City	no data										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	(08183500)											
1982	Cibolo Creek near Falls City (08186000)	Max:			N/A							
		8/1	93	31.0		10	101.3	101.2	0	63.7	.62	71.8
		8/2	94	31.0		9.5	100.6	101.1	0	56	.49	71.1
		8/14	106	31.0		19	100.5	97.8	.96	40.6	.29	71.4
		8/15	107	31.0		18	101.5	99.4	.96	32	.42	71.8
		8/4	96	30.5		9.3	100.3	100.4	.01	30.8	.58	71.8
		Mean:										
		7/25	86	29.5		12	100.6	99.6	.45	42.1	.1	72
		7/29	90	29.5		11	101.6	101.4	0	50.2	missing	missing
		7/31	92	29.5		11	101.1	101.4	0	57.5	.68	72.1
		8/15	107	29.5		18	101.5	99.4	.96	32	.42	71.8
		7/12	73	29.0		15	98.6	98.5	0	41	.52	71.4
1983	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max:			N/A							
		8/15	107	36.5		16	102.2	100.8	.74	74.4	.4	69
		7/29	90	35.5		16	99.7	100.4	0	98.5	.1	68
		7/30	91	35.5		16	98	100.2	0	62.9	.4	70
		7/25	86	35.0		21	100.2	96.6	0	120	0	71
		8/17	109	35.0		13	96.4	101.4	.04	78.6	.25	67
		Mean:										
		7/31	92	31.5		15	97	99.3	0	48.6	0	70
		8/12	104	31.5		19	100.4	95.1	1.14	103	.25	70
		8/31	123	31.5		18	100.1	96.2	0	59.3	0	68
		7/26	87	31.0		19	100.2	98	0	104.9	0	69
		7/29	90	31.0		16	99.7	100.4	0	98.5	.1	68
1983	West Fork Trinity River at Grand Prairie	Max:			N/A							
		7/24	85	32.0		158	98.8	96.7	0	104.1	0	68
		7/29	90	32.0		130	99	100.3	0	88.8	.1	68
		8/2	94	32.0		136	97.9	98	0	36.5	0	68

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	(08049500)	8/26	118	32.0		176	96.2	95.8	.43	40.2	0	69
		8/28	120	32.0		159	95.8	96.6	.05	29	0	69
		Mean:										
		7/30	91	31.5		125	98.1	100	0	58.1	.4	70
		8/28	120	31.5		159	95.8	96.6	.05	29	0	69
		7/28	89	31.0		137	100.1	100.2	0	104.1	0	69
		8/24	116	31.0		198	95.8	95.1	3.10	63.6	0	71
		8/26	118	31.0		176	96.2	95.8	.43	40.2	0	69
1983	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	no data										
1983	Trinity River below Dallas (08057410)	Max:			N/A							
		8/17	109	31.5		539	99.3	101.8	0	61.6	.25	67
		8/27	119	31.5		561	98.6	96.6	0	26.3	0	69
		8/30	122	31.5		564	100.3	97.7	.03	48.7	0	69
		7/27	88	31.0		524	100.5	99.1	0	81.7	0	67
		8/6	98	31.0		499	99.6	95.2	.14	34.7	0	68
		Mean:										
		7/31	92	31.0		482	98	99.1	0	38	0	70
		8/15	107	31.0		517	103.1	102	.26	53.2	.4	69
		8/30	122	31.0		564	100.3	97.7	.03	48.7	0	69
		8/2	94	30.5		500	98.6	98.6	0	34.1	0	68
		8/12	104	30.5		604	102.3	96.3	.92	81	.25	70
1983	East Fork Trinity River at Seagoville (08061980)	no data										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1983	East Fork Trinity River near Crandall (08062000)	no data										
1983	Trinity River near Rosser (08062500)	Max:			N/A							
		7/25	86	32.0		657	98	95.4	0	97.8	0	71
		8/3	95	31.5		629	95.9	97.7	0	61.3	.25	65
		8/26	118	31.5		747	95.7	94.9	.13	38.3	0	69
		8/28	120	31.5		664	96.4	95.7	.07	37.5	0	69
		8/31	123	31.5		661	100.4	97.3	.07	55.6	0	68
		Mean:										
		7/29	90	32.0		662	97.8	98	0	76.4	.1	68
		7/24	85	31.5		695	96.1	95	0	85.2	0	68
		7/26	87	31.5		677	97.3	96.2	0	90.9	0	69
		7/31	92	31.5		633	96.6	97.9	0	43.3	0	70
		9/1	124	31.5		941	101.6	98.6	.41	76.9	.25	68
1983	Trinity River at Trinidad (08062700)	no data										
1983	San Antonio River at Loop 410 at San Antonio (08178565)	no data										
1983	Salado Creek (lower station) at San Antonio (08178800)	no data										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1983	Medina River at La Coste (08180640)	no data										
1983	Medio Creek at Pearsall Rd. at San Antonio (08180750)	no data										
1983	Leon Creek at IH-35 at San Antonio (08181480)	no data										
1983	Medina River at San Antonio (08181500)	no data										
1983	San Antonio River near Elmendorf (08181800)	no data										
1983	San Antonio River near Falls City (08183500)	no data										
1983	Cibolo Creek near Falls City (08186000)	Max: 7/1 8/21 8/23	 62 113 115	 31.0 31.0 31.0	N/A	 11 8.0 7.8	 98.3 97.2 97.5	 98 97.9 97.2	 0 .01 .01	 111.7 60.1 47.8	 .67 .52 .42	 73.4 72.1 72.1

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		8/12	104	30.5		25	96.2	94.8	.74	47.1	.48	73.1
		8/19	111	30.5		9.0	98.2	96.7	.40	61.7	.72	72.1
		Mean:										
		7/28	89	29.5		11	95.6	95	0	79.1	.58	missing
		8/11	103	29.5		17	95.9	94.2	.71	40	.57	73.1
		9/1	124	29.5		9.6	99	97.4	.12	33.9	.1	67.8
		6/28	59	29.0		13	97.8	94.9	.39	86.7	.72	71.1
		8/19	111	29.0		9.0	98.2	96.7	.40	61.7	.72	72.1
1984	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max:			N/A							
		8/20	112	36.0		11.0	104.3	101.9	.02	47.4	.4	61
		7/20	81	35.5		15	97.8	98	0	67.9	0	58
		8/29	121	35.0		6.4	103.4	99.5	.16	111.4	.4	66
		8/18	110	34.5		12.0	102.6	96.1	.73	68.3	.4	63
		9/14	137	34.0		6.2	99.2	96.9	0	81.6	0	61
		Mean:										
		8/19	111	32.0		11.0	105.2	98.7	.24	65.8	.4	63
		6/23	54	31.0		21	102.1	98.8	0	123	0	67
		8/28	120	31.0		6.4	102.1	98	0	108.8	.4	67
		7/20	81	30.5		15	97.8	98	0	67.9	0	58
		7/22	83	30.5		15	98.1	98.1	0	90.5	0	57
1984	West Fork Trinity River at Grand Prairie (08049500)	Max:			N/A							
		7/23	84	32.5		46	99.3	98.9	0	54.9	0	56
		8/21	113	32.0		85	101.1	104.9	0	71.5	.6	67
		8/29	121	32.0		80	104.8	100.5	0	103.7	.4	66
		8/30	122	32.0		74	100.4	103	.01	94.9	1.0	66
		8/6	98	31.5		104	97.7	96.8	.11	110.6	.4	70
		Mean:										
		7/17	78	31.0		74	99.2	102	.33	88.3	.75	57
		6/24	55	30.5		69	97.9	100.6	0	81.5	.4	69

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/18	79	30.5		62	97.9	101.4	.32	63.6	.4	62
		8/9	101	30.5		80	98.4	98.1	.11	105.4	.75	68
		8/27	119	30.5		70	101.6	97.4	0	74.5	.4	68
1984	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	Max:			N/A							
		7/6	67	31.5		334	101.3	98.2	.39	84.8	.75	67
		7/9	70	31.5		299	98.6	100.5	.27	100.7	.4	66
		7/18	79	31.5		329	98.6	102.2	.19	64.1	.4	62
		8/21	113	31.5		276	100.6	105.6	0	78.9	.6	67
		8/27	119	31.5		275	102.6	97.6	0	71.8	.4	68
		Mean:										
		8/20	112	31.0		277	102.5	105.2	.11	56	.4	61
		6/24	55	30.5		294	97.9	100.1	0	74.7	.4	69
		7/11	72	30.5		299	101.6	98.9	.24	138.1	0	64
		7/16	77	30.5		332	104.3	101.1	.20	88.7	.4	62
		8/21	113	30.5		276	100.6	105.6	0	78.9	.6	67
1984	Trinity River below Dallas (08057410)	Max:			N/A							
		7/7	68	31.0		567	100.9	98.6	.32	83.7	0	66
		7/21	82	31.0		520	99.6	99.6	0	69.1	0	61
		6/23	54	30.5		543	101.4	98.8	0	94	0	67
		7/14	75	30.5		644	100.7	100.4	.25	100.5	0	61
		8/9	101	30.5		554	99.1	98.1	.17	102.8	.75	68
		Mean:										
		7/8	69	30.5		556	100.2	99.3	.32	89	.4	66
		7/21	82	30.5		520	99.6	99.6	0	69.1	0	61
		8/28	120	30.5		545	102.8	99.9	0	99.6	.4	67
		8/30	122	30.5		538	101.7	104.1	0	90.5	1.0	66
		8/17	109	30.0		601	101.7	97	.78	48.3	0	64
1984	East Fork Trinity River at Seagoville	no data										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	(08061980)											
1984	East Fork Trinity River near Crandall (08062000)	no data										
1984	Trinity River near Rosser (08062500)	Max:			N/A							
		7/8	69	31.5		732	99.8	97.8	.46	82	.4	66
		7/9	70	31.5		712	98.4	99.2	.46	90	.4	66
		7/13	74	31.5		958	100.6	99.2	0	70	.75	64
		6/30	61	31.0		1070	93.6	93.3	.45	72	.4	69
		8/19	111	31.0		692	106.2	100.2	.77	54.2	.4	63
		Mean:										
		7/8	69	31.0		732	99.8	97.8	.46	82	.4	66
		7/9	70	31.0		712	98.4	99.2	.46	90	.4	66
		7/21	82	30.5		675	99.4	98.8	0	75	0	61
		8/20	112	30.5		668	108.2	103.2	.45	68.3	.4	61
		8/21	113	30.5		670	105.1	106.1	.45	91	.6	67
1984	Trinity River at Trinidad (08062700)	no data										
1984	San Antonio River at Loop 410 at San Antonio (08178565)	no data										
1984	Salado Creek (lower station) at	no data										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	San Antonio (08178800)											
1984	Medina River at La Coste (08180640)	no data										
1984	Medio Creek at Pearsall Rd. at San Antonio (08180750)	no data										
1984	Leon Creek at IH-35 at San Antonio (08181480)	no data										
1984	Medina River at San Antonio (08181500)	no data										
1984	San Antonio River near Elmendorf (08181800)	Max:			N/A							
		6/25	56	32.0		144	99.7	98.2	.04	51.8	.25	65
		7/1	62	31.5		297	100.7	99.6	.19	69	.5	67
		7/2	63	31.5		174	100	100.2	.19	63.6	1.0	70
		7/5	66	31.5		136	98.8	99.4	.10	108.4	.75	69
		7/23	84	31.5		166	98.5	99.6	.08	57.6	.75	67
		Mean:										
		6/30	61	30.5		142	100.9	99.5	.19	58	.75	70
		7/1	62	30.5		297	100.7	99.6	.19	69	.5	67
		7/18	79	30.5		152	102.9	99.5	.03	63.2	.25	67
		7/19	80	30.5		153	101.3	101	.05	71	1.0	68

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/22	83	30.0		148	98.7	100.4	.08	60.6	.75	67
1984	San Antonio River near Falls City (08183500)	no data										
1984	Cibolo Creek near Falls City (08186000)	Max:			N/A							
		6/24	55	29.5		5.5	99.1	98.3	.03	56.8	.25	69.4
		6/30	61	29.5		4.0	101.7	99.8	.20	47.5	.57	71.1
		7/20	81	29.0		1.1	99.6	101.7	.12	42	.35	68.7
		7/9	70	28.5		2.9	98.4	98.8	.04	58.8	.57	69.4
		8/10	102	28.5		1.1	96	97.4	.54	59.9	.48	70
		Mean:										
		7/5	66	28.0		2.6	98.6	97.8	.19	89.8	.57	70.1
		8/11	103	27.5		2.1	97.8	96.3	.54	54.7	.85	69.3
		8/23	115	27.5		1.5	99.4	100	0	44.3	.82	66.9
		8/24	116	27.5		1.6	100.2	99.5	0	43.1	.1	missing
		8/29	121	27.5		2.6	100.4	98.6	0	69.4	.04	66.9
1985	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max:			N/A							
		7/28	89	35.5		14	99.6	95	1.18	41.5	.25	68
		7/29	90	35.0		13	100.9	96.7	1.06	63.3	.25	65
		8/6	98	34.0		9.6	101.4	101.1	.06	86.8	.75	66
		9/1	124	34.0		9.9	104.9	98.3	0	53	0	60
		9/3	126	34.0		6.8	99.9	102.9	0	58	missing	missing
		Mean:										
		7/9	70	31.0		8.7	96.4	94.7	.30	93.8	.25	68
		7/10	71	31.0		8.8	98.9	95.4	.15	97.9	.1	69
		8/6	98	31.0		9.6	101.4	101.1	.06	86.8	.75	66
		9/1	124	31.0		9.9	104.9	98.3	0	53	0	60
		7/6	67	30.5		8.3	94.4	92.4	.30	46.3	0	67

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1985	West Fork Trinity River at Grand Prairie (08049500)	Max:			N/A							
		7/17	78	32.5		157	98.3	98.2	.15	65.9	.5	67
		7/27	88	32.5		124	97.3	95.2	1.50	28.8	.1	69
		7/28	89	32.5		124	101.7	96.4	.97	40.7	.25	68
		8/20	112	32.5		150	105.5	103.2	.06	45.8	.75	61
		8/21	113	32.5		214	101.5	104.3	.15	70.2	.25	68
		Mean:										
		8/4	96	32.0		80	101.3	102.7	.07	84.4	0	68
		8/17	109	31.5		137	102.3	97.1	0	57.7	.1	65
		8/22	114	31.5		120	101.3	103.6	.17	85.1	.25	68
		8/24	116	31.5		131	97.2	101.7	.17	86.9	.9	65
		9/2	125	31.5		133	100	103.4	0	54.7	missing	missing
1985	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	Max:			N/A							
		8/3	95	32.0		386	101.9	103.7	0	57.6	.1	69
		8/19	111	32.0		349	103.3	101.8	.02	70.8	.25	62
		8/5	97	31.5		354	100.6	102.6	0	92	.25	67
		8/6	98	31.5		360	101.9	101.4	0	80.1	.75	66
		8/20	112	31.5		352	105.3	103.2	.02	49.4	.75	61
		Mean:										
		8/19	111	31.0		349	103.3	101.8	.02	70.8	.25	62
		8/22	114	31.0		347	101.6	103.2	.03	80	.25	68
		8/23	115	31.0		350	102.6	102.7	.01	106.7	0	66
		7/27	88	30.5		399	97.6	96.8	1.08	33.7	.1	69
		9/1	124	30.5		348	106.6	100.9	0	33.1	0	60
1985	Trinity River below Dallas (08057410)	too much data missing										
1985	East Fork Trinity River	no data										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	at Seagoville (08061980)											
1985	East Fork Trinity River near Crandall (08062000)	no data										
1985	Trinity River near Rosser (08062500)	Max:			N/A							
		8/1	93	32.5		633	99.6	99	0	82.7	0	67
		8/17	109	31.5		629	100	97.4	.25	40.1	.1	65
		8/22	114	31.5		627	101.7	103.6	.37	57.2	.25	68
		8/23	115	31.5		590	101.2	103.1	.12	82	0	66
		8/24	116	31.5		613	100.8	102.2	.12	73.4	.9	65
		Mean:										
		8/2	94	32.0		691	101.6	98.7	0	49.7	.25	68
		8/18	110	31.5		607	102	98.1	.25	65.7	0	66
		8/19	111	31.5		591	103.2	99.8	.25	59.5	.25	62
		8/17	109	31.0		629	100	97.4	.25	40.1	.1	65
		8/22	114	31.0		627	101.7	103.6	.37	57.2	.25	68
1985	Trinity River at Trinidad (08062700)	no data										
1985	San Antonio River at Loop 410 at San Antonio (08178565)	no data										
1985	Salado Creek (lower	no data										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	station) at San Antonio (08178800)											
1985	Medina River at La Coste (08180640)	no data										
1985	Medio Creek at Pearsall Rd. at San Antonio (08180750)	no data										
1985	Leon Creek at IH-35 at San Antonio (08181480)	no data										
1985	Medina River at San Antonio (08181500)	no data										
1985	San Antonio River near Elmendorf (08181800)	Max:			N/A							
		7/26	87	31.5		251	97.2	96.2	.04	86.3	.5	74
		7/28	89	31.5		234	97.4	96.8	0	32.2	.1	67
		7/29	90	31.5		235	98.3	97	0	48.1	.75	71
		8/24	116	31.5		196	99.1	99.9	.04	66.7	.1	73
		7/25	86	31.0		254	96.8	95.7	.04	97.5	.9	72
		Mean:										
		8/1	93	30.5		254	98.2	97.5	0	70.2	.6	73
		8/18	110	30.5		192	101.1	98.9	.02	74	.6	73
		8/19	111	30.5		198	101.7	100	.02	60.7	.1	70

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		8/21	113	30.5		204	100.9	101.5	0	49.6	.6	72
		7/30	91	30.0		243	97.2	97.3	0	62.5	.75	72
1985	San Antonio River near Falls City (08183500)	no data										
1985	Cibolo Creek near Falls City (08186000)	Max:			N/A							
		6/1	32	29.0		13	94.6	94.7	0	83.8	.57	70.7
		6/6	37	27.0		12	89.1	92.5	.30	73.6	.96	74
		7/2	63	27.0		40	90.8	92.4	.33	35	.76	70.3
		5/9	9	26.5		19	89.7	88.4	.31	40.3	.96	65.6
		6/24	55	26.5		66	89.2	87.4	2.55	60.7	.41	72.4
		Mean:										
		6/2	33	26.5		12	93.9	95.3	0	64.4	.67	69.1
		6/6	37	26.0		12	89.1	92.5	.30	73.6	.96	74
		6/7	38	26.0		241	93.7	91.2	.27	42.9	.91	73.7
		6/27	58	26.0		119	91.4	89.9	1.29	49.5	.56	70.9
		6/12	43	25.5		115	95.4	95.9	.27	41.4	.79	68.1
1986	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max:			N/A							
		7/31	92	35.5		39	106.1	104.2	0	89	0	64
		8/19	111	35.5		19	100.7	100.8	0	46	.4	68
		7/23	84	35.0		65	95.7	99.9	1.20	35.5	0	73
		7/24	85	35.0		49	97.6	97.6	1.20	67	.1	69
		7/9	70	34.0		95	95.8	93.7	.65	86.5	.5	70
		Mean:										
		8/1	93	33.5		30	104.9	105.4	0	57.4	0	65
		7/31	92	33.0		39	106.1	104.2	0	89	0	64
		8/2	94	32.5		28	102.6	105.6	0	66	.4	67
		8/8	100	31.0		30	95.5	94.9	.62	114	.75	69

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		8/13	105	31.0		37	93	92.2	.50	69.5	.5	69
1986	West Fork Trinity River at Grand Prairie (08049500)	Max:			N/A							
		8/1	93	33.5		132	104	106	0	49.4	0	65
		7/29	90	33.0		170	105	101.9	.06	71.9	0	63
		7/30	91	33.0		163	106.3	103.2	0	66.9	0	62
		8/18	110	33.0		105	102.7	99.8	.18	44.2	.4	74
		7/20	81	32.5		157	102.6	99.1	0	45.9	.1	66
		Mean:										
		5/13	13	32.5		409	87.5	84	2.20	71.2	.75	61
		7/26	87	32.0		141	100.9	99.3	1.29	77.9	0	67
		7/28	89	32.0		155	103.2	101.2	1.01	83.2	0	67
		7/29	90	32.0		170	105	101.9	.06	71.9	0	63
		8/18	110	32.0		105	102.7	99.8	.18	44.2	.4	74
1986	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	Max:			N/A							
		8/19	111	32.5		279	98.9	100.7	0	42.8	.4	68
		8/18	110	32.0		282	101.6	99.5	.28	44.7	.4	74
		8/9	101	31.5		289	97.3	95.6	.81	74.3	.5	69
		8/16	108	31.5		288	98.7	95.4	.90	123.6	.75	68
		8/20	112	31.5		273	95.9	100.7	0	47.3	.75	65
		Mean:										
		8/1	93	31.5		295	104.6	105.7	0	49.5	0	65
		7/25	86	31.0		343	101.3	97.2	1.11	77.1	.1	67
		8/9	101	30.5		289	97.3	95.6	.81	74.3	.5	69
		8/16	108	30.5		288	98.7	95.4	.90	123.6	.75	68
		8/21	113	30.0		276	94.6	98.8	0	60.8	1.0	66
1986	Trinity River below Dallas (08057410)	too much data missing										
1986	East Fork	no data										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	Trinity River at Seagoville (08061980)											
1986	East Fork Trinity River near Crandall (08062000)	no data										
1986	Trinity River near Rosser (08062500)	Max:			N/A							
		7/28	89	32.0		727	99.9	99.4	1.52	72.9	0	67
		8/3	95	31.5		674	98	103.7	0	61.1	.4	66
		7/22	83	31.0		1790	99.7	100.8	1.52	70.8	.9	69
		7/24	85	31.0		1650	97.4	98.8	1.52	43.7	.1	69
		7/25	86	31.0		1310	98.5	97.4	1.52	70.1	.1	67
		Mean:										
		7/26	87	31.0		1030	99.8	97	1.52	65	0	67
		7/21	82	30.5		1160	101.7	99.5	0	31.6	.1	68
		8/18	110	30.5		644	99.7	96.7	0	45.3	.4	74
		8/19	111	30.5		693	100.8	98.2	0	41.4	.4	68
		7/22	83	30.0		1790	99.7	100.8	1.52	70.8	.9	69
1986	Trinity River at Trinidad (08062700)	Max:			N/A							
		7/31	92	34.5		846	103.1	100.8	0	55.1	0	65.5
		8/1	93	34.5		830	103.6	102.3	0	49.8	0	67
		8/2	94	34.5		810	102.3	103.1	0	48.2	.33	68
		8/18	110	33.5		790	100.3	97.6	.41	44.8	missing	missing
		8/16	108	33.0		896	97.3	94.7	.42	126.9	.5	69.5
		Mean:										
		7/25	86	30.5		1570	97.7	96.7	2.11	63	.05	68
		7/26	87	30.5		1290	98.8	96.5	2.11	61.9	0	69
		7/28	89	30.0		893	98.9	98.4	2.11	63.9	0	69.5
		7/29	90	30.0		835	101.1	98.8	0	59.8	.05	66.5

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/10	71	29.0		4400	94.1	93.1	0	69.3	0	70.5
1986	San Antonio River at Loop 410 at San Antonio (08178565)	no data										
1986	Salado Creek (lower station) at San Antonio (08178800)	no data										
1986	Medina River at La Coste (08180640)	no data										
1986	Medio Creek at Pearsall Rd. at San Antonio (08180750)	no data										
1986	Leon Creek at IH-35 at San Antonio (08181480)	too much data missing										
1986	Medina River at San Antonio (08181500)	no data										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1986	San Antonio River near Elmendorf (08181800)	too much data missing										
1986	San Antonio River near Falls City (08183500)	no data										
1986	Cibolo Creek near Falls City (08186000)	Max:			N/A							
		7/30	91	31.5		19	102.4	102.6	0	62.2	.4	72.4
		7/25	86	31.0		21	100.5	99.4	0	65.5	.25	70.7
		7/27	88	31.0		20	102.6	100.8	0	81.8	.48	73.1
		7/29	90	31.0		19	102.1	102.5	0	72.8	.25	71.4
		7/31	92	31.0		18	102.1	102.5	0	56.2	.33	72.6
		Mean:										
		7/30	91	29.5		19	102.4	102.6	0	62.2	.4	72.4
		7/31	92	29.5		18	102.1	102.5	0	56.2	.33	72.6
		8/2	94	29.5		19	102.7	102.3	0	68	.1	73.6
		7/21	82	29.0		23	99.9	98.4	.23	56.8	.25	70.7
		7/24	85	29.0		22	99.8	99.4	0	61.4	.57	72
1987	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max:			N/A							
		8/6	98	36.0		24	102.2	101.5	.07	29.3	0	71
		8/8	100	35.5		8.1	99.1	101.9	.05	110.3	.5	70
		8/4	96	34.5		32	101.7	99.1	0	67.3	0	68
		8/10	102	34.5		7.5	99.9	99.7	.05	62.4	.25	71
		8/11	103	34.5		30	100.6	99.4	.14	35.5	.1	72
		Mean:										
		7/29	90	32.0		31	96.6	94.8	.07	54.8	0	66
		8/4	96	32.0		32	101.7	99.1	0	67.3	0	68

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/24	85	31.5		42	96.3	93.5	.08	49.9	.1	71
		7/25	86	31.5		41	94.5	94.7	.07	50.6	.25	69
		7/27	88	31.5		39	95	94.9	.07	44	0	70
1987	West Fork Trinity River at Grand Prairie (08049500)	Max:			N/A							
		8/9	101	34.5		149	99.9	100.7	.02	92.8	.1	72
		8/3	95	32.5		160	100	99.5	0	50.1	missing	missing
		8/10	102	32.5		148	100.8	99.8	.09	52	.25	71
		8/15	107	32.5		161	100	99.5	.40	111.3	.25	73
		8/21	113	32.5		132	99.7	101.6	.02	71.3	0	67
		Mean:										
		8/9	101	32.0		149	99.9	100.7	.02	92.8	.1	72
		8/8	100	31.5		164	99.5	101.9	.02	88.1	.5	70
		8/11	103	31.5		141	101.5	100	.41	34	.1	72
		8/12	104	31.5		168	100.2	100.7	.41	39.5	.1	73
		8/14	106	31.0		186	99.8	100	.40	124.6	.75	72
1987	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	Max:			N/A							
		8/2	94	32.5		421	99.6	101	0	42.4	.25	67
		7/30	91	32.0		458	102	97.7	.17	27.3	0	67
		7/31	92	32.0		447	101	99.7	0	30	0	70
		8/25	117	32.0		268	98.6	101.1	0	61.4	.25	70
		8/19	111	31.5		264	102	101.7	.01	73.1	.4	66
		Mean:										
		8/9	101	32.5		319	100.4	101.5	.01	87.2	.1	72
		8/10	102	32.0		439	102	100.4	.12	49.4	.25	71
		8/3	95	31.5		415	100.3	100	0	49.3	missing	missing
		8/20	112	31.0		255	102	101.9	.01	51.8	0	65
		8/22	114	31.0		354	101.6	101.3	.01	74.1	0	70
1987	Trinity River below Dallas (08057410)	Max:			N/A							
		7/26	87	34.5		687	94.8	95.5	.16	34.2	.25	68
		7/19	80	33.5		1080	94.2	92.5	.47	97.1	1.0	72

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/16	77	32.5		960	93.1	89.5	.16	30.2	.5	68
		8/14	106	32.0		726	100.4	99.8	.32	114.7	.75	72
		8/22	114	32.0		705	100.8	101.1	.01	70.9	0	70
		Mean:										
		6/30	61	34.5		5070	89.8	91.9	.04	71.7	1.0	68
		7/19	80	31.5		1080	94.2	92.5	.47	97.1	1.0	72
		7/23	84	31.5		743	95.3	94.2	.48	21.6	.25	69
		8/6	98	31.5		668	103.1	101.6	.01	26.7	0	71
		7/18	79	31.0		1800	93.4	91.8	.48	134.6	1.0	73
1987	East Fork Trinity River at Seagoville (08061980)	Max:			N/A							
		8/1	93	31.0		55	99.7	98.7	0	36.5	0	68
		8/7	99	31.0		74	101.8	101.9	0	47.2	.1	70
		7/30	91	30.5		58	99	96.3	.12	23.5	0	67
		8/15	107	30.5		55	99.8	100.2	.18	96.5	.25	73
		8/18	110	30.5		49	101.1	99.9	0	76.7	.9	70
		Mean:										
		8/7	99	30.0		74	101.8	101.9	0	47.2	.1	70
		8/1	93	29.5		55	99.7	98.7	0	36.5	0	68
		8/2	94	29.5		54	99.2	99.4	0	38	.25	67
		8/5	97	29.5		49	101.9	99.7	0	30.9	.1	68
		8/16	108	29.5		53	100.1	99.8	.18	104.4	.25	73
1987	East Fork Trinity River near Crandall (08062000)	Max:			N/A							
		8/15	107	31.5		55	99.8	100.2	0	96.2	.25	73
		8/21	113	31.5		48	101	101.5	0	53.8	0	67
		8/26	118	31.5		45	98.4	100.6	0	100.8	0	71
		8/14	106	31.0		45	100.1	100.1	0	113.4	.75	72
		8/25	117	31.0		47	98.9	101.1	0	54.6	.25	70
		Mean:										
		7/27	88	30.5		49	95.2	95.1	.53	25.7	0	70
		7/28	89	30.5		50	96.2	95.2	.53	30.3	.4	68

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		8/16	108	30.5		53	100	99.9	0	103.8	.25	73
		7/26	87	30.0		55	95.2	95.2	.53	28.7	.25	68
		8/15	107	30.0		55	99.8	100.2	0	96.2	.25	73
1987	Trinity River near Rosser (08062500)	Max:			N/A							
		8/2	94	32.0		742	99	99	0	36.9	.25	67
		8/5	97	32.0		721	101.4	99.3	0	37.1	.1	68
		8/8	100	32.0		593	98.6	101.8	0	59	.5	70
		8/15	107	31.5		749	99.6	99.9	0	82.8	.25	73
		7/24	85	31.0		1170	94.5	94.4	.26	31.7	.1	71
		Mean:										
		8/3	95	31.5		704	99.1	99	0	45.1	missing	missing
		8/5	97	31.5		721	101.4	99.3	0	37.1	.1	68
		8/6	98	31.5		715	102.7	100.1	0	29.5	0	71
		8/8	100	31.5		593	98.6	101.8	0	59	.5	70
		8/14	106	30.5		748	99.6	100	0	99.8	.75	72
1987	Trinity River at Trinidad (08062700)	too much data missing										
1987	San Antonio River at Loop 410 at San Antonio (08178565)	Max:			N/A							
		8/19	111	30.0		220	98.3	99.6	0	61.4	.9	74
		8/21	113	30.0		215	96.8	98.2	0	40.3	.75	75
		8/25	117	30.0		202	97.2	96.9	0	49.1	.9	75
		9/12	135	29.5		258	93.9	94.1	1.07	31	0	75
		9/13	136	29.5		269	94.6	93.9	1.07	60.8	.75	74
		Mean:										
		8/25	117	29.0		202	97.2	96.9	0	49.1	.9	75
		8/17	109	28.5		225	99.9	99.1	0	108.5	.9	74
		9/12	135	28.5		258	93.9	94.1	1.07	31	0	75
		9/14	137	28.5		308	95.6	93.8	.55	72	.9	75

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		9/15	138	28.5		238	94.4	94.6	.34	67.3	1.0	75
1987	Salado Creek (lower station) at San Antonio (08178800)	Max:			N/A							
		8/6	98	28.5		32	97.4	96.5	0	41.3	.6	74
		8/10	102	28.5		33	96.4	96.8	.01	36.3	.25	74
		8/15	107	28.5		29	98.8	98.7	.01	97.4	.25	76
		8/16	108	28.5		30	99.7	98.9	0	101.4	1.0	74
		8/4	96	28.0		35	96.5	95.5	0	59.9	.9	73
		Mean:										
		8/12	104	28.0		32	98.4	97.2	.01	66.5	1.0	73
		8/16	108	28.0		30	99.7	98.9	0	101.4	1.0	74
		8/17	109	28.0		31	99.8	99.2	0	107.3	.9	74
		6/20	51	27.5		160	91	91.9	.05	84.3	.9	71
		8/2	94	27.5		37	95.8	94.5	.14	53.6	missing	73
1987	Medina River at La Coste (08180640)	too much data missing										
1987	Medio Creek at Pearsall Rd. at San Antonio (08180750)	Max:			N/A							
		8/14	106	30.5		3.4	98.4	98.5	.02	95.9	.6	73
		7/5	66	30.0		5.2	95.2	94.8	0	107.1	.75	74
		8/3	95	30.0		4.1	95.9	95.5	0	63.4	missing	missing
		8/5	97	30.0		3.2	96.6	96.2	0	46.3	.4	74
		8/18	110	30.0		4.5	99.2	100.1	0	87.3	1.0	73
		Mean:										
		7/5	66	29.0		5.2	95.2	94.8	0	107.1	.75	74
		8/4	96	29.0		4.0	96.8	95.7	0	60.9	.9	73
		8/9	101	29.0		3.8	95	96.6	.02	57.5	.9	75
		8/12	104	29.0		3.9	97.2	97.1	.02	67.8	1.0	73
		8/17	109	29.0		4.6	100.7	99.4	0	108.2	.9	74
1987	Leon Creek at	Max:			N/A							

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	IH-35 at San Antonio (08181480)	6/17	48	29.0		270	91.7	91.5	2.56	40.2	1.0	75
		8/9	101	28.5		13	95.4	96.9	.01	57.2	.9	75
		8/12	104	28.5		13	97.8	96.8	.02	67.3	1.0	73
		8/18	110	28.5		13	99.1	99.5	0	86.9	1.0	73
		8/28	120	28.5		18	94.1	98.2	.58	82.9	.75	65
		Mean:										
		6/19	50	28.0		174	91.7	91.5	1.38	50.8	.4	73
		8/17	109	28.0		13	100	99.1	0	107.7	.9	74
		8/18	110	28.0		13	99.1	99.5	0	86.9	1.0	73
		8/10	102	27.5		13	96.4	96.3	.02	36.7	.25	74
		8/23	115	27.5		11	97.1	96.8	0	45	.6	73
1987	Medina River at San Antonio (08181500)	Max:			N/A							
		8/17	109	28.5		294	100	99.2	0	109.2	.9	74
		7/5	66	28.0		1130	95.4	94.8	0	107.3	.75	74
		8/6	98	28.0		451	97.4	96.5	0	43.1	.6	74
		8/20	112	28.0		272	97.3	99.3	0	47.6	.1	73
		8/25	117	28.0		251	97.4	97	.03	49.8	.9	75
		Mean:										
		8/13	105	28.0		344	98.9	97.9	.01	84.9	1.0	73
		8/16	108	28.0		304	99.7	98.9	0	103.7	1.0	74
		8/17	109	28.0		294	100	99.2	0	109.2	.9	74
		8/18	110	28.0		286	99.4	99.5	0	87.9	1.0	73
		8/26	118	27.5		246	98.5	97.1	.03	69.8	.6	74
1987	San Antonio River near Elmendorf (08181800)	Max:			N/A							
		8/16	108	30.0		495	100.4	99.6	.02	104.5	1.0	74
		8/7	99	29.5		719	98.5	97.5	0	63.2	.75	74
		8/14	106	29.5		528	99.8	99.4	.02	97.7	.6	73
		8/21	113	29.5		463	97.7	99.1	.04	41.3	.75	75
		9/13	136	29.5		559	95.3	95.2	.88	62.4	.75	74
		Mean:										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		8/11	103	29.0		612	99.6	97	.02	41.4	.1	74
		8/22	114	29.0		447	98	98.2	.04	55.7	.9	74
		9/16	139	29.0		515	95.6	95.7	.31	89.7	1.0	75
		8/9	101	28.5		682	97.1	98.1	.01	58.4	.9	75
		8/14	106	28.5		528	99.8	99.4	.02	97.7	.6	73
1987	San Antonio River near Falls City (08183500)	Max:			N/A							
		8/12	104	30.0		683	99.5	98	0	75.6	.97	73.7
		8/21	113	30.0		501	97.4	98.7	.31	43.9	.63	75.4
		8/5	97	29.5		899	97.4	96.2	0	49.2	.52	74.4
		8/10	102	29.5		743	96.7	98.1	0	39.7	.20	73.7
		9/15	138	29.5		623	96.8	96.4	.21	72.8	.86	75.7
		Mean:										
		8/11	103	29.5		712	99.3	97.6	0	44.4	.15	74.7
		8/18	110	29.5		532	99.6	99.7	0	90.6	.74	73.7
		8/22	114	29.5		492	97.9	98	.31	59.5	.67	74.4
		8/23	115	29.5		479	98.1	97.8	.31	51.2	.65	73.7
		8/5	97	29.0		899	97.4	96.2	0	49.2	.52	74.4
1987	Cibolo Creek near Falls City (08186000)	Max:			N/A							
		8/12	104	31.0		65	98.9	97.5	0	73.5	.96	73.7
		8/19	111	31.0		58	97.9	99.2	0	64.1	.79	74
		8/5	97	30.5		78	97.1	95.7	0	47.5	.52	74.4
		8/8	100	30.5		71	97.5	97.3	0	69.6	.63	73.7
		8/10	102	30.5		67	96.4	97.4	0	38.3	.20	73.6
		Mean:										
		8/12	104	29.5		65	98.9	97.5	0	73.5	.96	73.7
		8/13	105	29.5		64	98.4	98.1	0	87.6	.68	72.6
		8/17	109	29.5		61	99.6	98.8	0	112.8	.67	74.7
		8/19	111	29.5		58	97.9	99.2	0	64.1	.79	74
		8/23	115	29.0		60	97.4	97.4	.09	49.5	.65	73.7

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1988	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max:			N/A							
		7/1	62	35.5		31	99.2	96.6	.50	84.3	.5	72
		7/2	63	35.0		26	98.2	98	.50	55.4	.25	72
		7/26	87	35.0		4.0	102.1	99.5	.09	47.3	.75	65
		8/18	110	35.0		12	99.1	99.7	.05	40.5	.1	72
		7/15	76	34.5		18	96.1	93.9	1.00	117.6	0	73
		Mean:										
		8/8	100	34.0		6.2	105.3	102	.20	40.8	.4	69
		8/9	101	33.5		3.9	103.1	103.5	.20	36	.4	70
		8/10	102	32.5		4.4	101.1	104.2	.10	46.3	.5	65
		8/24	116	32.5		9.0	101	101.6	.30	55.3	.75	72
		8/15	107	32.0		25	99.8	99.3	.05	66	0	71
1988	West Fork Trinity River at Grand Prairie (08049500)	Max:			N/A							
		8/9	101	34.0		179	102.5	104.6	.09	35.2	.4	70
		7/26	87	33.0		122	102.7	100.1	.17	44.7	.75	65
		8/11	103	33.0		165	96.5	102.5	.07	45.1	.75	71
		8/24	116	33.0		e196	98.8	102.7	.18	52	.75	72
		8/17	109	32.5		200	96.1	100	.07	34.2	.25	72
		Mean:										
		8/9	101	32.5		179	102.5	104.6	.09	35.2	.4	70
		8/7	99	32.0		209	105.4	100.5	.10	26.7	.75	70
		8/25	117	32.0		e184	100.5	101.8	.18	51	.4	71
		7/16	77	31.5		177	97.9	95.7	1.96	113.7	0	74
		8/23	115	31.5		248	104.8	100.4	.18	97.9	.25	73
						e = estimated						
1988	Trinity River at Cedar Crest Blvd. at Dallas	Max:			N/A							
		8/7	99	32.5		e320	105.7	100.1	.03	30.7	.75	70
		8/10	102	32.0		293	98.4	104.8	0	49.8	.5	65
		7/31	92	31.5		335	97.3	98.7	0	58.9	.1	66

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	(08057055)	8/12	104	31.5		291	98	98.8	.01	62.2	.75	74
		8/22	114	31.5		405	101.1	98.6	.30	93.5	.75	73
		Mean:										
		8/8	100	31.5		320	105.7	102.6	.03	39.9	.4	69
		7/17	78	30.5		348	99.4	96.5	3.38	98.2	.4	71
		8/1	93	30.5		332	97.3	97.5	0	70.2	.75	68
		8/11	103	30.5		288	95	102.4	0	51.3	.75	71
		8/26	118	30.5		298	103.7	101.1	.22	45.9	.75	60
						e = estimated						
1988	Trinity River below Dallas (08057410)	Max:			N/A							
		8/5	97	32.0		589	98.7	97	.05	45.5	.5	72
		8/13	105	32.0		535	98.3	97.1	.03	97.4	.9	73
		8/16	108	32.0		543	99.7	99	.16	49.8	.1	67
		8/17	109	32.0		540	95.1	99.4	.16	37.5	.25	72
		8/18	110	32.0		529	97.7	98	.16	44.4	.1	72
		Mean:										
		8/6	98	31.5		562	102.2	97.5	.05	25.6	.25	70
		8/11	103	31.5		524	95.3	102.1	.02	51.7	.75	71
		8/18	110	31.5		529	97.7	98	.16	44.4	.1	72
		8/25	117	31.5		550	100	100.7	.30	51.1	.4	71
		7/17	78	31.0		620	98.6	95.8	3.31	96.1	.4	71
1988	East Fork Trinity River at Seagoville (08061980)	Max:			N/A							
		6/29	60	30.5		40	99.2	95.4	1.21	34.7	.5	73
		7/16	77	30.5		143	95.7	93.7	4.38	110.7	0	74
		8/14	106	30.5		52	99.1	96.7	.04	78.8	.1	73
		8/15	107	30.5		49	99.3	97.8	.04	60.7	0	71
		8/22	114	30.5		51	100.7	97.8	.57	94.9	.75	73
		Mean:										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		8/8	100	30.5		e50	103.7	100.5	.03	41.6	.4	69
		8/9	101	30.5		50	103.1	102.7	0	45	.4	70
		6/28	59	29.5		68	98.3	93.9	1.21	22.1	.75	72
		7/17	78	29.5		115	97	94.8	4.38	96.7	.4	71
		8/16	108	29.5		48	99.4	98.9	.18	54	.1	67
						e = estimated						
1988	East Fork Trinity River near Crandall (08062000)	Max:			N/A							
		7/17	78	31.5		115	97	94.7	4.33	95.9	.4	71
		8/6	98	31.5		e58	100.8	96.7	0	26.7	.25	70
		6/28	59	31.0		68	98.5	93.9	1.93	22.7	.75	72
		8/2	94	31.0		e65	97.9	97.3	0	99.4	.6	73
		8/18	110	31.0		59	96.1	98.1	.01	46.7	.1	72
		Mean:										
		8/9	101	31.0		50	103.1	102.6	0	45.4	.4	70
		6/29	60	30.0		40	99.3	95.3	1.93	35.5	.5	73
		8/6	98	30.0		e58	100.8	96.7	0	26.7	.25	70
		8/14	106	30.0		52	99.1	96.7	0	78.2	.1	73
		8/17	109	29.5		48	95.6	99.3	.01	40.6	.25	72
						e = estimated						
1988	Trinity River near Rosser (08062500)	Max:			N/A							
		8/9	101	32.5		568	102.8	102.3	.35	55.6	.4	70
		8/10	102	32.5		561	99.7	103.1	.35	59.4	.5	65
		7/19	80	32.0		684	98.8	97.4	0	77.3	1.0	71
		7/1	62	31.5		711	97.7	97.8	.15	65.1	.5	72
		8/17	109	31.5		607	96.6	99.2	0	44.8	.25	72
		Mean:										
		8/8	100	32.0		564	103.6	100.4	.35	45.3	.4	69

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/17	78	31.0		861	96.9	95	1.50	83.9	.4	71
		8/15	107	31.0		582	99.6	97.8	0	57	0	71
		8/19	111	31.0		600	98.5	97.6	0	57.1	.75	70
		8/25	117	31.0		635	99.3	100.5	0	51.3	.4	71
1988	Trinity River at Trinidad (08062700)	too much data missing										
1988	San Antonio River at Loop 410 at San Antonio (08178565)	Max:			N/A							
		8/10	102	36.0		24	102.3	100.9	.04	33.7	.4	71
		7/2	63	34.5		21	95.9	95.2	.81	50.7	.75	75
		7/5	66	34.5		23	95.6	96.5	.60	62.2	missing	missing
		8/26	118	34.5		24	99.5	100	.08	38.9	.25	71
		8/13	105	34.0		24	98.8	101.4	.05	64.3	.75	75
		Mean:										
		8/10	102	32.5		24	102.3	100.9	.04	33.7	.4	71
		8/11	103	31.5		25	101.4	101.8	.02	27.8	.1	72
		7/5	66	31.0		23	95.6	96.5	.60	62.2	missing	missing
		7/6	67	31.0		26	94.2	96.4	.69	63.2	.25	74
		8/13	105	31.0		24	98.8	101.4	.05	64.3	.75	75
1988	Salado Creek (lower station) at San Antonio (08178800)	Max:			N/A							
		7/18	79	31.0		11	98.2	97.1	.20	66.4	.25	72
		8/9	101	30.0		15	101.9	99.3	.25	34	.1	71
		8/11	103	30.0		14	101.4	101.8	.01	28	.1	72
		7/13	74	29.5		24	95.4	89.6	.58	70.8	.9	73
		8/15	107	29.5		17	97.6	99.2	.09	35	.25	72
		Mean:										
		7/17	78	30.0		12	97.2	96.8	.46	81.8	.9	74
		7/15	76	29.5		13	97.1	94.1	.58	77.7	.9	75
		7/16	77	29.5		13	97	96.2	.58	70.4	.9	74

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		8/12	104	29.5		14	100.6	102	.04	64	.9	75
		8/16	108	28.5		15	97.9	98.2	.12	37.3	.25	74
1988	Medina River at La Coste (08180640)	Max:			N/A							
		7/2	63	29.0		39	95.4	94.3	1.30	54	.75	75
		8/9	101	29.0		e39	102.2	99.6	.05	33	.1	71
		8/10	102	29.0		38	102.6	101.1	.03	37	.4	71
		8/15	107	29.0		37	97.2	98.7	0	37	.25	72
		8/25	117	29.0		31	99.6	98.9	.12	53	.4	73
		Mean:										
		8/12	104	28.5		37	100.4	102.1	0	66	.9	75
		8/25	117	28.5		31	99.6	98.9	.12	53	.4	73
		7/7	68	28.0		36	94	96.3	.08	49	1.0	72
		7/17	78	28.0		24	98.8	97.3	.13	89	.9	74
		8/23	115	28.0		30	98.2	97.3	.06	59	1.0	76
						e = estimated						
1988	Medio Creek at Pearsall Rd. at San Antonio (08180750)	Max:			N/A							
		6/30	61	30.0		3.9	95.5	93	1.42	M*	1.0	72
		7/15	76	30.0		3.9	97.6	95.1	.58	82	.9	75
		8/9	101	30.0		4.0	102.1	99.5	.10	33	.1	71
		8/10	102	29.5		4.1	102.8	101	.02	37	.4	71
		8/15	107	29.5		3.7	97.5	99.1	.10	37	.25	72
		Mean:										
		7/3	64	29.0		4.4	97.2	95.9	.47	49	1.0	75
		7/19	80	29.0		3.2	99.4	98.3	.01	55	.5	72
		8/10	102	29.0		4.1	102.8	101	.02	37	.4	71
		8/23	115	29.0		3.9	98.3	97.2	.21	59	1.0	76
		8/12	104	28.5		4.1	100.8	102.2	0	66	.9	75
										* M =		

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
										miss-ing		
1988	Leon Creek at IH-35 at San Antonio (08181480)	too much data missing										
1988	Medina River at San Antonio (08181500)	Max:			N/A							
		7/14	75	30.0		104	96.7	91.9	.51	83.9	.75	75
		7/18	79	30.0		91	98.4	97.4	.22	72.4	.25	72
		8/10	102	30.0		75	102.8	101.1	.02	33.7	.4	71
		8/24	116	30.0		72	101.1	98.7	.05	39.3	.25	73
		8/9	101	29.5		76	102.1	99.7	.19	33.9	.1	71
		Mean:										
		7/15	76	29.0		97	97.2	94.6	.52	80.3	.9	75
		8/9	101	29.0		76	102.1	99.7	.19	33.9	.1	71
		8/17	109	29.0		78	98.2	98.1	.28	39.8	.25	73
		8/22	114	29.0		70	98.6	96.3	.21	66.6	.5	74
		7/1	62	28.5		107	95.4	94.2	1.08	72.6	.75	73
1988	San Antonio River near Elmendorf (08181800)	Max:			N/A							
		7/19	80	31.5		184	98.9	98	.01	63.3	.5	72
		8/24	116	31.5		184	101.6	99	.05	44.1	.25	73
		7/3	64	31.0		228	97.8	96.1	.34	59.7	1.0	75
		7/15	76	31.0		194	97.3	95.1	.50	82.3	.9	75
		8/27	119	31.0		208	99.6	101	.10	45.6	.6	72
		Mean:										
		7/3	64	30.0		228	97.8	96.1	.34	59.7	1.0	75
		7/19	80	30.0		184	98.9	98	.01	63.3	.5	72
		7/27	88	30.0		302	97.2	97	1.10	65.9	X*	75
		8/21	113	30.0		135	98.7	94.9	.21	68.9	1.0	75
		8/23	115	30.0		168	99.5	98.1	.15	59.6	1.0	76

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
											* X = sky obscured	
1988	San Antonio River near Falls City (08183500)	Max:			N/A							
		8/24	116	31.5		129	102.5	99.8	0	43.7	.37	73.7
		8/14	106	31.0		144	99.9	100.3	0	53.7	.6	75.1
		8/16	108	31.0		129	98.5	98.7	0	42.8	.48	74
		8/22	114	31.0		127	99.2	97.8	0	62.3	.41	74.7
		7/4	65	30.5		210	96.4	99	.11	65.5	.65	75.4
		Mean:										
		8/10	102	31.0		157	102.5	101.7	0	40.6	.44	72.4
		8/11	103	30.5		152	101.3	102.2	0	50.3	.15	73.1
		8/24	116	30.5		129	102.5	99.8	0	43.7	.37	73.7
		7/2	63	30.0		246	99.2	missing	0	62	.52	75
		7/18	79	30.0		148	99.2	97.7	0	74.4	.25	72.7
1988	Cibolo Creek near Falls City (08186000)	Max:			N/A							
		8/10	102	32.5		17	102.3	101.5	0	40.6	.44	72.4
		8/7	99	32.0		21	100.8	96.9	.05	54.6	.25	71.4
		8/23	115	32.0		12	100.1	98.8	.11	53.6	.74	76
		8/26	118	32.0		13	100.1	101.2	.08	36.8	.34	71.7
		8/27	119	31.5		13	98.7	101.2	.08	43	.53	72
		Mean:										
		8/6	98	30.0		21	99.5	95.2	.13	44.9	.25	74
		8/12	104	30.0		16	99.6	101.8	0	69.7	.62	75.4
		8/14	106	30.0		15	99.6	100.1	0	53.7	.6	75.1
		8/16	108	29.5		14	98.4	98.5	.02	42.8	.48	74
		8/20	112	29.5		12	97.8	94.5	.13	51.7	.85	75

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1989	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max:			N/A							
		8/31	123	33.5		15	97.8	97.7	0	91	.1	73
		7/15	76	33.0		626	87.8	92.5	.31	33	1.0	73
		7/9	70	32.5		3240	91.1	91.7	.84	54	.4	72
		7/16	77	32.5		590	96	90.3	.31	30	.4	71
		8/24	116	32.5		27	98.8	95.4	.27	77	.75	71
		Mean:										
		8/29	121	31.0		18	97.7	96.3	0	84	.4	69
		9/2	125	31.0		14	99.3	98.2	0	104	.4	71
		7/31	92	30.5		47	96	94.8	.16	69	.4	71
		8/26	118	30.5		22	97.1	97.7	0	107	0	72
		9/7	130	30.0		59	96	97.8	.01	89	.4	73
1989	West Fork Trinity River at Grand Prairie (08049500)	too much data missing										
1989	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	no data										
1989	Trinity River below Dallas	Max:			N/A							
		9/8	131	32.0		650	94.4	96	.05	86.6	0	71

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	(08057410)	9/7	130	30.5		694	95	96.9	.04	58.1	.4	73
		8/31	123	30.0		1110	96.7	97.7	0	62.6	.1	73
		8/24	116	29.0		1810	97.1	95.9	.38	51.2	.75	71
		9/10	133	29.0		717	91.2	94.9	.30	67.7	.75	65
		Mean:										
		9/5	128	30.5		672	97.3	98	.04	46	0	70
		9/1	124	30.0		782	98.5	97.5	0	105.5	0	68
		9/6	129	30.0		680	95.7	97.6	.04	46.3	.4	69
		8/22	114	28.0		2060	95.4	93.9	.83	67.9	0	70
		8/23	115	28.0		1890	97.4	94.8	.77	49.3	.4	71
1989	East Fork Trinity River at Seagoville (08061980)	Max:			N/A							
		7/4	65	29.0		1980	91.7	90.1	.66	31	0	72
		7/6	67	29.0		1440	90.5	91.2	.41	35.1	0	72
		7/7	68	28.5		1120	91.7	90.8	.63	32	.75	70
		8/4	96	28.5		1720	92.3	89.8	.05	132	.4	72
		9/4	127	28.5		1780	98.3	98.2	.04	56.6	0	74
		Mean:										
		7/17	78	28.5		2140	94.9	90.5	1.34	92.3	.75	73
		7/19	80	28.0		1430	92	93.9	1.43	79.4	missing	missing
		8/31	123	28.0		557	96.2	97.8	0	67.7	.1	73
		9/4	127	28.0		1780	98.3	98.2	.04	56.6	0	74
		7/8	69	27.5		1310	85.7	90.8	.80	30.9	1.0	72
1989	East Fork Trinity River	Max:			N/A							
		7/29	90	29.0		1700	93	87.9	.29	58.1	.4	71

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	near Crandall (08062000)	7/28	89	28.5		1680	87.9	88.1	.29	41.6	.75	69
		7/31	92	28.5		1690	94.5	91.8	.11	53.7	.4	71
		8/4	96	28.5		1720	92.4	90	0	130.5	.4	72
		8/5	97	28.5		1710	93.3	89.9	0	118.3	0	72
		Mean:										
		7/17	78	28.5		2140	95.3	90.5	1.10	90.3	.75	73
		7/19	80	28.0		1430	92.3	94.2	1.12	79.7	missing	missing
		7/30	91	28.0		1690	94.4	89.5	.29	57	.4	72
		9/6	129	28.0		1820	96.6	98.3	0	47.7	.4	69
		9/7	130	28.0		1850	95.3	97.7	0	59.1	.4	73
1989	Trinity River near Rosser (08062500)	Max:			N/A							
		8/27	119	30.0		2120	97	95.9	0	44.2	.4	72
		9/5	128	30.0		2450	97.5	98.5	.20	34.9	0	70
		9/6	129	29.5		2470	96.4	98.1	.20	33	.4	69
		9/8	131	29.5		2490	95.1	96.2	.20	72.8	0	71
		7/29	90	29.0		7610	92.8	87.3	.96	48.6	.4	71
		Mean:										
		8/29	121	30.0		1850	97.7	96.1	0	39.2	.4	69
		9/4	127	29.5		2430	98.4	98.2	.20	40.1	0	74
		9/5	128	29.5		2450	97.5	98.5	.20	34.9	0	70
		8/25	117	29.0		3640	95.6	96.3	0	61	.75	72
		9/8	131	29.0		2490	95.1	96.2	.20	72.8	0	71
1989	Trinity River at Trinidad	Max:			N/A							
		8/30	122	30.5		1810	97.8	97.9	.03	48.5	.25	72

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	(08062700)	8/28	120	30.0		2110	97.8	97	0	35.7	.05	72.5
		8/25	117	29.5		3720	96.8	96.6	0	58.2	.75	72.5
		9/8	131	29.5		2480	96.5	96.9	.02	73.6	.05	72
		8/23	115	29.0		4080	96.5	95.1	.23	39.1	.33	71.5
		Mean:										
		8/28	120	29.5		2110	97.8	97	0	35.7	.05	72.5
		9/4	127	29.5		2390	99.4	99.1	.04	43.6	0	73
		9/5	128	29.5		2420	97.8	99.5	.02	35.4	.05	69
		7/6	67	28.5		13800	91.5	91.8	1.07	27.6	0	70.5
		8/23	115	28.5		4080	96.5	95.1	.23	39.1	.33	71.5
1989	San Antonio River at Loop 410 at San Antonio (08178565)	no data										
1989	Salado Creek (lower station) at San Antonio (08178800)	Max:			N/A							
		7/5	66	29.5		5.7	97.3	99.4	.02	36.3	1.0	69
		7/19	80	29.5		3.7	103.3	102.4	0	70.9	.75	72
		8/27	119	29.5		5.6	98.5	96.9	.34	62.6	.75	76
		7/15	76	29.0		3.1	102.4	99.2	0	73.5	.9	68
		8/5	97	29.0		3.7	99.3	97.7	.03	96.7	.9	73
		Mean:										
		8/29	121	29.5		6.8	98.2	98.2	.35	69.3	.25	74

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/8	69	29.0		4.3	97.7	97.8	.06	49.9	1.0	74
		8/24	116	29.0		5.2	96.8	98.3	.15	65	.75	72
		8/7	99	28.5		4.6	97.8	99.4	.06	67.3	.75	72
		8/25	117	28.5		7.3	96.1	97.9	.37	58.7	1.0	75
1989	Medina River at La Coste (08180640)	Max:			N/A							
		7/17	78	30.0		20	102.6	101.7	0	69	.9	72
		7/18	79	30.0		20	101.8	102.4	0	80	.9	72
		7/16	77	29.5		20	102.8	100.1	0	49	.6	74
		9/2	125	29.5		18	99.4	98.2	0	71	.4	75
		7/7	68	29.0		28	97.4	96.9	0	42	.5	73
		Mean:										
		7/10	71	28.5		22	98.2	97.5	0	85	X*	73
		8/31	123	28.5		18	98.4	97.5	.21	69	.6	74
		9/1	124	28.5		18	99.2	97.7	.12	88	.6	74
		9/4	127	28.5		16	100.8	99.7	0	45	0	69
		9/5	128	28.5		17	99.8	100.2	0	49	.1	71
											* X = sky obscured	
1989	Medio Creek at Pearsall Rd. at San Antonio (08180750)	Max:			N/A							
		7/19	80	30.5		4.9	102.8	102.4	0	65	.75	72
		6/20	51	30.0		7.3	97.5	94.6	1.38	40	0	71
		7/15	76	30.0		6.2	102.4	99.2	.01	80	.9	68
		6/21	52	29.5		5.4	96.7	96.7	.44	38	.1	70
		7/7	68	29.5		6.9	97.9	97.4	.01	42	.5	73

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		Mean:										
		8/6	98	29.0		4.1	99.3	98.3	.07	95	.9	74
		5/23	23	28.5		5.2	99.5	99	.17	87	.75	71
		5/26	26	28.5		3.4	101.6	100.3	.02	121	.75	70
		7/11	72	28.5		5.5	98.1	98	.01	70	.1	73
		8/23	115	28.5		4.3	97.6	97.9	.06	66	.75	74
1989	Leon Creek at IH-35 at San Antonio (08181480)	Max:			N/A							
		7/17	78	32.5		2.3	102.5	101.9	.01	69	.9	72
		7/7	68	31.5		1.9	98.2	97.6	.02	42	.5	73
		7/2	63	31.0		2.2	100.9	95	.14	49	.5	73
		7/4	65	31.0		2.3	98	99.2	.01	57	.75	74
		7/11	72	31.0		2.9	97.9	97.9	.01	70	.1	73
		Mean:										
		7/18	79	30.5		2.3	102.1	102.5	0	80	.9	72
		7/19	80	30.5		2.4	102.9	102.4	0	65	.75	72
		7/4	65	29.5		2.3	98	99.2	.01	57	.75	74
		7/7	68	29.5		1.9	98.2	97.6	.02	42	.5	73
		7/2	63	29.0		2.2	100.9	95	.14	49	.5	73
1989	Medina River at San Antonio (08181500)	Max:			N/A							
		6/11	42	32.0		386	96.4	96.5	.99	120.5	1.0	68
		8/6	98	30.5		70	99.7	98.8	.02	97	.9	74
		7/2	63	30.0		68	100.7	94.2	.11	57.1	.5	73
		7/11	72	30.0		69	97.6	98.1	.02	72.4	.1	73
		7/30	91	30.0		71	97.2	93.3	.36	56.2	.75	73

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		Mean:										
		8/28	120	29.5		64	98.5	97.6	.40	64.5	.75	75
		8/29	121	29.5		63	98.4	98.3	.40	71	.25	74
		9/1	124	29.5		61	99.8	98.5	.01	88.3	.6	74
		7/3	64	29.0		69	100.5	96.1	.02	91.2	1.0	73
		8/24	116	29.0		63	97.1	98.4	.12	69.9	.75	72
1989	San Antonio River near Elmendorf (08181800)	Max:			N/A							
		7/18	79	32.0		103	102.6	103.1	0	97.8	.9	72
		8/5	97	32.0		137	99.6	98.3	.01	107.3	.9	73
		8/6	98	32.0		169	99.8	99	.01	98.2	.9	74
		9/4	127	32.0		125	100.7	100.1	.01	50.8	0	69
		5/26	26	31.5		176	100.6	100.1	.02	133.4	.75	70
		Mean:										
		9/3	126	31.0		127	100.4	99.7	0	57.3	.1	73
		7/19	80	30.5		97	103.2	102.8	0	85.2	.75	72
		8/5	97	30.5		137	99.6	98.3	.01	107.3	.9	73
		8/30	122	30.5		145	98.1	98.5	.35	65.4	.6	75
		9/4	127	30.5		125	100.7	100.1	.01	50.8	0	69
1989	San Antonio River near Falls City (08183500)	Max:			N/A							
		6/6	37	32.0		69	98.4	97.4	0	60.1	.21	72.4
		7/18	79	32.0		102	103	103	0	108.9	.67	73.8
		9/2	125	32.0		148	100.4	100.1	0	75.5	.35	76.1
		9/4	127	32.0		139	100.5	101	0	56	.04	70.8
		7/7	68	31.5		146	98.7	99	0	49.8	.47	74.1

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		Mean:										
		7/6	67	31.0		133	98.4	99.7	0	41.1	.69	71.5
		7/14	75	30.5		105	101.8	98.6	0	106.7	.75	71.8
		8/30	122	30.5		147	98.7	99.1	.13	67.9	.43	75.7
		9/1	124	30.5		149	101.4	98.9	0	89.8	.48	74.7
		9/2	125	30.5		148	100.4	100.1	0	75.5	.35	76.1
1989	Cibolo Creek near Falls City (08186000)	Max:			N/A							
		7/15	76	32.5		6.6	102.6	100.1	.03	86.8	.72	70.5
		5/19	19	32.0		17	96	90.3	.71	59.3	.96	74.8
		5/26	26	32.0		11	96.2	97.5	.04	130.9	.57	71.8
		7/13	74	32.0		8.2	100.3	97.4	.04	60.3	.32	72.3
		6/20	51	31.5		29	97.5	95.1	.43	57.4	.26	71.4
		Mean:										
		7/16	77	30.5		6.2	102.6	101.4	.03	82.2	.42	74.4
		7/17	78	30.5		7.2	102.1	102.2	.03	85.7	.62	74.1
		6/6	37	30.0		7.3	97.8	96.6	0	59.7	.21	72.4
		7/14	75	30.0		7.6	101.3	98.1	.04	102.7	.75	71.8
		7/31	92	29.5		9.1	96.8	96.6	.04	56.2	.15	73.1
1990	West Fork Trinity River at Beach Street at Fort Worth	Max:			2774							
		8/31	123	35.0		19	104	101.6	0	27.2	.1	66
		7/1	62	34.5		43	96.5	96	.09	73.8	.1	70
		8/28	120	34.5		21	101.3	101	.09	26.1	0	68
		6/27	58	34.0		115	98.1	95.1	026	86.4	.9	72

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	(08048543)	7/9	70	34.0		59	97.8	96.5	.21	87.1	.4	64
		Mean:										
		8/28	120	32.5		21	101.3	101	.09	26.1	0	68
		8/26	118	32.0		22	101.2	98.6	.09	53.8	0	67
		9/1	124	31.5		17	102.3	102.5	.02	31.6	.25	66
		7/11	72	31.0		8.8	98.3	97.1	.21	84.1	.75	69
		9/5	128	31.0		22	99.9	96.4	.02	29.3	.1	65
1990	West Fork Trinity River at Grand Prairie (08049500)	Max:			829							
		7/2	63	31.0		208	99.1	95.8	0	47.1	0	65
		7/30	91	31.0		212	94	98.5	1.21	26.2	.4	67
		8/20	112	31.0		188	99.1	97.5	0	50.5	.1	71
		8/10	102	30.5		238	95.3	89.2	2.10	48.6	.5	67
		8/12	104	30.5		235	97.4	95.1	.53	30.5	.4	65
		Mean:										
		8/22	114	31.5		193	100.6	100.4	0	25.3	.1	69
		7/5	66	30.5		180	98.8	99	0	44.2	.1	69
		7/30	91	30.5		212	94	98.5	1.21	26.2	.4	67
		7/1	62	30.0		217	97.1	95.4	.10	61.1	.1	70
		8/15	107	30.0		203	95.4	96.5	.03	55.2	.25	69
1990	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	too much data missing			3014							

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1990	Trinity River below Dallas (08057410)	too much data missing			2178							
1990	East Fork Trinity River at Seagoville (08061980)	Max:			695							
		8/29	121	31.5		84	101.1	101.2	0	34.9	0	69
		7/29	90	30.5		62	96.6	95.2	.87	28.2	.25	69
		9/1	124	30.5		75	104.4	101.9	.06	33.7	.25	66
		9/3	126	30.5		70	94.8	102.1	.06	52.8	.6	68
		7/12	73	30.0		432	94.8	96.1	.07	66.3	1.0	69
		Mean:										
		7/11	72	29.5		79	94.6	96.1	.07	71.5	.75	69
		8/22	114	29.5		63	101.8	99.4	0	36.2	.1	69
		9/6	129	29.5		85	100.7	96.7	.06	23	.75	67
		8/21	113	29.0		62	102.4	97.4	0	35.4	.25	67
		9/5	128	29.0		73	99.1	96.6	.06	24.7	.1	65
1990	East Fork Trinity River near Crandall (08062000)	Max:			447							
		8/20	112	31.5		64	98.4	96.6	0	55.5	.1	71
		8/28	120	31.5		86	101.7	100.9	0	28.7	0	68
		8/16	108	31.0		83	94.6	95.7	0	58.9	.1	71
		8/18	110	31.0		70	96.3	95.4	0	77.9	.75	73
		8/23	115	31.0		88	98.6	100.9	0	42.5	.25	69
		Mean:										
		8/20	112	30.5		64	98.4	96.6	0	55.5	.1	71

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		8/22	114	30.5		63	102	99.3	0	36.6	.1	69
		7/30	91	30.0		60	100	96.6	.96	33.9	.4	67
		8/19	111	30.0		66	97.2	95.7	0	79.9	.6	70
		9/4	127	29.5		76	96.5	99.5	.10	28.5	.1	68
1990	Trinity River near Rosser (08062500)	Max:			48							
		9/8	131	31.0		838	99.2	99.9	.02	59.4	.9	69
		8/22	114	30.5		1960	101.9	99.1	0	43.9	.1	69
		7/13	74	30.0		2300	87.8	95.4	0	93	.1	52
		8/18	110	30.0		2780	96.1	95.4	0	76.1	.75	73
		9/19	142	30.0		1010	93.2	93.3	0	67.6	.1	72
		Mean:										
		8/23	115	30.5		1670	98.6	100.6	0	47.9	.25	69
		8/20	112	29.5		2400	98.3	96.6	0	62.7	.1	71
		9/19	142	29.5		1010	93.2	93.3	0	67.6	.1	72
		8/14	106	29.0		4180	94.8	95.8	0	46.4	.75	68
		9/21	144	29.0		915	90.9	92.9	0	54.7	.9	74
1990	Trinity River at Trinidad (08062700)	Max:			42							
		8/27	119	32.0		984	102	99.2	.17	33.8	0	64.5
		8/30	122	32.0		807	101.4	101.7	.09	36.8	.05	68.5
		9/3	126	31.0		737	95.4	101.4	.03	62	.68	68
		9/7	130	31.0		731	99.3	99.1	.06	57.7	.63	68
		8/23	115	30.5		1900	98.1	100	.10	55.8	.5	70.5
		Mean:										
		8/29	121	31.5		829	101.1	101.4	.09	41.9	0	69.5

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		9/6	129	30.5		733	100.4	97.4	.06	34.2	.63	68
		7/12	73	30.0		1630	95.1	96.2	.17	76.1	.95	69.5
		8/21	113	30.0		2320	101.3	97.4	.08	42.7	.18	66.5
		8/23	115	30.0		1900	98.1	100	.10	55.8	.5	70.5
1990	San Antonio River at Loop 410 at San Antonio (08178565)	no data			3491							
1990	Salado Creek (lower station) at San Antonio (08178800)	Max:			2269							
		6/2	33	29.0		8.9	98.7	94.6	.02	126.8	.9	73
		8/16	108	28.5		17	94.6	93.8	.05	75.4	.6	73
		8/17	109	28.5		13	94.1	94.3	0	79.7	.75	75
		8/12	104	28.0		19	93.1	92.6	.05	47.7	.6	72
		8/14	106	28.0		18	93.7	93.3	.05	50	.9	73
		Mean:										
		6/3	34	28.0		9.0	98.9	97.4	.02	105.5	.9	73
		6/7	38	28.0		7.3	98.1	97.5	.21	112.7	.9	72
		8/20	112	28.0		13	96.5	94.7	.04	69.4	.75	73
		8/23	115	28.0		11	95.6	96.7	.08	47.4	.1	74
		8/25	117	28.0		11	97	95.9	.05	74.1	.4	74
1990	Medina River at La Coste (08180640)	Max:			246							
		6/26	57	30.5		e15	101.2	102.1	0	91	.9	74
		6/18	49	30.0		21	98.6	99.5	0	62	.25	73

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		6/25	56	30.0		e13	102.8	100.8	0	76	.1	74
		6/8	39	29.5		16	97.6	99.3	.01	108	.75	72
		6/30	61	29.5		e16	95.4	99.1	.01	124	.25	72
		Mean:										
		6/24	55	29.5		e15	102	99.7	0	44	.1	73
		6/25	56	29.5		e13	102.8	100.8	0	76	.1	74
		6/17	48	29.0		18	99.8	98.8	0	101	.75	72
		6/20	51	29.0		22	99	99.1	0	69	.25	72
		6/30	61	29.0		e16	95.4	99.1	.01	124	.25	72
						e = estimated						
1990	Medio Creek at Pearsall Rd. at San Antonio (08180750)	Max:			763							
		6/17	48	30.0		4.4	99.6	98.7	.01	101	.75	72
		6/25	56	30.0		4.6	102.4	100.5	0	76	.1	74
		6/27	58	30.0		4.3	99.8	101.6	0	66	.6	74
		8/5	97	30.0		6.1	93.6	91.6	.29	48	.9	74
		8/17	109	30.0		4.8	94.6	94.2	0	81	.75	75
		Mean:										
		6/27	58	29.0		4.3	99.8	101.6	0	66	.6	74
		8/26	118	29.0		4.5	97.7	96.4	0	66	0	74
		8/31	123	29.0		4.0	98.6	96.9	.07	42	.1	74
		6/22	53	28.5		4.0	98.9	98.6	0	71	.75	73
		8/2	94	28.5		6.5	90.9	91.9	.22	44	.9	74

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1990	Leon Creek at IH-35 at San Antonio (08181480)	Max:			1864							
		6/8	39	29.0		4.4	97.6	98.6	.03	108	.75	72
		6/25	56	29.0		2.5	102.2	100.4	0	76	.1	74
		6/27	58	29.0		2.7	99.7	101.4	0	66	.6	74
		6/21	52	28.5		2.8	98.6	98.5	0	80	.25	70
		8/22	114	28.5		5.0	96.2	96.2	.04	36	.5	73
		Mean:										
		8/19	111	28.0		4.9	95.1	94.6	.04	73	1.0	75
		8/31	123	28.0		4.8	98.5	97	.07	42	.1	74
		6/26	57	27.5		2.7	100.6	101.5	0	91	.9	74
		8/15	107	27.5		5.9	94.4	93.1	0	88	1.0	74
		8/27	119	27.5		5.0	99.8	96.7	.03	76	0	63
1990	Medina River at San Antonio (08181500)	Max:			114							
		6/22	53	30.5		49	98.9	98.4	0	78.7	.75	73
		6/25	56	30.5		46	102.1	100.5	0	78	.1	74
		6/18	49	30.0		48	98.7	98.9	.05	69.1	.25	73
		7/4	65	30.0		50	98.8	96.9	.14	63	missing	72
		8/26	118	30.0		101	98.1	96.5	.03	67.7	0	74
		Mean:										
		6/23	54	29.5		52	101.1	98.7	0	50.1	.1	75
		6/25	56	29.5		46	102.1	100.5	0	78	.1	74
		6/3	34	29.0		77	99	97.7	.01	110.2	.9	73
		6/16	47	29.0		56	99	97.7	.06	105.5	.9	73
		6/29	60	29.0		46	98.1	99.7	0	79	1.0	72

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1990	San Antonio River near Elmendorf (08181800)	Max:			87							
		6/23	54	32.5		87	101.5	99.2	0	54.4	.1	75
		6/18	49	32.0		84	99.1	99.4	.05	70.1	.25	73
		6/25	56	32.0		113	102.4	101	0	80.2	.1	74
		7/12	73	31.5		88	98.2	97.6	.45	63.8	.25	70
		8/30	122	31.5		208	97.2	98.4	.09	47.1	.6	74
		Mean:										
		6/24	55	31.0		72	102	100	0	53.2	.1	73
		6/28	59	30.5		90	99.2	100.8	0	65.8	.9	73
		6/19	50	30.0		91	98.2	99.5	0	55.4	.25	71
		7/12	73	30.0		88	98.2	97.6	.45	63.8	.25	70
		8/26	118	30.0		245	98.3	96.7	.01	67.4	0	74
1990	San Antonio River near Falls City (08183500)	Max:			15							
		7/12	73	33.0		91	98	97.3	1.11	73.4	.25	71.4
		6/9	40	32.0		139	96.3	97.3	0	101.4	.43	72
		6/29	60	32.0		51	96.6	98.9	0	85.3	.74	72
		7/6	67	31.5		78	98.1	98.8	0	90.8	.91	73.4
		7/8	69	31.5		72	93.6	97	.22	79.8	.85	72.7
		Mean:										
		6/24	55	32.0		67	101.9	100.1	0	64.9	.07	73.4
		6/20	51	31.0		53	98.6	98.1	0	73	.20	72
		6/21	52	31.0		61	98.8	98.1	0	89.1	.20	70
		6/4	35	30.5		166	96.7	97.9	0	95.7	.85	69.5
		6/30	61	30.5		58	94.3	98.1	0	90.5	.25	72.4

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1990	Cibolo Creek near Falls City (08186000)	too much data missing			15							
1991	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max:			N/A							
		8/8	100	36.5		20	97.3	97.9	0	45.9	.1	70
		8/4	96	36.0		28	98.1	96.2	.35	53.2	.1	72
		8/7	99	36.0		21	97.9	98	0	49.7	.1	71
		7/6	67	35.5		50	94.6	94.6	.67	21.9	.1	74
		8/3	95	35.0		31	96.2	95.5	1.13	41.5	0	70
		Mean:										
		7/7	68	32.5		40	97	94	.73	46.1	0	73
		6/25	56	32.0		74	94.4	93.5	.66	50	0	71
		8/23	115	32.0		56	87.7	93.8	.04	40.3	.1	70
		8/2	94	31.5		36	96.4	95.3	1.75	19.1	0	68
		8/26	118	31.5		36	90.4	90.4	.04	13.2	0	66
1991	West Fork Trinity River at Grand Prairie (08049500)	Max:			N/A							
		7/2	63	31.0		e239	97.3	93.8	.10	30.8	.1	71
		7/14	75	31.0		201	98	96.6	0	18.8	.9	68
		7/17	78	31.0		206	96.7	98.5	.01	21.7	.25	66
		7/22	83	31.0		169	97.5	97.8	.01	76	.1	71
		8/9	101	31.0		203	97.5	98	0	35.6	.1	71
		Mean:										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		8/8	100	31.0		202	98.1	98.1	0	25.4	.1	70
		7/14	75	30.5		201	98	96.6	0	18.8	.9	68
		8/3	95	30.5		217	97	96	.99	29.7	0	70
		7/19	80	30.0		176	99	97.6	.01	48.1	.25	68
		7/21	82	30.0		167	97.2	98.1	.01	87.1	.1	73
						e = estimated						
1991	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	too much data missing										
1991	Trinity River below Dallas (08057410)	Max:			N/A							
		8/6	98	32.5		568	98	97.5	0	56.5	.5	70
		8/1	93	32.0		653	95.9	93.9	1.52	25.8	.1	66
		8/8	100	32.0		558	98	97.7	0	42	.1	70
		7/16	77	31.5		601	98.2	98.9	.02	31.1	.1	70
		7/18	79	31.0		589	97.2	98	0	27.2	0	62
		Mean:										
		8/6	98	32.0		568	98	97.5	0	56.5	.5	70
		8/9	101	32.0		552	97.5	97.7	.18	50.7	.1	71
		8/2	94	31.5		620	96.5	95.5	1.28	17.1	0	68
		8/29	121	31.0		756	92.3	91.3	1.0	53.3	.1	72
		7/17	78	30.5		597	96.4	98.6	0	28.1	.25	66

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1991	East Fork Trinity River at Seagoville (08061980)	Max:			N/A							
		8/8	100	31.0		52	97.8	97.7	0	40.3	.1	70
		6/27	58	30.5		104	92.4	93.3	1.41	48	.1	73
		6/28	59	30.5		93	94.2	93.1	1.41	58.5	.1	73
		7/5	66	30.5		103	94.1	96.6	0	21.5	0	70
		8/7	99	30.5		61	96.8	98	0	40.4	.1	71
		Mean:										
		8/6	98	30.0		60	98.2	97.2	0	55.1	.5	70
		8/7	99	30.0		61	96.8	98	0	40.4	.1	71
		6/28	59	29.5		93	94.2	93.1	1.41	58.5	.1	73
		7/14	75	29.5		64	98.2	95.8	.03	31.1	.9	68
		7/23	84	29.5		68	97.5	97.3	0	53.3	.1	70
1991	East Fork Trinity River near Crandall (08062000)	too much data missing										
1991	Trinity River near Rosser (08062500)	Max:			N/A							
		7/6	67	31.0		1010	96.3	96.5	0	35.1	.1	74
		8/4	96	31.0		704	96.8	95.9	.66	55	.1	72
		8/5	97	31.0		682	97.7	96.5	0	55.6	.5	70
		7/1	62	30.5		871	93.9	92.8	0	54.6	.75	70
		7/18	79	30.5		e721	96.3	97.9	0	34.2	0	62
		Mean:										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		6/22 7/15 8/4 8/5 6/20	53 76 96 97 51	30.5 30.5 30.5 30.5 30.0		1210 e699 704 682 1380 e = estimated	93.8 98.5 96.8 97.7 93.7	93.7 96.5 95.9 96.5 88.9	.20 0 .66 0 .20	64 23.8 55 55.6 24.1	.75 1.0 .1 .5 .75	75 67 72 70 71
1991	Trinity River at Trinidad (08062700)	too much data missing										
1991	San Antonio River at Loop 410 at San Antonio (08178565)	no data										
1991	Salado Creek (lower station) at San Antonio (08178800)	Max: 6/22 7/31 8/12 8/16 8/17 Mean:	53 92 104 108 109	28.0 28.0 28.0 28.0 28.0	N/A	15 8.3 10 9.2 9.8	97.6 101.7 100.3 96.3 98	96.1 98.2 97.4 97.1 95.8	1.42 .10 .53 .03 .06	70.7 33.3 67.9 56.3 54.8	.9 .1 .6 .9 1.0	75 64 74 74 74

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		8/13	105	28.0		9.3	100.4	98.6	.37	64.6	1.0	73
		8/19	111	27.5		10	98.3	97.6	.15	30.8	.9	72
		8/30	122	27.5		7.6	98.7	95.9	.33	50.2	.5	73
		6/28	59	27.0		12	93	93.1	1.56	67	.25	75
		7/26	87	27.0		12	95.4	92.6	.55	55.3	.6	74
1991	Medina River at La Coste (08180640)	Max:			N/A							
		6/18	49	29.0		31	97.4	95	.82	21	.1	70
		6/19	50	29.0		28	95.2	96.3	.49	28	.4	71
		6/20	51	29.0		27	95	95.6	.49	33	.5	70
		7/15	76	28.5		30	94.6	92.9	.01	38	1.0	74
		8/19	111	28.5		e27	98.2	97.7	.27	21	.9	72
		Mean:										
		6/19	50	28.0		28	95.2	96.3	.49	28	.4	71
		7/19	80	28.0		22	96.8	95.9	0	55	.1	73
		8/2	94	28.0		e24	98.2	100.9	0	79	0	71
		7/14	75	27.5		32	94	91.3	.12	53	1.0	74
		8/10	102	27.5		e25	97.2	95.4	.26	45	.75	74
						e = estimated						
1991	Medio Creek at Pearsall Rd. at San Antonio (08180750)	Max:			N/A							
		6/22	53	30.0		5.6	98.6	96	1.30	75	.9	75
		6/15	46	29.0		5.8	93.7	96	.51	69	.75	68
		7/21	82	29.0		4.2	96.3	96.4	.01	68	1.0	75
		7/31	92	29.0		4.6	101.5	98.8	0	30	.1	64

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		8/21	113	29.0		4.6	99.5	97.7	.21	34	.75	74
		Mean:										
		6/5	36	28.0		5.5	96	93.7	.10	49	1.0	74
		6/27	58	28.0		4.7	94.9	92.6	2.09	71	.75	74
		7/17	78	28.0		3.9	96.2	94.9	.01	29	.4	72
		7/21	82	28.0		4.2	96.3	96.4	.01	68	1.0	75
		8/21	113	28.0		4.6	99.5	97.7	.21	34	.75	74
1991	Leon Creek at IH-35 at San Antonio (08181480)	Max:			N/A							
		7/21	82	28.5		7.3	96.2	96.5	.01	68	1.0	75
		7/27	88	28.5		6.8	95.3	94.7	.41	61	.75	74
		7/31	92	28.5		4.7	101.6	98.5	0	30	.1	64
		8/10	102	28.5		4.7	96.8	95.4	.72	45	.75	74
		8/18	110	28.5		3.5	98.1	96	.14	21	.4	72
		Mean:										
		7/7	68	27.5		38	92.8	91	1.71	50	.9	75
		7/19	80	27.5		8.8	96.8	96.2	.01	55	.1	73
		7/22	83	27.5		6.7	93.7	96.4	.19	29	.75	74
		8/4	96	27.5		3.7	97.3	99.1	0	57	1.0	75
		8/30	122	27.5		3.1	99.1	96.1	.33	45	.5	73
1991	Medina River at San Antonio (08181500)	Max:			N/A							
		8/12	104	30.0		134	100	97.3	.66	75.8	.6	74
		7/18	79	29.5		176	96.3	95.6	.04	43.4	.5	71
		7/31	92	29.5		165	101.5	98.2	.10	35.6	.1	64
		8/16	108	29.5		131	96.2	97.1	.03	59.3	.9	74

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		8/22	114	29.5		127	99.2	98.6	.23	41.6	.4	74
		Mean:										
		8/11	103	29.0		135	98.5	96.1	.80	70.1	.4	73
		8/12	104	29.0		134	100	97.3	.66	75.8	.6	74
		8/18	110	29.0		128	98.3	95.8	.13	35.9	.4	72
		7/22	83	28.5		163	94.2	96.2	.18	46.2	.75	74
		8/3	95	28.5		158	98	100.3	.10	56.8	.9	75
1991	San Antonio	Max:			N/A							
	River near	7/19	80	32.0		304	97	96.5	.01	57.9	.1	73
	Elmendorf	7/29	90	32.0		343	98.6	95.9	.62	46.6	.25	74
	(08181800)	8/18	110	32.0		388	98.6	95.9	.12	41	.4	72
		7/16	77	31.5		309	95.8	94.9	0	35.7	.5	69
		7/17	78	31.5		268	96.9	95.5	.01	35.4	.4	72
		Mean:										
		7/31	92	30.5		308	101.9	98.6	.10	34.4	.1	64
		7/18	79	30.0		264	96.8	96	.01	42.3	.5	71
		7/19	80	30.0		304	97	96.5	.01	57.9	.1	73
		8/14	106	30.0		283	97.6	99.9	.17	66.7	1.0	71
		8/29	121	30.0		444	97.4	95.8	.55	62.9	.9	75
1991	San Antonio	Max:			N/A							
	River near	8/20	112	31.5		328	97.4	98.3	.37	39.8	.25	69.2
	Falls City	8/1	93	31.0		236	98.9	99.1	.27	42.5	0	65.8
	(08183500)	8/2	94	31.0		221	97.6	99.5	.27	53.9	.04	72.4
		8/3	95	31.0		206	96.9	98.9	.27	61.4	.62	74.7

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		8/21	113	31.0		283	98.5	98.2	.37	50.1	.58	74.7
		Mean:										
		7/17	78	30.5		360	95.1	93.9	0	37	.35	72.7
		7/21	82	30.5		325	95	95.2	0	79.6	.74	75.4
		7/31	92	30.5		245	100.3	97.7	.27	41	.07	67.2
		8/18	110	30.5		250	99.2	95.1	0	53.7	.44	73.1
		8/21	113	30.5		283	98.5	98.2	.37	50.1	.58	74.7
1991	Cibolo Creek near Falls City (08186000)	Max:			N/A							
		7/18	79	32.5		23	93.7	93.2	0	48.7	.36	71.7
		7/21	82	32.5		20	94.2	93.9	0	78.6	.74	75.4
		6/16	47	32.0		29	93.1	94.6	1.13	68.4	.57	76.4
		7/5	66	32.0		31	91.9	91.2	1.24	30.4	.30	73.1
		7/16	77	32.0		25	93.2	92.5	0	39.5	.41	70.8
		Mean:										
		6/22	53	30.5		25	95.5	94.5	1.78	92.3	.85	76.4
		6/16	47	30.0		29	93.1	94.6	1.13	68.4	.57	76.4
		7/6	67	30.0		28	93.2	91.3	.86	38.3	.85	74.7
		7/19	80	30.0		22	94.2	93.7	0	64.4	.06	73.7
		7/31	92	29.5		23	98.9	96.8	.23	40.8	.06	67.2
1992	West Fork Trinity River at Beach Street at Fort	Max:			N/A							
		10/3/91	156	35.5		38	86.9	83.6	0	67.6	0	63
		8/11	103	35.0		34	95.4	96.4	0	29.3	.75	72
		7/24	85	34.5		41	95.8	91.3	.48	66.8	.1	74

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	Worth (08048543)	9/21	144	34.5		1120	95	92.8	.68	126	.4	73
		7/23	84	33.5		45	94.6	90.2	.54	78	.1	73
		Mean:										
		8/10	102	32.5		37	97.2	95.8	0	67.2	.75	72
		8/9	101	31.5		37	96.4	95.5	.08	83.4	0	73
		7/23	84	30.5		45	94.6	90.2	.54	78	.1	73
		7/2	63	30.0		1150	94.7	88.4	2.81	95.3	.9	76
		7/8	69	30.0		521	94.6	94.5	.02	135.6	.1	72
1992	West Fork Trinity River at Grand Prairie (08049500)	Max:			N/A							
		7/26	87	31.5		221	97.4	95	.09	68.2	.25	72
		7/23	84	30.5		261	93.5	89.7	.33	61.1	.1	73
		7/30	91	30.5		400	95.8	95.2	.98	63	.5	72
		8/6	98	30.5		288	95	93.9	1.72	54.3	.9	71
		7/31	92	30.0		2390	94.1	94.6	2.21	81.1	1.0	68
		Mean:										
		7/26	87	31.0		221	97.4	95	.09	68.2	.25	72
		7/27	88	30.5		222	97.6	96.2	.16	59.7	.75	72
		8/6	98	30.0		288	95	93.9	1.72	54.3	.9	71
		7/23	84	29.5		261	93.5	89.7	.33	61.1	.1	73
		9/8	131	29.0		185	94.4	90.4	.90	89.6	0	72
1992	Trinity River at Cedar Crest Blvd. at Dallas	Max:			N/A							
		7/25	86	32.0		457	95.6	92.5	.29	67.8	0	74
		7/10	71	30.0		912	94.7	94.2	0	108.7	.1	72
		7/11	72	30.0		829	94.6	94.3	0	102.8	.25	71

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	(08057055)	8/12	104	30.0		577	91.3	95.9	.27	55.2	.9	72
		6/19	50	29.5		3920	94.6	94.1	.06	62	.9	71
		Mean:										
		7/15	76	29.5		551	95.8	95	0	100.9	.9	73
		7/12	73	29.0		681	95.1	94.4	0	167.9	.25	71
		7/14	75	29.0		556	95.3	94.7	0	129.7	.25	71
		7/28	89	29.0		2150	96	96.8	.59	41.1	.9	74
		9/8	131	29.0		433	93.3	90.2	1.13	89.9	0	72
1992	Trinity River below Dallas (08057410)	Max:			N/A							
		7/26	87	31.5		732	96.7	94.1	.13	74.1	.25	72
		8/10	102	31.5		778	95.8	94.9	0	59.6	.75	72
		8/5	97	30.5		957	93.8	93	2.12	58.3	.5	71
		8/6	98	30.5		877	94	93.1	2.00	58.8	.9	71
		7/28	89	30.0		1910	96.3	96.4	.63	41.8	.9	74
		Mean:										
		8/9	101	30.5		777	95.2	94.4	.06	74	0	73
		8/11	103	30.5		778	95.6	95.2	.01	29.7	.75	72
		8/6	98	30.0		877	94	93.1	2.00	58.8	.9	71
		8/12	104	30.0		818	91	95.5	.26	55.3	.9	72
		9/8	131	29.0		758	92.8	90.1	1.19	89.6	0	72
1992	East Fork Trinity River at Seagoville (08061980)	Max:			N/A							
		7/25	86	31.0		41	94.7	91.6	.34	62.5	0	74
		7/27	88	31.0		38	96.9	94.9	.11	68.4	.75	72
		8/10	102	31.0		71	95	93.9	0	55.8	.75	72

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/2	63	30.0		156	93.5	87.2	2.54	129.5	.9	76
		7/23	84	30.0		39	92	89.1	.35	56.9	.1	73
		Mean:										
		7/25	86	30.0		41	94.7	91.6	.34	62.5	0	74
		7/26	87	30.0		40	95.7	93.7	.20	70.2	.25	72
		8/10	102	30.0		71	95	93.9	0	55.8	.75	72
		7/19	80	29.5		110	89.1	91.8	.15	37.7	.9	70
		7/24	85	29.5		44	94.4	89.5	.35	60.6	.1	74
1992	East Fork Trinity River near Crandall (08062000)	Max:			N/A							
		7/27	88	31.5		38	96.9	95	.10	68.1	.75	72
		8/11	103	31.0		83	95.7	94.2	.01	29.6	.75	72
		6/19	50	30.5		40	92.6	92.8	.05	59.1	.9	71
		7/2	63	30.5		156	93.5	87.2	2.44	128.6	.9	76
		7/13	74	30.0		33	93.6	93.7	0	135.8	.5	72
		Mean:										
		8/10	102	30.5		71	94.9	93.8	0	55.4	.75	72
		7/28	89	30.0		93	97.2	95.8	.77	41.8	.9	74
		7/10	71	29.0		45	93.3	93.3	0	98.7	.1	72
		7/11	72	29.0		38	94	93.2	0	109.1	.25	71
		7/23	84	29.0		39	92.2	89.2	.34	56.2	.1	73
1992	Trinity River near Rosser (08062500)	Max:			N/A							
		8/9	101	31.0		1050	94.6	93.2	.20	63.8	0	73
		8/7	99	30.5		1180	93.4	92.2	.42	58.6	.1	70
		8/12	104	30.5		1060	92.3	95.3	0	57	.9	72

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/24	85	30.0		1040	94.2	89.5	.33	54.7	.1	74
		6/21	52	29.5		4610	90	92.8	.11	56.6	1.0	68
		Mean:										
		8/10	102	31.0		1050	94.8	93.9	0	52.8	.75	72
		8/7	99	30.0		1180	93.4	92.2	.42	58.6	.1	70
		7/10	71	29.0		e1640	93	93.3	0	87.2	.1	72
		7/31	92	29.0		2610	95.5	94.1	2.89	79.4	1.0	68
		8/13	105	29.0		1640	84.9	94.6	.53	48.3	missing	missing
						e = estimated						
1992	Trinity River at Trinidad (08062700)	Max:			N/A							
		8/10	102	32.0		984	95.9	94.3	0	58.2	.43	72.5
		8/11	103	31.5		976	96.7	94.9	0	35.7	.43	72
		7/28	89	31.0		969	95.1	94.1	.63	61.2	.95	74.5
		7/14	75	30.5		1240	94	93.6	0	127.9	.18	72
		7/12	73	30.0		1540	93.7	92.9	0	159.7	.58	72
		Mean:										
		8/13	105	30.5		990	87.5	95.1	.58	58.7	missing	missing
		7/30	91	30.0		2980	93.7	93.7	.87	83.6	.3	72.5
		7/13	74	29.5		1380	93.6	93.4	0	140.3	.3	72
		7/31	92	29.5		2340	94	93.3	1.17	92.5	1.0	67.5
		8/6	98	29.5		1490	93.6	92.3	1.07	61.1	.58	72

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1992	San Antonio River at Loop 410 at San Antonio (08178565)	no data										
1992	Salado Creek (lower station) at San Antonio (08178800)	Max:			N/A							
		8/3	95	29.5		301	92	94.9	1.07	30.1	1.0	69
		7/24	85	28.5		48	92.8	87.7	1.95	48.2	.75	73
		7/28	89	28.5		33	93.9	93.6	.26	38.9	.9	72
		7/31	92	28.5		33	94.4	94.2	0	48.4	.9	73
		8/9	101	28.5		40	95.3	95.7	1.08	50.2	.75	74
		Mean:										
		7/26	87	28.0		37	93.9	92.5	1.20	49.9	.75	72
		7/9	70	27.5		51	94.9	94.7	.10	80.9	1.0	71
		7/13	74	27.5		47	94.1	94	0	82.4	.9	72
		7/18	79	27.5		42	95.1	95.8	.02	53.2	.9	73
		9/8	131	27.5		16	96.5	96.4	.05	65.6	.9	73
1992	Medina River at La Coste (08180640)	Max:			N/A							
		6/24	55	28.5		886	94.6	92.1	0	43	.1	71
		6/30	61	28.5		915	92.6	92.9	.87	23	.9	75
		6/23	54	28.0		967	93.6	91.5	0	86	.25	72
		8/5	97	27.5		197	94.6	92.9	.93	34	.5	72
		8/8	100	27.5		158	94.6	95.1	.93	45	.9	73
		Mean:										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		6/26	57	27.5		736	92.6	94.3	0	M*	.75	73
		6/27	58	27.5		701	91.6	94	0	24	.75	70
		6/30	61	27.5		915	92.6	92.9	.87	23	.9	75
		7/16	77	27.0		333	96.2	95.1	0	97	.9	71
		8/12	104	27.0		178	91.6	95.6	.63	9	.75	70
										* M = miss-ing		
1992	Medio Creek at Pearsall Rd. at San Antonio (08180750)	Max:			N/A							
		7/2	63	30.5		6.7	95	94.7	.73	78	1.0	73
		7/15	76	30.0		5.6	96.2	93.9	0	64	.5	73
		7/26	87	30.0		6.2	93.7	92.2	.61	44	.75	72
		8/8	100	30.0		5.8	95.3	95.2	.99	45	.9	73
		8/9	101	30.0		6.0	95.1	95.4	.98	41	.75	74
		Mean:										
		8/7	99	29.0		6.1	96.1	94.3	.99	50	.6	73
		8/11	103	29.0		6.0	97.3	95.3	.16	31	.1	69
		6/17	48	28.5		10	91.7	91.5	.52	80	1.0	72
		7/17	78	28.5		5.3	95.2	95.8	0	39	1.0	73
		9/8	131	28.5		5.7	95.8	96.1	.01	60	.9	73
1992	Leon Creek at IH-35 at San Antonio (08181480)	Max:			N/A							
		7/26	87	28.5		13	93.9	92.4	.92	44	.75	72
		7/27	88	28.5		14	93.5	93.2	.56	34	.25	72
		9/4	127	28.5		11	97.6	97	.19	53	.9	71

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		6/15	46	28.0		113	91.9	90.5	1.47	53	.75	74
		7/15	76	28.0		16	96.2	94.1	0	64	.5	73
		Mean:										
		6/16	47	27.5		102	92.4	91.1	.68	69	.9	73
		8/5	97	27.5		24	94.9	93.4	1.02	34	.5	72
		8/9	101	27.5		14	95.3	95.7	.89	41	.75	74
		8/10	102	27.5		13	95.9	95.7	.08	28	.6	74
		8/13	105	27.5		37	91.1	95.7	.70	23	missing	missing
1992	Medina River at San Antonio (08181500)	Max:			N/A							
		7/2	63	28.0		915	95.5	94.2	.75	91.5	1.0	73
		7/28	89	28.0		487	93.6	93.4	.25	43	.9	72
		8/5	97	28.0		420	94.9	93.6	1.01	43.6	.5	72
		8/6	98	28.0		405	95.4	93.5	1.01	51.5	.75	73
		8/9	101	28.0		364	95.5	95.8	.94	52.7	.75	74
		Mean:										
		7/2	63	28.0		915	95.5	94.2	.75	91.5	1.0	73
		8/7	99	27.5		393	96.1	94.5	1.01	60.6	.6	73
		8/11	103	27.5		346	97.1	95.8	.13	36.7	.1	69
		9/8	131	27.5		258	96.6	96.5	.04	66.2	.9	73
		7/29	90	27.0		476	94.1	93.6	.07	58.2	.9	72
1992	San Antonio River near Elmendorf (08181800)	Max:			N/A							
		9/5	128	29.5		401	97.1	98.3	.04	72.2	.9	73
		7/2	63	29.0		1560	95.9	94.5	.53	99.1	1.0	73
		7/16	77	29.0		763	96.7	95.6	0	104	.9	71

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/30	91	29.0		694	95.2	94.3	0	64.8	.6	72
		9/7	130	29.0		393	97	97.5	.02	61.6	.75	74
		Mean:										
		8/7	99	28.5		616	97.1	95.2	.85	62.7	.6	73
		7/18	79	28.0		718	95.8	96.3	.02	62	.9	73
		7/29	90	28.0		708	94.6	94.2	.04	56.2	.9	72
		9/2	125	28.0		435	97.6	95.7	.08	95.5	1.0	73
		9/4	127	28.0		426	98.4	97.7	.04	64.4	.9	71
1992	San Antonio River near Falls City (08183500)	Max:			N/A							
		8/7	99	32.0		886	96.1	95.1	.39	71.7	.43	74.1
		6/18	49	31.0		3430	92.5	92.1	0	71	.69	72.7
		8/4	96	31.0		1560	94.2	94	.39	39.2	.36	73.4
		8/12	104	31.0		759	94.3	96.4	0	39.2	.80	70.7
		9/4	127	31.0		592	97.7	96.8	0	68.7	.85	72.4
		Mean:										
		8/7	99	31.5		886	96.1	95.1	.39	71.7	.43	74.1
		8/14	106	30.5		892	92	94.1	0	36.2	.42	70.1
		9/3	126	30.5		601	97.6	96.1	0	85	.67	73.7
		9/5	128	30.5		589	96.8	97.4	0	71.4	.73	73.4
		6/27	58	30.0		1950	93.8	94.3	0	43.7	.58	70.7
1992	Cibolo Creek near Falls City (08186000)	no data										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1993	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max:			N/A							
		7/20	81	36.0		14	97.6	97	0	73.2	.1	72
		7/19	80	35.5		14	98.3	96.3	0	83.1	.1	71
		8/19	111	35.5		25	102.4	101.3	0	79	0	64
		8/16	108	35.0		29	101.3	101.1	0	98	.25	69
		6/3	34	34.5		43	101	87	.24	163.7	0	73
		Mean:										
		8/15	107	31.0		28	101.1	100.9	0	97.5	.25	68
		8/16	108	31.0		29	101.3	101.1	0	98	.25	69
		8/19	111	31.0		25	102.4	101.3	0	79	0	64
		6/4	35	30.0		38	96	92.4	.18	159.8	.25	71
		8/2	94	30.0		32	100.8	103.4	0	53	.9	71
1993	West Fork Trinity River at Grand Prairie (08049500)	too much data missing										
1993	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	Max:			N/A							
		7/31	92	32.0		779	102.4	101.4	0	55.7	0	71
		8/11	103	32.0		468	100.5	96.4	.53	67	.5	69
		8/19	111	32.0		411	101.4	101.1	0	56.2	0	64
		8/20	112	32.0		407	102.2	101.6	0	50	0	64
		8/21	113	32.0		424	102	101.7	0	40	0	63

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		Mean:										
		7/30	91	31.0		610	103.1	100.1	0	40.4	0	72
		8/21	113	31.0		424	102	101.7	0	40	0	63
		8/10	102	30.5		508	100.5	91.2	.74	80	.75	72
		8/16	108	30.5		433	100.5	100.8	0	71	.25	69
		8/2	94	30.0		768	100.5	102.9	.01	51.7	.9	71
1993	Trinity River below Dallas (08057410)	Max:			N/A							
		8/12	104	31.0		642	99.8	99.1	.47	83.3	.1	69
		8/14	106	31.0		579	100.5	100	.11	59.8	.1	69
		8/22	114	31.0		594	101.6	101.6	0	71.1	.25	67
		8/23	115	31.0		614	100.1	101.7	0	111.1	.1	70
		8/25	117	30.5		624	98.6	100.2	0	72.2	.25	70
		Mean:										
		7/31	92	31.0		934	102.3	100.8	0	55.1	0	71
		8/11	103	30.5		671	100.1	95.8	.56	66.2	.5	69
		8/15	107	30.5		559	100.9	100.1	0	72	.25	68
		8/22	114	30.5		594	101.6	101.6	0	71.1	.25	67
		8/28	120	30.0		583	96.8	98.4	.01	59.5	.1	70
1993	East Fork Trinity River at Seagoville (08061980)	Max:			N/A							
		7/29	90	32.5		74	100.3	98.8	0	46.7	.1	71
		7/20	81	31.5		79	97.4	95.7	0	53.7	.1	72
		7/28	89	31.5		79	98.7	98.9	0	84.8	.1	72
		8/10	102	31.5		84	99.1	90.4	.57	72.5	.75	72
		8/13	105	31.5		68	99.4	99.3	.55	60.9	.75	68

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		Mean:										
		7/20	81	30.0		79	97.4	95.7	0	53.7	.1	72
		7/22	83	30.0		79	97.5	96.9	0	95.4	.25	72
		7/26	87	29.5		71	99.1	98.1	0	102.9	.25	69
		7/27	88	29.5		69	98.7	98.7	0	90.8	.1	67
		7/14	75	29.0		83	93.5	93.8	0	133.8	1.0	72
1993	East Fork Trinity River near Crandall (08062000)	too much data missing										
1993	Trinity River near Rosser (08062500)	Max:			N/A							
		8/10	102	30.0		1220	99.3	92	.17	67.2	.75	72
		7/16	77	29.5		3560	94.8	93.5	0	76.1	.25	72
		7/21	82	29.5		4100	96.8	96.1	0	58.6	0	71
		7/27	88	29.5		2360	98.5	98.6	0	75.8	.1	67
		8/6	98	29.5		1230	99.3	97.7	0	81.3	1.0	69
		Mean:										
		8/10	102	29.5		1220	99.3	92	.17	67.2	.75	72
		9/1	124	29.5		1390	96	96.5	.03	47.6	1.0	67
		9/2	125	29.5		1110	96.9	96.5	.03	27.9	.25	67
		7/22	83	29.0		4090	97.5	96.6	0	81.1	.25	72
		7/23	84	29.0		4120	97	97.1	0	90.2	.1	69
1993	Trinity River	Max:			N/A							

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	at Trinidad (08062700)	8/2	94	32.5		1190	99.1	100.5	.02	50.2	.83	70
		8/19	111	32.0		816	99.6	99.5	0	39	0	63.5
		7/30	91	31.5		2010	100.3	97.8	0	42.1	0	72
		8/22	114	31.5		777	100.2	100.5	0	60.7	.13	68.5
		8/4	96	31.0		1130	97	99.9	.05	52.8	.38	70.5
		Mean:										
		8/18	110	31.5		812	99.9	99.3	0	56.8	.05	68
		8/21	113	31.5		792	101	100.1	0	36.1	0	63.5
		7/30	91	31.0		2010	100.3	97.8	0	42.1	0	72
		7/31	92	31.0		1210	100.7	99	.02	47.7	0	71
		8/13	105	31.0		893	98.4	98.1	.40	57.5	.38	69
1993	San Antonio River at Loop 410 at San Antonio (08178565)	Max:			N/A							
		8/14	106	32.5		e34	98.6	97.5	0	63.5	.9	74
		8/4	96	32.0		57	98	98.2	0	54.3	.9	72
		8/7	99	32.0		50	98.4	98.1	0	56	.75	72
		8/21	113	32.0		e31	98.1	98.3	0	49.3	.1	66
		8/29	121	31.5		24	96.2	93.6	.07	72	.75	72
		Mean:										
		8/14	106	30.0		e34	98.6	97.5	0	63.5	.9	74
		7/28	89	29.5		85	96.7	96.6	0	56.5	.75	74
		8/3	95	29.5		62	97.8	97.7	0	57.4	.75	73
		8/4	96	29.5		57	98	98.2	0	54.3	.9	72
		8/6	98	29.5		52	98.3	98	0	68.3	.1	72

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
						e = estimated						
1993	Salado Creek (lower station) at San Antonio (08178800)	Max:			N/A							
		7/30	91	31.0		13	98.4	96.7	0	38.6	.25	73
		7/28	89	30.0		13	96.9	96.7	0	56.9	.75	74
		8/5	97	29.5		8.3	98.1	98.2	0	63.1	.1	73
		8/7	99	29.5		6.5	98.5	98.1	0	56	.75	72
		7/26	87	29.0		14	96.2	97.5	0	71.2	.75	71
		Mean:										
		8/3	95	29.5		11	97.9	97.9	0	57.6	.75	73
		7/31	92	29.0		13	97.7	97.5	0	43.2	0	73
		8/10	102	29.0		5.5	97.5	98.3	0	43.3	.1	72
		7/25	86	28.5		14	97.6	96.8	0	90.9	.9	73
		8/17	109	28.5		8.4	97.8	98.7	0	62.6	.6	72
1993	Medina River at La Coste (08180640)	Max:			N/A							
		7/27	88	28.5		61	95.6	96	0	66	.75	73
		8/6	98	28.5		58	97	96.7	0	61	.1	72
		8/7	99	28.5		58	97.2	96.7	0	56	.75	72
		7/20	81	28.0		66	93.6	92.9	0	67	.75	73
		8/18	110	28.0		53	97.6	97.1	0	59	.75	73
		Mean:										
		8/6	98	28.0		58	97	96.7	0	61	.1	72
		8/13	105	28.0		55	96.6	95.7	0	54	.9	73
		7/15	76	27.5		69	91	91.9	0	69	.75	72

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		8/8	100	27.5		57	97	96.9	0	55	.75	73
		8/24	116	27.5		50	98.6	97.3	0	96	.9	73
1993	Medio Creek at Pearsall Rd. at San Antonio (08180750)	Max:			N/A							
		8/1	93	29.5		5.0	97.6	97	0	40	1.0	74
		7/20	81	29.0		4.7	94	93.9	0	67	.75	73
		7/27	88	29.0		4.8	95.9	96.9	0	66	.75	73
		8/14	106	29.0		4.0	98	96.5	0	65	.9	74
		8/18	110	29.0		4.2	97.7	97.5	0	59	.75	73
		Mean:										
		7/29	90	28.5		4.4	96.5	96	0	36	.6	74
		8/1	93	28.5		5.0	97.6	97	0	40	1.0	74
		8/4	96	28.5		4.9	97.1	97.2	0	47	.9	72
		8/8	100	28.0		4.3	97.5	97.3	0	55	.75	73
		8/13	105	28.0		4.3	97.1	96.3	0	54	.9	73
1993	Leon Creek at IH-35 at San Antonio (08181480)	Max:			N/A							
		7/13	74	29.0		e10	92.8	92	0	87	1.0	72
		7/9	70	28.0		e11	91.9	90.9	0	80	1.0	73
		7/17	78	28.0		e9.0	94.1	92.7	0	87	1.0	73
		7/3	64	27.5		16	90.5	89.8	0	99	.9	72
		7/27	88	27.5		8.9	96	97	0	66	.75	73
		Mean:										
		7/14	75	28.0		e10	92.3	92.7	0	87	1.0	71
		7/2	63	26.5		18	89.4	90	0	97	.6	72
		7/8	69	26.5		e12	90.5	90.8	0	104	1.0	72

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/16	77	26.5		e9.0	93.6	92.4	0	76	1.0	74
		7/27	88	26.5		8.9	96	97	0	66	.75	73
						e = estimated						
1993	Medina River at San Antonio (08181500)	Max:			N/A							
		8/2	94	30.0		158	98.5	97.9	0	53.8	.25	72
		9/20	143	30.0		130	96.5	92.7	.09	42.7	1.0	74
		8/7	99	29.5		140	98.5	98.2	0	61.8	.75	72
		8/13	105	29.5		128	97.8	97.6	0	60	.9	73
		8/15	107	29.5		123	99.2	98	0	66.8	.75	74
		Mean:										
		9/20	143	29.0		130	96.5	92.7	.09	42.7	1.0	74
		8/8	100	28.5		137	98.3	98.5	0	67.3	.75	73
		8/10	102	28.5		136	97.6	98.4	0	45.5	.1	72
		8/15	107	28.5		123	99.2	98	0	66.8	.75	74
		8/24	116	28.5		134	99.2	98.2	0	104.7	.9	73
1993	San Antonio River near Elmendorf (08181800)	Max:			N/A							
		7/31	92	31.5		317	97.7	97.5	0	49.5	0	73
		7/28	89	31.0		333	97	96.8	0	65.4	.75	74
		8/15	107	31.0		266	100	98.6	0	72.4	.75	74
		8/19	111	30.5		276	99.1	98.8	0	55.2	.75	71
		8/25	117	30.5		253	99	99	0	88	.9	73
		Mean:										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/30	91	30.5		329	98.4	96.8	0	40	.25	73
		7/31	92	30.5		317	97.7	97.5	0	49.5	0	73
		8/16	108	30.0		272	98.6	99.3	0	70	.9	73
		8/20	112	29.5		262	98.3	98.8	0	53	.1	71
		8/31	123	29.5		252	97.1	95.7	.13	71.3	1.0	73
1993	San Antonio River near Falls City (08183500)	Max:			N/A							
		8/31	123	33.5		259	96.4	94	0	81.1	.83	73.7
		7/30	91	32.0		373	97.3	96.4	0	41	.20	73.7
		8/2	94	32.0		346	98.7	97.3	0	69.1	.34	72.4
		8/7	99	31.5		343	98.3	98.5	0	70.8	.49	72.4
		8/11	103	31.5		317	98.1	98.2	0	47.4	.65	73.7
		Mean:										
		7/29	90	31.5		383	97.1	96	0	57.3	.43	74.7
		8/10	102	31.5		313	98	98.3	0	52.2	.07	72
		8/11	103	31.5		317	98.1	98.2	0	47.4	.65	73.7
		8/17	109	31.0		279	97.5	98.7	0	76.9	.43	72.7
		8/19	111	31.0		298	98.9	98	0	58.8	.58	71.7
1993	Cibolo Creek near Falls City (08186000)	no data										
1994	West Fork Trinity River	Max:			N/A							
		8/14	106	34.0		26	97.9	95.7	.18	32.7	0	70

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	at Beach Street at Fort Worth (08048543)	6/20	51	33.5		55	93.8	93.2	.51	23.8	.5	73
		7/21	82	33.5		43	97.6	97.4	.27	100.3	1.0	74
		8/6	98	33.5		33	96.4	94.6	.13	55.4	.4	75
		8/26	118	33.5		30	98	95.8	.58	71.2	0	74
		Mean:										
		6/20	51	32.0		55	93.8	93.2	.51	23.8	.5	73
		7/18	79	32.0		58	98	94.6	.93	57.8	.9	72
		6/21	52	31.5		50	93.8	93.8	.51	30.9	.75	69
		7/17	78	31.5		69	96.5	92.8	1.39	58.9	.5	75
		6/26	57	31.0		39	101.9	98.4	.10	139.2	.1	75
1994	West Fork Trinity River at Grand Prairie (08049500)	Max:			N/A							
		7/22	83	32.0		233	96.9	96.9	.04	42.5	.75	75
		7/24	85	32.0		224	101.4	97.9	.01	56.6	1.0	70
		6/25	56	31.5		260	99.5	95.3	.10	51	.1	72
		7/20	81	31.5		248	96.4	97.3	.41	95.8	0	72
		6/23	54	31.0		274	96.3	93.4	.15	37.5	.1	72
		Mean:										
		7/24	85	31.0		224	101.4	97.9	.01	56.6	1.0	70
		6/24	55	30.5		269	97	94.3	.21	50.3	0	73
		7/20	81	30.5		248	96.4	97.3	.41	95.8	0	72
		7/21	82	30.5		240	97.1	97.1	.30	89.9	1.0	74
		8/19	111	30.5		192	102.5	96	.03	67.5	.9	71
1994	Trinity River at Cedar	Max:			N/A							
		6/26	57	31.5		530	99.4	97.1	.17	129.7	.1	75

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	Crest Blvd. at Dallas (08057055)	8/25	117	31.5		464	97.1	94.3	.65	56.7	.1	71
		8/30	122	31.5		444	98.1	97.1	0	71.3	0	73
		6/24	55	31.0		592	96.8	94.1	.38	61.2	0	73
		7/5	66	31.0		492	94.4	94.2	.32	102.4	.1	74
		Mean:										
		8/26	118	30.5		449	97.4	95.8	.65	65.7	0	74
		6/25	56	30.0		562	98.6	95	.19	43.6	.1	72
		6/29	60	30.0		512	96.2	98.5	.16	95.5	1.0	78
		7/2	63	30.0		632	93.6	95.1	.32	109.2	1.0	73
		8/24	116	30.0		486	95.4	93.9	.65	62	.1	74
1994	Trinity River below Dallas (08057410)	Max:			N/A							
		8/19	111	31.0		526	102.1	95	.12	73.3	.9	71
		8/26	118	31.0		542	96.7	95.1	.78	65.8	0	74
		8/30	122	31.0		526	97.6	96.6	0	71.1	0	73
		6/24	55	30.5		770	95.5	93.4	.50	61.9	0	73
		8/15	107	30.5		836	95.4	96.3	.10	56.6	1.0	67
		Mean:										
		6/25	56	30.0		723	97.5	94.1	.38	43.3	.1	72
		6/26	57	30.0		655	98	96	.37	129.9	.1	75
		8/12	104	30.0		578	95.1	92.3	.60	32.6	0	72
		8/18	110	30.0		572	100.5	93.3	.12	57.6	.9	67
		8/27	119	30.0		511	96.5	95.9	.70	77	0	74
1994	East Fork Trinity River	Max:			N/A							
		6/26	57	31.5		108	96.2	94.7	.45	125.4	.1	75

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	at Seagoville (08061980)	6/27	58	31.5		95	95	95.7	.48	117	0	76
		9/6	129	31.5		88	93.2	89.1	2.18	48.4	.9	72
		6/25	56	31.0		130	95.9	93	.46	37.9	.1	72
		9/7	130	31.0		79	92.1	91.9	2.02	37.4	1.0	70
		Mean:										
		6/28	59	30.0		92	94.7	95.7	.42	151.6	.25	75
		6/25	56	29.5		130	95.9	93	.46	37.9	.1	72
		6/23	54	29.0		218	93.3	92	.10	31.7	.1	72
		6/24	55	29.0		173	94.9	92.3	.52	60.3	0	73
		7/24	85	29.0		1840	99.8	95.5	.04	55.9	1.0	70
1994	East Fork Trinity River near Crandall (08062000)	Max:			N/A							
		6/26	57	31.5		108	95.9	94.4	.49	124.1	.1	75
		6/27	58	31.5		95	94.7	95.4	.53	116.2	0	76
		7/4	65	31.0		83	93.4	92.3	.20	85.4	0	72
		7/6	67	30.5		77	93.9	93.1	.18	122.3	missing	70
		8/24	116	30.5		62	94.5	92.3	.74	59.2	.1	74
		Mean:										
		8/19	111	30.0		65	100.7	93.2	.16	70.3	.9	71
		8/27	119	30.0		63	95.6	95.3	.71	71.2	0	74
		7/6	67	29.5		77	93.9	93.1	.18	122.3	missing	70
		7/8	69	29.5		96	95.3	93.5	.37	137.3	.9	71
		8/25	117	29.5		66	95.3	92.1	.74	51.3	.1	71
1994	Trinity River near Rosser	Max:			N/A							
		6/27	58	31.0		906	94.8	95.2	1.54	105.7	0	76

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	(08062500)	8/26	118	31.0		768	95.9	94.3	1.25	60.2	0	74
		6/29	60	30.5		832	93.3	95.3	1.54	85.5	1.0	78
		7/8	68	30.5		1330	95.5	93.6	.26	123.6	.9	71
		8/18	110	30.5		888	99.4	93.3	.34	59.5	.9	67
		Mean:										
		8/14	106	30.5		781	96.8	94.9	.05	39.2	0	70
		8/19	111	30.5		772	100.7	93.9	.34	70.2	.9	71
		6/23	54	30.0		1090	93.1	91.6	0	33.5	.1	72
		8/12	104	30.0		847	94.7	92	.18	33.5	0	72
		8/26	118	30.0		768	95.9	94.3	1.25	60.2	0	74
1994	Trinity River at Trinidad (08062700)	too much data missing										
1994	San Antonio River at Loop 410 at San Antonio (08178565)	Max:			N/A							
		6/25	56	35.5		e40	97.4	94.6	.94	48.5	.25	76
		6/7	38	34.0		55	96	91.9	.43	97.4	.9	73
		6/30	61	34.0		e25	96.4	98.1	.11	59.1	.75	72
		7/11	72	34.0		23	98.5	97.5	.08	60.7	.75	72
		8/17	109	34.0		36	97.5	95.6	.28	42.6	1.0	73
		Mean:										
		6/25	56	32.0		e40	97.4	94.6	.94	48.5	.25	76
		6/24	55	31.0		e50	96.8	92.6	.94	37	.25	69
		6/28	59	31.0		e25	99	97	.31	85.7	.25	72

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/27 8/23	88 115	31.0 30.5		17 24 e = estimated	99.4 96.6	101.4 96.8	0 .14	52.1 62.4	.9 .75	69 75
1994	Salado Creek (lower station) at San Antonio (08178800)	Max: 6/7 8/20 6/10 6/25 7/27 Mean: 7/21 8/19 8/21 6/10 8/24	 38 112 41 56 88 82 111 113 41 116	 28.5 28.5 28.0 28.0 28.0 28.0 28.0 28.0 27.5 27.5	N/A	 15 2.7 9.2 6.2 4.7 4.0 2.1 2.9 9.2 3.3	 96.1 98.6 94 97.4 99.3 99.3 98.8 96.4 94 97	 91.9 98.4 96.3 94.5 101.5 99.3 97.5 98.7 96.3 96.6	 .45 .27 .11 .95 0 0 .27 .25 .11 .13	 96.3 86 35.3 48.6 52.3 72.5 70 54.7 35.3 69.2	 .9 .75 1.0 .25 .9 .75 .75 .75 1.0 .9	 73 73 72 76 69 72 73 72 72 74
1994	Medina River at La Coste (08180640)	Max: 6/27 7/3 7/7 7/8 7/11 Mean:	 58 64 68 69 72	 29.0 29.0 29.0 29.0 29.0	N/A	 41 e46 e44 e43 e42	 97.2 95.2 98.6 97.8 97.6	 95.9 95.1 96.1 97.4 96.1	 .30 0 0 0 0	 96 59 88 69 61	 0 .75 .9 .9 .75	 71 73 73 73 71

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/13	74	28.5		e43	97	96.6	0	80	.9	73
		6/8	39	28.0		47	96.2	94.5	.02	64	.25	72
		7/4	65	28.0		e46	94.6	95.1	0	79	.75	72
		7/14	75	28.0		e43	93.6	97.4	0	69	.75	76
		7/15	76	28.0		e44	96	96.1	0	81	.75	74
						e = estimated						
1994	Medio Creek at Pearsall Rd. at San Antonio (08180750)	Max:			N/A							
		7/9	70	30.5		4.7	96.8	98.1	.07	54	.75	74
		7/16	77	30.5		4.1	98.8	96.4	0	70	1.0	75
		7/20	81	30.5		4.0	99	99.1	0	88	.5	72
		7/21	82	30.5		3.9	98.6	99	0	62	.75	72
		7/19	80	30.0		4.1	98.6	99.1	0	63	.9	71
		Mean:										
		6/25	56	29.5		6.0	96.7	94.6	.87	47	.25	76
		7/12	73	29.5		4.6	98.3	97.9	.07	69	.6	74
		7/25	86	29.5		4.1	100.9	100	0	48	.5	72
		7/1	62	29.0		5.6	95.9	97.7	0	65	.75	72
		7/16	77	29.0		4.1	98.8	96.4	0	70	1.0	75
1994	Leon Creek at IH-35 at San Antonio (08181480)	Max:			N/A							
		6/25	56	29.5		7.5	96.9	94.8	.85	47	.25	76
		7/6	67	29.0		4.9	97.3	96	0	87	.9	74
		7/16	77	29.0		4.2	98.6	96.8	0	70	1.0	75
		7/22	83	29.0		4.3	99.2	98.9	0	67	.25	72

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/27	88	29.0		3.6	98.7	100.9	0	50	.9	69
		Mean:										
		6/11	42	28.0		11	93.1	95.8	.40	19	1.0	71
		7/1	62	28.0		5.4	95.9	97.9	0	65	.75	72
		7/7	68	28.0		4.9	98.9	96.6	0	88	.9	73
		7/13	74	28.0		4.8	97.7	97.5	.07	80	.9	73
		7/23	84	28.0		4.0	99.6	99	0	64	.1	70
1994	Medina River at San Antonio (08181500)	Max:			N/A							
		7/23	84	30.5		109	100.6	99.3	0	66.7	.1	70
		7/1	62	30.0		139	95.7	97.9	0	74.1	.75	72
		7/15	76	30.0		124	97.1	97.8	.06	85	.75	74
		7/25	86	30.0		110	101	100.6	0	59.4	.5	72
		8/24	116	30.0		112	96.7	96.5	.14	73.6	.4	73
		Mean:										
		6/26	57	29.0		141	96.3	96.2	.73	77.5	.4	74
		7/3	64	29.0		130	95.4	95.8	0	69.5	.75	73
		8/21	113	29.0		104	96.5	98.5	.23	64.6	.75	72
		8/22	114	29.0		108	96.2	97.9	.13	48.4	1.0	71
		8/25	117	29.0		110	96	96.6	.16	49	.4	73
1994	San Antonio River near Elmendorf (08181800)	Max:			N/A							
		7/23	84	32.5		149	101	99.7	0	73.4	.1	70
		7/9	70	32.0		163	97.6	98.7	.05	66.3	.75	74
		7/12	73	32.0		154	99.3	97.7	.05	71.5	.6	74
		6/8	39	31.5		318	96.8	94.2	.69	65.8	.25	72

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		8/21	113	31.5		176	96.5	98.8	.19	81.2	.75	72
		Mean:										
		7/2	63	30.5		288	95.9	97.3	0	79.2	.9	72
		7/8	69	30.5		171	98.8	98	0	91.4	.9	73
		7/20	81	30.5		161	99.5	99.7	0	91.5	.5	72
		8/22	114	30.5		187	96.8	98	.07	54.3	1.0	71
		8/23	115	30.5		197	97.6	97.4	.07	65.9	.75	75
1994	San Antonio River near Falls City (08183500)	Max:			N/A							
		7/25	86	32.5		147	99.7	100.3	0	83.9	.36	
		7/17	78	32.0		169	98.2	97.1	0	77.2	.58	
		7/18	79	32.0		163	98.6	97.8	0	68.5	.25	
		7/27	88	32.0		145	98.4	100.9	0	78.6	.9	
		7/14	75	31.5		153	96.3	98.1	0	84.9	.80	
		Mean:										
		6/26	57	31.0		388	96.2	96.2	0	69.8	.26	
		6/30	61	31.0		340	95.3	98.3	0	68	.75	
		7/17	78	31.0		169	98.2	97.1	0	77.2	.58	
		7/23	84	31.0		153	100.4	98.8	0	79.2	.15	
		7/24	85	31.0		155	101.6	99.3	0	76.5	.07	
1994	Cibolo Creek near Falls City (08186000)	no data										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1995	West Fork Trinity River at Beach Street at Fort Worth (08048543)	Max:			N/A							
		7/13	74	36.0		17	99.8	100.2	0	31.7	.75	73
		7/14	75	35.0		15	96.2	100.5	0	54.9	.25	73
		8/19	111	34.5		125	98.9	96	.10	40.3	.25	71
		8/26	118	34.5		22	97.3	95.5	.48	25.5	.25	72
		7/9	70	34.0		31	97.1	93.7	1.52	50.3	.1	68
		Mean:										
		7/29	90	32.5		26	102.4	101.9	.49	53.2	missing	missing
		8/27	119	32.5		20	98.4	96.2	.19	20.7	.25	72
		7/8	69	32.0		39	96.1	91.7	1.53	39.8	0	69
		7/9	70	32.0		31	97.1	93.7	1.52	50.3	.1	68
		9/2	125	32.0		15	99	96.9	.07	21.7	.1	70
1995	West Fork Trinity River at Grand Prairie (08049500)	Max:			N/A							
		7/28	89	33.0		107	104.5	98.9	.62	76.5	missing	missing
		7/13	74	32.0		116	99.9	100.4	0	27.3	.75	73
		7/22	83	32.0		94	99.3	97.3	.14	108	.25	74
		7/26	87	32.0		169	98.4	97.4	.63	85	missing	missing
		8/23	115	32.0		212	96	99.9	.43	64.4	0	71
		Mean:										
		7/27	88	31.0		140	100.6	97.8	.63	99.3	missing	missing
		8/18	110	31.0		194	97	95.1	.01	64.7	.1	72
		8/28	120	31.0		173	100.8	97.8	.06	10.7	0	71
		7/21	82	30.5		102	99.2	96.8	.15	66.1	1.0	71
		8/22	114	30.5		271	98.1	100.3	.43	39.7	0	70

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1995	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	too much data missing										
1995	Trinity River below Dallas (08057410)	Max:			N/A							
		7/13	74	32.0		668	100.1	100	.13	27.2	.75	73
		7/28	89	32.0		630	103.3	97.9	.54	80.7	missing	missing
		8/19	111	31.5		574	99.3	96	.01	34.8	.25	71
		8/28	120	31.5		626	101.7	98.2	.09	14.8	0	71
		9/2	125	31.5		558	99.9	97.7	.17	20.6	.1	70
		Mean:										
		7/14	75	31.0		660	96.8	100.4	0	51.1	.25	73
		7/28	89	31.0		630	103.3	97.9	.54	80.7	missing	missing
		8/20	112	31.0		622	102	97.4	.09	32.4	.4	73
		7/11	72	30.5		695	100	97.1	1.48	26.5	0	68
		8/18	110	30.5		610	97.2	95	.01	60.7	.1	72
1995	East Fork Trinity River at Seagoville (08061980)	Max:			N/A							
		8/6	98	31.0		123	95.1	92	2.02	24.6	.25	74
		8/9	101	31.0		89	93.5	94.4	.24	94.3	0	72
		8/18	110	31.0		78	97.2	95	.01	55.8	.1	72
		9/3	126	31.0		92	100.9	98.1	.33	26	0	68
		8/14	106	30.5		74	95.5	95.9	0	79.1	.9	75

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		Mean:										
		7/28	89	30.5		92	101.2	96.5	.49	73.1	missing	missing
		8/19	111	30.0		73	99.3	96	.01	32.5	.25	71
		8/20	112	30.0		72	102.5	97.4	.03	33.4	.4	73
		8/21	113	30.0		77	100.9	99.7	.04	26.9	.75	71
		9/2	125	29.5		89	99.9	98.2	.36	19.9	.1	70
1995	East Fork Trinity River near Crandall (08062000)	Max:			N/A							
		7/26	87	31.5		e90	96.3	95.6	.48	80.2	missing	missing
		8/12	104	31.5		82	96.4	94.6	0	43.7	0	73
		7/22	83	31.0		e86	96.5	95.6	.85	92.8	.25	74
		8/16	108	31.0		82	95	94.9	0	85.5	.1	72
		8/23	115	31.0		71	96.5	101.6	.05	57.6	0	71
		Mean:										
		7/26	87	30.5		e90	96.3	95.6	.48	80.2	missing	missing
		8/7	99	30.5		95	94	94.1	1.66	60.5	.1	74
		8/9	101	30.5		89	93.3	94.3	.22	93	0	72
		8/12	104	30.5		82	96.4	94.6	0	43.7	0	73
		8/13	105	30.5		75	95.2	95.6	0	57.7	0	73
						e = estimated						
1995	Trinity River near Rosser (08062500)	Max:			N/A							
		8/28	120	32.0		924	100.5	97	0	19.1	0	71
		8/29	121	32.0		916	100.6	98.7	.58	22.7	.25	71
		8/14	106	31.5		1510	94.2	94.6	0	65.1	.9	75

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		8/22	114	31.5		1580	101.3	99.5	0	47.5	0	70
		8/30	122	31.5		923	98.7	100	.58	24.1	1.0	72
		Mean:										
		8/19	111	31.5		957	97.5	94.9	0	34.6	.25	71
		8/18	110	31.0		997	96	93.9	0	49.5	.1	72
		8/27	119	31.0		920	98.7	96.6	0	20.7	.25	72
		8/30	122	31.0		923	98.7	100	.58	24.1	1.0	72
		7/14	75	30.5		1610	96.6	99.6	0	46.9	.25	73
1995	Trinity River at Trinidad (08062700)	Max:			N/A							
		8/22	114	32.0		1270	100	98.9	.07	44.3	0	70
		8/23	115	32.0		1490	95.3	99.9	.07	52.3	0	70.5
		8/12	104	31.5		2220	94.5	93.3	0	40.8	0	73
		8/25	117	31.5		949	95.6	97.4	.07	28	.5	72
		9/3	126	31.5		946	100.3	97.2	.25	25.8	0	69.5
		Mean:										
		8/22	114	31.5		1270	100	98.9	.07	44.3	0	70
		8/29	121	31.5		901	99.7	98.3	.32	22.6	.13	72
		8/28	120	31.0		892	99.9	96.9	.19	23	0	72
		8/30	122	31.0		894	98.6	99.4	.42	23.7	.5	72.5
		9/4	127	31.0		847	100.1	98.4	.23	51.6	.2	70.5
1995	San Antonio River at Loop 410 at San	Max:			N/A							
		7/19	80	35.0		25	97.4	95.4	.01	36	0	72
		7/11	72	34.5		28	95.1	92.1	.30	27.4	0	66

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	Antonio (08178565)	6/23	54	34.0		19	92.4	89.8	.26	35.2	0	64
		6/28	59	34.0		19	95	93.9	.75	72.7	1.0	74
		8/28	120	34.0		16	97.5	96.3	.54	26.5	0	71
		Mean:										
		7/12	73	31.5		27	96	93.7	.30	29	0	67
		7/26	87	31.5		11	99.8	100.4	0	92.7	missing	missing
		7/21	82	31.0		16	98.3	97.3	0	63.3	.75	73
		8/6	98	31.0		16	97.5	96.8	.20	41.9	.4	73
		8/28	120	31.0		16	97.5	96.3	.54	26.5	0	71
1995	Salado Creek (lower station) at San Antonio (08178800)	Max:			N/A							
		7/30	91	28.0		5.9	96.1	101.4	.09	52.4	missing	missing
		8/7	99	28.0		5.7	96.4	97.5	.23	51.2	1.0	75
		8/8	100	28.0		7.0	95.7	97.1	.15	63	1.0	75
		8/10	102	28.0		5.4	97.5	96.6	.09	49.2	0	69
		8/18	110	28.0		5.4	96.8	97	.30	48.6	.4	73
		Mean:										
		7/25	86	28.0		5.7	99.4	100.4	0	52.1	missing	missing
		8/5	97	27.5		5.9	97.4	96.5	.36	36.3	.75	70
		8/15	107	27.5		6.0	96.7	95	.27	69	1.0	75
		8/17	109	27.5		5.1	97.7	96.7	.28	62.3	.4	73
		8/24	116	27.5		12	96	98.8	.85	34.2	0	72
1995	Medina River at La Coste (08180640)	Max:			N/A							
		7/24	85	29.5		32	99.6	99.1	0	81	missing	missing
		7/29	90	29.5		32	99.4	99.9	0	52	missing	missing

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/19	80	29.0		39	96.4	94.3	0	33	0	72
		7/25	86	29.0		32	98	99.7	0	39	missing	missing
		8/3	95	29.0		32	96.4	92.8	.15	53	.4	75
		Mean:										
		7/23	84	28.5		32	100.4	98	0	80	1.0	74
		7/25	86	28.5		32	98	99.7	0	39	missing	missing
		7/28	89	28.5		32	100.2	99.2	0	32	missing	missing
		8/7	99	28.0		27	92.8	96.6	.04	44	1.0	75
		8/10	102	28.0		27	96.6	95.1	.01	40	0	69
1995	Medio Creek at Pearsall Rd. at San Antonio (08180750)	Max:			N/A							
		7/24	85	30.0		5.1	100.7	99.5	0	81	missing	missing
		7/29	90	30.0		4.8	99.9	100.6	.01	52	missing	missing
		7/3	64	29.5		8.4	92.4	88.3	2.92	83	.4	74
		7/19	80	29.5		5.6	96.9	94.9	.01	33	0	72
		8/14	106	29.5		6.5	96.3	94.8	.22	76	1.0	75
		Mean:										
		7/26	87	29.5		5.3	99.6	100.2	0	103	missing	missing
		7/27	88	29.5		5.2	101	99.8	0	51	missing	missing
		7/22	83	29.0		5.3	99.7	97.4	.01	90	1.0	74
		7/24	85	29.0		5.1	100.7	99.5	0	81	missing	missing
		8/9	101	28.5		5.1	96.7	95.9	.02	50	missing	71
1995	Leon Creek at IH-35 at San Antonio	Max:			N/A							
		7/23	84	29.5		3.2	101	98.7	0	80	1.0	74
		7/22	83	29.0		3.3	99.8	97.9	.01	90	1.0	74

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	(08181480)	7/29	90	29.0		3.2	100.4	100.8	.01	52	missing	missing
		8/3	95	29.0		3.9	96.1	94.7	.20	53	.4	75
		8/16	108	29.0		2.4	96.4	95.9	.18	72	.75	74
		Mean:										
		7/22	83	28.0		3.3	99.8	97.9	.01	90	1.0	74
		8/5	97	28.0		3.0	97.2	96.4	.19	35	.75	70
		8/15	107	28.0		2.5	96.8	94.8	.18	85	1.0	75
		7/6	67	27.5		9.8	91.1	92	1.03	44	.75	76
		8/24	116	27.5		5.2	95.4	98.3	.81	25	0	72
1995	Medina River at San Antonio (08181500)	Max:			N/A							
		7/22	83	30.5		114	99.7	98.1	0	88.4	1.0	74
		8/5	97	30.0		102	97.5	96.6	.31	40.4	.75	70
		8/25	117	30.0		269	95.8	97.6	.74	32.2	0	72
		8/26	118	30.0		242	96.1	96.3	.42	33.7	0	72
		8/27	119	30.0		124	97.4	95.9	.39	34.3	0	71
		Mean:										
		7/23	84	29.5		108	101	98.8	0	89.5	1.0	74
		7/28	89	29.5		107	102.1	100.3	0	46	missing	missing
		8/3	95	29.0		116	95.5	95	.32	58.7	.4	75
		8/8	100	29.0		102	95.5	97.2	.13	63.5	1.0	75
		9/6	129	29.0		94	97.1	98.6	.46	69.8	.75	73
1995	San Antonio River near Elmendorf	Max:			N/A							
		7/22	83	32.0		273	100.1	98.6	0	98.5	1.0	74
		7/26	87	32.0		262	100.4	101	0	100.7	missing	missing

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
	(08181800)	7/13	74	31.5		312	95.7	95.4	.02	45.8	0	68
		8/26	118	31.5		238	96.4	96.7	.44	37.1	0	72
		9/4	127	31.5		156	99	96.5	.59	34.3	0	71
		Mean:										
		7/20	81	31.0		282	99	97.1	.01	60.2	.4	73
		7/23	84	31.0		261	101.4	99.3	0	103.7	1.0	74
		8/21	82	30.5		164	98.9	97.2	.42	31.8	0	69
		8/27	88	30.5		191	97.8	96.2	.39	35.5	0	71
		9/17	140	30.5		166	97.8	92.8	.09	62.9	0	75
1995	San Antonio	Max:			N/A							
	River near	7/19	80	31.5		e319	99.4	96.4	.06	56.3	.09	72.4
	Falls City	7/26	87	31.5		e279	101.3	101.6	0	109.4	missing	missing
	(08183500)	7/24	85	31.0		e283	103.2	101.9	0	120.8	missing	missing
		8/14	106	31.0		e143	96.2	94.3	0	72.2	1.0	76.1
		8/28	120	31.0		e237	98.9	96.8	.13	32.8	.35	73.5
		Mean:										
		7/21	82	31.0		e307	100.5	99	.06	99.8	.58	74.4
		7/23	84	31.0		e291	102.4	101.4	0	122.5	.65	74.7
		7/24	85	31.0		e283	103.2	101.9	0	120.8	missing	missing
		6/25	56	30.5		361	96.5	95	1.81	47.5	.18	66.7
		7/17	78	30.5		e339	98.4	95.7	.06	62.3	.09	72.7
						e = estimated						

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
1995	Cibolo Creek near Falls City (08186000)	no data										
1996	West Fork Trinity River at Beach Street at Fort Worth. (08048543)	Max:			N/A							
		7/4	65	37.0		5.9	104.6	101.2	.02	19.5	0	68
		7/7	68	37.0		5.3	105.6	104.9	.01	80.6	0	70
		6/30	61	36.5		5.6	98.6	96.5	.10	56.5	0	70
		6/21	52	35.5		15	97.6	101.6	.21	58.7	0	70
		6/22	53	35.5		8.4	95.7	100.3	.16	65.3	0	70
		Mean:										
		7/20	81	32.5		20	97.5	95.6	1.45	74	0	71
		6/16	47	32.0		41	97.8	94.9	.82	55.5	0	71
		6/27	58	32.0		5.4	94.9	94.8	.10	89.8	0	74
		6/22	53	31.5		8.4	95.7	100.3	.16	65.3	0	70
		7/28	89	31.5		84	93.2	93.6	1.25	18.9	0	72
1996	West Fork Trinity River at Grand Prairie (08049500)	Max:			N/A							
		7/3	64	32.5		143	102.8	99.3	.02	42.1	0	66
		7/6	67	32.5		133	104.2	103.9	.04	98.9	0	69
		7/22	83	32.5		160	99.5	97.9	.38	67.3	0	69
		6/19	50	32.0		206	101.5	99.1	.71	53.7	0	71
		7/2	63	32.0		158	101.4	97.9	.10	54	0	67
		Mean:										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/7	68	31.5		133	105.3	104.3	.04	75.3	0	70
		7/8	69	31.5		136	103.6	104.6	.04	64.6	0	69
		7/2	63	31.0		158	101.4	97.9	.10	54	0	67
		7/6	67	31.0		133	104.2	103.9	.04	98.9	0	69
		6/30	61	30.5		152	97.8	95.7	.11	58.6	0	70
1996	Trinity River at Cedar Crest Blvd. at Dallas (08057055)	Max:			N/A							
		7/2	63	32.0		391	102	97.8	.06	56.1	0	67
		7/4	65	32.0		401	104.7	101.7	.04	22.8	0	68
		7/9	70	31.5		493	100.8	104.4	.05	86	0	74
		7/23	84	31.5		526	99	99.7	.17	54.2	.25	71
		7/29	90	31.0		583	97.1	94.7	.83	49.2	0	71
		Mean:										
		7/3	64	31.0		410	104.3	99.4	.02	45.1	0	66
		6/30	61	30.5		396	97.6	96	.07	59	0	70
		7/5	66	30.5		385	104.5	103.7	.06	58.4	0	68
		7/6	67	30.5		389	103.4	104.5	.05	97.2	0	69
		8/6	98	30.5		439	99.4	99.9	.22	112.5	0	72
1996	Trinity River below Dallas (08057410)	Max:			N/A							
		7/7	68	31.5		601	104.6	103.3	.06	86	0	70
		7/20	81	31.5		740	98.2	96	1.11	79.4	0	71
		6/22	53	31.0		657	95.2	100.7	.70	69.3	0	70
		6/29	60	31.0		601	96	94.3	.41	44.4	0	72
		6/30	61	31.0		590	96.9	95	.41	59.1	0	70
		Mean:										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/5	66	30.5		600	104.3	102.5	.39	59.3	0	68
		7/23	84	30.5		652	99.3	99.2	.18	54.9	.25	71
		6/23	54	30.0		628	95.8	98.6	.56	80.6	0	72
		6/28	59	30.0		637	95.9	93.8	.12	62.2	0	72
		7/27	88	30.0		737	95	95.5	.93	63.6	0	72
1996	East Fork Trinity River at Seagoville (08061980)	Max:			N/A							
		8/4	96	31.5		116	98.9	96	.48	104.8	0	72
		8/5	97	31.5		118	100.2	99.3	.47	141.3	.25	73
		6/30	61	31.0		81	96	94.5	.84	59.9	0	70
		6/22	53	30.5		81	95.2	100.9	.82	69.5	0	70
		7/1	62	30.5		81	97.3	95.6	.84	42.9	missing	missing
		Mean:										
		7/20	81	30.0		93	98.1	96	.95	79.8	0	71
		8/7	99	30.0		106	98.9	99.6	.30	96.6	0	73
		6/21	52	29.5		93	99.8	100.7	.84	63.9	0	70
		7/17	78	29.5		172	95.1	90.7	1.96	93	0	72
		7/30	91	29.5		126	97.6	95.3	.87	86.1	.75	70
1996	East Fork Trinity River near Crandall (08062000)	Max:			N/A							
		7/7	68	32.0		72	103.6	101.8	.06	89.5	0	70
		7/19	80	31.5		102	96.5	94.1	1.68	98.8	0	73
		7/22	83	31.5		93	99.6	97.9	.09	78.6	0	69
		6/20	51	31.0		113	101.6	99.6	.99	69.4	0	73
		8/3	95	31.0		132	101.2	94.1	.52	49.5	.25	71
		Mean:										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/23	84	31.0		96	100	98.9	.15	57.1	.25	71
		7/7	68	30.5		72	103.6	101.8	.06	89.5	0	70
		7/21	82	30.5		91	99.1	97	.60	87.9	0	69
		8/5	97	30.5		118	100.2	99.4	.47	140.5	.25	73
		6/20	51	30.0		113	101.6	99.6	.99	69.4	0	73
1996	Trinity River near Rosser (08062500)	Max:			N/A							
		7/7	68	32.0		633	103.2	101.6	0	91.2	0	70
		7/23	84	32.0		747	99.8	98.4	0	62	.25	71
		6/30	61	31.5		700	95.3	94.1	1.38	57.4	0	70
		7/11	72	31.0		1430	93	101.4	.60	75.4	.5	72
		8/8	100	31.0		750	98.7	99.8	0	53.7	.25	73
		Mean:										
		7/8	69	31.5		633	104.3	101.7	0	75.5	0	69
		7/6	67	31.0		627	97.9	102.7	0	88.1	0	69
		7/10	71	31.0		1030	97.5	103.3	.60	70.5	1.0	72
		7/21	82	31.0		794	98.8	96.9	.36	86.8	0	69
		8/3	95	30.5		830	101.3	95.1	.18	61.9	.25	71
1996	Trinity River at Trinidad (08062700)	Max:			N/A							
		7/8	69	33.0		634	102	99.4	.14	83.4	0	72
		7/3	64	32.5		654	100.4	96	.78	52.9	0	67
		7/1	62	32.0		701	96.1	93.8	.91	46.2	missing	missing
		7/11	72	32.0		1010	92.8	99.2	.57	74.4	.38	74
		7/21	82	32.0		888	99.2	97.4	.38	95.5	0	70.5
		Mean:										

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/9	70	32.0		639	100.3	100.4	.14	65.3	0	74.5
		7/1	62	31.0		701	96.1	93.8	.91	46.2	missing	missing
		7/2	63	31.0		661	97.7	94.7	.84	58.7	0	69.5
		7/11	72	31.0		1010	92.8	99.2	.57	74.4	.38	74
		8/5	97	30.5		732	99.5	99.3	.15	138.6	.5	73
1996	San Antonio River at Loop 410 at San Antonio (08178565)	Max:			N/A							
		8/12	104	36.5		5.8	100.6	97.6	.09	15.6	0	71
		8/2	94	35.5		5.6	100.2	99.1	0	27	missing	missing
		7/2	63	35.0		6.5	98.1	95.3	.42	40	0	71
		7/14	75	35.0		5.6	99.1	97	.75	53.5	.5	72
		8/7	99	35.0		4.8	99.5	101.4	.01	31.8	.25	73
		Mean:										
		6/17	48	31.5		6.5	98.2	97.2	0	33.2	0	72
		8/13	105	31.5		31	100.4	98.9	.13	14.5	0	69
		6/14	45	31.0		6.6	97.6	97.3	.06	42.6	1.0	72
		7/7	68	31.0		10	99.7	98.7	0	40.5	.25	72
		8/2	94	31.0		5.6	100.2	99.1	0	27	missing	missing
1996	Salado Creek (lower station) at San Antonio (08178800)	Max:			N/A							
		7/17	78	31.0		0.28	98.9	99.2	.13	54.6	.5	73
		6/17	48	30.0		0.57	98.3	97.2	0	33.6	0	72
		6/21	52	29.5		0.65	101.1	101.4	0	33.5	1.0	71
		8/2	94	28.5		0.45	100.5	99.3	0	26.7	missing	missing
		8/3	95	28.5		0.33	101.8	100	0	45.2	0	73

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		Mean:										
		6/20	51	28.0		0.92	102.5	100.1	0	32.8	0	72
		7/13	74	28.0		1.6	98.6	96.6	.54	53.7	.25	73
		7/22	83	28.0		1.1	100.9	100.3	0	49.4	.5	72
		7/24	85	28.0		2.0	100.3	100.9	0	39.1	1.0	72
		8/7	99	28.0		0.12	99.6	101.5	.01	32.5	.25	73
1996	Medina River at La Coste (08180640)	no data										
1996	Medio Creek at Pearsall Rd. at San Antonio (08180750)	no data										
1996	Leon Creek at IH-35 at San Antonio (08181480)	Max:			N/A							
		6/20	51	31.0		1.5	102.3	100.1	.01	23	0	72
		6/18	49	30.0		0.64	100.4	97.2	.01	17	0	69
		7/13	74	30.0		1.1	98.2	96.5	.96	57	.25	73
		7/20	81	30.0		1.1	100.6	98.7	0	65	.75	72
		7/28	89	30.0		2.0	97	97.6	.44	37	1.0	73
		Mean:										
		8/4	96	29.0		0.63	102.7	100.7	0	78	.75	71
		8/6	98	29.0		0.57	100.2	102.1	0	49	.75	73
		8/7	99	29.0		0.58	99.4	101.5	.02	23	.25	73

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/31	92	28.5		1.2	99.4	97.6	.44	42	.75	72
		8/12	104	28.5		0.54	100.7	97.5	.06	18	0	71
1996	Medina River at San Antonio (08181500)	Max:			N/A							
		6/19	50	31.0		71	101.8	98.5	.08	55.6	0	72
		8/2	94	31.0		62	100.3	99.3	0	39.8	missing	missing
		8/3	95	31.0		62	101.5	99.8	0	55.6	0	0
		8/13	105	31.0		113	100.6	99.1	.11	23.1	0	0
		6/21	52	30.5		81	101	101.3	.08	43.4	1.0	1.0
		Mean:										
		6/21	52	30.0		81	101	101.3	.08	43.4	1.0	71
		7/19	80	30.0		67	99.5	98.8	0	73.7	1.0	73
		7/24	85	30.0		63	100.5	100.9	0	52.2	1.0	72
		7/31	92	30.0		62	99.4	97.8	.72	53.1	.75	72
		8/6	98	30.0		56	100.5	101.8	0	63.1	.75	73
1996	San Antonio River near Elmendorf (08181800)	Max:			N/A							
		6/19	50	33.5		74	102	98.6	.11	70.4	0	72
		6/17	48	33.0		86	98.6	97.4	.09	54.4	0	72
		7/2	63	33.0		110	98.7	95.3	.14	52.5	0	71
		8/12	104	33.0		99	101.3	98	.06	27	0	71
		8/14	106	33.0		107	100.6	100.3	.05	26.3	.5	70
		Mean:										
		6/20	51	31.5		80	102.6	100.2	.11	60.8	0	72
		8/2	94	31.5		100	100.5	99.6	.01	42.1	missing	missing
		7/14	75	31.0		165	99.7	97.5	.59	76	.5	72

Water Year	Water temperature gaging station	Observation date	'Date rank'	Daily max or mean water temp. (°C)	Pop. density - from gage site to 8 mi. upstream (persons per square mile)	Mean daily discharge (cubic feet per second)	Maximum daily air temp. (°F)	Previous 3 days average maximum daily air temp. (°F)	Precip. - previous 7 days (inches)	Total daily wind (miles per day)	Cloud-cover: (0.0-clear to 1.0-total overcast)	Dew point temp. (°F)
		7/31	92	31.0		104	99.7	98.1	.81	69.5	.75	72
		8/12	104	31.0		99	101.3	98	.06	27	0	71
1996	San Antonio River near Falls City (08183500)	Max:			N/A							
		7/6	67	34.0		67	98.8	97.7	0	60.7	.65	73
		8/13	105	34.0		65	102.5	99.4	.16	44.6	0	71.1
		7/4	65	33.5		79	98.1	96.8	0	41.9	0	66.7
		7/25	86	33.5		85	97.4	101.8	2.18	92.1	.65	74.4
		7/23	84	33.0		71	101.4	101.4	0	103.5	.49	73.1
		Mean:										
		6/20	51	32.0		69	102.8	100.2	1.02	78.6	0	72.4
		8/12	104	32.0		59	101.6	97.4	.16	59.7	0	72.4
		6/17	48	31.5		63	98.6	98.8	.84	66.1	.14	72.7
		7/4	65	31.5		79	98.1	96.8	0	41.9	0	66.7
		7/9	70	31.5		77	100.4	99.5	0	85	.09	76.1
1996	Cibolo Creek near Falls City (08186000)	no data										

REFERENCES

Ahtiainen, Marketta. 1988. Effects of forest clear-cutting and drainage on water quality in the Nurmes-study. *Suomen Akatemian julkaisuja* 4: 206-19.

_____. 1992. The effects of forest clear-cutting and scarification on the water quality of small brooks. *Hydrobiologia* 243-244 (Oct 2): 465-73.

Anderson, H. W. 1973. The effects of clearcutting on stream temperature: A literature review. DNR Report no. 29. Olympia, WA: State of Washington, Department of Natural Resources.

Bengeyfield, P. H. 1973. Chemical sensing of thermal pollution on forest watersheds. M.S. Thesis, University of West Virginia, Morgantown.

Beschta, R. L., R. E. Bilby, G. W. Brown, L. B. Holtby, and T. D. Hofstra. 1987. Stream temperature and aquatic habitat: fisheries and forestry interactions. In *Stream-side management. An interdisciplinary symposium on forestry and fisheries interactions*, ed. E. F. Salo and T. Cundy. Seattle, WA: University of Wahington, College of Forest Resources, 191-232.

Beschta, Robert L. and R. Lynn Taylor. 1988. Stream temperature increases and land use in a forested Oregon watershed. *Water Resources Bulletin* 24, no.1 (Feb): 19-25.

Binkley, Dan and Thomas C. Brown. 1993. Forest practices as nonpoint sources of pollution in North America. *Water Resources Bulletin* 29, no.5 (Oct): 729-40.

Brazier, J. R. and G. W. Brown. 1973. Buffer strips for stream temperature control. Research Paper 15. Forest Research Laboratory, School of Forestry, Oregon State University, Corvallis.

Brett, J. R. 1956. Some principles in the thermal requirements of fishes. *Quarterly Review of Biology* 31, no.2 (June): 75-87.

Brown, George W. 1969. Predicting temperatures on small streams. *Water Resources Research* 5, no.1 (Feb): 68-75.

_____. 1970. Predicting the effect of clearcutting on stream temperature. *Journal of Soil and Water Conservation* 25, no.1 (Jan-Feb): 11-13.

_____. 1980. *Forestry and water quality*. Corvallis, OR: Book Stores, Inc., Oregon State University, Corvallis.

_____. 1989. *Forestry and water quality*. Corvallis, OR: Oregon State University Bookstore.

Brown, George W. and James T. Krygier. 1967. Changing water temperatures in small mountain streams. *Journal of Soil and Water Conservation* 22, no.6 (Nov-Dec): 242-44.

Brown, George W. and James T. Krygier. 1970. Effects of clear-cutting on stream temperature. *Water Resources Research* 6, no.4 (Aug): 1133-40.

Brown, G. W., G. W. Swank, and J. Rothacher. 1971. Water temperature in the Steamboat drainage. USDA Forest Service Research Paper PNW-119, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

Brown, T. C., D. Brown, and D. Binkley. 1993. Law and programs for controlling nonpoint source pollution control in forest areas. *Water Resources Bulletin* 29: 1-13.

Burton, T. M. and G. E. Likens. 1973. The effect of strip-cutting on stream temperatures in the Hubbard Brook experimental forest, New Hampshire. *BioScience* 23, no.7 (July): 433-35.

Clark, John R. 1969. Thermal pollution and aquatic life. *Scientific American* 220, no.3 (Mar): 19-27.

Cooter, E. J. and W. S. Cooter. 1990. Impacts of greenhouse warming on water temperature and water quality in the southern United States. *Climate Res.* 1: 1-12.

Corbett, E. S., J. A. Lynch, and W. E. Sopper. 1975. Forest management practices as related to nutrient leaching and water quality. In *Conference on non-point sources of water pollution proceedings, Virginia Water Resources Research Center*. V.P.I. State University, Blacksburg, VA, 157-73.

Corbett, E. S., J. A. Lynch, and W. E. Sopper. 1978. Timber harvesting practices and water quality in the eastern United States. *Journal of Forestry* 76 (Aug): 484-88.

Craig, Robert P. 1979. The effects of urbanization on flood frequency in Pennsylvania, with population density as the index of development. M.S. Thesis, The Pennsylvania State University, University Park.

Crisp, D. T. and G. Howson. 1982. Effect of air temperature upon mean water temperature in streams in the North Pennines and English Lake District. *Freshwater Biology* 12: 359-67.

Delay, William H. and John Seaders. 1966. Predicting temperatures in rivers and reservoirs. *Journal of the Sanitary Engineering Division, Proceedings of the American Society of Civil Engineers* 92, no.SA1 (Feb): 115-33.

Dunne, Thomas and Luna B. Leopold. 1978. *Water in environmental planning*. New York: W.H. Freeman and Company.

Ebdon, David. 1985. *Statistics in geography*. New York: Basil Blackwell Inc.

Edington, J. M. 1966. Some observations on stream temperature. *Oikos* 15: 265-73.

Erman, D. C., J. D. Newbold, and K. B. Roby. 1977. *Evaluation of streamside buffer strips for protecting aquatic organisms*. California Water Resources Center, University of California, Davis.

Eschner, A. R. and J. Larmoyeux. 1963. Logging and trout: Four experimental forest practices and their effect on water quality. *Progressive Fish-Culturist* 25, no.2 (Apr): 59-67.

Feller, M. C. 1981. Effects of clearcutting and slashburning on stream temperature in southwestern British Columbia. *Water Resources Bulletin* 17, no.5 (Oct): 863-67.

Ferguson, Bruce K. and Philip W. Suckling. 1990. Changing rainfall-runoff relationships in the urbanizing Peachtree Creek watershed, Atlanta, Georgia. *Water Resources Bulletin* 26, no.2 (Apr): 313-22.

Frankel, R. J. and W. W. Hansen. 1968. Biological and physical responses in a freshwater dissolved oxygen model. In *Advances in water quality improvement*, ed. E. F. Gloyna and W. W. Eckenfelder, Jr. Austin, TX: University of Texas Press, 126-42.

Fritts, H. C. 1961. An analysis of maximum summer temperature inside and outside a forest. *Ecology* 42: 436-40.

Garman, Greg C. and John R. Moring. 1991. Initial effects of deforestation on physical characteristics of a boreal river. *Hydrobiologia* 209: 29-37.

Geiger, Rudolf. 1965. *The climate near the ground.* Cambridge, MA: Harvard University Press.

Gibbons, D. R. and E. O. Salo. 1973. An annotated bibliography of the effects of logging on fish of the western United States and Canada. U.S. Department of Agriculture Forest Service General Technical Report PNW-10.

Golterman, H., R. Clymo, and M. Ohnstad. 1978. *Methods for physical and chemical analysis of fresh waters*. Oxford, England: Blackwell Scientific.

Gousha Travel Publications. 1987. *Texas Roadmap*. San Jose, CA: Simon & Schuster.

Gray, J. R. A. and J. M. Edington. 1969. Effect of woodland clearance on stream temperature. *Journal of the Fisheries Research Board of Canada* 26, no.2 (Feb): 399-403.

Graynoth, E. 1979. Effects of logging on stream environments and faunas in Nelson. *New Zealand Journal of Marine and Freshwater Research* 13: 79-110.

Greene, G. E. 1950. Land use and trout streams. *Journal of Soil Conservation* 5: 125-26.

Gunter, G. 1957. Temperature. *Geological Society of America Memoir* 67: 15-184.

Harr, R. Dennis and Richard L. Fredriksen. 1988. Water quality after logging small watersheds within the Bull Run watershed, Oregon. *Water Resources Bulletin* 24, no.5 (Oct): 1103-11.

Hesser, R., R. Hoopes, C. B. Weirich, J. Selcher, B. Hollender, and R. Snyder. 1975. Chapter 2. The aquatic biota. In *Clearcutting in Pennsylvania.* Pennsylvania State University School of Forestry Resources, University Park, PA, 9-20.

Hewlett, J. D. and J. C. Forston. 1982. Stream temperature under an inadequate buffer strip in the Southeast Piedmont. *Water Resources Bulletin* 18, no.6 (Dec): 983-88.

Holopainen, A-L. and P. Huttunen. 1992. Effects of forest clear-cutting and soil disturbance on the biology of small forest brooks. *Hydrobiologia* 243-244 (Oct 2): 457-64.

Hornbeck, J. W., G. E. Likens, R. S. Pierce, and F. H. Bormann. 1975. Strip cutting as a means of protecting site and streamflow quality when clearcutting northern hardwoods. In *Forest Soils and Forest Land Management. American Forestry Soils Conference Proceedings 4, Quebec*, 209-25.

Hostetler, S. W. 1991. Analysis and modeling of long-term stream temperatures on the Steamboat Creek basin, Oregon: Implications for land use and fish habitat. *Water Resources Bulletin* 27, no.4 (Aug): 637-47.

Jeppesen, E. and T. M. Iversen. 1987. Two simple models for estimating daily mean water temperatures and diel variations in a Danish low gradient stream. *Oikos* 49: 149-55.

Jones, R. Christian and Christopher C. Clark. 1987. Impact of watershed urbanization on stream insect communities. *Water Resources Bulletin* 23, no.6 (Dec): 1047-55.

Lam, W. Y. C. 1981. Ecological studies of phytoplankton in the Waikato River and its catchment. *New Zealand Journal of Marine and Freshwater Research* 15: 95-103.

Larkin, P. A. and graduate students. 1959. The effects on fresh water fisheries of man-made activities in British Columbia. *Canadian Fish Culturist* 25: 27-59.

Lazaro, Timothy R. 1979. *Urban hydrology: A multidisciplinary perspective.* Ann Arbor, MI: Ann Arbor Science Publishers.

LeClerc, E. 1963. Self-purification of fresh water streams as affected by temperature and by the content of oxygen, nitrogen and other substances. *International Journal of Air and Water Pollution* 7: 357-65.

Lee, R. 1978. *Forest microclimatology.* New York, NY: Columbia University Press.

Lee, R. and D. E. Samuel. 1976. Some thermal and biological effects of forest cutting in West Virginia. *Journal of Environmental Quality* 5, no.4 (Oct-Dec): 362-66.

Likens, G. E., F. H. Bormann, N. M. Johnson, D. W. Fisher, and R. S. Pierce. 1970. Effects of forest cutting and herbicide treatment on nutrient budgets in the Hubbard Brook Watershed ecosystem. *Ecological Monographs* 40: 23-47.

Ludwig, Ch., H. Ranner, G. Kavka, W. Kohl, and U. Humpesch. 1990. Long term and seasonal aspects of water quality of the River Danube within the region of Vienna (Austria). In *Water pollution control in the Danube Basin*, ed. M. Miloradov. International Association on Water Pollution Research and Control, 51-58.

Lynch, J. A., E. S. Corbett, and R. Hoopes. 1979. Implications of forest management practices on the aquatic environment. *Fisheries* 2, no.2: 16-23.

Macan, T. T. 1958. The temperature of a small stony stream. *Hydrobiologia* 12, no.2-3: 89-106.

Maidment, David R. ed. in chief. 1993. *Handbook of hydrology.* New York, NY: McGraw-Hill.

Matthews, William J. 1987. Physicochemical tolerance and selectivity of stream fishes as related to their geographic ranges and local distributions. In *Community and evolutionary ecology of North American stream fishes*, ed. W. J. Matthews and D. C. Heins. Norman, OK: University of Oklahoma Press, 111-20.

Matthews, William J. and Earl G. Zimmerman. 1990. Potential effects of global warming on native fishes of the southern Great Plains and the Southwest. *Fisheries* 15, no.6 (Nov-Dec): 26-32.

Moore, A. M. 1967. Correlation and analysis of water-temperature data for Oregon streams. U.S. Geological Survey Water-Supply Paper 1819-K.

_____. 1968. Water temperatures in the lower Columbia River. U.S. Geological Survey Circular 551, 1-45.

Morgan, D. R. and E. Graynoth. 1978. The influence of forestry practices on the ecology of freshwater fish in New Zealand: An introduction to the literature. New Zealand Ministry of Agriculture and Fisheries, Fisheries Research Division, Occasional Publication no. 14.

Norusis, Marija J. and SPSS Inc. 1990. *SPSS introductory statistics student guide.* Chicago, IL: SPSS Inc.

O'Connor, D. J. 1967. The temporal and spatial distribution of dissolved oxygen in streams. *Water Resources Research* 3: 65-79.

O'Connor, D. J. and D. M. DiToro. 1968. An analysis of the dissolved oxygen variation in a flowing stream. In *Advances in water quality improvement*, ed. E. F. Gloyna and W. W. Eckenfelder, Jr. Austin, TX: University of Texas Press, 96-102.

Patton, D. R., 1973. A literature review of timber-harvesting effects on stream temperatures: Research needs for the Southwest. U.S. Department of Agriculture Forest Service Research Note RM-249.

Patton, R. D. 1980. The effect of streamside forest harvesting on stream temperature in the Georgia Mountains. M. S. Thesis, University of Georgia, Athens.

Pluhowski, Edward J. 1961. Variation in temperature of two streams on Long Island, New York. U.S. Geological Survey Professional Paper 424-D, Article 314, D55-58.

_____. 1970. Urbanization and its effect on the temperature of streams on Long Island, New York. U.S. Geological Survey Professional Paper 627-D, D1-110

_____. 1972. Clear-cutting and its effects on the water temperature of a small stream in northern Virginia. U.S. Geological Survey Professional Paper 800-C, C257-62.

Pluhowski, E. J. and I. H. Kantrowitz. 1963. Influence of land-surface conditions on ground-water temperatures in southwestern Suffolk County, Long Island, New York. U.S. Geological Survey Professional Paper 475-B, Article 51, B186-88.

Rand McNally. 1995. *Fort Worth, Texas: EasyFinder™.* Chicago, IL: Rand McNally.

Rand McNally. 1995. *San Antonio, Texas: city map.* Chicago, IL: Rand McNally and Company.

Rand McNally. 1996. *Dallas metro, Texas: city map.* Chicago, IL: Rand McNally.

Reynolds, W. W. 1977. Temperature as a proximate factor in orientation behavior. *Journal of the Fisheries Research Board of Canada* 34, no.5 (May): 734-39.

Rickard, William H. and Donald G. Watson. 1985. Four decades of environmental change and their influence upon native wildlife and fish on the Mid-Columbia River, Washington, USA. *Environmental Conservation* 12, no.3 (Autumn): 241-48.

Riggs, H. C., 1965. Effect of land use on the low flow of streams in Rappahannock County, Virginia. U.S. Geological Survey Professional Paper 525-C, 196-98.

Rishel, G. B., J. A. Lynch, E. S. Corbett. 1982. Seasonal stream temperature changes following forest harvesting. *Journal of Environmental Quality* 11, no.1: 112-16.

Rowe, L. K. and C. H. Taylor. 1994. Hydrology and related changes after harvesting native forest catchments and establishing *Pinus radiata* plantations. Part 3. Stream temperatures. *Hydrological Processes* 8, no.4 (Jul-Aug): 299-310.

Savini, J. and J. C. Kammerer. 1961. Urban growth and the water regimen. U.S. Geological Survey Water Supply Paper 1591-A, A1-9.

Scott, D. and M. Poynter. 1991. Upper temperature limits for trout in New Zealand and climate change. *Hydrobiologia* 222: 147-51.

Sharpe, W. E. and D. R. DeWalle. 1980. Water quality. In *Forest hydrology*. New York, NY: Columbia University Press, 217-65.

Shingleton, Michael V., Charles H. Hocutt, and Jay R. Stauffer, Jr. 1981. Temperature preference of the New River shiner. *Transactions of the American Fisheries Society* 110: 660-61.

Simmons, Dale L. and Richard J. Reynolds. 1982. Effects of urbanization on base flow of selected south-shore streams, Long Island, New York. *Water Resources Bulletin* 18, no.5 (Oct): 797-805.

Sinokrot, Bashar A. and Heinz G. Stefan. 1993. Stream temperature dynamics: Measurements and modeling. *Water Resources Research* 29, no.7 (July): 2299-312.

Sinokrot, Bashar A. and Heinz G. Stefan. 1994. Stream water-temperature sensitivity to weather and bed parameters. *Journal of Hydraulic Engineering* 120, no.6 (June): 722-39.

Smith, K. and M. E. Lavis. 1975. Environmental influences on the temperature of a small upland stream. *Oikos* 26: 228-36.

Stankowski, Stephen J. 1972. Population density as an indirect indicator of urban and suburban land-surface modifications. U.S. Geological Survey Professional Paper 800-B, B219-24.

Stauffer, J. R., Jr., K. L. Dickson, J. Cairns, Jr., and D. S. Cherry. 1976. The potential and realized influence of temperature on the distribution of fishes in New River, Glen Lyn, Virginia. *Wildlife Monographs* no.50 (Nov): 1-40.

Swift, L. W. and J. B. Messer. 1971. Forest cuttings raise temperatures of small streams in the southern Appalachians. *Journal of Soil and Water Conservation* 26, no.3 (May-Jun): 111-16.

Texas Department of Water Resources. 1983. *Intensive survey of Medio Creek: Hydrology, field measurements, water chemistry, and benthal oxygen demand.* Report no. IS-51. By Steve R. Twidwell. Austin, TX: Texas Department of Water Resources.

Texas Department of Water Resources. Water Quality Assessment Unit. 1982. *Intensive survey of Cibolo Creek Segment 1902: Hydrology, water chemistry, biology, reaeration rates.* Report no. IS-39. By David Buzan. Austin, TX: Texas Department of Water Resources.

Texas Department of Water Resources. Water Quality Assessment Unit. 1982. *Intensive survey of Salado Creek Segment 1910: Hydrology, water chemistry, biology.* Report no. IS-42. By David Buzan. Austin, TX: Texas Department of Water Resources.

Texas Department of Water Resources. 1984. *Intensive survey of East Fork Trinity River Segment 0819. Hydrology, field measurements, and water chemistry.* Report no. IS-58. By Steve R. Twidwell. Austin, TX: Texas Department of Water Resources.

Texas Department of Water Resources. 1984. *Intensive survey of the Trinity River Segment 0805, July 1983: Hydrology, field measurements, and water chemistry.* Report no. IS-67. By Jack R. Davis. Austin, TX: Texas Department of Water Resources.

Texas Natural Resource Conservation Commission. 1997. *Chapter 307 - Texas surface water quality standards.* Austin, TX: Texas Natural Resource Conservation Commission.

Texas Parks and Wildlife Department. 1975. *An analysis of Texas waterways: A report on the physical characteristics of rivers, streams, and bayous in Texas.* Austin, TX: The Texas Parks and Wildlife Department.

Texas Water Commission. 1986. *Intensive survey of Medio Creek Segment 1912, March 31 - April 3, 1986: Hydrology, field measurements, water chemistry.* Report no. IS 86-08. By Stephen R. Twidwell. Austin, TX: Texas Water Commission.

Texas Water Commission. 1987. *Intensive surveys of San Antonio River Segments 1901 and 1911, June 6, 1984 - May 16, 1985: Hydrology, field measurements, water chemistry, and benthic macroinvertebrates*. Report no. IS 87-04. By Stephen R. Twidwell and Jack R. Davis. Austin, TX: Texas Water Commission.

Texas Water Commission. 1989. *Segment identification maps for Texas river and coastal basins. LP 85-01*. Austin, TX: Texas Water Commission.

Texas Water Quality Board. Field Operations Division. Special Studies Section. 1977. *Intensive surface water monitoring survey for Segment nos. 0804, 0805, 0806, 0819, & 0822 Trinity River*. Report no. IMS-57. By Clyde E. Bohmfalk. Austin, TX: Texas Water Quality Board.

Texas Water Quality Board. Field Operations Division. Special Studies Section. 1977. *Intensive surface water monitoring survey for Segment no. 1903 Medina River*. Report no. IMS-46. By Steve R. Twidwell. Austin, TX: Texas Water Quality Board.

Texas Water Quality Board. Field Operations Division. Surveillance Section. 1977. *Intensive surface water monitoring survey for Segment no. 1906 Leon Creek*. Report no. IMS-45. By H. Dwayne Rathburn. Austin, TX: Texas Water Quality Board.

U.S. Department of Commerce. Bureau of the Census. 1971. *Census of population, 1970· General population characteristics. Final Report PC(1)-B45, Texas*. Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. Bureau of the Census. 1972. *U.S. census of population and housing: 1970. Census tracts. Final report PHC(1)-52, Dallas, Tex. SMSA*. Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. Bureau of the Census. 1972. *U.S. census of population and housing. 1970. Census tracts. Final report PHC(1)-74, Fort Worth, Tex. SMSA and adjacent area*. Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. Bureau of the Census. 1972. *U.S. census of population and housing: 1970. Census tracts Final report PHC(1)-186, San Antonio, Tex. SMSA*. Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. Bureau of the Census. 1973. *Census of population: 1970. Volume 1. Characteristics of the population. Part 45, Texas - Section 1*. Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. Bureau of the Census. 1982. *1980 Census of population. Volume 1. Characteristics of the population. Chapter B. General population characteristics Part 45. Texas PC80-1-B45*. Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. Bureau of the Census. 1982(?). *1980 Census of population and housing Census tracts: Dallas-Fort Worth, Tex. Standard Metropolitan Statistical Area. Maps. PHC80-2-131*. Sections 1&2 of 2. Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. Bureau of the Census. 1982(?). *1980 Census of population and housing. Census tracts: San Antonio, Tex. Standard Metropolitan Statistical Area. Maps. PHC80-2-319*. Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. Bureau of the Census. 1983. *1980 census of population and housing. Census tracts: Dallas-Fort Worth, Tex. Standard Metropolitan Statistical Area (PHC80-2-131).* Sections 1&2 of 2. Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. Bureau of the Census. 1983. *1980 census of population and housing. Census tracts: San Antonio, Tex. Standard Metropolitan Statistical Area (PHC80-2-319)* Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. Bureau of the Census. 1991. *1990 census of population and housing. Population and housing characteristics for census tracts and block numbering areas. Dallas-Fort Worth, TX CMSA (part): Dallas, TX PMSA. Maps. 1990 CPH-3-125A.* Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. Bureau of the Census. 1991. *1990 census of population and housing Population and housing characteristics for census tracts and block numbering areas. Dallas-Fort Worth, TX CMSA (part): Fort Worth-Arlington, TX PMSA. Maps. 1990 CPH-3-125B.* Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. Bureau of the Census. 1991. *1990 census of population and housing Population and housing characteristics for census tracts and block numbering areas. San Antonio, TX MSA Maps 1990 CPH-3-292.* Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. Bureau of the Census. 1991. *1990 census of population and housing. Population and housing characteristics for census tracts and block numbering areas Texas (outside metropolitan areas). Maps (1990 CPH-3-45): Henderson County (213), Karnes County (255), Medina County (325), Navarro County (349), Wilson County (493).* Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. Bureau of the Census. 1993. *1990 census of population and housing. Population and housing characteristics for census tracts and block numbering areas. Dallas-Fort Worth, TX CMSA (part)· Dallas, TX PMSA (CPH-3-125A).* Section 1 of 3. Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. Bureau of the Census. 1993. *1990 census of population and housing. Population and housing characteristics for census tracts and block numbering areas. Dallas-Fort Worth, TX CMSA (part): Fort Worth-Arlington, TX PMSA (CPH-3-125B).* Section 1 of 2. Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. Bureau of the Census. 1993. *1990 census of population and housing. Population and housing characteristics for census tracts and block numbering areas. San Antonio, TX MSA (CPH-3-292).* Section 1 of 2. Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. Bureau of the Census. 1993. *1990 census of population and housing. Population and housing characteristics for census tracts and block numbering areas. Texas (outside metropolitan areas).* Section 1 of 3. Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. Bureau of the Census and Manpower Administration. 1974. *Urban Atlas, GE80-7240, San Antonio, Tex., SMSA.* Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. Bureau of the Census and Manpower Administration. 1975. *Urban Atlas, GE80-1920, Dallas, Tex., SMSA.* Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. Bureau of the Census and Manpower Administration. 1975(?). *Urban Atlas, GE80-2800, Fort Worth, Tex., SMSA*. Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. Census Bureau. 1990. *Post 1990 Census TIGER/Line files*. Washington, D.C.: U.S. Census Bureau.

U.S. Department of Commerce. Census Bureau. 1992(?). *TIGER/Line '92*. Washington, D.C.: U.S. Census Bureau.

U.S. Department of Commerce. National Oceanic and Atmospheric Administration. 1973-74. *Climatological data: National summary* (1972-73). Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. National Oceanic and Atmospheric Administration. Environmental Data and Information Service. 1978-83. *Daily weather maps: Weekly series* (1978-83). Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. National Oceanic and Atmospheric Administration. Environmental Data and Information Service. National Climatic Center. 1979-83. *Climatological data: Texas* (1978-82). Asheville, NC: National Oceanic and Atmospheric Administration. National Climatic Center.

U.S. Department of Commerce. National Oceanic and Atmospheric Administration. Environmental Data Service. 1977-78. *Daily weather maps: Weekly series* (1977-78). Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. National Oceanic and Atmospheric Administration. Environmental Data Service. National Climatic Center. 1978-79. *Climatological data· Texas* (1977-78). Asheville, NC: National Oceanic and Atmospheric Administration. National Climatic Center.

U.S. Department of Commerce. National Oceanic and Atmospheric Administration. National Environmental Satellite, Data, and Information Service. 1983-84. *Daily weather maps: Weekly series* (1983-84). Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. National Oceanic and Atmospheric Administration. National Environmental Satellite, Data, and Information Service. National Climatic Data Center. 1983-96. *Climatological data: Texas* (1982- 95). Asheville, NC: National Oceanic and Atmospheric Administration. National Climatic Data Center.

U.S. Department of Commerce. National Oceanic and Atmospheric Administration. National Weather Service. National Meteorological Center. Climate Analysis Center. 1984-90. *Daily weather maps: Weekly series* (1984-90). Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. National Oceanic and Atmospheric Administration. National Weather Service. National Meteorological Center. Meteorological Operations Division & Climate Analysis Center. 1990-95. *Daily weather maps: Weekly series* (1990-95). Washington, D.C.: U.S. Government Printing Office.

U.S. Geological Survey. 1964. *Texas. Base map with highways and contours (topographic). 1:500,000.* NE and SE sheets. Washington, D.C.: U.S. Geological Survey.

U.S. Geological Survey. 1978. *Water resources data for Texas, water year 1977*, vol. 1 and 3. Austin, TX: U.S. Geological Survey.

U.S. Geological Survey. 1979-81. *Water resources data for Texas* (1978-80), vol. 1 and 3. Austin, TX: U.S. Geological Survey.

U.S. Geological Survey. 1982-91. *Water resources data - Texas* (1981-90), vol. 1 and 3. Austin, TX: U.S. Geological Survey.

U.S. Geological Survey. 1985. *Corsicana, Texas. 1:100,000-scale metric topographic map.* Denver, CO: U.S. Geological Survey.

U.S. Geological Survey. 1985. *Cuero, Texas. 1:100,000-scale metric topographic map.* Denver, CO: U.S. Geological Survey.

U.S. Geological Survey. 1985. *Fort Worth, Texas. 1:100,000-scale metric topographic map.* Denver, CO: U.S. Geological Survey.

U.S. Geological Survey. 1985. *Pleasanton, Texas. 1:100,000-scale metric topographic map.* Denver, CO: U.S. Geological Survey.

U.S. Geological Survey. 1985. *San Antonio, Texas. 1:100,000-scale metric topographic map.* Denver, CO: U.S. Geological Survey.

U.S. Geological Survey. 1986. *Dallas, Texas. 1:100,000-scale metric topographic map.* Denver, CO: U.S. Geological Survey.

U.S. Geological Survey. 1992. *New Braunfels, Texas. 1:100,000-scale metric topographic map.* Denver, CO: U.S. Geological Survey.

U.S. Geological Survey. 1992-96. *Water resources data - Texas* (1991-95), vol. 1 and 3 *Surface water.* Austin, TX: U.S. Geological Survey.

U.S. Geological Survey. EROS Data Center. 1996. One-meter color infrared digital orthophoto quarter quads: Dallas SE, Dallas SW, Fort Worth NE, Fort Worth NW, Haltom City SE, Haltom City SW, Hutchins NW, Oak Cliff NE, Oak Cliff NW, San Antonio East SE, San Antonio East SW, Southton NE, Southton NW, Terrell Wells NE, and Terrell Wells NW quarter quads. Produced by VARGIS LLC of Herndon, VA for the Texas Orthoimagery Program (TOP). Sioux Falls, SD: U.S. Geological Survey.

Vannote, R. L. and B. W. Sweeney. 1980. Geographic analysis of thermal equilibria; a conceptual model for evaluating the effect of natural and modified thermal regimes on aquatic insect communities. *American Naturalist* 115: 667-95.

Webb, B. W., and D. E. Walling. 1985. Temporal variation of river water temperatures in a Devon river system. *Hydrological Sciences Journal/Journal des Sciences Hydrologiques* 30: 449-64.

Webb, B. W. and D. E. Walling. 1992. Long term water temperature behaviour and trends in a Devon, UK, river system. *Hydrological Sciences Journal/Journal des Sciences Hydrologiques* 37, no.6 (Dec): 567-80.

Webb, B. W., and D. E. Walling. 1993. Longer-term water temperature behaviour in an upland stream. *Hydrological Processes* 7, no.1 (Jan-Mar): 19-32.

Williams, Owen O. 1968. Reservoir effect on downstream water temperatures in the upper Delaware River Basin. U.S. Geological Survey Professional Paper 600-B, B195-99.

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