MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS
FISHERIES DIVISION

JOB PROGRESS REPORT

State:	Montana	Title:	Southwest Montana Fisheries Investigations
Project No.:	F-9-R-32	Title:	Inventory and Survey of Waters of the Project Area
Job No.:	I-C		

Project Period: July 1, 1982 through June 30, 1984

Report Period: July 1, 1982 through June 30, 1984

ABSTRACT

Populations of rainbow, brown and Yellowstone cutthroat trout in four (4) sections of the Upper Yellowstone River are discussed. Particular emphasis is given to Yellowstone cutthroat and factors that may be limiting to their numbers.

Tributaries of the Upper Yellowstone were sampled to assess the characteristics of Yellowstone cutthroat spawning runs.

Two sections of the Shields River were sampled. Summer flows appear to be one factor limiting the populations of brown trout near Wilsall. Selected water quality parameters of the Shields River are discussed.

Water temperatures at two sites on the Yellowstone River are discussed.

Fish populations in Dailey Lake have returned to pre-rehabilitation levels. Walleye are growing well, but do not appear to be capable of controlling the number of yellow perch at this time.

Stream protection efforts in the area are discussed.

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OBJECTIVES

1. To determine fish populations in at least two (2) established study sections of the Yellowstone River, and one (1) established study section of the Shields River.

2. To determine flow, water temperatures and selected water quality parameters at two (2) established sites on the Shields River.

3. To monitor water temperatures at two (2) established sites on the Yellowstone River.

4. To assess walleye planting success in Dailey Lake.

5. To mitigate or enhance habitat alterations due to agricultural, residential, mining and industrial development.

DEGREE OF ATTAINMENT

1. Fish population estimates were made in four (4) sections of the Yellowstone River and two (2) sections of the Shields River. Data are presented in this report.

2. Flows, water temperatures, and water quality were collected from the Shields River. Data are presented in this report.

3. Water temperatures were monitored at two (2) sites on the Yellowstone River. Data are presented in this report.

4. An assessment of walleye planting success in Dailey Lake was made. Data are presented in this report.

5. Mitigation and enhancement of habitat alterations due to agricultural, residential, mining and industrial development was accomplished. Data are included in this report.

BACKGROUND

As a result of legislative action, the Montana Department of Fish, Wildlife and Parks has obtained water rights or reservations for instream flows in numerous Montana streams. At this time the Yellowstone Drainage is the only river system that has been through the reservation process. As of December 15, 1978 the Montana Department of Fish, Wildlife and Parks and the Montana Department of Health and Environmental Sciences were granted certain instream flows in streams throughout the Yellowstone Drainage. The Board of Natural Resources, which granted these rights, instructed the Department to update and enhance its justifications for receiving these instream flows. Therefore, the Department must continue to monitor fish populations and study the correlations between these populations and stream flows in the mainstem Yellowstone and its tributaries.

At the same time, these studies should identify the effects that fishermen are having on populations of brown, rainbow and Yellowstone cutthroat trout in the Yellowstone River. As a result of these studies, the Department will adapt regulations and limits to best manage the fisheries resource.

The Shields River drainage is an unstable environment characterized by channel changes, erosion, flooding and summer dewatering. The effects of these conditions on the fisheries within the Shields River continue to be monitored.

The effects of different management plans on Dailey Lake fish populations continue to be monitored.

The Department of Fish, Wildlife and parks is responsible for protecting and enhancing the fishery resource in Montana. The Stream Protection Act of 1963 and the Natural Streambed and Land Preservation Act of 1975 were passed by the state legislature to give the Department the ability to protect the physical integrity of streams. These laws have been a valuable aid in protecting the fishery resources of Montana.

PROCEDURES

Fish populations were sampled in the Yellowstone River using an 18-foot aluminum boat powered by an 80-hp outboard jet motor. The boat was equipped with a double boom electrode system which was designed according to Novotny and Priegel (1971) as modified by Peterman (1978).

Generally, three mark and three recapture runs were made on each section to obtain a population estimate. Also, electrofishing was conducted throughout the Upper Yellowstone during 1983 for the purpose of tagging fish to study seasonal movements within the system.

In the Shields River, fish populations were sampled with a mobile electrode system. Population estimates were calculated according to Vincent (1971). Electrofishing in tributary streams was accomplished with a mobile electrode and a stationary streambank power source.

Water quality and flows were monitored on the Shields River at approximately weekly intervals during critical flow periods and monthly intervals during the winter. Water temperatures were measured with maximum/minimum termometers while turbidity was measured using a Hach Model 2100 A turbidimeter. Flow measurements were made with a hand-held current meter and stage measurements.

Fish populations in Dailey Lake were sampled using experimental 125-foot (3/4 to 2 inch) gill nets.

FINDINGS

Yellowstone River

Four study sections of the Yellowstone River were sampled during 1982 and and 1983 (Figure 1). Two new sections have been sampled since the last report period--the Mill Creek Bridge section, and the Springdale section.

Springdale. This section was sampled during the springs of 1982 and 1983. Its confluence is near the mouth of Peterson Creek and its terminus at the Springdale Bridge, a distance of 4.8 miles. Table 1 depicts the population estimates for 1982 and 1983 in this section.

Brown trout and rainbow trout populations were similar in 1982 and 1983 while Yellowstone cutthroat numbers decreased dramatically between 1982 and 1983. The Yellowstone cutthroat numbers decreased in 1983 due to a poor year class of two-year-olds in 1983. This decrease appears to be related to low flows during the 1981 spawning season and is discussed in detail in other report sections.

Table 2 characterizes the Yellowstone cutthroat population in this section during 1982 and 1983.

9th Street Bridge. This section has been electrofished since 1973. Spring estimates for rainbow and brown trout in this section since 1973 are presented in Table 3.

Rainbow trout have generally increased in numbers since 1973, a year after stocking of hatchery rainbow trout ceased. Vincent (1973) documented increases in wild trout populations in total numbers after a 20-year catchable rainbow trout program had been discontinued on the Madison River. He also found that the population of brown trout in O'Dell Creek decreased by 45% in number after stocking of hatchery rainbow trout. It appears that since the cessation of stocking in the Yellowstone River, the population of rainbow has increased.

Brown trout numbers have oscillated since 1973. The factors influencing fluctuations in the brown trout population are unclear but may be related to the influence of flow regime on brown trout recruitment.

The number of rainbow trout longer than 16 inches in this section is presented in Figure 2. The population of 16-inch and longer fish decreased dramatically in 1983. The reason for this decrease may be related to the water year 1982. An extended high flow period was followed by an excessive amount of turbidity resulting from unstable stream conditions in the Lamar River Valley of Yellowstone National Park. It appears as though growth rates for rainbow trout were reduced during the 1982 water year. Figure 4 compares length/weight relationship of rainbow trout during the fall of 1981, 1982 and 1983. During the fall of 1982, the rainbow trout were in poorer condition due to poor growth during 1982 and this may have resulted in a loss of 16-inch and longer fish during 1982 (Table 4). The fish entered the winter of 1982 in poor shape and mortality by the spring of 1983 may have been excessive, resulting in a low population of fish in 1983 (Figure 2). By the fall of 1983 the population had recovered partially (Table 4).

Brown trout longer than 16 inches have fluctuated in the past 10 years in this section (Figure 3). Since 1981 the number of brown trout has decreased.

This section has a very small population of Yellowstone cutthroat. Table 5 depicts the number of Yellowstone cutthroat in 1982 and 1983.

The mortality rate of three-year-old and older cutthroat trout was 75% between 1982 and 1983. This section in heavily fished and fishermen may be affecting the number of larger cutthroat trout in the section.

Mill Creek Bridge. This section begins at the Mill Creek Bridge and extends downstream to the lower Loch Leven Fishing access site, a distance of 5.75 miles. This section contains primarily brown trout with lesser numbers of rainbow and cutthroat trout.

Population estimates have been collected since the fall of 1980. Spring estimates are generally easily obtainable; however, fall population estimates are very difficult to collect because of warm water temperatures and water clarity.

Brown Trout. Spring population estimates of brown trout are presented in Table 6. The population of brown trout was similar in 1981 and 1982, but decreased in 1983. A creel census conducted on this section during 1982 indicated fishermen harvested about 27% of the four-year-old and older brown trout (preliminary data from Javorsky 1983). This harvest may be having an effect on the number of large brown trout in the section. This section is characterized by low recruitment to the population (Table 7). Considering the low recruitment rates, the population of large brown trout may not be able to support significant fishing harvest.

Table 7 indicates the number of one-year-olds per mile during the fall was between 83 and 334 per mile. This is much lower recruitment than many other streams in the area. The low recruitment appears to be related to the absence of instream cover for juvenile fish.

The number of one-year-olds during 1983 was considerable lower than previous years. This may be related to flows during the 1981 spawning season for brown trout. Discharge in the Yellowstone River during the fall and winter of 1981 was quite low and may have resulted in decreased brown trout reproductive success.

Rainbow Trout. The rainbow trout population in this section appears to be somewhat migratory. Table 8 illustrates the population estimates of rainbow trout in this section during the periods indicated.

It appears that spring population estimates are inflated due to movement into this section of spawning rainbows from downstream. Fall estimates appear to represent the resident rainbow population. Recruitment of young rainbow appears to be poor in this section. In the fall of 1982 numbers of yearling rainbow per mile were estimated to be 33, which is very low.

During the spring of 1983, 191 rainbow trout 14 inches and longer were tagged in this section in an attempt to assess movement between spring and fall. Four of these fish have been collected since then, one by a fisherman and three by electrofishing. All were found downstream from the section--one about two miles downstream and the others about five miles downstream.

This section may support a small population of resident rainbow and a population of migratory rainbow trout during the spring. If this is true, it will be difficult to assess the effects of fishing harvest on the population.

Yellowstone Cutthroat. The population of Yellowstone cutthroats in this section apppears to be receiving heavy fishing harvest pressure and also has fairly low recruitment of young fish when compared to other sections of the river (Table 9). Table 9 illustrates the 1982 and 1983 population estimates and the fishing harvest during 1982 of three-year-old and older Yellowstone cutthroat.

The population of age three and older cutthroat trout suffered a 52% mortality rate between spring and fall, most of it fishing related. When the 14% winter mortality rate is added to that, the population suffered a 66% annual mortality rate.

Considering the high mortality rate and the low recruitment in this section, regulations which protect the cutthroat trout from fishing harvest should be considered.

Corwin Springs. This section was electrofished in 1978, 1979 and from 1981-1983. Table 10 lists the number of two-year-old and older brown trout and Yellowstone cutthroat in this section during the years of the study. Rainbow trout have not been aged; data will be presented in a later report.

Brown trout numbers have fluctuated between 2014 and 3413 in the five years of study. The number of brown trout longer than 14 inches has remained fairly constant, except during 1981 when the population was considerably lower (Figure 5).

Yellowstone cutthroat have fluctuated between 1052 and 1677 in the five years studied. Recruitment from the younger year classes varies considerably between years and affects the total population dramatically. Instream flows during the incubation period of cutthroat trout may be affecting the survival of young-of-the-year cutthroat. Table 12 depicts the mean September flow at Corwin Springs and the number of two-year-old cuttroat trout in the Corwin Springs study section two years later.

While cutthroat trout are basically tributary spawners and the amount of spawnint in the river is unknown, river flows are an indication of tributary flows for which there are no measured data. There does appear to be a relationship between flows and survival of young cutthroat trout.

The annual mortality rate of three-year-old and older cutthroat varied during the two years studied (Table 12). Between he spring of 1981 and 1982, the annual mortality for two-year-old and older Yellowstone cutthroat was 71%. Between spring 1982 and 1983, the annual mortality rate was 54%. The difference between the two years may be attributable to fishing as 1981 was considered a much better year for fishing. The 71% annual mortality rate during 1981 may be excessive and the possibility of more restrictive regulations may be considered.

Cutthroat trout are vulnerable to fishing harvest (MacPhee 1966). They tend to be over represented in the catch when compared to actual numbers in the stream (Vincent and Clancey 1980; Behnke 1983).

Restrictive regulations have been implemented in many areas in an attempt to increase the number of larger trout. Catch and release appears to be an effective method for increasing the numbers of large cutthroat trout as it has succeeded on many streams (Lindland 1979, 1982, 1983; Johnson and Bjornn 1978). Other regulations have also increased the number of larger cutthroat trout such as closing spawning tributaries to fishing (Thurow and Bjornn 1978), which increased the number of spawners and increased reproduction. Minimum or maximum size limits have produced larger trout in Yellowstone Park (Gresswell 1983).

Decreasing the daily possession limit may work if the number is set below the number that most fishermen are keeping. In the North Fork of the Clearwater River a daily limit was decreased from 15 to 3 but it did not increase the number of larger cutthroat trout (Johnson and Bjornn 1978), while a 3-fish limit on the St. Joe River did increase the number of large cutthroat trout. Depending on the situation, a decrease in daily limit may or may not succeed (Lewinsky and Bjornn 1983).

Yellowstone Cutthroat Spawning Survey

During the spring of 1983 over 1200 Yellowstone cutthroat were tagged in the mainstem of the Yellowstone River between Corwin Springs and Springdale. During late June and July of 1983 tributary streams in the same area were electrofished to assess relative size of the spawning run and to search for tagged fish from the mainstem of the Yellowstone. Tributary streams sampled included: Mol Heron, Cedar, Tom Miner, Big, Emigrant Spring, Mill, McDonald Spring, Shields River, Mission and Peterson creeks (Figure 6). The following sections characterize the spawning run in each of the above mentioned streams.

Mol Heron Creek. Table 13 illustrates the dates the lower 500 feet of Mol Herron Creek was sampled and contains pertinent information about the run.

The spawning run was first sampled on June 28th when a few fish were found. Ripe males were collected all through the sampling season, but ripe females were found only on July 12th. This was apparently near the peak of the spawning run. Water temperatures at this time were reaching a maximum of 60° and the minimum in the low 40s.

Six tag returns from the Yellowstone River were collected during sampling. All six of these had been tagged within one mile of the mouth of Mol Heron Creek.

Cedar Creek. Table 14 illustrates the dates Cedar Creek was sampled and contains pertinent information about the run.

The spawning run was first sampled on June 23rd when a few fish were found. After July 1st, the number of fish collected remained fairly constant until July 27th. There did not appear to be a definite peak to the run as the sex ratio of males to females was closest to 1:1 on two occasions--July 8th and 22nd. Berg (1975) found the spawning run in Cedar Creek peaked when the water temperature reached a peak of 54-56°F. This is consistent with the results of 1983, as the run peaked when the maximum water temperature was in the 54°F range (Table 14).

Eighteen tag returns from the Yellowstone River were collected during sampling. Six of these were tagged upstream from the mouth of Cedar Creek and 12 were tagged downstream from the mouth of Cedar Creek.

The furthest distance that a tagged fish had covered to enter Cedar Creek was from about one mile dowstream from Tom Miner Creek, a total distance of about 8 miles. Berg (1975) found fish from as far as 12 to 14 miles downstream had entered Cedar Creek.

Most fish were captured only once during sampling;however, of the fish that were captured on more than one occasion, males tended to remain in the area longer. Of the multiple recaptures, males averaged 12 days between first and last capture while females averaged 6 days. Berg (1975) stated that males either entered the stream more often or stayed longer than females. This is confirmed by the 1983 data.

Table 15 depicts the mean size of Yellowstone cutthroat captured during 1981 and 1983 sampling compared to sampling during 1973 and 1974. The average size and percent of fish longer than 15 inches has decreased since 1973-74. This could be a result of fishing pressure in the Upper Yellowstone. Fishermen may be harvesting the larger fish and therefore the spawning run is composed of smaller fish.

Tom Miner Creek. Table 16 contains dates and other pertinent information characterizing the Yellowstone cutthroat spawning run into Tom Miner Creek during 1983.

The spawning run was first sampled on July 6th. Earlier sampling was ineffective due to high water. The peak of the spawning run appears to have occurred in early July when maximum water temperatures were in the low 60s. The sex ratio was 1:1 on July 8th. This was also the time period when the highest number of females were captured.

Twelve tag returns from the Yellowstone River were collected during sampling. Three of the returns were tagged upstream from Tom Miner Creek and nine of the returns were from downstream from Tom Miner Creek. The furthest distance a fish migrated to spawn in Tom Miner Creek was one tagged 28 miles downstream. Another migrated nine miles upstream to spawn in Tom Miner Creek. Males tended to stay in the area for a longer period of time as four were recaptured once in the creek and no females were captured more than once in the creek.

Big Creek. Table 17 illustrates the dates that 1000 feet of Big Creek near US 89 were sampled and contains pertinent information about the spawning run.

Sampling during 1983 indicated the spawning run in Big Creek is light. A total of four Yellowstone cutthroat trout were captured in three survey samples, indicating the spawning run is not extensive.

The lower section of Big Creek dries up many years as a result of dewatering by irrigation. This could be causing the Yellowstone cutthroat spawning run to diminish (Berg 1975).

One tag return from the Yellowstone River was collected during sampling. This fish had been tagged near the Emigrant Bridge and had migrated eight miles upstream to spawn in Big Creek.

Mill Creek. Mill Creek was electrofished on four occasions during 1983 between June 30th and July 20th. A total of four migratory Yellowstone cutthroat were captured, none of which was previously tagged in the Yellowstone River. The lower section of Mill Creek is dewatered in many years during the late summer. This could be detrimental to the Yellowstone cutthroat spawning migration.

McDonald Spring Creek. Table 18 illustrates the dates McDonald Spring Creek was sampled and contains pertinent information about the run.

The spawning migration in McDonald Spring Creek was sampled three times between June 23rd and July 7th. The sample on June 23rd produced the most fish and it declined there after. Female cutthroat were not captured during sampling. The peak of migration may have been finished before sampling began.

No tag returns from the Yellowstone River were collected. However, a fisherman captured a fish that was tagged in McDonald Spring Creek. It ws caught on October 10th approximately 20 miles downstream from the mouth of McDonald Spring Creek.

Peterson Creek. Table 19 illustrates the dates Peterson Creek was sampled and contains pertinent information about the run.

The spawning migration in Peterson Creek was sampled between June 20th and July 5th. The total number of fish was fairly constant between June 20th and July 1st, and declined after that. The sex ratio approached1:1 on June 24th; this may have been the peak of the run. Maximum water temperatures at this time were in the high 50s and low 60s.

Seven tag returns from the Yellowstone River were captured in Peterson Creek. Six of the returns were from downstream from Peterson Creek and one was from upstream. The furthest a tagged fish had migrated to spawn in Peterson Creek was five miles.

Emigrant Spring Creek, Shields River and Mission Creek. These waters were also sampled during the same time period. No migratory Yellowstone cutthroat were captured in these waters. Berg (1975) documented a spawning migration into Emigrant Spring Creek; future sampling may delineate the size of this run.

Summary of Yellowstone Cutthroat Movements

Tag returns in 1983 indicate Yellowstone cutthroat tend to live downstream from their spawning tributaries. Four streams were found to support strong runs of cutthroat: Mol Heron, Cedar, Tom Miner and Peterson creeks. The streams in the Paradise Valley do not appear to support strong spawning runs of cutthroat trout and as a result, there appears to be some upstream movement from Paradise Valley into the Tom Miner Creek area for spawning purposes. This is apparent from tag returns in Tom Miner Creek as well as a fish captured on May 27th that had moved upstream from the Mill Creek Bridge section to Carbella in less than one month. A fisherman returned a tag from a fish he had caught on September 3rd near Tom Miner Creek which had been tagged on May 5th in the Mill Creek Bridge section.

Dewatering of tributaries in Paradise Valley may well be limiting the reproduction by Yellowstone cutthroat in that area. Table 20 depicts the spring number of two-year-old cutthroat trout per mile in the four study sections of the Yellowstone River.

Two-year-old Yellowstone cutthroat are between 7 and 10 inches in the spring and are probably a good indicator of recruitment success. The number of two-year-olds in the spring of 1982 was highest at Springdale and Corwin Springs. Mill Creek Bridge and 9th Street Bridge had fewer two-year-olds, probably because of poorer reproduction in that section of river.

The number of two-year-olds in 1983 was fewer than in 1982. This may be a result of poorer reproductive success in 1981. During 1981, flows tended to be quite low when compared to 1980. Flow data are not available for the spawning tributaries of the Upper Yellowstone, but in general 1980 maintained more consistant flows in all streams than 1981. It is possible 1980 produced a larger year class of Yellowstone cutthroat than 1981 for this reason. Continued data collection should help define the needs of Yellowstone cutthroat in the Upper Yellowstone.

Cutthroat trout often migrate from large bodies of water to small streams for spawning or other purposes. Mallet (1963) found seasonal movements of cutthroat trout in the Salmon River, Idaho to be related to icing of tributaries. Johnson (1963) found cutthroat trout moving as much as 40 miles in the Flathead River; however, he did not speculate as to why. Most migrations appear to be related to spawning. McCleave (1967), LaBar (1971), and McCleave and LaBar (1972) found cutthroat trout tend to home to a particular stream after being displaced from it. Berg (1975) illustrated cutthroat trout in the Yellowstone River homed to Cedar Creek. It is possible these fish are returning to their natal stream. If this is the case, the fish which are moving upstream in the Yellowstone River may be returning to their natal stream. It is possible the creeks in the upper basin are supporting cutthroat trout populations in Paradise Valley. Miller (1957) found younger cutthroat trout tended to drift downstream while mature cutthroat trout were more sedentary. If this is occurring in the Yellowstone River, the young cutthroat may be drifting downstream from the upper basin to supplement the population in Paradise Valley. This could be the reason for the lower number of two-year-olds in Paradise Valley compared to Corwin Springs. Some non-spawning movement occurs in the Yellowstone River but most cutthroat caught in the Yellowstone River were captured near the area of tagging. Ball and Cope (1961) found less than 15% of adult cutthroat trout spawn every year; Miller (1957) found adult cutthroat trout were sedentary in Gorge Creek, Alberta.

Shields River

The Shields River is characterized by unstable eroding stream banks caused by frequent high water and man made channel alterations (Batchelor 1983). Also, portions of the stream are dewatered during the irrigation season.

Two sections of the Shields River were studied during 1982-1983: the Convict Grate section (Site 1), located near the mouth, and the Zimmerman section (Site 3), located north of Wilsall (Figure 7).

Convict Grade. This section has been electrofished at irregular intervals in the past 10 years. Population estimates were completed in 1972, 1974, 1975, 1978, 1979, 1982 and 1983. The 1972, 1974, 1975 and 1978 estimates were completed during the fall; they will not be included in this discussion. Tables 21-23 illustrate the spring population estimates from this section during 1979, 1982 and 1983.

Brown trout numbers decreased between 1979 and 1982 and then increased in 1983 to a level similar to 1979. Rainbow trout also increased between 1982 and 1983. Mountain whitefish numbers have decreased between 1979 and 1983; however, the difference may not be significant.

Zimmerman.

Brown Trout. This section was electrofished at irregular intervals in the past. Population estimates were collected in 1975 and 1978-1983. The following discussion pertains to the data collected from 1980-1983.

Further collection will be needed before any conclusions may be drawn as to the status of the younger age groups, so the following discussion pertains to three-year-old and older brown trout. Table 24 depicts the population estimates of three-year-old and older brown trout and mortality rates between population estimates.

The trend in pouplation estimates suggests mortality rates during the winter are generally about 11% or lower, while mortality rates during the summer months are considerably higher. This could be a result of summer dewatering. Figure 8 depicts the summer flow patterns in this section from 1981-1983.

Depending upon the year, flows tend to be lowest during mid-August through mid-September; the lowest flow recorded was 6.4 cfs during September 1981. The low winter mortality rates may be a result of low populations in the fall which overwinter with little competition and therefore display insignificant mortality.

Water temperatures do not appear to reach a point which would be detrimental to trout. Figure 9 depicts water temperatures in this section during 1982 and 1983. The highest recorded temperature in the section was 70° in August 1983. However, during 1981 and 1982 the water temperature never reached 70° (Clancy 1983).

Mountain Whitefish. Table 25 depicts the numbers of mountain whitefish per 1000 feet in this section during the spring of 1979 and 1981-1983.

Mountain whitefish populations appear to have increased between 1979 and 1981 and decreased between 1981 and 1983.

Turbidity. The turbidity measurements collected during 1982 and 1983 are presented in Figures 10 and 11. Turbidity tends to be higher at Site 1 near the mouth of the Shields River. The turbidity during 1982 fluctuated between January and July as intermittent thawing during warm weather would cause higher readings. The turbidity then drops off dramatically when high water recedes during July.

Yellowstone River Water Temperatures

The five-day mean maximum water temperatures for 1982 and 1983 at Greybear and Livingston (Carter Bridge) are presented in Figures 12 and 13, respectively. As previously noted (Clancy 1983), during the peak temperature period (which is during late July or August) Greybear reaches higher temperatures than Livingston. During 1982 temperatures at Greybear did not reach as high as during 1983, when the five-day mean maximum was over 70°F. However, the water temperature did not remain in the 70° range for as long as it did in 1981 (Clancy 1983). This is probably related to flows and ambient air temperatures.

Dailey Lake

Dailey Lake, which lies south of Livingston in Paradise Valley, has had a reputation for producing good catches of trout and yellow perch (Perca flavescens).

Gill net surveys in the late sixties and early seventies indicated yellow perch averaged between 7.3 and 8.3 inches, while rainbow trout averaged between 10.7 and 13.5 inches (Figures 14 and 15). A survey in 1977 revealed that the situation had changed and yellow perch had overpopulated the lake. Subsequent stunting of perch and rainbow trout occurred as they averaged 6.2 and 8.0 inches, respectively.

The lake was rehabilitated with rotenone and by 1978 the average size of both species increased. In an effort to control the perch population, fingerling walleye (Stizostedion vitreum) were introduced into the lake. The average size of perch and trout increased in 1979 and leveled off in 1980. By 1981 the average size of perch had decreased to pre-rehabilitation levels and rainbow trout size had decreased to 1978 levels.

Netting efforts in 1982 and 1983 indicated perch had remained stunted (Figure 14). Rainbow trout size increased; however, few trout smaller than 10 inches were collected. It is not known why smaller rainbow trout were not collected in 1982 and 1983. The walleye reached an average size of 14.7 inches by 1982 and 16.2 inches by 1983. Although the walleye are preying on the perch, it is apparent they cannot control perch numbers adequately to increase the average size of perch.

The original plant of walleye in 1979 consisted of 100 adults and 50,000 fingerlings. The fingerlings are the cohort that averaged 16.2 inches in 1983. The 1980 plant of walleye consisted of 100,000 sac fry. This cohort has not appeared in collections, and it appears that this plant failed.

The success of walleye introductions has correlated with stocking densities, size of stocked fish, and timing of the introduction. Carlander et al. (1960) found stocking rates of 5000 fry per acre resulted in signficiant contributions to the fishery. Stocking rates less than this resulted in poor contributions to the fishery. In Dailey Lake, stocking rates have been 250 and 500 fry per acre. Momot et al. (1977) found introductions of walleye fry are most successful when stocking is timed to correlated with forage fish spawning. In the future it would be advantageous to stock walleye as fingerlings in an effort to increase survival.

Stream Protection

The quality of fish habitat is the most important variable in controlling fish populations. When high quality fisheries habitat is destroyed, no amount of fisheries management will bring the fishery back to its original level. Quality water, plenty of it and a stable streambed are the most important elements to provide a fishery. The Yellowstone River water reservation of 1978 has provided some instream flow protection for fisheries and state water quality standards give that water some protection from degradation. However, without proper streambed and streambank management, these two are not enough. The Stream Protection Act of 1963 and the Natural Streambed and Land Preservation Act of 1975 have given the physical stream much needed protection. The Department spends a great deal of time enforcing these two laws in the Upper Yellowstone drainage.

During 1982 and 1983 the Department inspected 10 projects in Park County under the provisions of the Stream Protection Act. Also, the Department inspected 89 projects in Park County and 21 projects in Sweetgrass County under the provisions of the Natural Streambed and Land Preservation Act.

TABLES AND FIGURES

Table 1. Population estimates of two-year-old and older brown, rainbow and Yellowstone cutthroat trout in the Springdale section of the Yellowstone River (80% confidence intervals in parentheses).

Year	Brown Trout	Rainbow Trout	Yellowstone Cutthroat
1982	1158 (± 166)	1137 (± 201)	1915 (± 641)
1983	1032 (± 149)	1095 (± 239)	800 (± 121)

Table 2. Yellowstone cutthroat age structure in the Springdale section of the Yellowstone River during 1982 and 1983.

	AGE CLASS		
YEAR	II	III(+)[1]	IV+
1982	1677	237	
1983	--	523	106

[1] This number is for three-year-old and older trout in 1982.

Table 3. Population estimates of rainbow and brown trout longer than six inches in the 9th Street Bridge study section during the springs of 1973-1978 and 1981-1983 (80% confidence intervals in parentheses).

Year	Rainbow Trout	Brown Trout
1973	4637 (± 878)	2268 (± 615)
1974	8692 (± 1358)	2453 (± 372)
1975	--	2924 (± 697)
1976	7045 (± 1014)	1868 (± 444)
1977	8680 (± 1669)	1501 (± 366)
1978	9359 (± 1578)	2435 (± 730)
1981	9643 (± 2105)[1]	4061 (± 1353)[2]
1982	9766 (± 1496)	2173 (± 468)[2]
1983	7280 (± 697)	1687 (± 231)[2]

[1] This estimate is for trout longer than 10 inches. The figure for trout longer than 6 inches would be higher.

[2] This estimate is for trout longer than 8.5 inches. The figure for trout longer than 6 inches would be higher.

Table 4. The number of 16-inch and longer rainbow trout in the 9th Street Bridge section during 1981-1983.

Season	Year	Number of Fish
Spring	1981	1536
Fall	1981	1607 ($\pm$ 536)
Spring	1982	1325 ($\pm$ 481)
Fall	1982	952
Spring	1983	329
Fall	1983	607 ($\pm$ 229)

Table 5. The number of Yellowstone cutthroat trout in the 9th Street Bridge section of the Yellowstone River during the springs of 1982 and 1983.

	AGE CLASS		
YEAR	II	III[1]	IV+
1982	374	152	
1983	--	303	48

[1] This number is only for three-year-old trout in 1983, but is for three-year-old and older trout in 1982.

Table 6. Population estimates of brown trout in the Mill Creek Bridge section of the Yellowstone River during the springs of 1981-1983 (80% confidence intervals in parentheses).

	SIZE (IN INCHES)				
YEAR	6.0-9.9	10.0-13.9	14.0-17.9	18.0+	Total
1981		724	1367	286	
1982		760	1321	294	2567 ($\pm$ 364)
1983	338	384	585	145	1450 ($\pm$ 187)

Table 7. The number of yearling brown trout in the Mill Creek Bridge section during the fall of the years indicated.

Year	Number of Yearlings
1980	1665
1981	1592
1982	1920
1983	477

Table 8. Population estimates of 14-inch and longer rainbow trout during the time periods indicated in the Mill Creek Bridge section of the Yellowstone River.

Season	Year	Number
Spring	1981	1299
Fall	1981	246
Spring	1982	804
Fall	1982	146
Spring	1983	331

Table 9. Population estimates and mortality rates of three-year-old and older Yellowstone cutthroat in the Mill Creek Bridge section of the Yellowstone River.

N, April, 1982	+ 214	
Fisherman Harvest	- 64	{ 52% Mortality
Other Mortality	- 48	
N, September, 1982	102	
Mortality	- 30	14% Mortality
(IV+) N, April, 1983	72	

Table 10. Population estimates of two-year-old and older brown trout and Yellowstone cutthroat in the Corwin Springs study section of the Yellowstone River during the years indicated.

Year	Brown Trout	Yellowstone Cutthroat
1978	2746 (± 524)	1442 (± 464)
1979	3413 (± 635)	1052 (± 277)
1981	2014 (± 391)	--
1982	2554 (± 386)	1677 (± 340)
1983	2214 (± 347)	1317 (± 263)

Table 11. Two-year-old and older Yellowstone cutthroat and annual mortality rates in the Corwin Springs study section of the Yellowstone River.

	AGE CLASS			
YEAR	II	III+	IV+	Mortality
1981		671		71 %
1982	988	491	196	54 %
1983	352	646	319	

Table 12. Mean September flows at Corwin Springs and numbers of two-year-old Yellowstone cutthroat trout two years later.

Year	Flow (cfs)	Number Two-Year-Old (2 yrs later)
1976	2263	931
1977	1381	399
1980	2186	988
1981	1416	352

Table 13. Dates, sex ratios and water temperature characterizing the Yellowstone cutthroat spawning run in Mol Heron Creek during 1983.

Date	Number Males	Number Females	Number Unknown	Total	Sex Ratio M:F	Water Temperatures Maximum	Minimum
6/28	2	0	2	4	—	58	40
7/01	2	0	1	3	—	50	42
7/05	1	0	0	1	—	56	40
7/12	4	3	0	7	4:3	60	42
7/15	1	0	0	1	—	60	45
7/19	5	0	0	5	—	56	41
7/22	3	0	0	3	—	60	44
7/27	2	0	3	5	—	61	45

Table 14. Dates, sex ratios and water temperatures characterizing the Yellowstone cutthroat spawning run in Cedar Creek during 1983.

Date	Number Males	Number Females	Number Unknown	Total[1]	Sex Ratio M:F[2]	Water Temperatures Maximum	Minimum
6/23	3	0	1	4	—	51	44
6/28	4	3	1	8	4:3	53	34
7/01	8	2	3	13	11:3	50	40
7/05	6	2	5	13	4:1	52	38
7/08	9	7	1	17	7:6	54	43
7/12	8	5	0	13	7:4	—	—
7/15	10	5	0	15	2:1	54	42
7/19	8	7	1	16	3:1	53	38
7/22	8	7	0	15	8:7	55	39
7/27	2	1	1	4	2:1	54	44

1 Below culvert only.

2 Both above and below culvert.

Table 15. Mean size and percent of fish longer than 15 inches in Cedar Creek spawning run during the years indicated.

Parameters	1973-74 (N=53)	1981,83 (N=106)
$\bar{X}$ Length	14.3	13.2
% >15 inches	36	13

Table 16. Dates, sex ratios and water temperatures characterizing the Yellowstone cutthroat spawning run in Tom Miner Creek during 1983.

Date	Number Males	Number Females	Number Unknown	Total	Sex Ratio M:F	Water Temperatures Maximum	Minimum
7/06	9	6	1	16	3:2	61	40
7/08	8	8	0	16	1:1	62	46
7/12	7	1	2	10	7:1	55	44
7/15	7	3	6	16	7:3	58	46
7/19	8	3	1	12	8:3	62	43
7/22	5	0	2	7	--	64	45
7/27	4	0	5	9	--	56	46

Table 17. Dates, sex ratios and water temperature characterizing the Yellowstone cutthroat spawning migration in Big Creek during 1983.

Date	Number Males	Number Females	Total	Sex Ratio M:F	Water Temperatures Maximum	Minimum
7/06	0	1	1	--	57	38
7/13	1	0	1	--	61	39
7/20	1	1	2	1:1	61	40

Table 18. Dates, sex ratios and water temperatures characterizing the Yellowstone cutthroat spawning run in McDonald Spring Creek during 1983.

Date	Number Males	Number Females	Number Unknown	Total	Sex Ratio M:F	Water Temperatures Maximum	Minimum
6/23	4	0	0	4	--		
6/29	1	0	0	1	--	58	46
7/07	0	0	0	0	--	63	46

Table 19. Dates, sex ratios and water temperatures characterizing the Yellowstone cutthroat spawning run in Peterson Creek during 1983.

Date	Number Males	Number Females	Number Unknown	Total	Sex Ratio M:F	Water Temperatures Maximum	Minimum
6/20	4	1	5	10	4:1	59	44
6/24	5	3	0	8	5:3	58	44
6/28	5	1	2	8	5:1	60	48
7/01	8	1	1	10	8:1	60	49
7/05	2	0	0	2	--	60	45

Table 20. Two-year-old Yellowstone cutthroat per 1000 feet in the four study sections of the Yellowstone River during the springs of 1982 and 1983.

	STUDY SECTION			
YEAR	Corwin Springs	Mill Creek Bridge	9th Street Bridge	Spr.
1982	35.8	24.8	14.4	66.5
1983	12.8	8.4	--	--

Table 21. Population estimates of brown trout per 1000 feet in the Convict Grade section of the Shields River during the springs of 1979, 1982 and 1983.

YEAR	SIZE (IN INCHES) 6.0-9.9	10.0-13.9	14.0-17.9	18.0+	Total
1979	16	25	10	1	52 (± 13)
1982	8	14	11	1	34 (± 5)
1983	15	18	14	1	48 (± 9)

Table 22. Population estimates of rainbow trout per 1000 feet in the Convict Grade section of the Shields River during the springs of 1982 and 1983.

YEAR	SIZE (IN INCHES) 6.0-9.9	10.0-13.9	14.0-17.9	18.0+	Total
1982	14	17	1	--	32 (± 12)
1983	27	21	1	--	49 (± 16)

Table 23. Population estimates of mountain whitefish per 1000 feet in the Convict Grade section of the Shields River during 1979, 1982 and 1983.

YEAR	SIZE (IN INCHES) 6.0-9.9	10.0-13.9	14.0-17.9	18.0+	Total
1979	391	274	14	--	679 (± 185)
1982	--	233	8	--	613 (± 151)
1983	291	277	11	--	579 (± 94)

Table 24. Population estimates and mortality rates of brown trout in the Zimmerman section of the Shields River during the years indicated (expressed as number per 1000 feet).

Time Period	AGE III+	AGE IV+	MORTALITY RATES (%) F - S[1]	MORTALITY RATES (%) S - F[1]
Fall, 1980	74		11	
Spring, 1981	23	66		55
Fall, 1981	25	30	9	
Spring, 1982	28	50		26
Fall, 1982	19	37	4	
Spring, 1983	45	54		56
Fall, 1983	27	24		

[1] F - S indicates mortality between fall and the following spring; S - F indicates mortality between spring and the following fall.

Table 25. Population estimates of mountain whitefish per 1000 feet in the Zimmerman section of the Shields River during 1979, 1981, 1982 and 1983.

YEAR	SIZE (IN INCHES) 6.0-9.9	10.0-13.9	14.0-17.9	18.0+	Total
1979	74	270	21	1	366 ($\pm$ 103)
1981	--	512	22	--	534
1982	--	312	17	--	329
1983	--	215	15	--	230

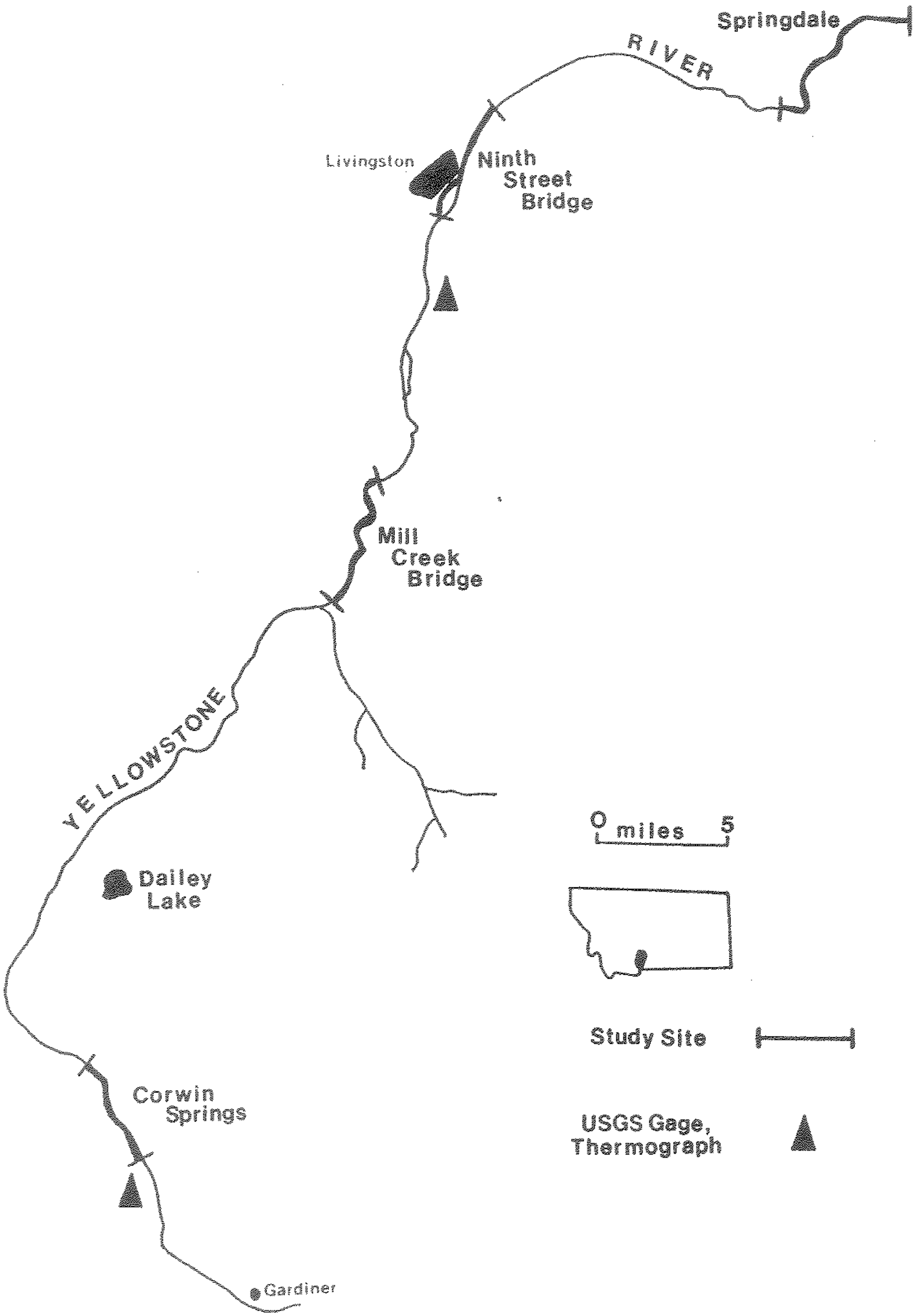

Figure 1. Map of the Upper Yellowstone River showing the location of the four study sections.

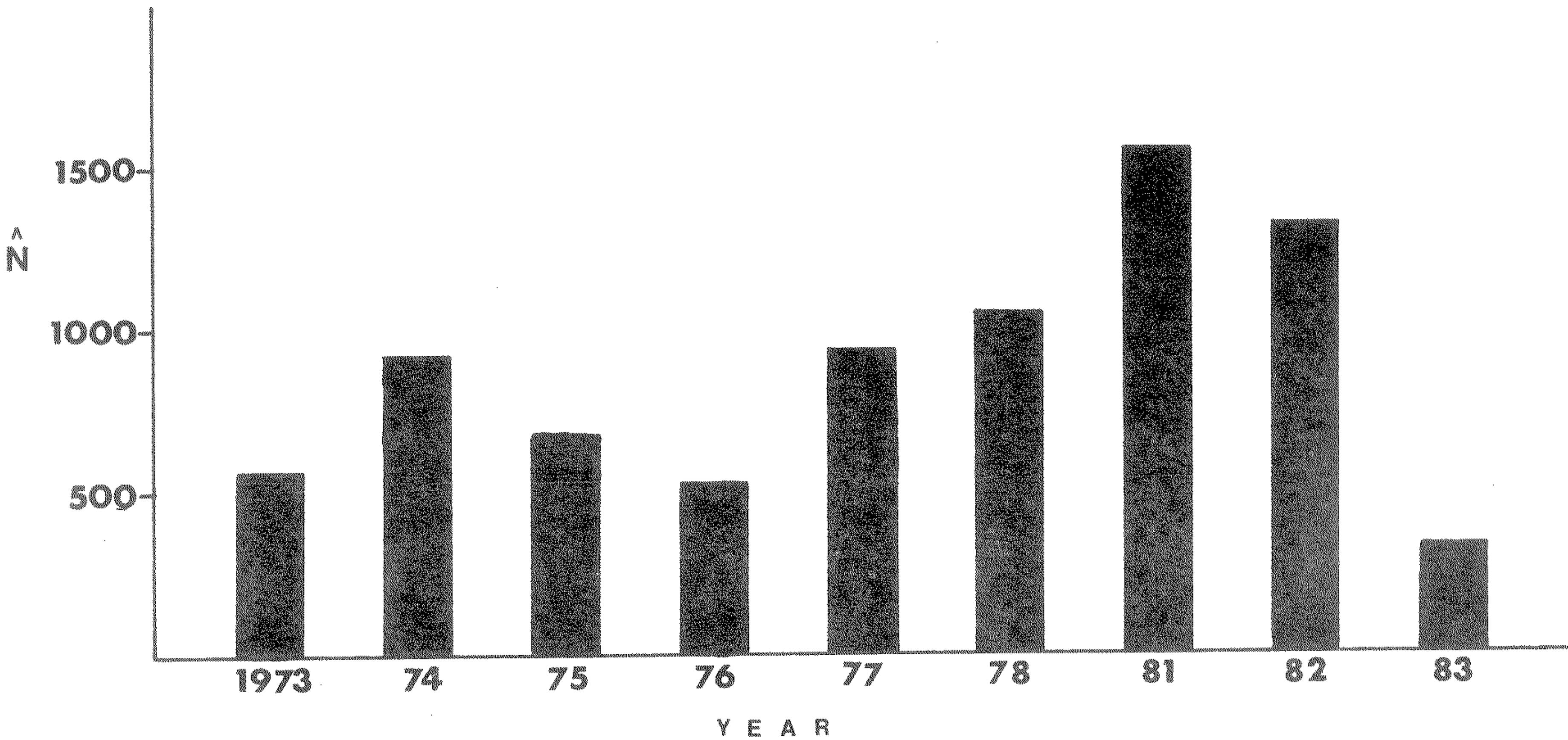

Figure 2. Spring population estimates of rainbow trout longer than 16 inches in the 9th Street Bridge study section of the Yellowstone during the years indicated.

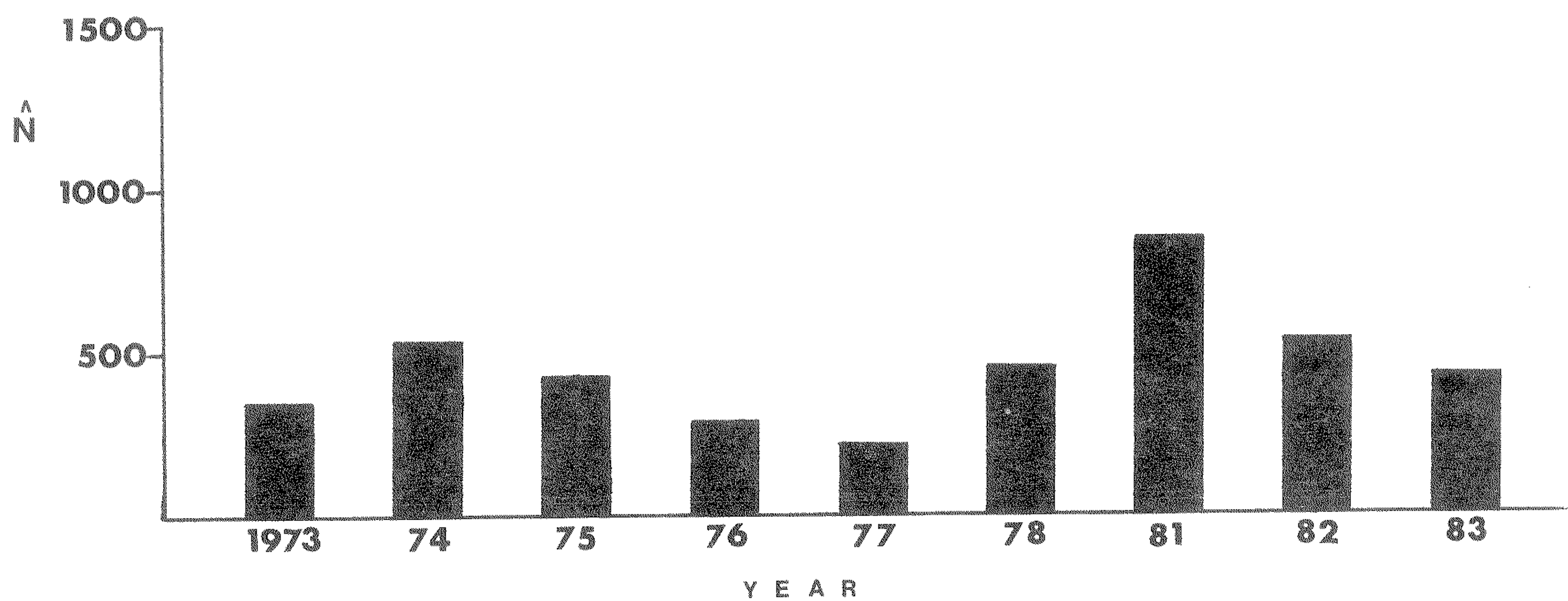

Figure 3. Spring population estimates of brown trout 16 inches and longer in the 9th Street Bridge study section during the years indicated.

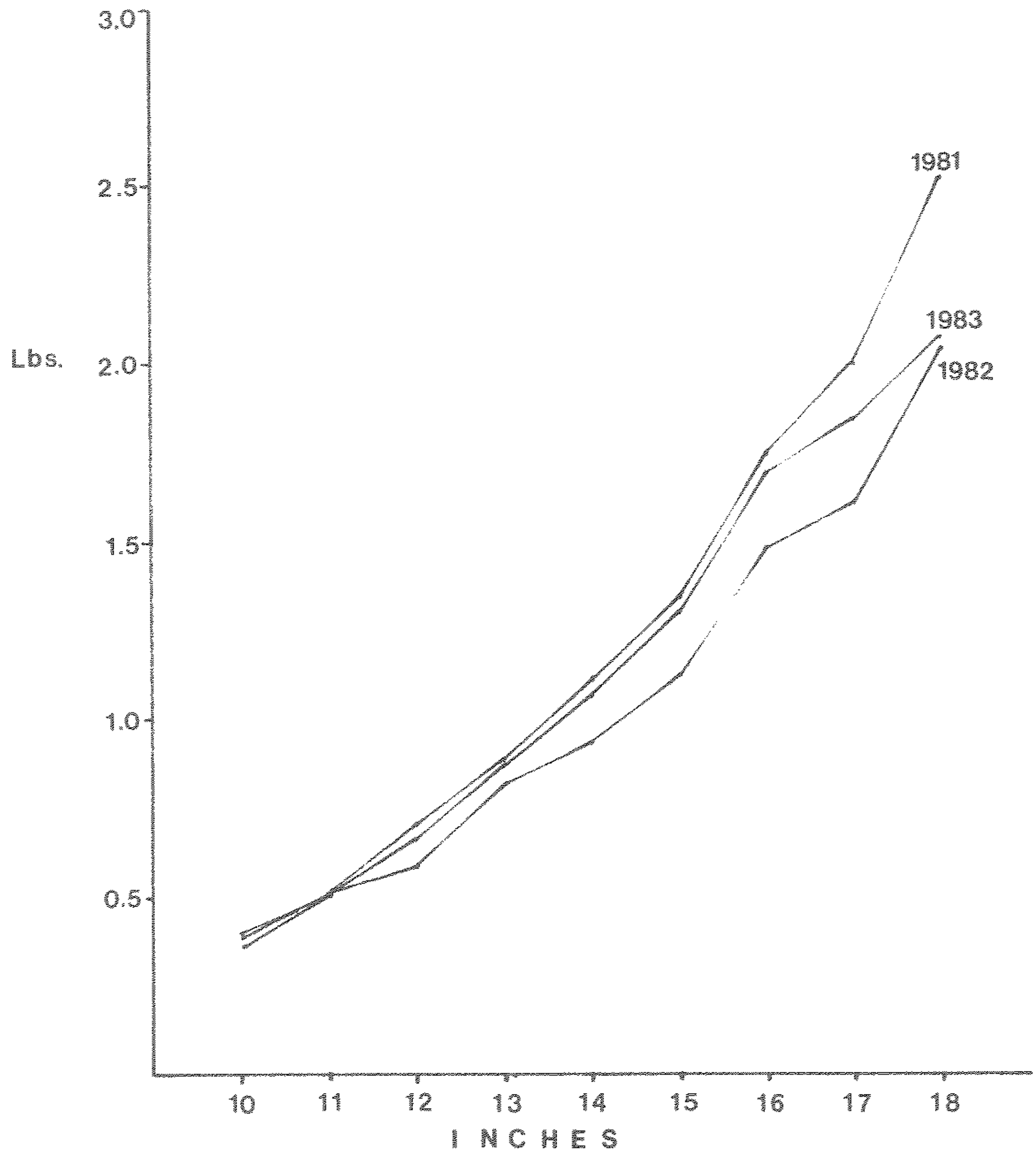

Figure 4. The length-weight relationship of rainbow trout in the 9th Street Bridge section of the Yellowstone River during September of the years indicated.

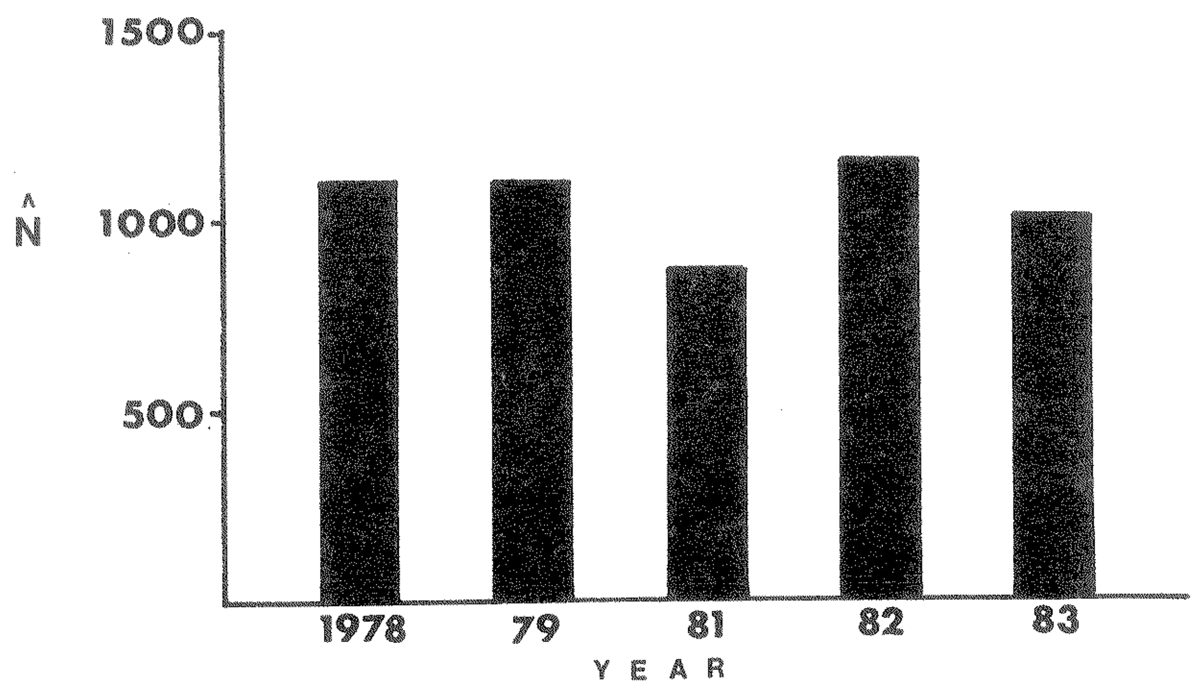

Figure 5. Population estimates of 14-inch and longer brown trout in the Corwin Springs study section during the years indicated.

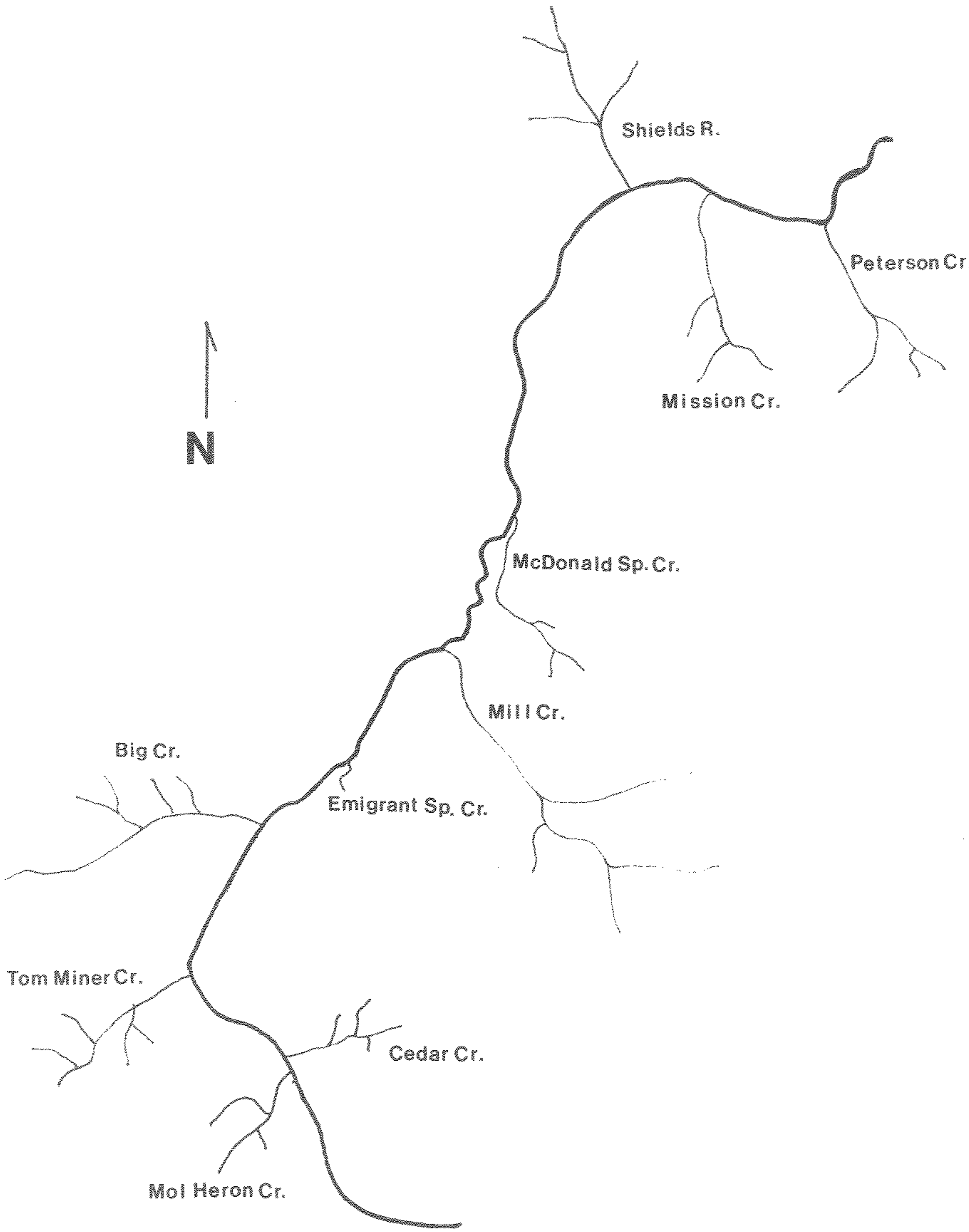

Figure 6. Tributaries to the Upper Yellowstone River which were sampled for Yellowstone cutthroat spawning runs in 1983.

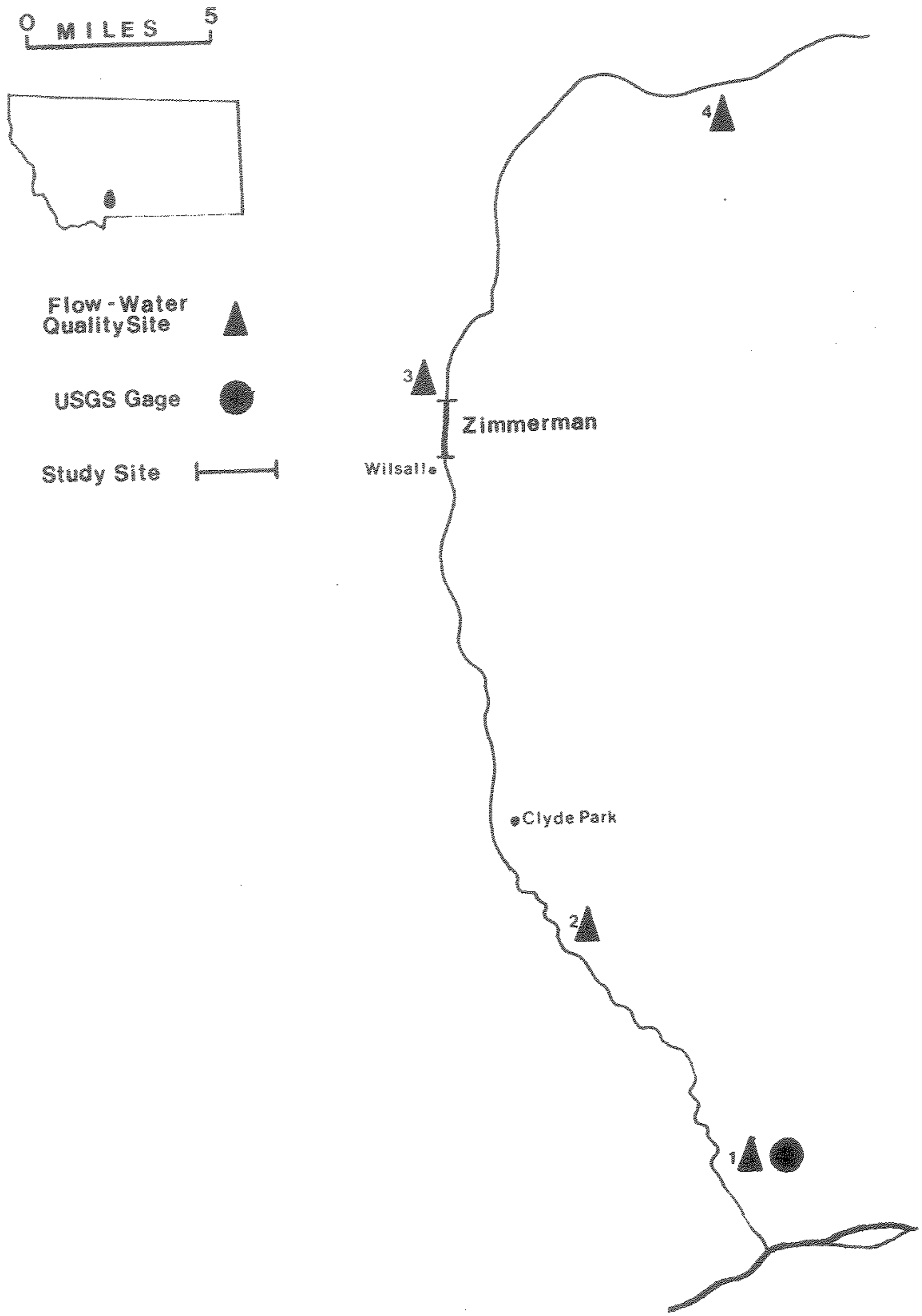

Figure 7. Map of the Shields River showing the study site and flow/water quality sampling sites.

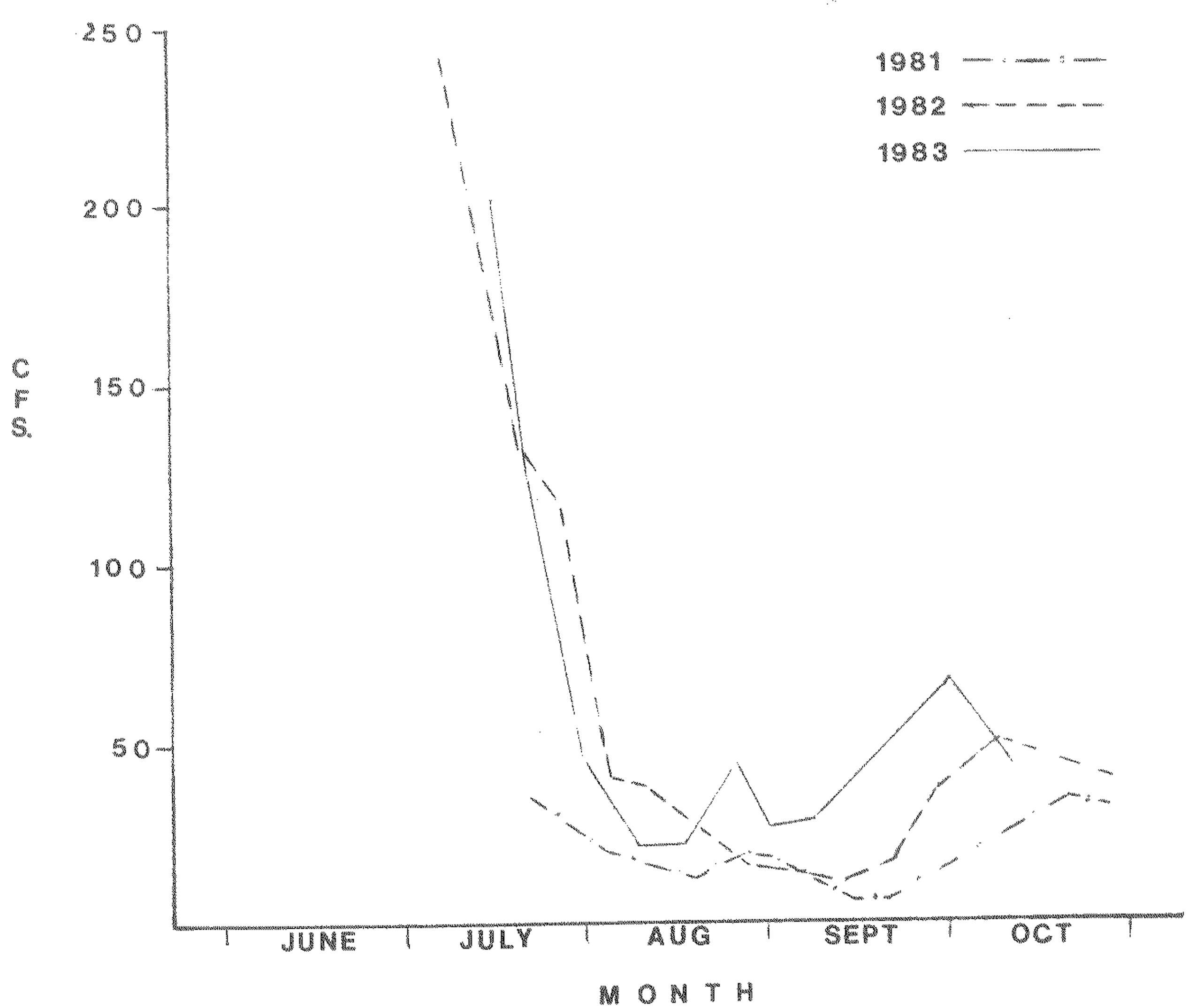

Figure 8. Summer flows in the Zimmerman section of the Shields River during the years indicated.

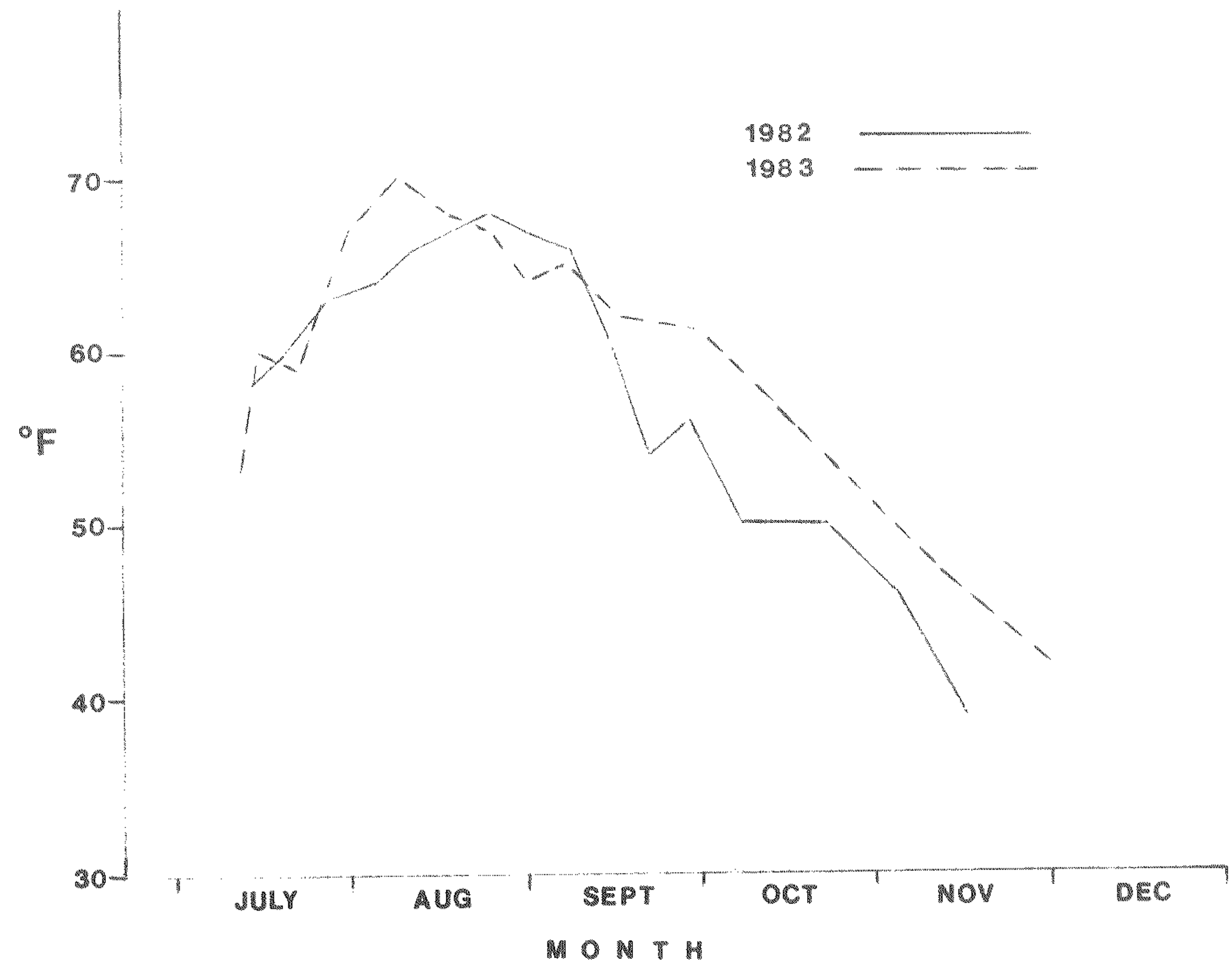

Figure 9. Maximum water temperatures in the Zimmerman section of the Shields River during 1982 and 1983.

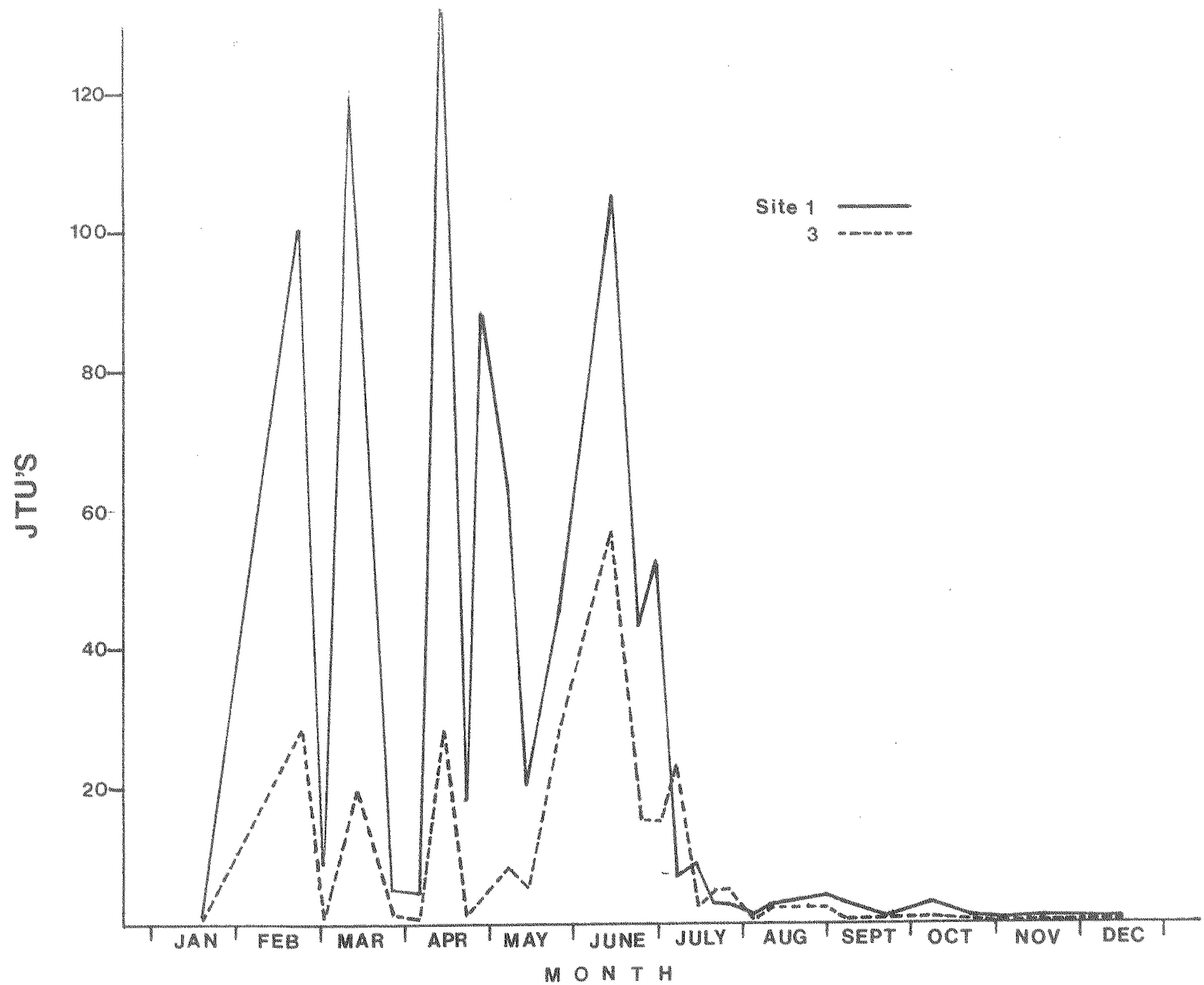

Figure 10. Turbidity at Sites 1 and 3 of the Shields River during 1982.

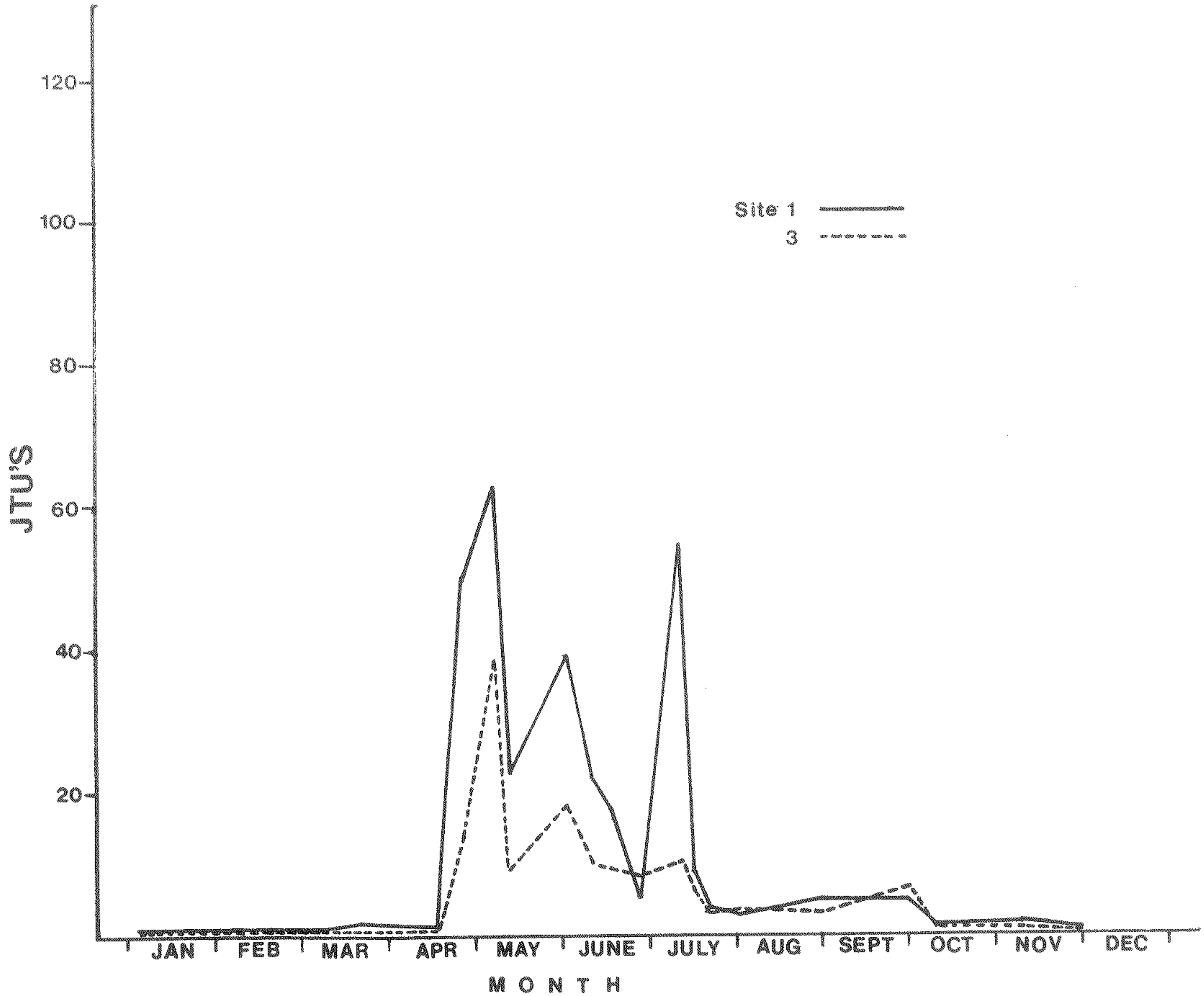

Figure 11. Turbidity at Sites 1 and 3 of the Shields River during 1983.

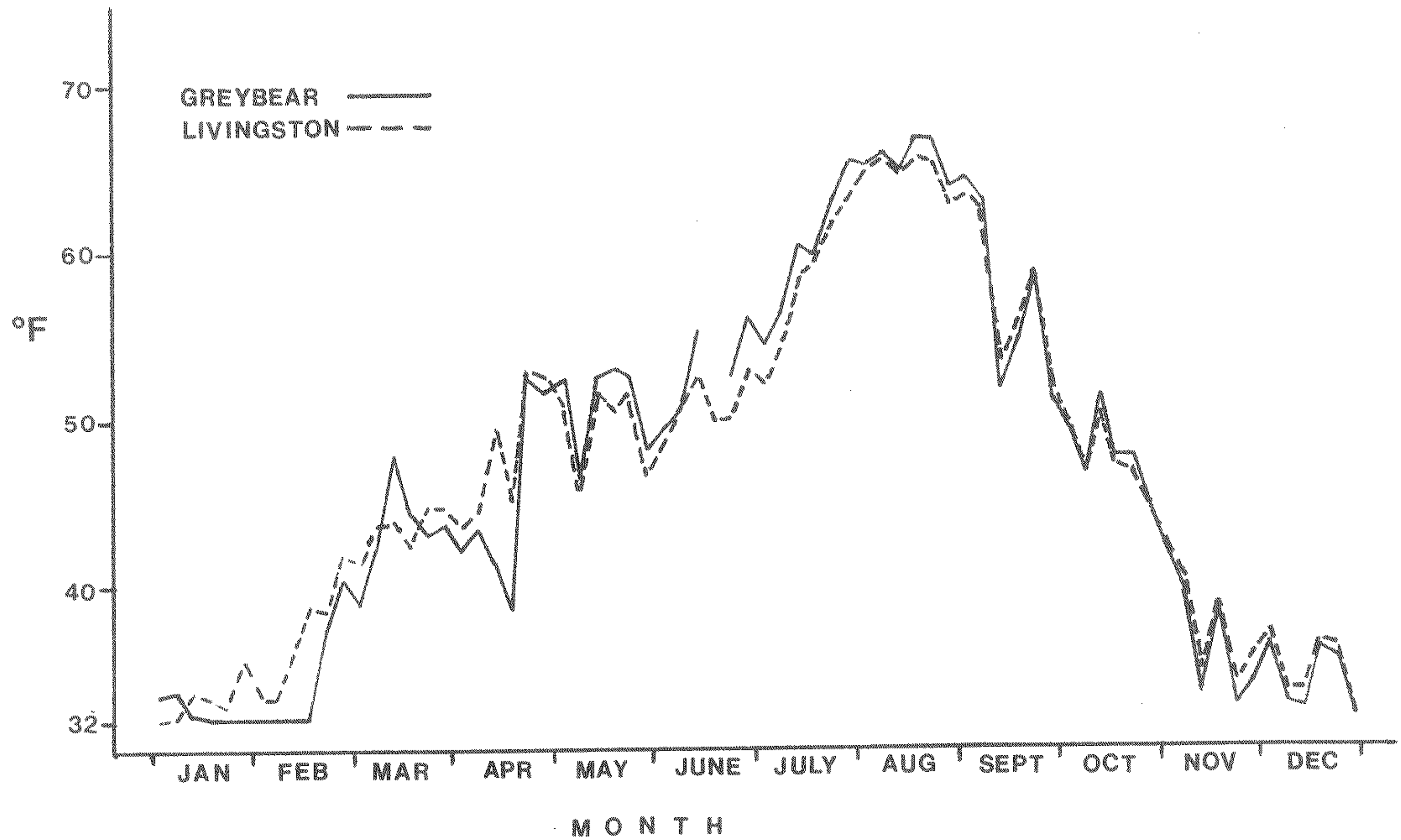

Figure 12. The five-day mean maximum water temperatures of the Yellowstone River at Greybear and Livingston during 1982.

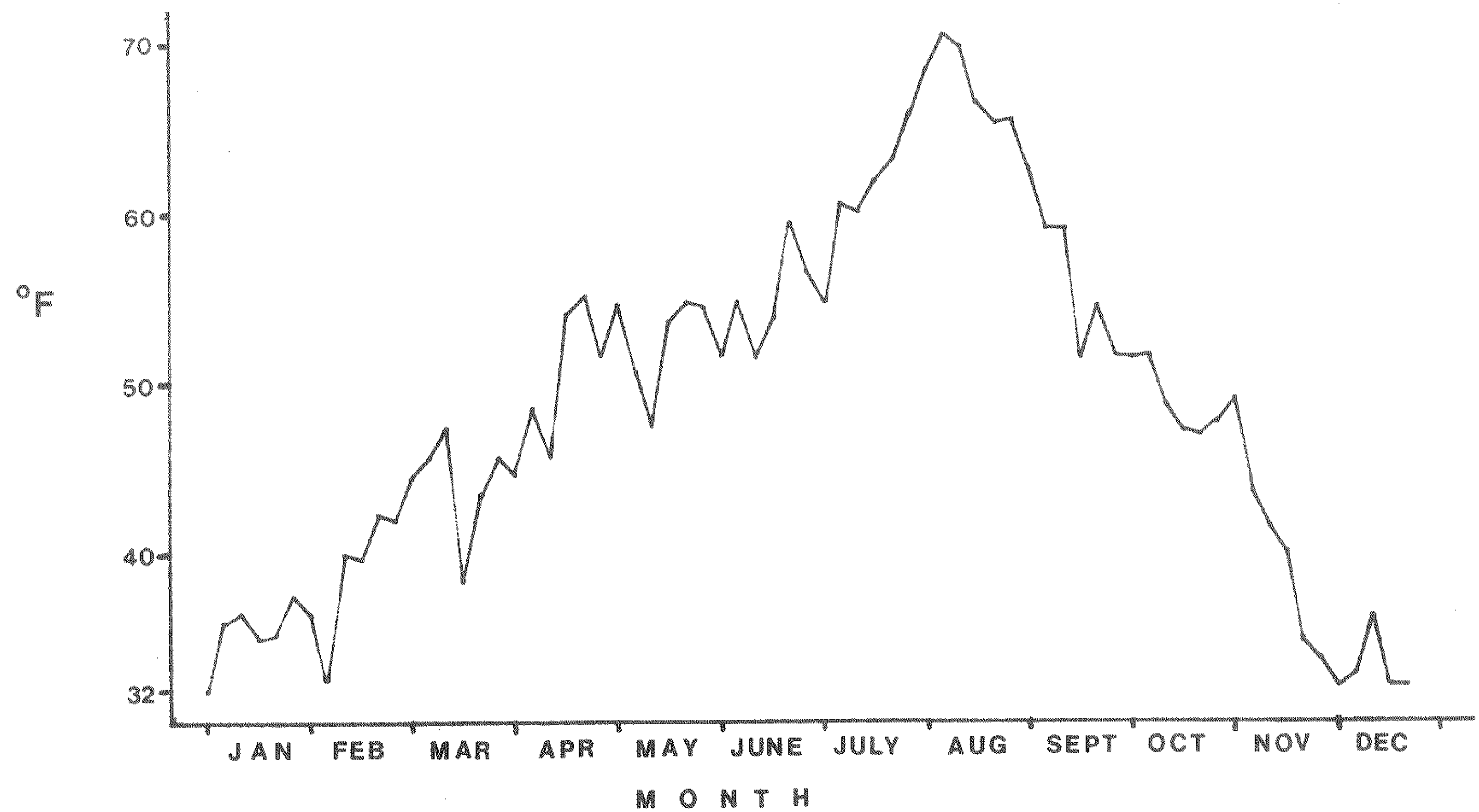

Figure 13. The five-day mean maximum water temperatures of the Yellowstone River at Greybear during 1983.

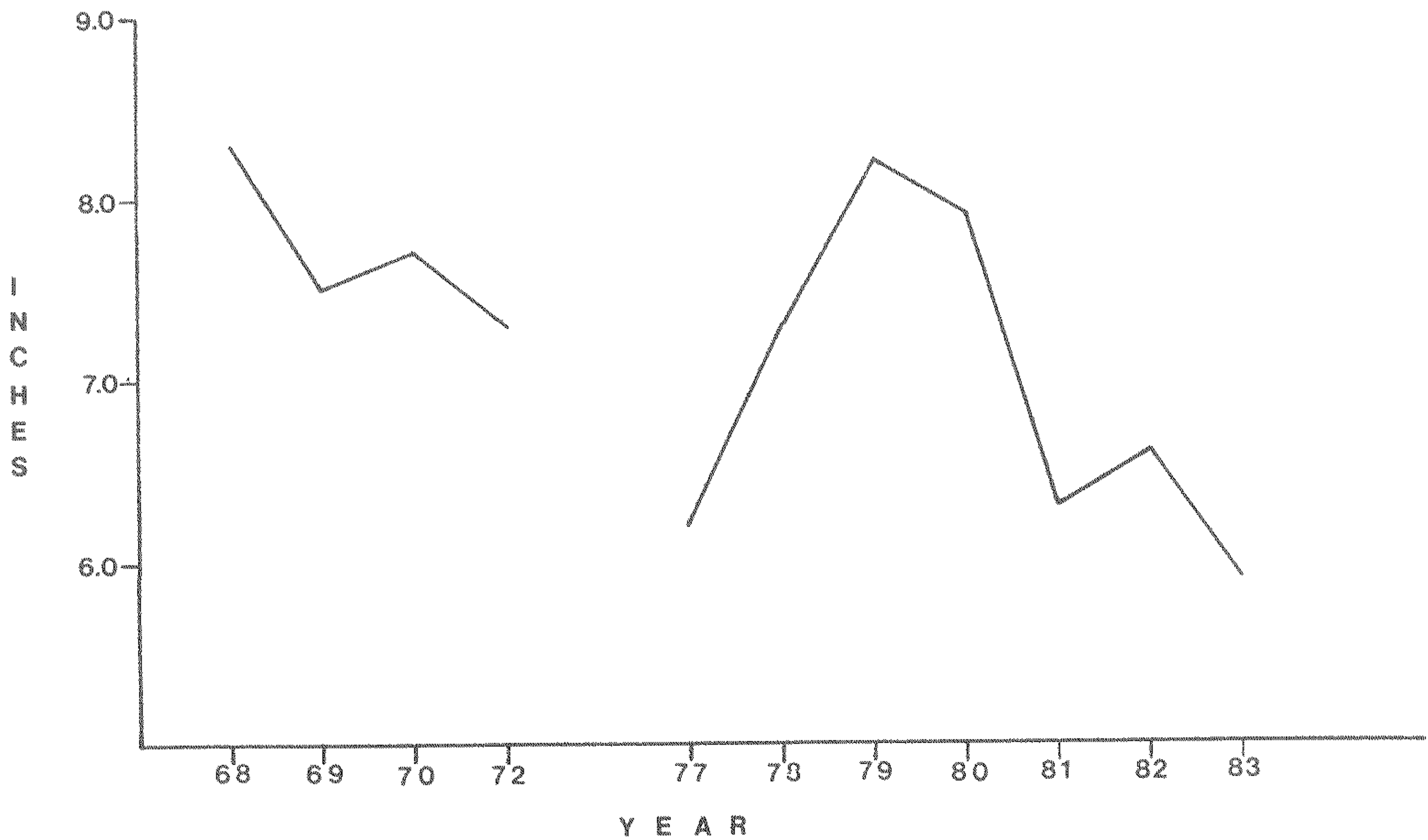

Figure 14. Mean length of yellow perch captured in gill nets during the years indicated.

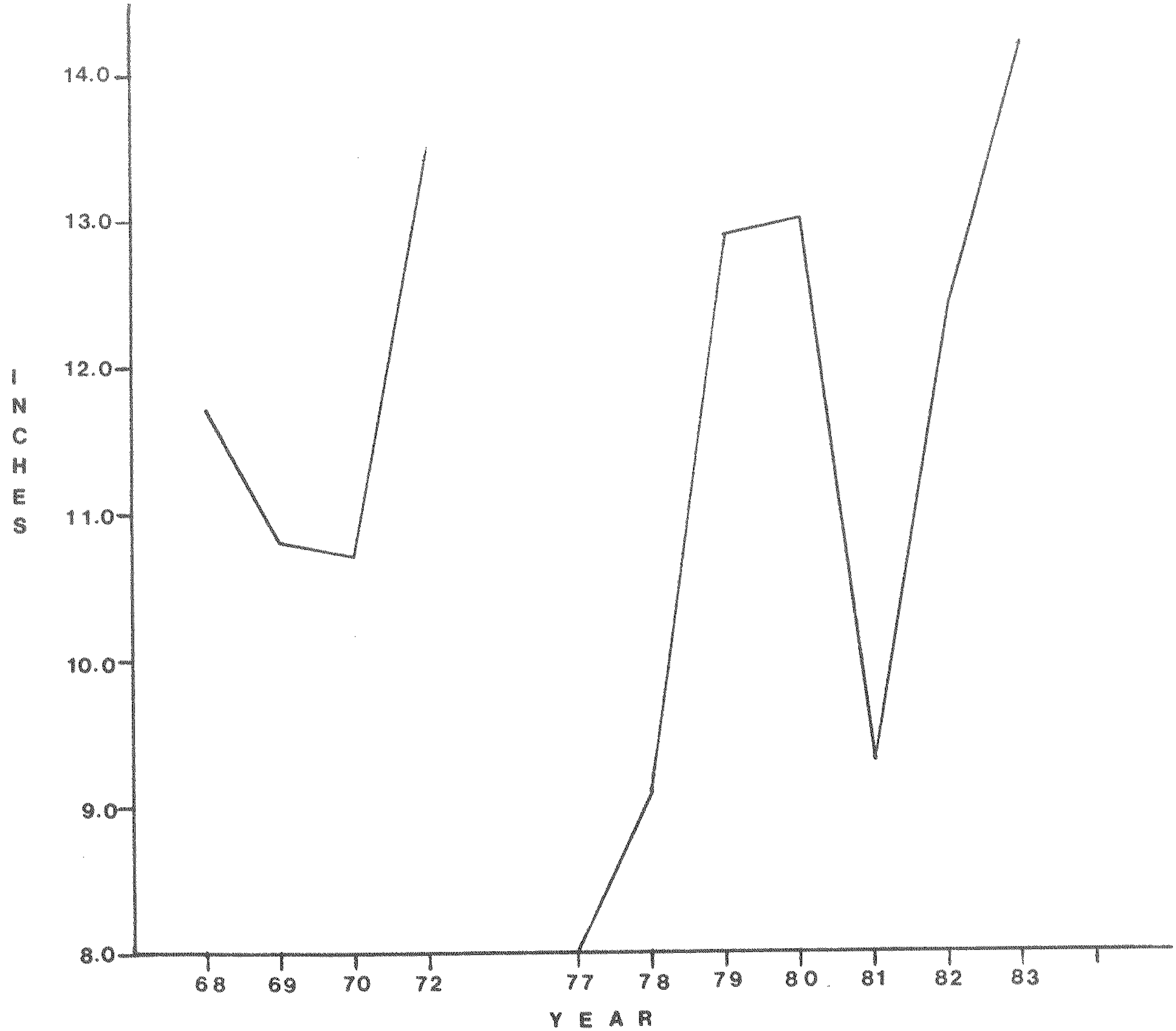

Figure 15. Mean length of rainbow trout captured in gill nets during the years indicated.

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Prepared By:	Chris G. Clancy	
Date:	August, 1984	
Waters Referred To:	Dailey Lake	3-22-7644-03
	Shields River	3-22-5362-01
	Shields River	3-22-5334-01
	Yellowstone River	3-22-7056-01
	Yellowstone River	3-22-7070-01
	Yellowstone River	3-22-7084-01
	Big Creek	3-22-0476-01
	Cedar Creek	3-22-1078-01
	Emigrant Spring Creek	3-22-2368-01
	McDonald Creek	3-22-3930-01
	Mill Creek	3-22-4172-01
	Mission Creek	3-22-4242-01
	Mol Heron Creek	3-22-4270-01
	Peterson Creek	3-22-4620-01
	Tom Miner Creek	3-22-6328-01
Key Words:	Population Survey	
	Spawning Migration	
	Brown Trout	
	Rainbow Trout	
	Yellowstone Cutthroat	
	Dewatering	
	Overfishing (fishing regulations)	

PREPARED BY: ______________________ APPROVED: ______________________

DATE: ______________________ ______________________