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Madison River/Ennis Reservoir Fisheries

1996 Annual Report
to
Montana Power Company
Environmental Division
Butte

from
Montana Fish, Wildlife, & Parks
Pat Clancey
Ennis
March 1997

Montana Fish, Wildlife & Parks

INTRODUCTION

During 1996, the Montana Power Company (MPC) and Montana Fish, Wildlife, & Parks (FWP) continued the cooperative agreement they began in 1990, and modified in 1992. Under this agreement, MPC provided funding to FWP for a biologist to study the Madison River/Ennis Reservoir arctic grayling (*Thymallus arcticus*) population (Montana Fish, Wildlife, & Parks 1995). Additional duties and money were added to the contract to assist MPC in gathering information for relicensing of MPC's Madison/Missouri hydropower system, and to carry out protection, mitigation, and enhancement (P,M & E) activities. The Federal Energy Regulatory Commission (FERC) is expected to release a Draft Environmental Impact Statement (DEIS) on the relicensing in the spring of 1997. MPC owns and operates nine dams on the Madison and Missouri Rivers (Figure 1). These nine dams collectively are called the 2188 Project, refering to the FERC license number that authorizes their operation.

METHODS

Electrofishing from a driftboat mounted mobile anode system remains the principle method used to capture trout and grayling for population estimates and sampling. Fish captured for population estimates are weighed and measured, marked with a fin clip and/or tagged with a Visual Implant (V.I.) tag, and released. A log-liklihood statistical analysis (Montana Fish, Wildlife, & Parks 1994) is used to estimate trout populations throughout the Madison River (Figure 2).

Young-of-the-year (yoy) grayling in Ennis Reservoir are sampled using a beach seine. Two people are let off a boat in water up to five feet deep. They stretch a 125 beach seine between them, and proceed to walk directly into the shoreline, pulling the seine into a large arch behind them. The seine is pulled onto the shoreline and captured fish are enumerated by species.

Gill nets are used to sample fish from Ennis Reservoir. Netting is conducted seasonally, in June, August, and October. Experimental nets, composed of five 25 foot panels of progressively larger mesh, are set at four locations in Ennis Reservoir and left to fish overnight (Figure 3). The smallest mesh panel is always set in the most shallow water, the largest mesh in the deepest water. Sites selected for netting were chosen partly in an effort to avoid sampling grayling, since netting mortality of salmonids is usually high. Floating nets are used at the shallow south end of the reservoir, and one floating net and one sinking net are used near the county bridge at the north end of the reservoir. Because the south end of the reservoir is so shallow, floating nets are capable of sampling the entire water column. At the deeper north end of the reservoir, a sinking net and a floating net are required to sample benthic and pelagic areas, respectively. Captured fish

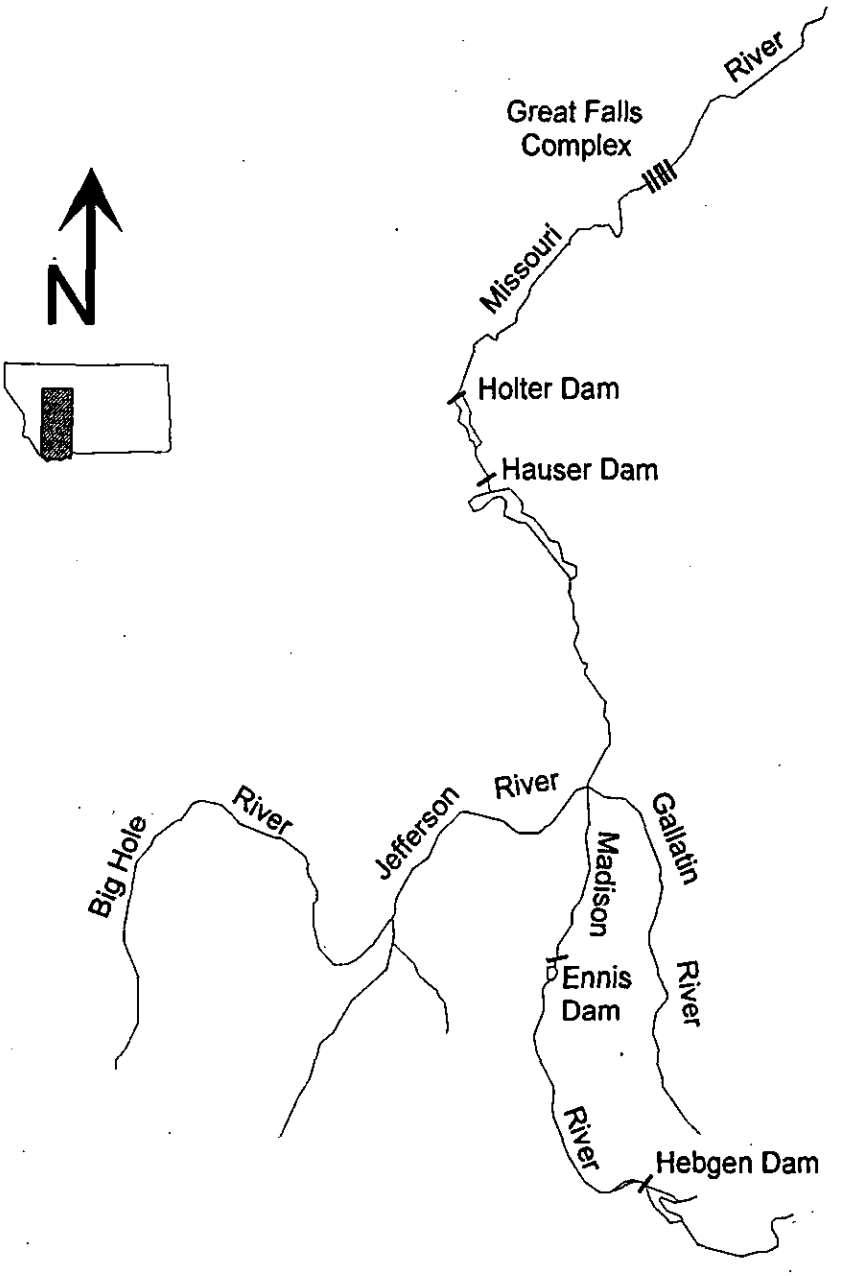

Figure 1. Locations of Montana Power Company dams on the Madison and Missouri Rivers.

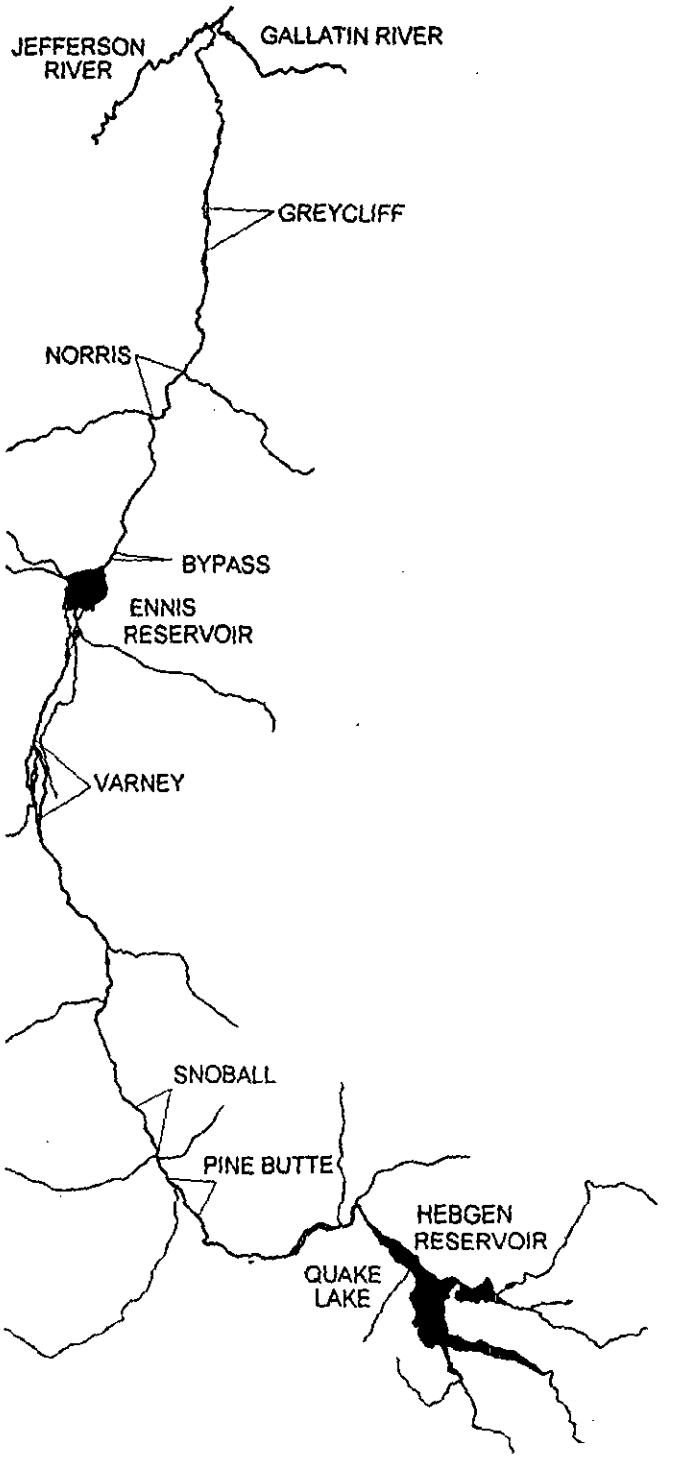

Figure 2. Locations of Montana Fish, Wildlife, & Parks Madison River trout population estimate sections.

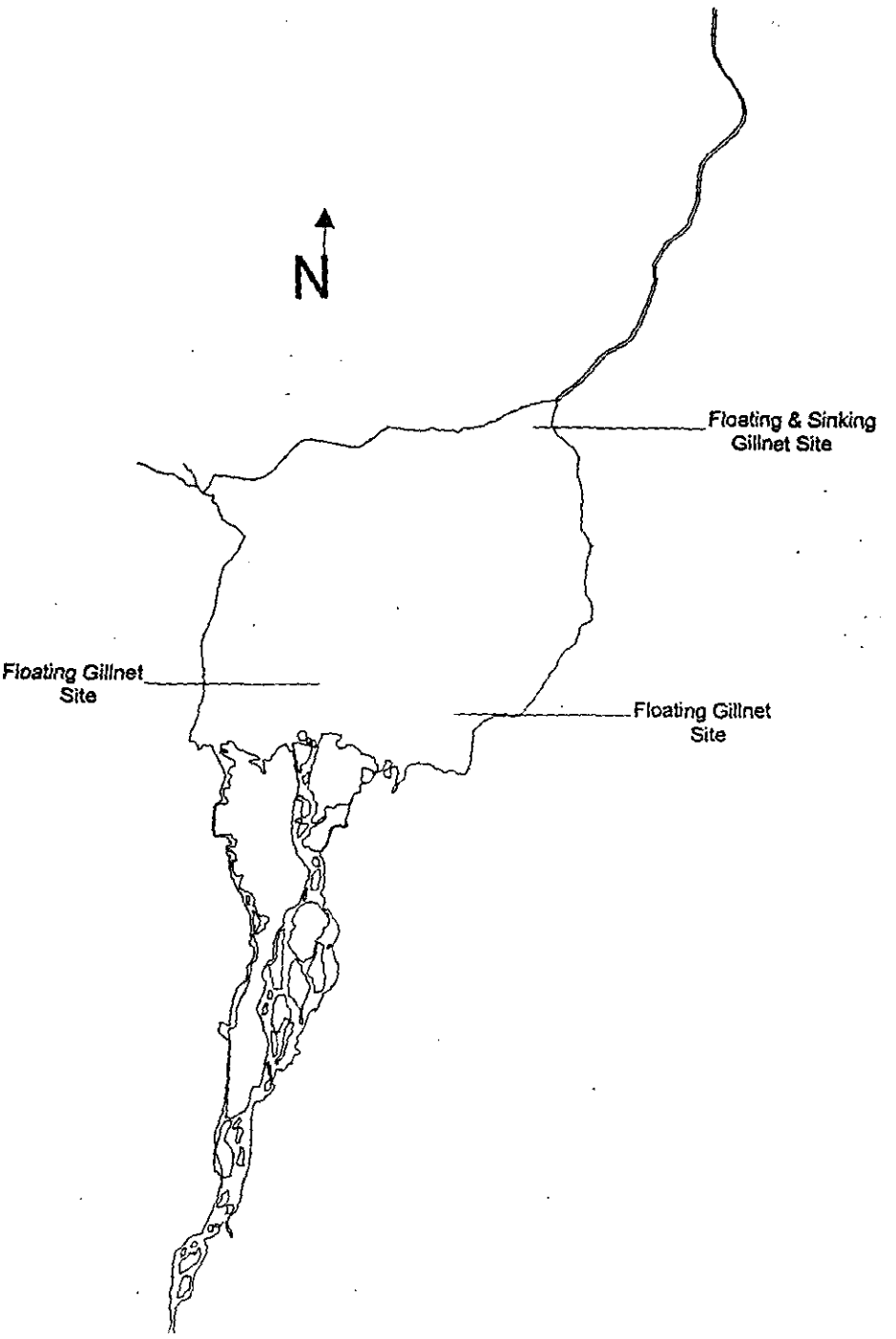

Figure 3. Locations of Montana Fish, Wildlife, & Parks seasonal gillnet sites in Ennis Reservoir.

are removed from the nets, separated by species, weighed, measured, and released. If a large number of one species is captured in a given net, generally 25 are weighed and measured and the remainder are simply enumerated.

Young-of-the-year rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*) are sampled from areas within the Pine Butte, Snoball, and Norris sections of the Madison River to determine the timing of the affects of whirling disease (*Myxobolus cerebralis*), and to determine the infection rate of the disease. To accomplish these tasks, two methods are used to collect yoy trout. The drift boat system is modified by adding a 75 foot electrical cord to the anode. This system is then used to sample selected 150 foot sections of the river bank within the standard population estimate sections. The boat is anchored within a few feet of the river bank, the 75-foot anode carried downstream, and electrofishing proceeds in an upstream direction past the boat. Three passes are conducted at each location, with captured fish enumerated by species after each run. The Zippin Removal Method (Zippin 1958) is used to derive a numeric estimate of yoy brown and rainbow trout in that 150 feet of river bank. Generally, areas that look most likely to hold yoy are selected for sampling, so the numbers generated should not be extrapolated to arrive at yoy estimates for larger sections of the river. Abnormalities potentially caused by whirling disease are noted. Fish are held in water-filled buckets until the sampling is completed, then released. During each sampling period, up to ten individuals of each species are preserved in Davidson's Solution for examination for whirling disease spores.

Additionally, a backpack mounted shocker is used to collect yoy trout from a series of locations throughout the Madison River drainage in early winter (Figure 4). These fish are collected soley for determining the presence or absence of whirling disease in a given area and its rate of infection of yoy trout.

During 1996, an effort was made to evaluate the habitat used by yearling brown trout in the Madison River. This was undertaken to assess the potential to increase or improve brown trout habitat in parts of the upper Madison River where rainbow trout numbers have been severly reduced by whirling disease. If habitat in the upper Madison could be modified, such as through minor flow modifications or creation of brushy streamside areas, to increase brown trout numbers, it would be possible to provide more fish for anglers. Electrofishing as described for sampling yoy trout was conducted in areas where yearling brown trout were expected to reside. Captured fish were measured, weighed, and their capture location noted. Radio telemetry transmitters were kept on-hand for implantation into selected fish to monitor their subsequent habitat selection. The shielded-needle technique of implanting the radio transmitter (Ross and Kleiner 1982) was used to implant a transmitter in one yearling brown trout in July. After a fairly

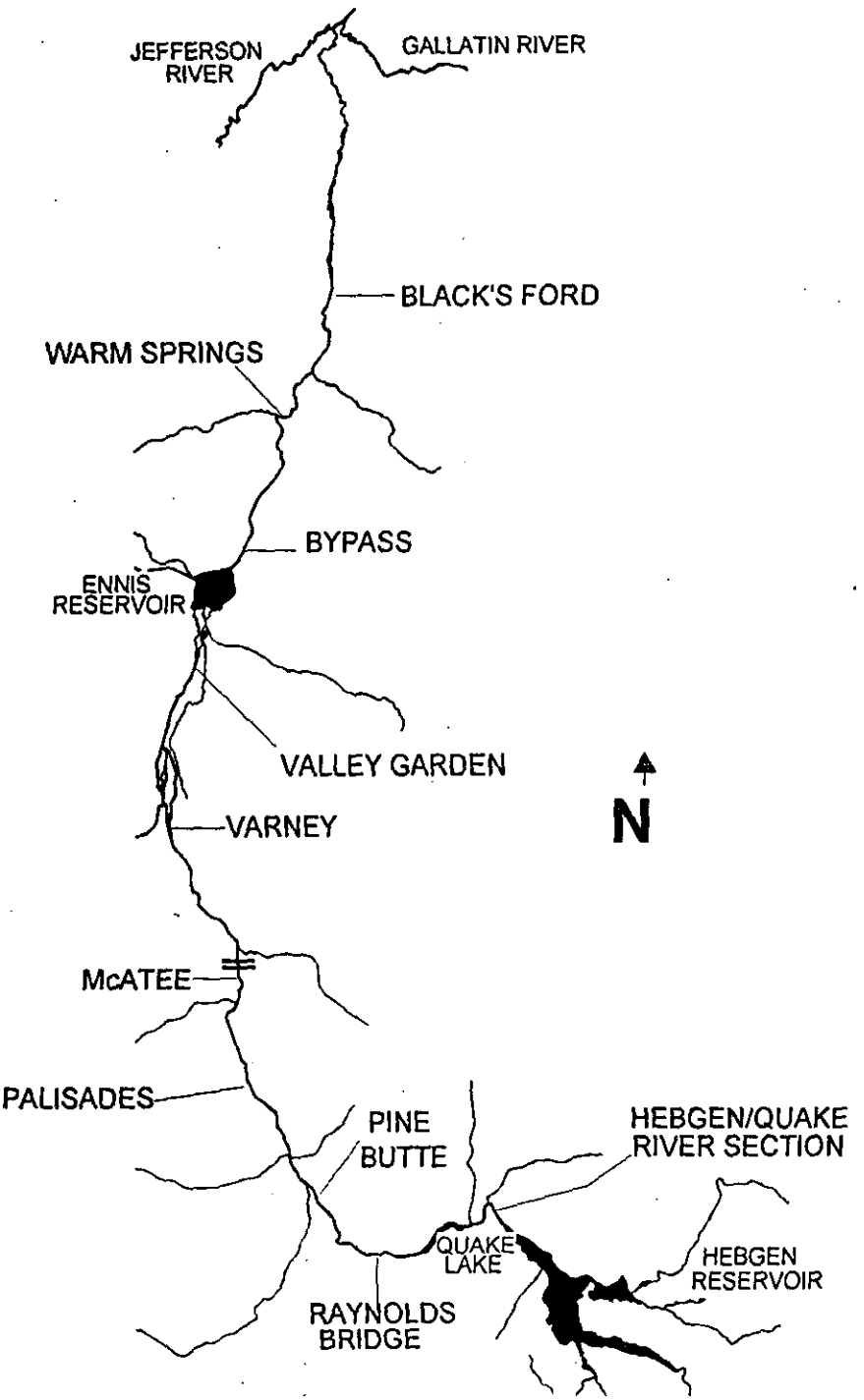

Figure 4. Collection sites of 1996 Madison River young-of-the-year trout for whirling disease testing.

specific location of the fish was determined using radio telemtry, a snorkeler would sight the fish. Measurements of specific habitat variables, such as current velocity, water depth, proximity to cover, and substrate type would be taken.

Water and air temperature is recorded throughout the course of the Madison River from the Hebgen Reservoir outlet to the Headwaters State Park (Figure 5). Optic StowAway loggers are used to record water temperature, and are programmed to read every 15 minutes, in Fahrenheit. StowAway loggers are generally used to record air temperature, and are programmed to read every half-hour. At times, it is necessary to use Optic StowAways to record air temperature. When this is the case, the Optics are programmed to record temperature until the scheduled end of the monitoring period, so frequency of readings varies.

As part of its relicensing effort, MPC has initiated a water quality monitoring program. In this program, personnel of several agencies, including FWP, and MPC, conduct biological and biocontaminant monitoring collections at locations within the Madison/Missouri System (Appendix A). Aquatic invertebrate and periphyton samples are collected for biological trend monitoring at seven sites from the Madison River within Yellowstone National Park (YNP) to the Missouri River below Morony Dam. In 1996, open-water and bottom feeding fish were gillnetted from Hebgen and Hauser Reservoirs for heavy metals testing. In previous years, biocontaminant samples were collected at sites near or below MPC dams to test for a variety of contaminants. Samples are analyzed by a variety of consultants, and reported to the MPC Environmental Division.

RESULTS AND DISCUSSION

Madison Grayling

Nineteen grayling were captured in seven electrofishing runs through the Channels section. One grayling, a male captured in Fletchers Channel on 4/26/96, was originally tagged in Fletchers on 4/23/93. It had grown from 15.8 inches and 1.1 pounds to 17.1 inches and 1.42 pounds.

Beach seining in Ennis Reservoir was conducted in June, July and August. Seining scheduled for October was cancelled due to high winds and large waves on the north shore of the reservoir. Despite seining areas with abundant macrophytes, no yoy grayling were captured in Ennis Reservoir in 1996, and only six yoy mountain whitefish (*Prosopium williamsoni*) were captured, in June. Other fish captured were utah chub (*Gila atraria*), longnosed sucker (*Catostomus catostomus*), white sucker (*Catostomus commersoni*), longnosed dace (*Rhinichthys cataractae*), and yoy rainbow and brown trout. Site descriptions, dates, and catches are listed in Appendix B.

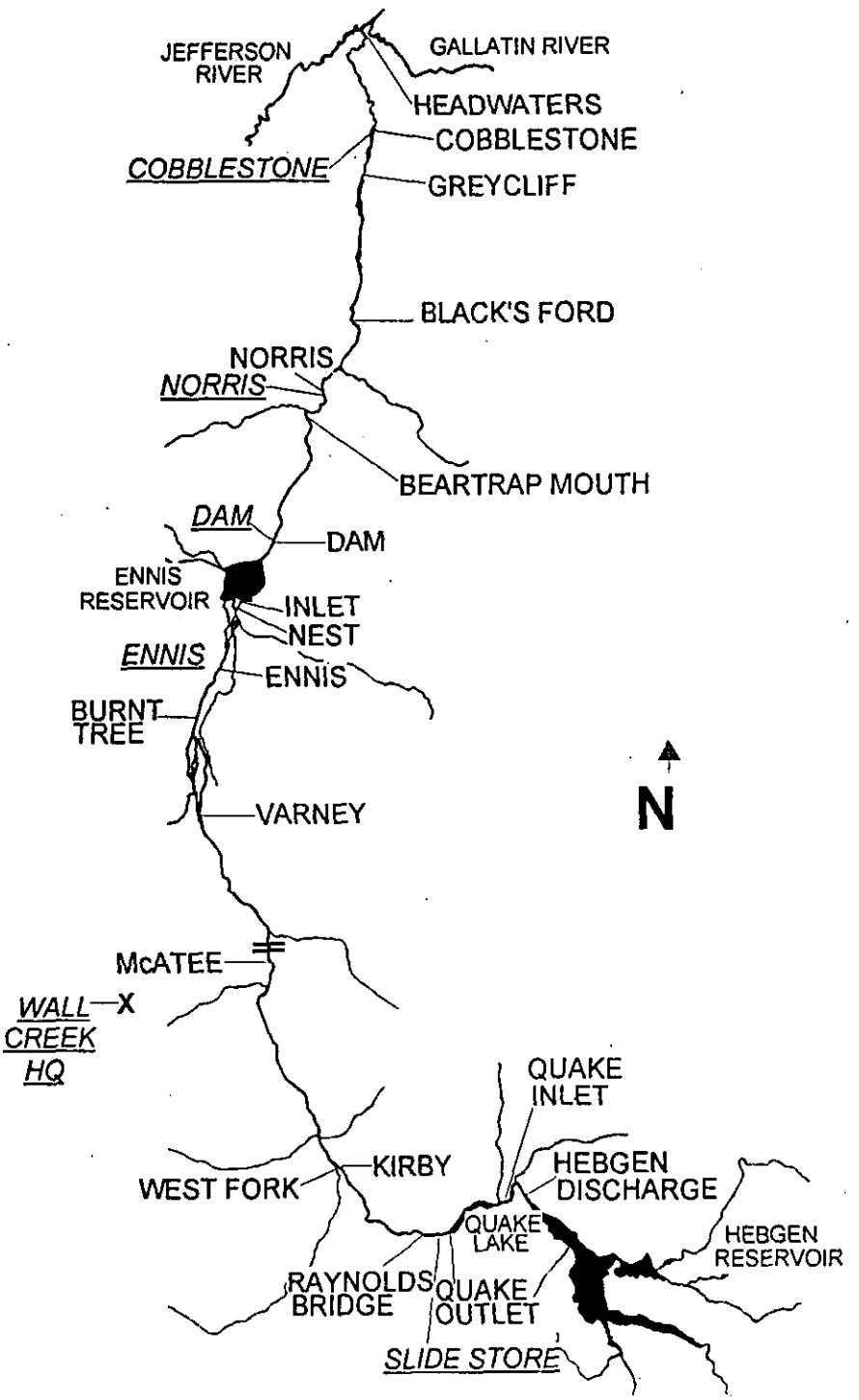

Figure 5. Locations of Montana Fish, Wildlife, & Parks 1996 Madison River temperature monitoring sites. Air temperature sites are underlined.

Planned introductions of offspring of Big Hole River grayling into the Butler Reach of Cherry Creek, a tributary of the lower Madison River, were cancelled when it was discovered that the fish had become infected with Bacterial Kidney Disease (BKD) (*Renibacterium salmoninarum*) while being reared at the U.S. Fish and Wildlife Service's (USFWS) Bozeman Fish Technology Center. All of these grayling were euthanized in January, 1997.

Population Estimates

Seasonal population estimates were conducted in March/April and September, 1996. Figures 6-14 illustrate historic population levels of rainbow and brown trout in sections of the Madison River (Figure 2). One year old fish are distinguished from two year old & older fish because of the natural fluctuations that occur within yearling numbers from year to year. Generally, the numbers of two year old & older fish is the best indicator of population trends. Aging of all fish has not been completed for 1995 and 1996, so fish greater than 10" are substituted for two year old & older in fall estimates, and fish greater than 8" are substituted in spring estimates. The actual number of yearlings and two year old & older will most likely change once aging is completed. Appendix C contains historic population levels of two year old & older rainbow and brown trout (± 80% C.I.).

In the Pine Butte section in 1996, total rainbow trout numbers are at their highest level since 1991, due to a strong yearling cohort. Age 2 & older fish remain at less than 200/mile. Rainbow trout numbers in the Snoball section remain suppressed, though it appears the population is at it's highest level since estimates were resumed in 1994. However, the 1996 estimate is questionable due to poor recapture efficiency of rainbow trout greater than 9 1/2 inches. The rainbow population in Varney is essentially unchanged from the 1995 level, though it is higher than the 1993 and 1994 levels when whirling disease is thought to have initially invaded that section of river. A larger proportion of the population is composed of age 2 & older fish in 1996 than in 1995. In the Norris section in the lower Madison, the rainbow trout population remains at levels seen in recent years. Though not confirmed to be related to whirling disease, several adult rainbow trout captured in the Norris section during spring electrofishing exhibited cranial deformaties.

Total brown trout numbers in Pine Butte are the highest they've been since 1989, due to a strong yearling cohort. The 1996 brown trout estimate in the Snoball section appears to be almost 1900/mile, but is questionable because of poor recapture efficiency among large size adult fish. In the Varney section in 1996, yearling brown trout exhibited their strongest year class since 1983, while 2 year old & older fish were at their lowest level since 1969. In the Norris section, the brown trout population is similar to the 1995 level.

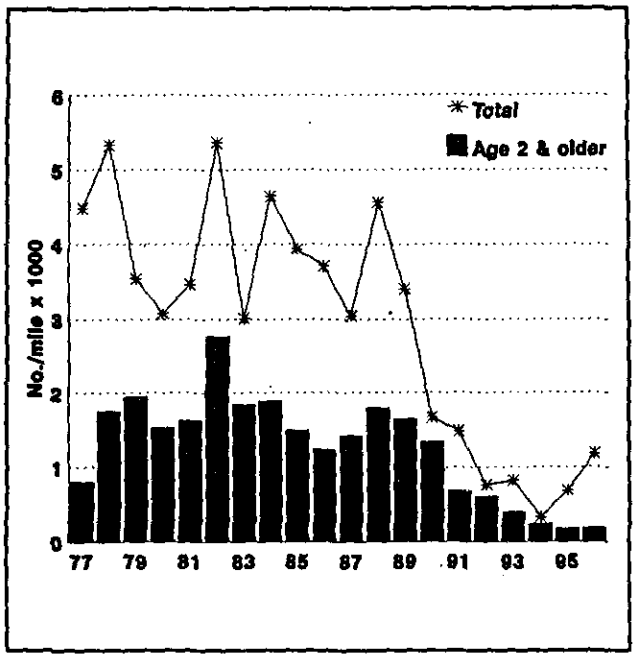

Figure 6. Rainbow trout populations in the Pine Butte section of the Madison River, 1977-1996, fall estimates.

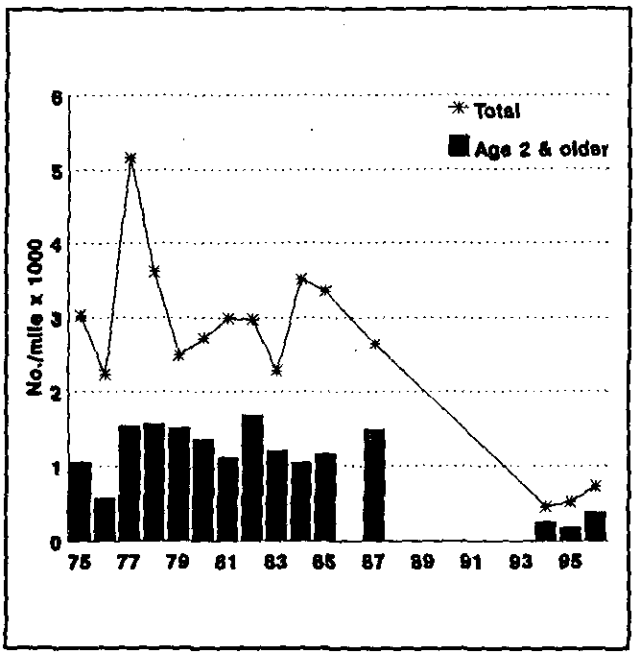

Figure 7. Rainbow trout populations in the Snoball section of the Madison River, 1975-1996, fall estimates.

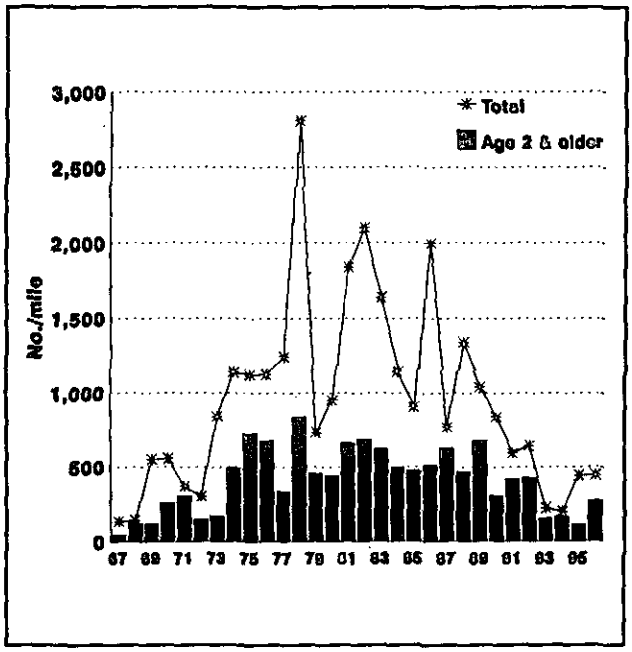

Figure 8. Rainbow trout populations in the Varney section of the Madison River, 1967-1996, fall estimates.

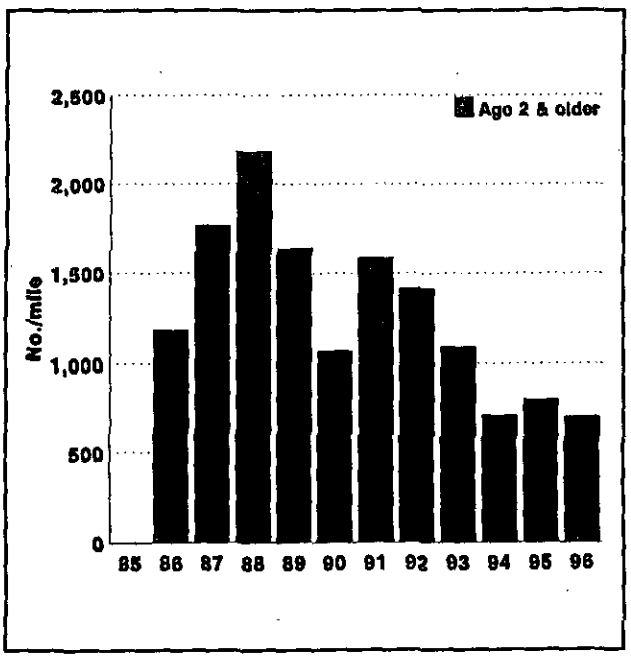

Figure 9. Rainbow trout populations in the Norris section of the Madison River, 1986-1996, spring estimates.

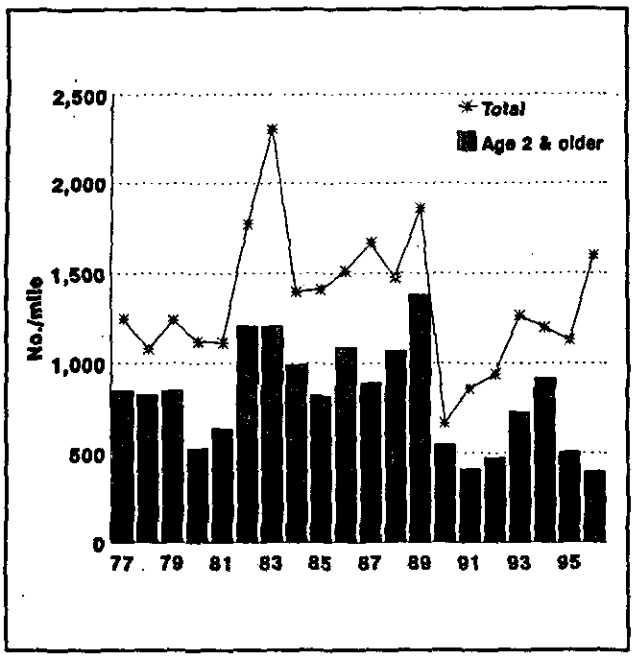

Figure 10. Brown trout populations in the Pine Butte section of the Madison River, 1977-1996, fall estimates.

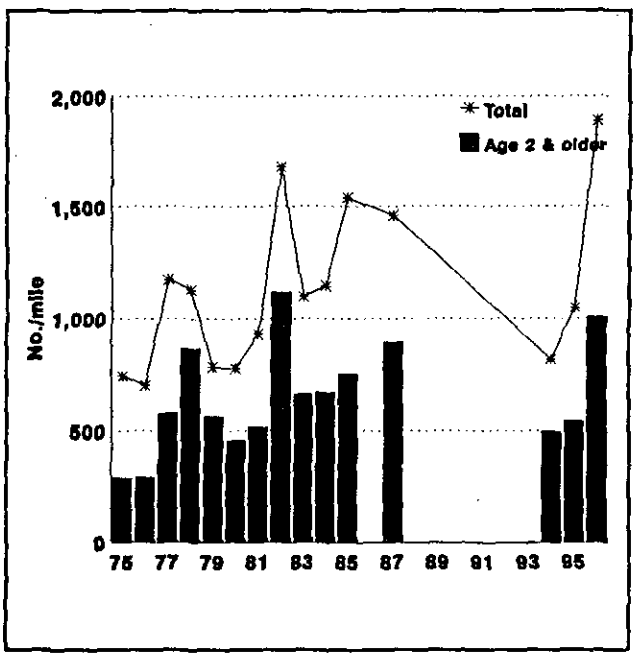

Figure 11. Brown trout populations in the Snoball section of the Madison River, 1975-1996, fall estimates.

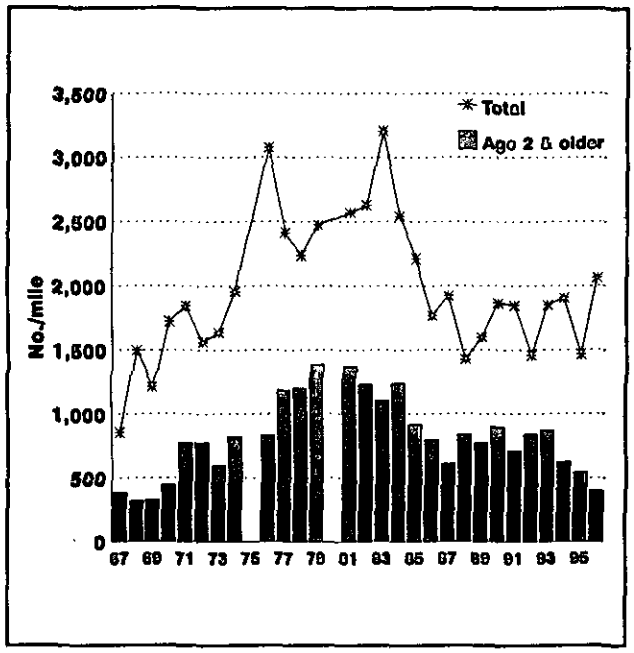

Figure 12. Brown trout populations in the Varney section of the Madison River, 1967-1996, fall estimates.

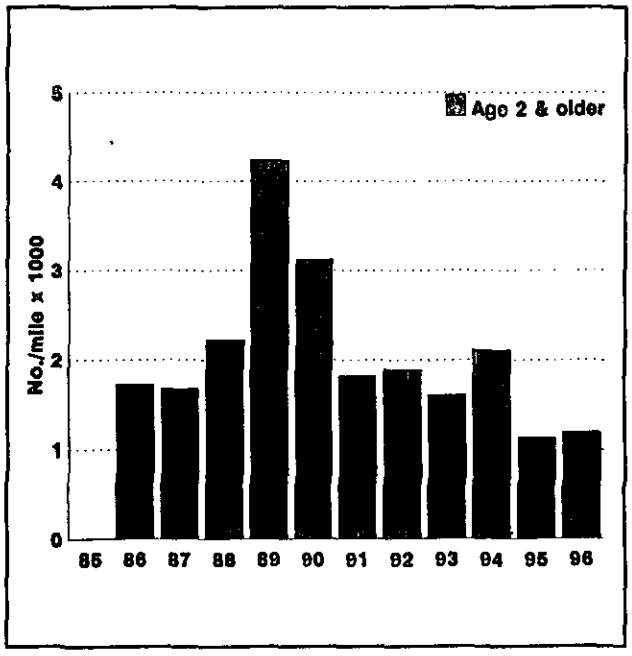

Figure 13. Brown trout populations in the Norris section of the Madison River, 1986-1996, spring estimates.

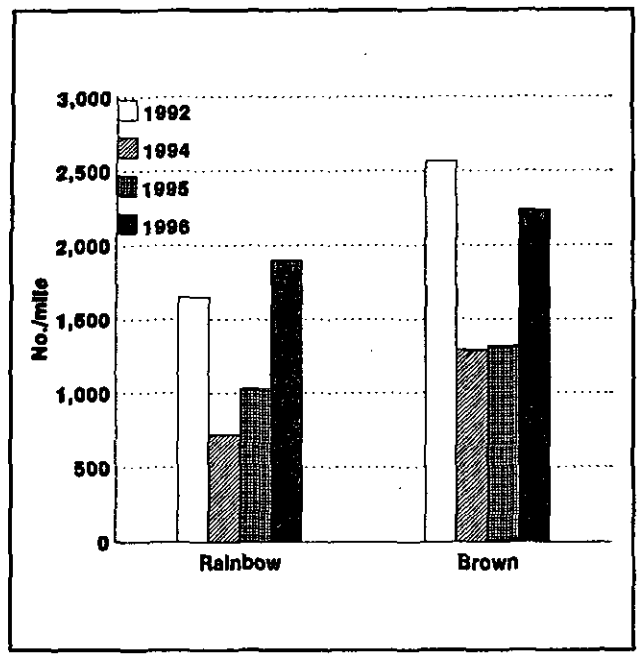

Figure 14. Population estimates of rainbow and brown trout in the Bypass section of the Madison River, spring estimates. Bypass flows (in cfs) during the estimates were as follows: 1992, 1118-1685; 1994, 90; 1995, 355-560; 1996, 82-200.

Each spring since 1994, FWP fisheries personnel have conducted an estimate in the Bypass section of the Madison River, between the upstream footbridge and Double-Drop Rapids. This has been done to establish a baseline for future estimates. In 1992, MPC personnel conducted a summertime estimate in the same reach of the Bypass. It is likely that trout populations in this section are closely linked to the magnitude and duration of spill over Ennis Dam. Flows within the Bypass section are subject to sudden and significant change. For instance, in 1996, flows in the Bypass on the day of the marking run were 82 cfs, but for the week prior to the marking run, had been as high as 450 cfs. Bypass flow on the day of the recapture run was 200 cfs.

Estimates were not conducted in the Greycliff section in 1996. Historic population information for rainbow and brown trout in Greycliff has been previously reported (MFWP 1996).

During 1981, 1995, and 1996, a summertime creel census was conducted on the Madison River. The 1995 survey was conducted throughout the entire Madison River, while the 1981 and 1996 surveys were conducted on segments of the river above Lyon's Bridge. Catch rates in the Pine Butte section (Figure 2) from each survey are presented in Table 1. Data is from Lere, FWP, pers. comm.

Table 1. Catch rates (number of fish caught per hour of angling) for rainbow and brown trout in the Pine Butte section of the Madison River.

	rainbow	brown
1981	0.63	0.23
1995	0.20	0.34
1996	0.23	0.25

Gill netting

Statistics of fish captured during gill netting in Ennis Reservoir are presented in Table 2. Few trout and no grayling were captured in 1996. Together, brown and rainbow trout account for 7, 4, and 11 percent of the total catch in June, August, and October, respectively. One of the rainbow trout netted in October displayed cranial deformity, a symptom of whirling disease infection.

Table 2. Summary of gill net catch in Ennis Reservoir, 1996. Length is in inches, weight in pounds.

	UC[1]	WSu	LnSu	MWF	Rb	LL
June						
Av.length	10.4	13.2	9.0	10.0	--	14.7
Av.weight	0.47	1.0	0.30	0.35		1.05
# measured	97	62	7	4		24
total catch	240	70	7	4		24
August						
Av.length	9.6	13.4	8.3	--	8.6	12.5
Av.weight	0.45	1.2	0.25		0.26	0.91
# measured	95	61	4		1	12
total catch	210	88	5		1	12
October						
Av.length	11.3	14.6	16.4	10.5	10.5	12.6
Av.weight	0.60	1.3	1.7	0.4	0.4	0.8
# measured	44	52	5	19	6	16
total catch	44	106	5	19	6	16

[1] UC= Utah Chub, WSu= white sucker, LnSu= Longnose sucker, MWF= Mountain whitefish, Rb= Rainbow trout, LL= Brown trout

Whirling Disease

The experiment comparing summertime mortality of rainbow and brown trout between the Pine Butte and Snoball sections was repeated in 1996. As in 1995, Pine Butte was open to catch-and-release, while Snoball was closed to all angling. Because of the poor quality of the fall rainbow trout and brown trout estimates in the Snoball section, a valid comparison of spring and fall populations is not possible.

Approximately every two weeks from early July through mid-November, 150 foot segments of riverbank that looked likely to be hospitable to yoy trout were sampled to monitor numbers of yoy trout and to document the onset and incidence of clinical signs of whirling disease. Sampling was conducted in the Pine Butte and/or Snoball sections, as occurred in 1995, and additionally in 1996, in the Norris section. Once a particular segment was sampled, it was not repeated at any time later in the season. Numbers of rainbow and brown trout yoy in the upper Madison River, as derived by the Zippin Removal Method (Zippin 1958), are illustrated in Figure 15. Numbers of yoy trout sampled throughout the season in the Norris section are illustrated in Figure 16.

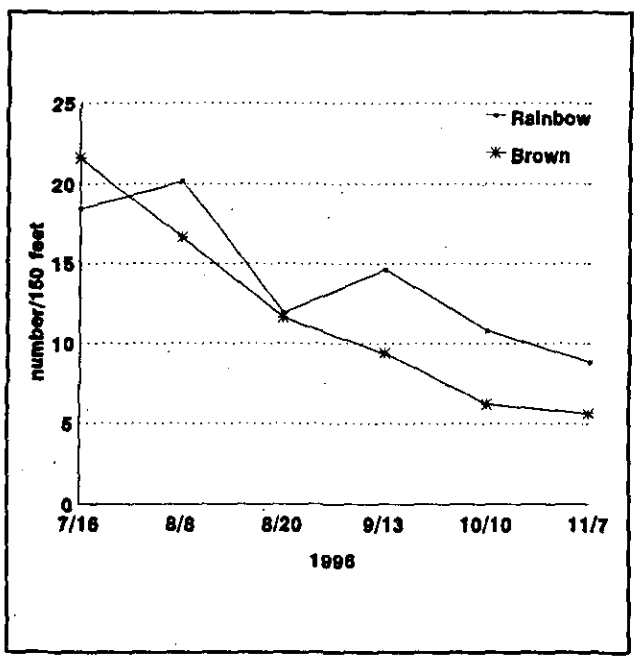

Figure 15. Average number of young-of-the-year rainbow and brown trout per 150 feet of riverbank in the Pine Butte and Snoball sections of the upper Madison River, July-November, 1996.

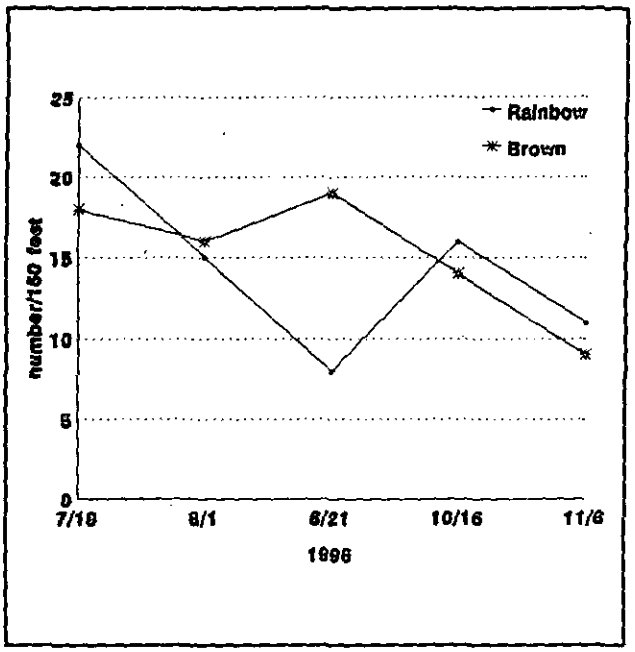

Figure 16. Average number of young-of-the-year rainbow and brown trout per 150 feet of riverbank in the Norris section of the lower Madison River, July-November, 1996.

It should be noted that the estimated number of yoy rainbow trout in the upper Madison in July, 1996, is significantly less than the estimated number in July, 1995. This indicates that fewer rainbow trout were produced in the spring of 1996 than in the spring of 1995. This phenomenon persists throughout equivalent sampling periods of each year (Table 3). The incidence of deformity among yoy rainbow trout in 1996 is presented in Table 4.

Table 3. Estimated number of young-of-the-year rainbow trout per 150 feet of riverbank in the Pine Butte and Snoball sections of the upper Madison River, 1995 and 1996.

1995		1996	
Sample date	#/150'	Sample date	#/150'
7/25,26	116	7/16,17	18
8/9,10	84	8/8	20
8/22,23	64	8/19,20	12
9/11,12	39	9/13	15
9/25,26	38		
10/11,12	35	10/10	11
11/13,14	18	11/7	9

Table 4. Incidence of deformity among young-of-the-year rainbow trout in the Pine Butte and Snoball sections of the upper Madison River, 1996.

Date	Number sampled[1]	Normal (%)	Exopthalmia/ cranial deform.	Blacktail	Caudal deform.	Whirling
7/16,17	135	132	3			
		(98)	(2)			
8/8	101	99	1	1		
		(98)	(1)	(1)		
8/19,20	106	101	3	1		1
		(95)	(3)	(1)		(1)
9/13	71	60	11			
		(85)	(15)			
10/10	54	34	16	3	1	
		(63)	(30)	(6)	(1)	
11/7	44	39	5	1		
		(89)	(11)	(1)		

[1] An individual fish may exhibit more than one clinical symptom, so the number sampled may be exceeded by the summation of the other categories.

In early December, a backpack shocker was used to collect yoy trout from nine sites along the Madison River to determine the range and infection rate of whirling disease (Figure 4). Up to 25 rainbow trout and brown trout are collected from each location and provided to the Washington Animal Disease Diagnostic Laboratory at Washington State University for analyses of presence and degree of infection of whirling disease (Appendix Table D1). Whirling disease has been confirmed in two yoy brown trout in the lower Madison River. This is the first confirmation of whirling disease below Bear Trap Canyon. The samples were taken from near the Warm Springs Access and from near Blacks Ford. At the present time, whirling disease is not affecting trout populations in the Madison River below Ennis Dam.

Efforts to evaluate habitat usage by yearling brown trout met with mixed success. In the early summer, yearling brown trout are generally 3.5-4.5 inches, and are difficult to capture during higher flows associated with spring runoff. General habitat conditions could be determined simply by noting the nature of the area electrofished. Specific habitat selection of individual yearling brown trout was not determined because fish were not large enough to accept an implantable radio transmitter until well into the fall, at the earliest. The sole brown trout implanted on July 12 was 5.0 inches, and weighed 0.05 lbs. The transmitter weight was approximately 10 % of the fish's body weight. A general rule of thumb states that the weight of the transmitter should not

exceed 2 % of the fish's body weight. This suggested rule has been violated in sturgeon research without seemingly affecting the behavior of the fish, though not to the degree it was violated in this instance. The implanted brown trout was held in a net live-car until it recovered from the affects of the anesthesia and was facing upstream into the current. It was released into the same brush pile where it had been captured. Over the next 12 days, this fish was relocated four times, but had not moved from the release location. It was decided not to attempt sighting the fish or to collect habitat information until the fish showed some movement. On July 24, the brush pile was systematically disassembled from the downstream side, and the fish was recovered. It was in an advanced stage of decay, but still held the radio transmitter. No further attempts were made to implant brown trout with radio tags in 1996.

Generally, yearling brown trout were captured in areas along the margins of the riverbank and islands that were brushy, with moderate to high amounts of instream cover. Water depth did not exceed three feet, and current velocity was moderate (less than 1.0 ft/sec). In rare instances, velocity was too slow to obtain a measurement. Young-of-the-year and 2 year old & older brown trout were often captured or seen in the same area that yearling brown trout were found.

Controlled experiments conducted by the MFWP were designed to test the affects of whirling disease on yoy grayling of Big Hole River stock. However, the grayling used in the tests suffered bacterial coldwater disease (*Flexibacter psychrophilus*). Too few grayling survived the coldwater disease to be conclusively tested for whirling disease infection.

Water Temperatures

StowAway and Optic StowAway temperature recorders are deployed throughout the Madison River to document air and water temperatures (Figure 5). Table 5 summarizes the data collected at each location in 1996, and Appendix E contains thermographs for each location. Some overlap of data occurred between recording units at air temperature monitoring locations. Recorders deployed to monitor air temperatures were located in areas that were shaded 24 hours per day.

Recorders at Quake Lake outlet, Raynolds Bridge, and Kirby may have become temporarily dewatered on two occasions in early August. The recorder at Headwaters State Park (Madison mouth) is known to have been dewatered shortly after deployment. It was moved to a new location below the waterline on the morning of August 5. The data in Table 5 ignores these episodes.

Table 5. Maximum and minimum temperatures (°F), the dates of each, the period monitored, and the number of recordings at selected locations in the Madison River drainage, 1996. Charts for each location are Appendix C.

Site	Maximum	Minimum	Period	# readings
Hebgen discharge	65.0 (8/2)	51.9 (10/17)	7/27-10/17	7944
Quake Lake inlet	63.9 (8/19)	50.9 (10/17)	7/27-10/17	7944
Quake Lake outlet	63.6 (8/13)	50.3 (10/17)	7/27-10/17	7944
Slide Store air	90.1 (8/11)	23.3[1/] (9/23)	7/27-10/14	3600
Raynolds Bridge	64.1 (8/11,15)	49.5 ((10/17)	7/27-10/17	7944
Kirby Bridge	67.8 (8/10)	46.6 (10/17)	7/27-10/17	7944
West Fork Madison	65.5 (7/31 & 8/1,10)	33.7 (10/17)	7/27-10/17	7944
McAtee Bridge	69.1 (7/28)	42.5 (10/17)	7/27-10/17	7944
Wall Creek HQ air	100.6 (7/27,28 8/10,11,16)	23.3[1/] (10/17)	7/27-10/22	9743
Varney Bridge	69.0 (8/15,16)	41.4 (10/17)	7/27-10/17	7944
Burnt Tree	70.3 (7/30)	40.3 (10/17)	7/27-10/17	7944
Ennis Bridge	70.3 (8/15)	40.9 10/17)	7/27-10/17	7944
Ennis Fisheries office air	98.9 (8/12)	23.3[1/] (10/17)	7/27-10-20	9504
Eagles' Nest	73.8 (8/1)	39.3 (10/17)	7/27-10/17	7944

Table 5 (continued).

Inlet	73.4 (7/27 8/1)	39.3 (10/17)	7/27-10-17	7944
Ennis Dam	70.9 (8/1,2)	47.2 (10/17)	7/27-10/17	7944
Ennis Dam air	89.4 (8/12)	31.1 (9/23)	7/27-10/14	3600
Beartrap Mouth	74.7 (8/1)	46.9 (10/17)	7/27-10/17	7944
Norris	75.6 (8/1)	45.9 (10/17)	7/27-10/17	7944
Norris air	97.7 (8/12)	27.5 (9/23)	7/27-10/14	3600
Blacks' Ford	77.0 (7/28)	44.5 (10/17)	7/27-10/17	7944
Greycliff	78.0 (7/28)	44.0 (10/17)	7/27-10/17	7944
Cobblestone	78.7 (7/28)	43.7 (10/17)	7/27-10/17	7944
Cobblestone air	94.0 (8/10)	23.9 (9/23)	7/27-10/14	3600
Headwaters S.P. (Madison mouth)	74.67 (8/16)	42.41 (10/17)	7/27-10/17	7944

[1/] 23.26°F is the lowest temperature the recorders will register. Actual air temperatures were probably colder than that shown here.

The fall stepdown of Madison River water temperatures occurred September 15th and 16th throughout the entire river (Appendix Table E1). Maximum air temperatures exhibited marked declines at all six monitoring stations from the 15th to the 16th. A second stepdown may have been occuring in October when the temperature monitors ceased recording.

Biological and Biocontaminant Monitoring

Results of the biological and biocontaminant monitoring conducted in 1996 are not yet available. Preliminary baseline data for 1994 and 1995 have been reported to MPC. Data collected during 1994-6 are to serve as a baseline for a water quality monitoring program which will be conducted over the life of the FERC license granting authority to MPC to operate the 2188 Project. Analyses by consultants and subsequent reporting of results to MPC are not yet completed. Detailed information is available from the MPC Environmental Division in Butte.

Densities of the New Zealand Mud Snail (*Potamopyrgus antipodarum*) in the Madison River within Yellowstone National Park have increased by an order of magnitude each year since initially sampled in 1994. A total of 38 NZMS were captured in 1994, 311 in 1995 (McGuire 1996), and 4,374 in 1996 (McGuire 1997 pers. comm.). Four 1/2 square meter samples were collected each year. In 1996, the NZMS comprised 52 percent of all invertebrates collected at the Yellowstone National Park site of the Madison River. The NZMS has not yet been found below Hebgen Reservoir. Positive verification of the identity of the NZMS was made by researchers from New Zealand in a letter to MFWP dated October 24, 1996.

CONCLUSIONS AND FUTURE PLANS

The apparently poor reproductive year of the Madison/Ennis grayling in 1996 will further hamper efforts to determine conclusively if the population contains a fluvial component, and may reduce the viability of any fluvial component that does exist. Due to the poor survival of the grayling that were to be used in the 1996 whirling disease field trials, too little evidence is available to draw firm conclusions regarding the affects of whirling disease on grayling.

The planned introduction of Big Hole River grayling progeny into Cherry Creek, a tributary of the lower Madison, was abandoned when it was learned that these fish were infected with bacterial kidney disease (BKD). Warren (1991) states that BKD "typically has a slowly progressive, relentless course that is difficult to control and nearly impossible to completely cure." It is the policy of the Montana Fish, Wildlife, & Parks to use only certified disease free fish in any reintroduction or stocking program. The Cherry Creek fluvial grayling effort will be revisited at some point in the future to determine the next course of action.

The Snoball section of the Madison River, which has been closed to angling since March 1, 1995, is expected to reopen in 1997, pending approval of the Montana Fish, Wildlife, & Parks Commission. Due to the low number of recaptures among rainbow trout in this section during the 1996 fall population estimate, and

the subsequent poor confidence in that estimate, conclusive information regarding the affects of the second year of closure is lacking. In 1995, it appeared that the removal of angling pressure during the summer season enhanced survival of older rainbow trout (MFWP 1996).

Young-of-the-year numbers will again be monitored approximately every two weeks during 1997 from about July through November.

Water temperatures will continue to be collected throughout the drainage to monitor measures implemented to address thermal issues and to provide data to update the MPC Thermal Model, or other models, if required.

It is expected in 1997 that the major effort of the Madison Protection, Mitigation, & Enhancement (P,M,& E) Project will be spent on Upper Missouri Westslope Cutthroat Trout (UMWCT) Conservation & Recovery Program. A ten year plan is currently being developed that will outline efforts to conserve and restore native UMWCT in portions of tributary streams of the Madison River. The Madison P,M,& E Biologist, funded through a contract between Montana Power Company and FWP, is expected to be the lead on field efforts of this project. Ongoing duties that will remain with the P,M, & E Biologist are Ennis Reservoir gillnetting, Madison River water temperature monitoring, biological and biocontaminant collections, monitoring the grayling spawning run and yoy production, and possibly some participation in Madison River population estimates and whirling disease monitoring.

The Federal Energy Regulatory Commission is expected to release their Draft Environmental Impact Statement on the relisencing of MPC's 2188 Project sometime in the spring of 1997. After the review and public comment period for the DEIS, a final determination will be made by FERC regarding the MPC application to renew the 2188 license. At the time the license is granted, the budget to formally conduct P,M,& E activities will become available. Currently, MPC is budgeting that money to become available in February, 1998.

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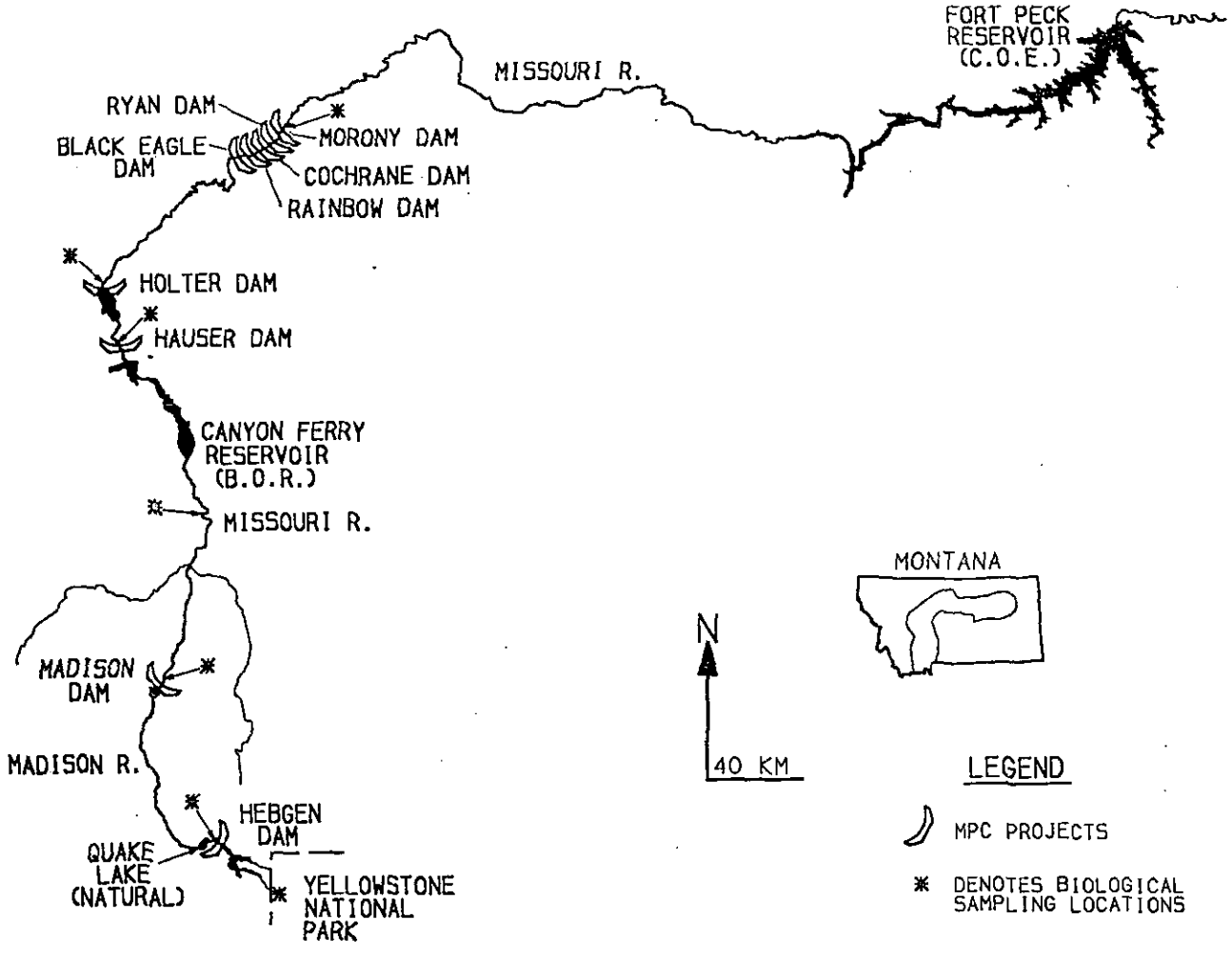
APPENDIX A

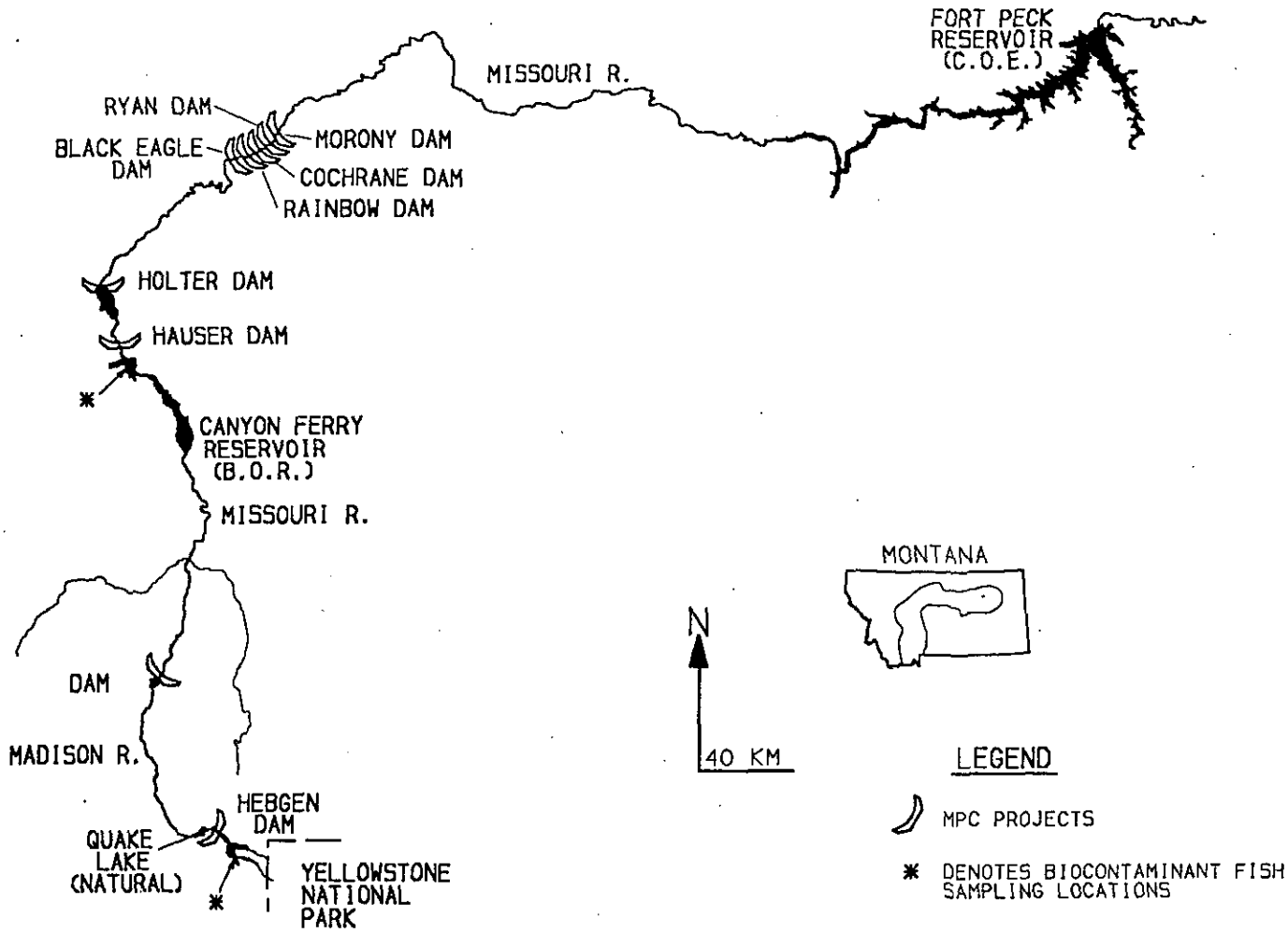
BIOLOGICAL AND BIOCONTAMINANT MONITORING LOCATIONS IN THE MADISON AND MISSOURI RIVERS, MONTANA.

Figures provided by Montana Power Company, Environmental Division

MAP OF MISSOURI - MADISON RIVER SYSTEM SHOWING MPC PROJECTS AND BIOLOGICAL SAMPLING LOCATIONS



MAP OF MISSOURI - MADISON RIVER SYSTEM SHOWING MPC PROJECTS AND 1996 BIOCONTAMINANT FISH SAMPLING LOCATIONS



APPENDIX B.

DESCRIPTION OF YOUNG-OF-THE-YEAR GRAYLING BEACH SEINING LOCATIONS IN ENNIS RESERVOIR, AND CATCH AT EACH SITE.

Species abbreviations:

WSu	white sucker
LND	Longnosed dace
UC	Utah Chub
Rb	rainbow trout
LL	brown trout

June 18 1996

Site seined/time	AG	MWF	Other[1/]	Note
east side of willow patch between Meadow Creek FAS and Peterson property ($1000 house) 1145 hrs.	0	0	2 adult WSu 1 LND 1 adult UC	no macrophytes
300' north of Meadow Creek mouth 1200 hrs.	0	0	2 yoy Rb 1 adult LL 3 juv. UC 7 adult WSu	no macrophytes
immediately north of Meadow Cr. mouth 1305 hrs.	0	5	3 adult WSu 5 adult UC	no macrophytes
big bay 600' east of Fletchers mouth 1420 hrs.	0	1	1 juv. LL 7 WSu 4 UC	no macrophytes

July 22 1996

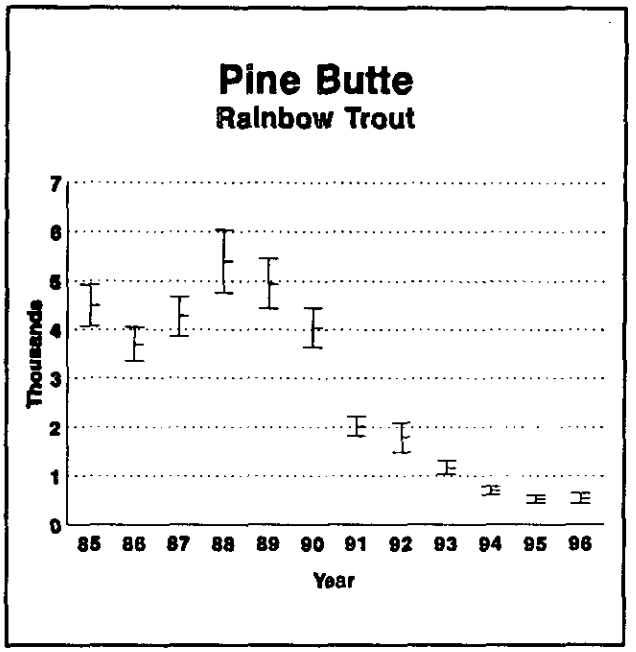
Site seined/time	AG	MWF	Other[1/]	Note
east of willows at $1000 house 1251 hrs	0	0	0	no macrophytes
west of willows at $1000 house	0	0	1 LND	no macrophytes
west end of willows at Meadow Cr. FAS	0	0	4 LND	sparse macrophytes
200' north of Meadow Cr. mouth	0	0	1 juv. UC	sparse macrophytes
large bay east of Fletchers mouth	0	0	0	sparse-to-continuous macrophytes
SW corner of reservoir, into Moores Cr. mouth 1320 hrs	0	0	2 adult UC	sparse
willows west of mouth of west main channel 1415 hrs	0	0	1 yoy sucker	mostly continuous macrophytes

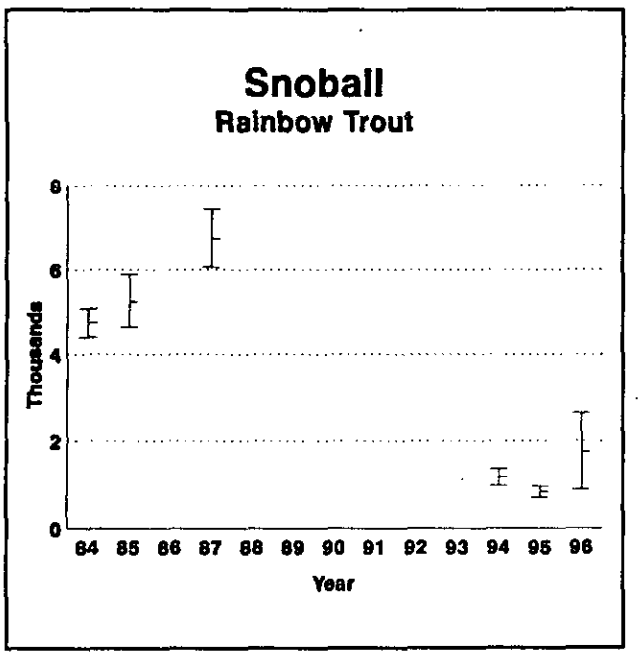
August 22 1996

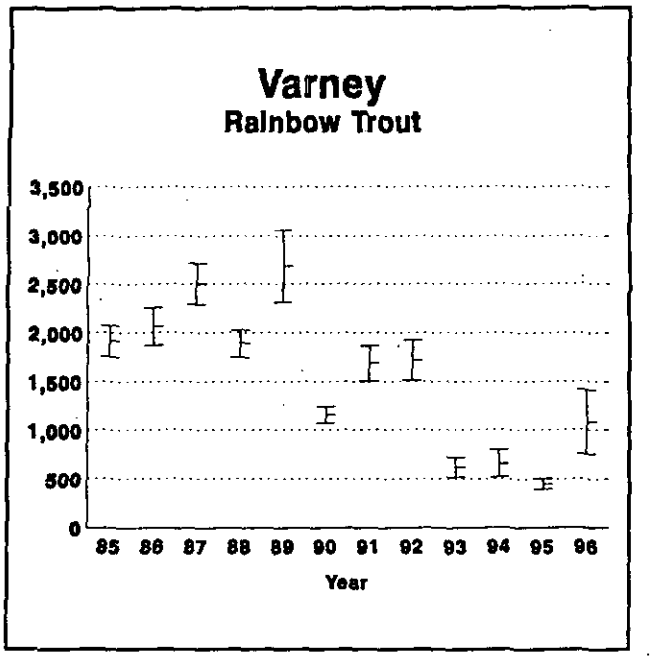
Site seined/time	AG	MWF	Other[1/]	Note
west of willows- $1000 house 0945 hrs.	0	0	3 adult UC many yoy suckers	thick stands of macrophytes, not continuous
midway between willow bushes west of $1000 house- Meadow Cr bay 1000 hrs	0	0	juv. UC& suckers	thick stands not continuous
east end of 2nd willows east of $1000 house 1020 hrs	0	0	0	macrophytes thick
picnic area at Meadow Cr. FAS 1040 hrs	0	0	juv UC 1 adult WSu	macrophytes thick,continuous
300' north of Meadow Cr. mouth 1100 hrs	0	0	0	few macrophytes mud bottom
300' south of Klutes Landing 1140 hrs	0	0	0	macrophytes thick-absent
west point at Moores Cr mouth 1215 hrs	0	0	0	macrophytes thick-absent
point west of Fletchers mouth 1240	0	0	1 yoy LL	macrophytes thick

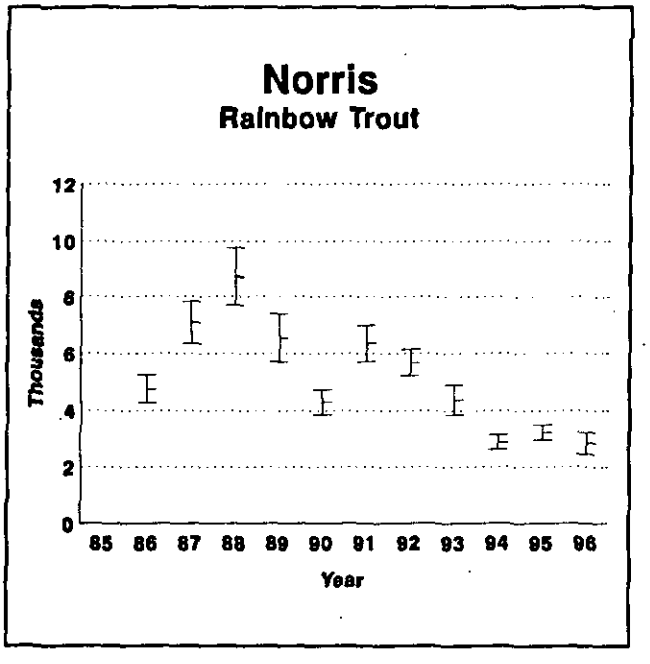
APPENDIX C

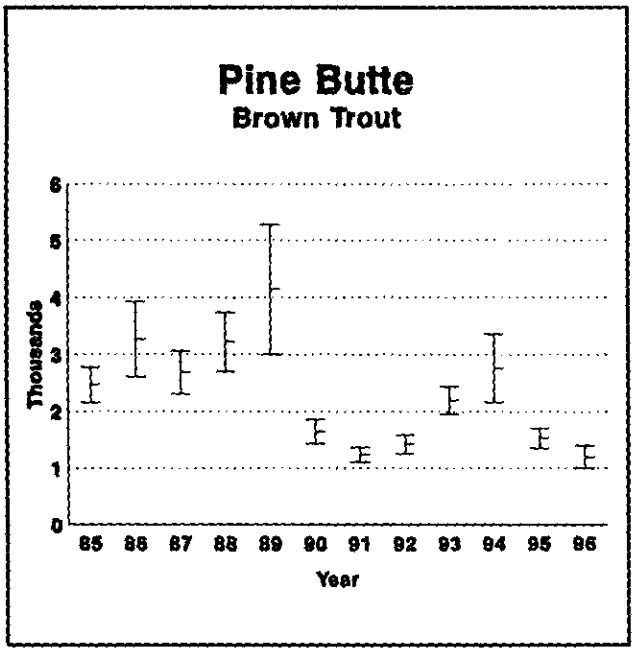
POPULATION ESTIMATES OF AGE 2 & OLDER RAINBOW TROUT AND BROWN TROUT IN THE MADISON RIVER ±80 PERCENT CONFIDENCE INTERVALS.

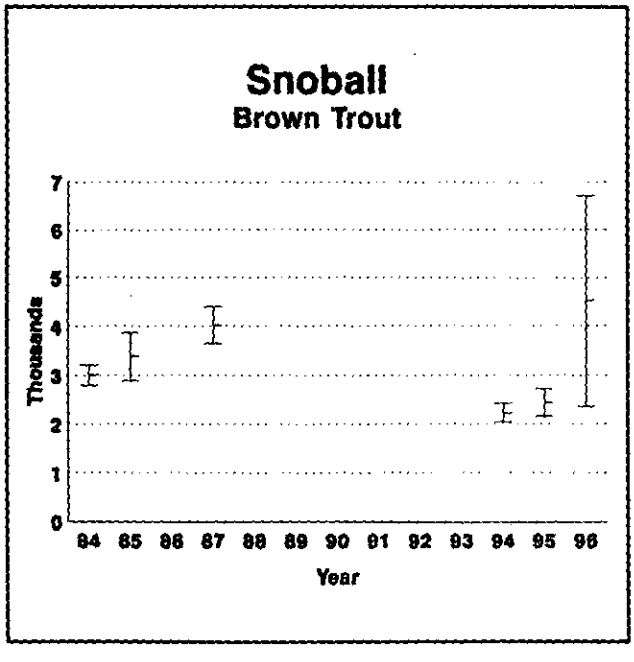

Pine Butte
Rainbow Trout
Thousands
0
1
2
3
4
5
6
7
85 86 87 88 89 90 91 92 93 94 95 96
Year

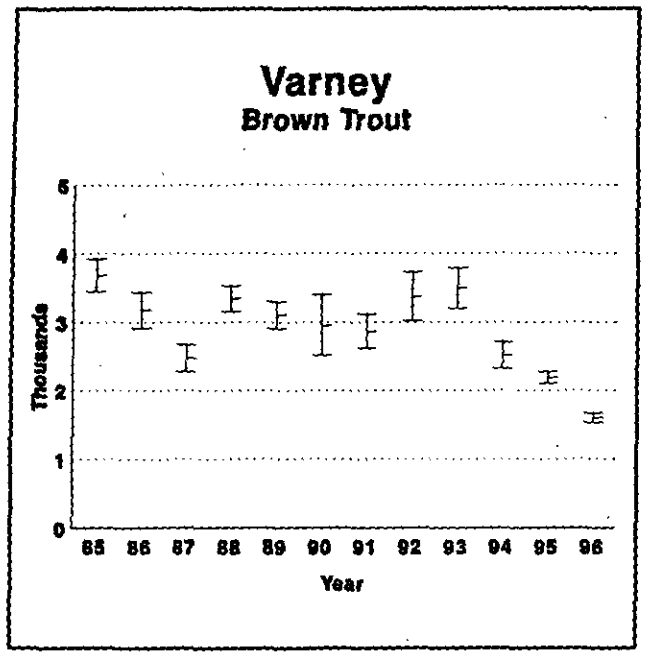

Snoball
Rainbow Trout
Thousands
0
2
4
6
8
84 85 86 87 88 89 90 91 92 93 94 95 96
Year

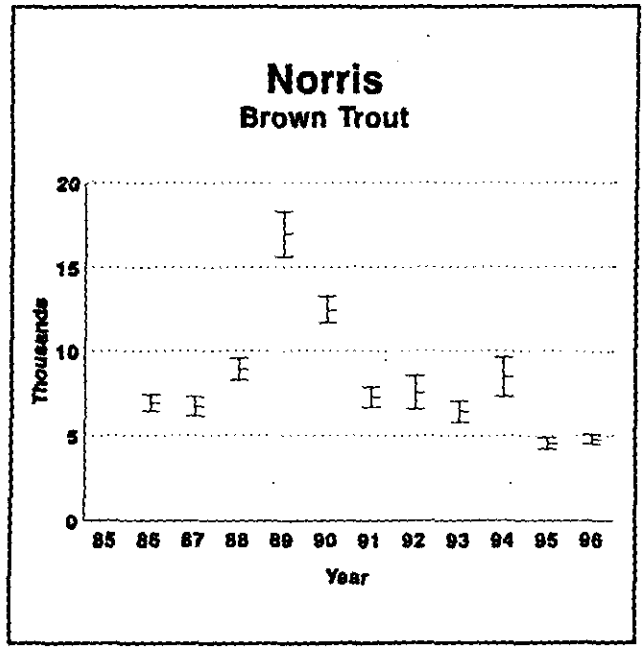

Varney
Rainbow Trout
3,500
3,000
2,500
2,000
1,500
1,000
500
0
85 86 87 88 89 90 91 92 93 94 95 96
Year


Norris
Rainbow Trout
Thousands
12
10
8
6
4
2
0
85 86 87 88 89 90 91 92 93 94 95 96
Year


Pine Butte
Brown Trout
Thousands
0
1
2
3
4
5
6
85 86 87 88 89 90 91 92 93 94 95 96
Year


Snoball
Brown Trout
Thousands
0
1
2
3
4
5
6
7
84 85 86 87 88 89 90 91 92 93 94 95 96
Year


Varney
Brown Trout
Thousands
0
1
2
3
4
5
85 86 87 88 89 90 91 92 93 94 95 96
Year


Norris
Brown Trout
Thousands
0
5
10
15
20
85 86 87 88 89 90 91 92 93 94 95 96
Year

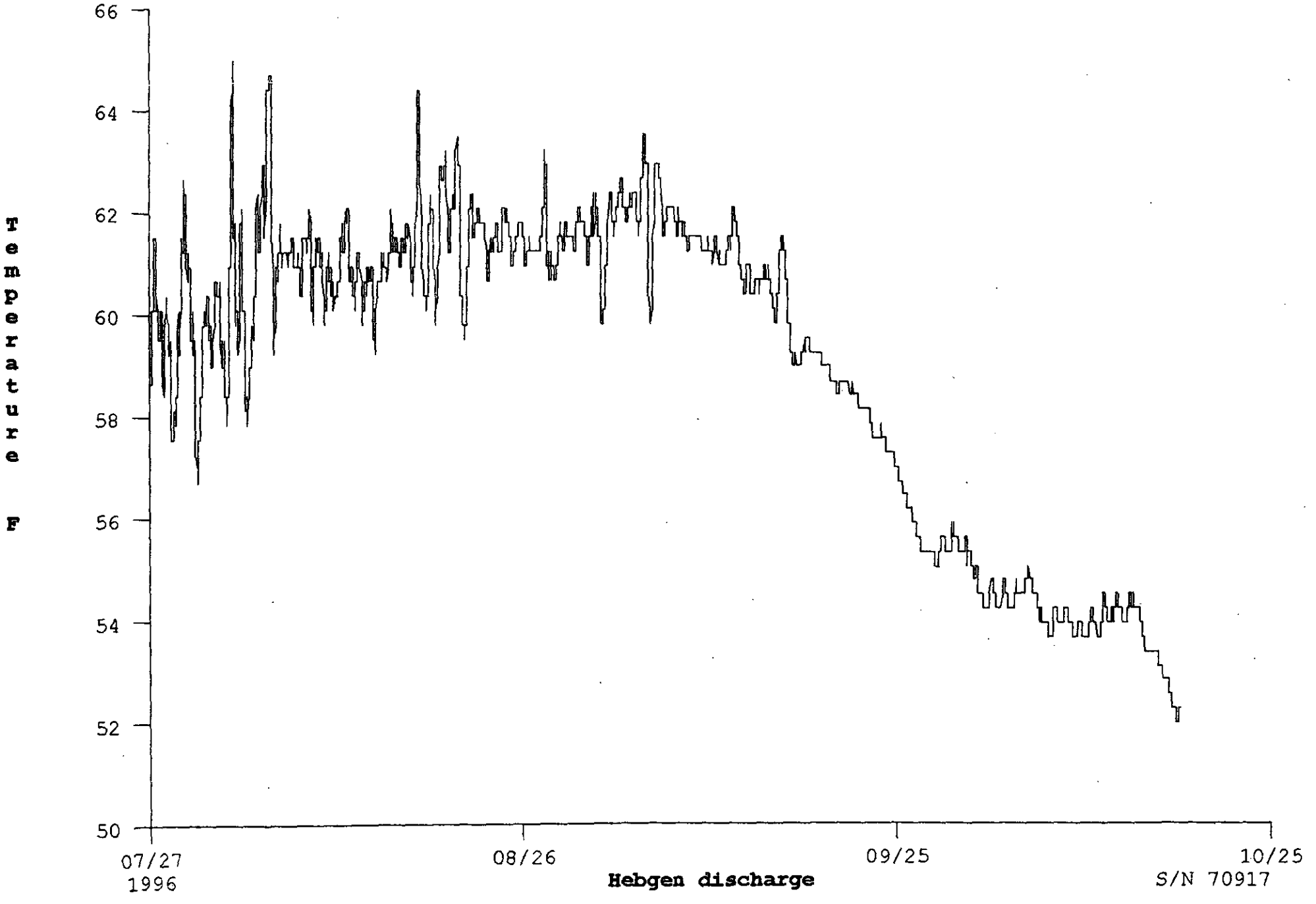
APPENDIX TABLE D1. Results of analyses of samples collected during annual series sampling for whirling disease on the Madison River, 1996.

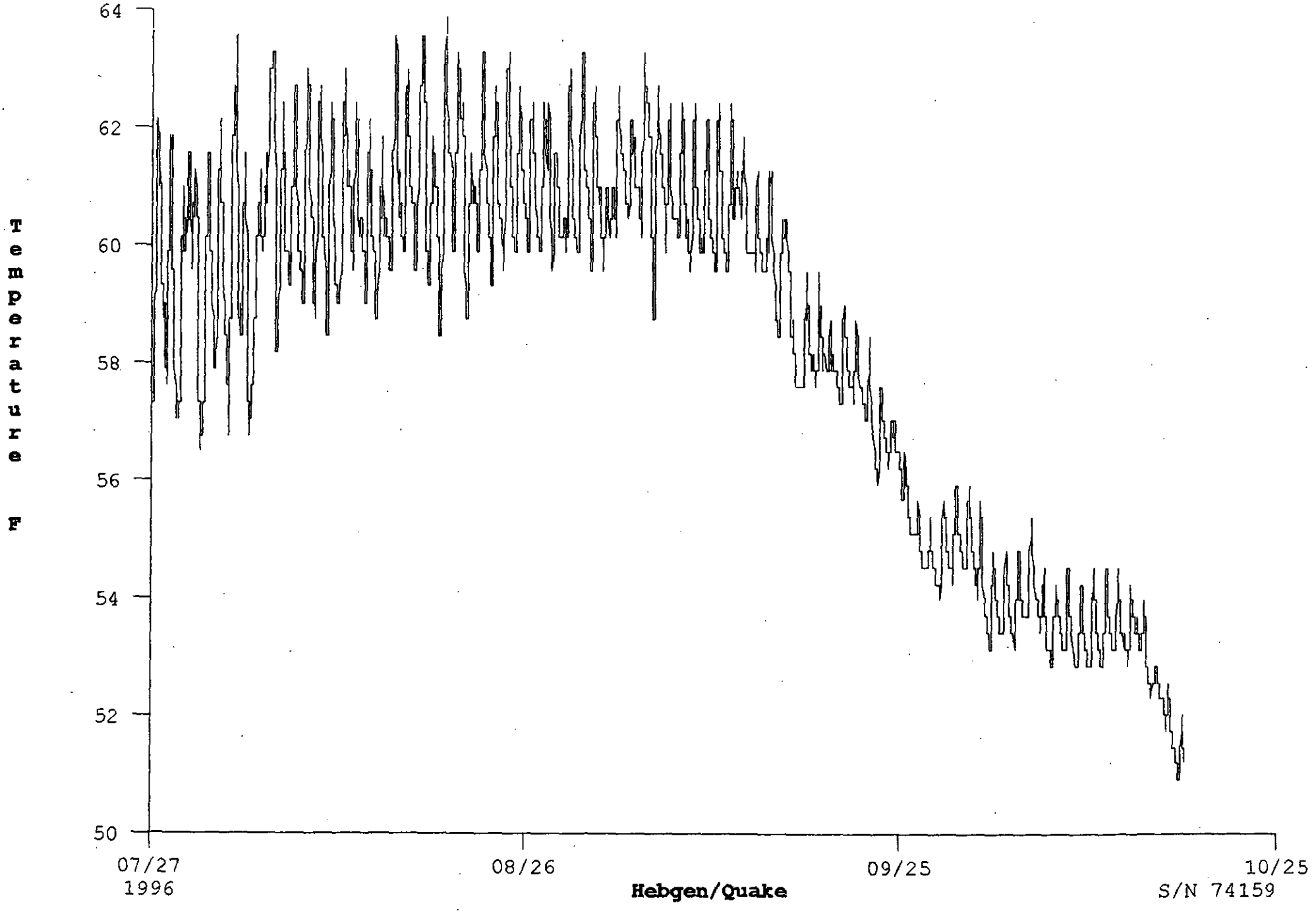
Sample site[1/]	Rainbow trout # WD+/# sampled	Brown trout # WD+/# sampled
Black's Ford	0/4	1/18
Warm Springs	0/19	1/15
Bypass	0/9	0/3
Valley Garden	2/3	5/20
Pine Butte	2/5	2/16
Raynolds Pass	9/14	3/13
Hebgen/Quake river section	0/21	none sampled

[1/] additional collections were made in January, 1997, at Varney, McAtee, Palisades, and an unnamed spring creek on the west side of Three Dollar Bridge.

APPENDIX E.

TEMPERATURE RECORDINGS FROM MONITORED SITES ON THE MADISON RIVER


Temperature F
66
64
62
60
58
56
54
52
50
07/27
1996
08/26
09/25
10/25
Hebgen discharge
S/N 70917


Temperature F
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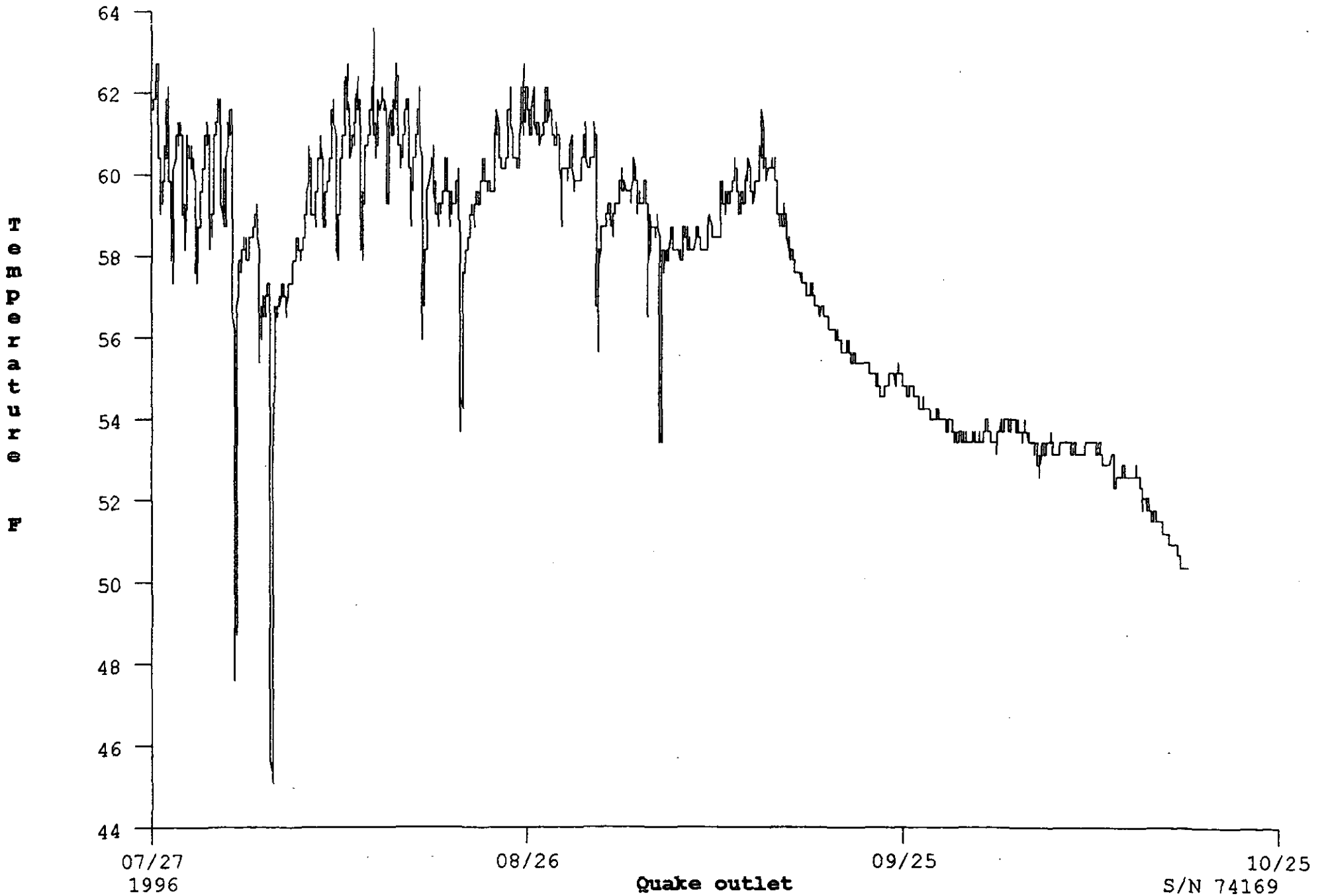
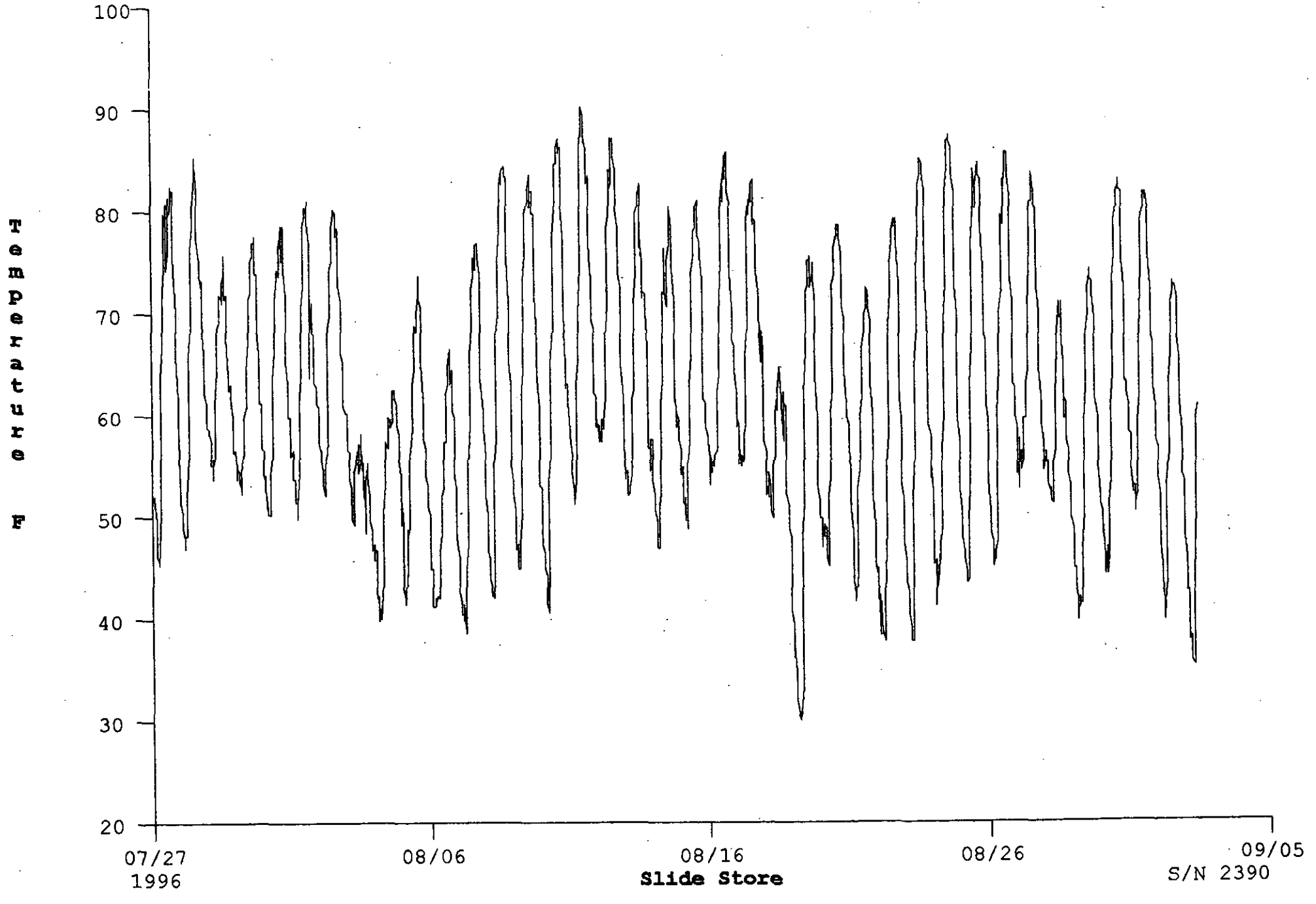
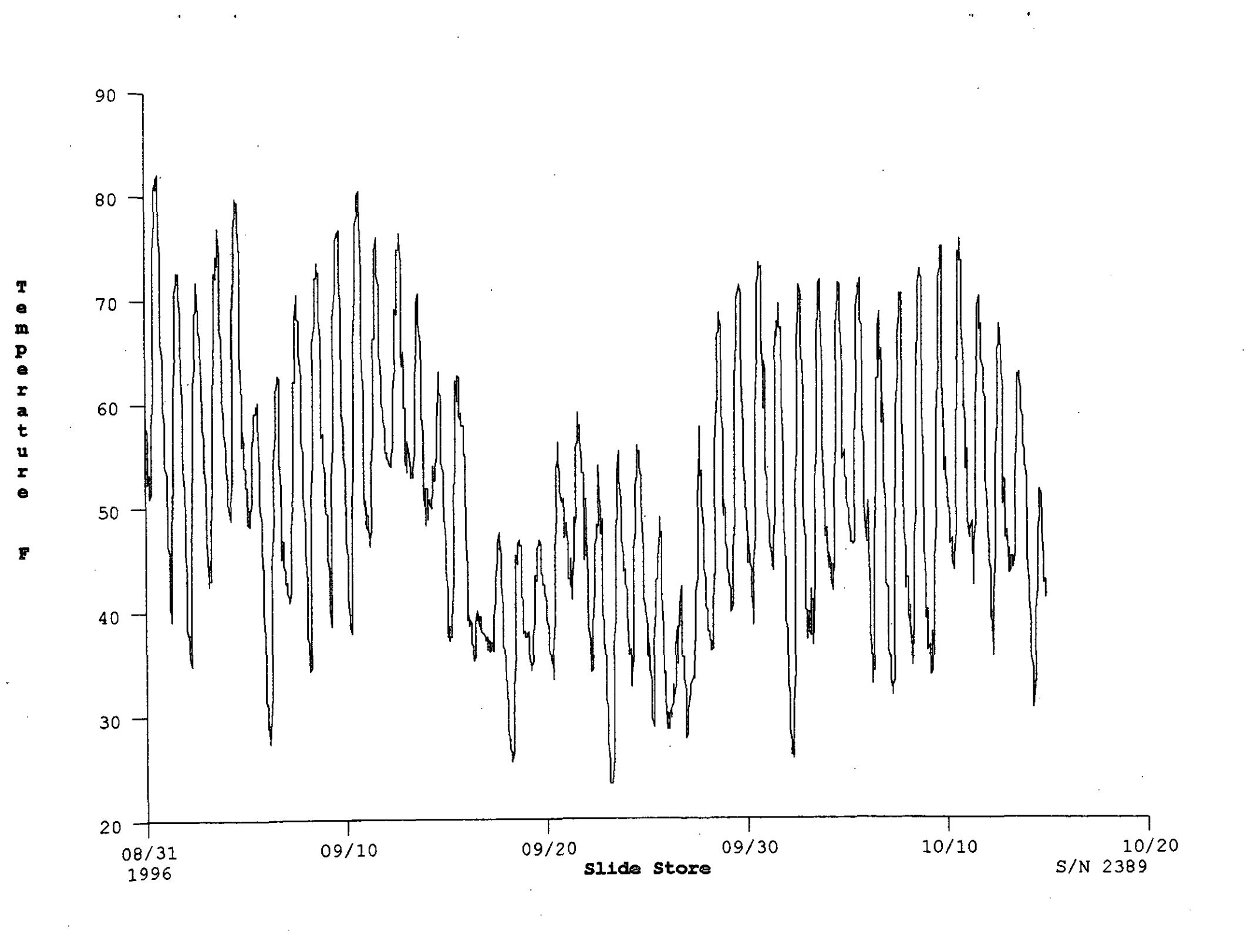
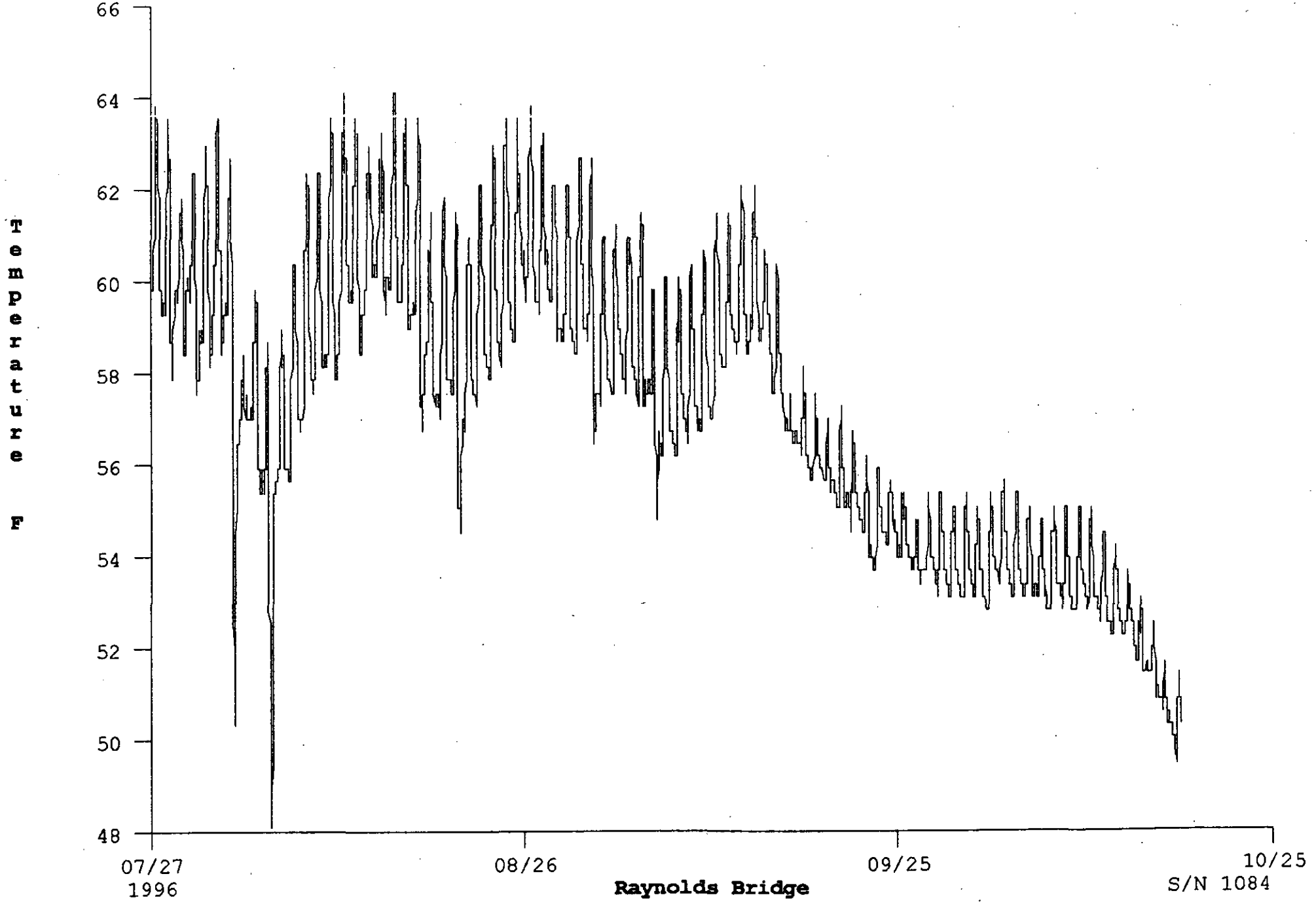
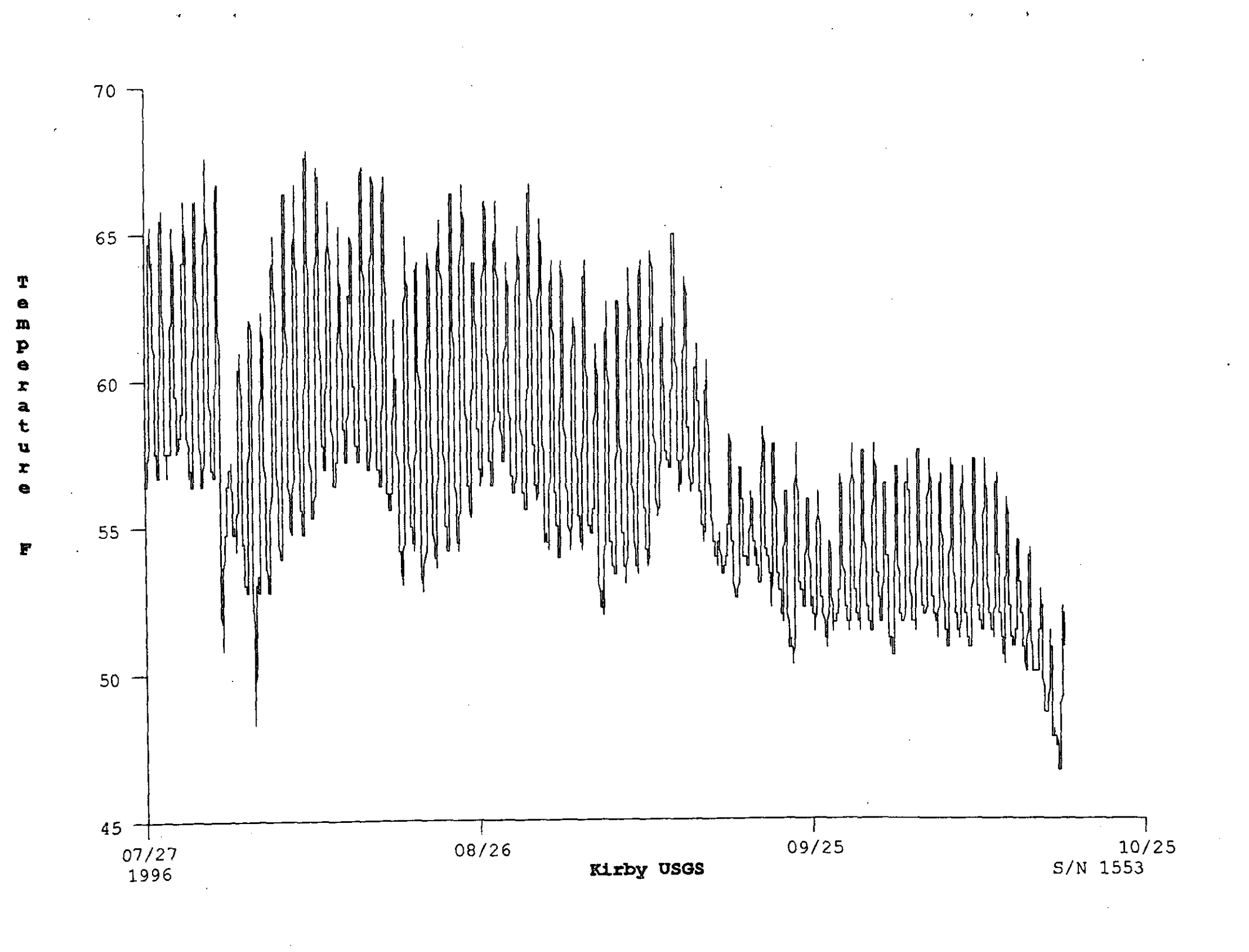
62
60
58
56
54
52
50
07/27
1996
08/26
09/25
10/25
Hebgen/Quake
S/N 74159

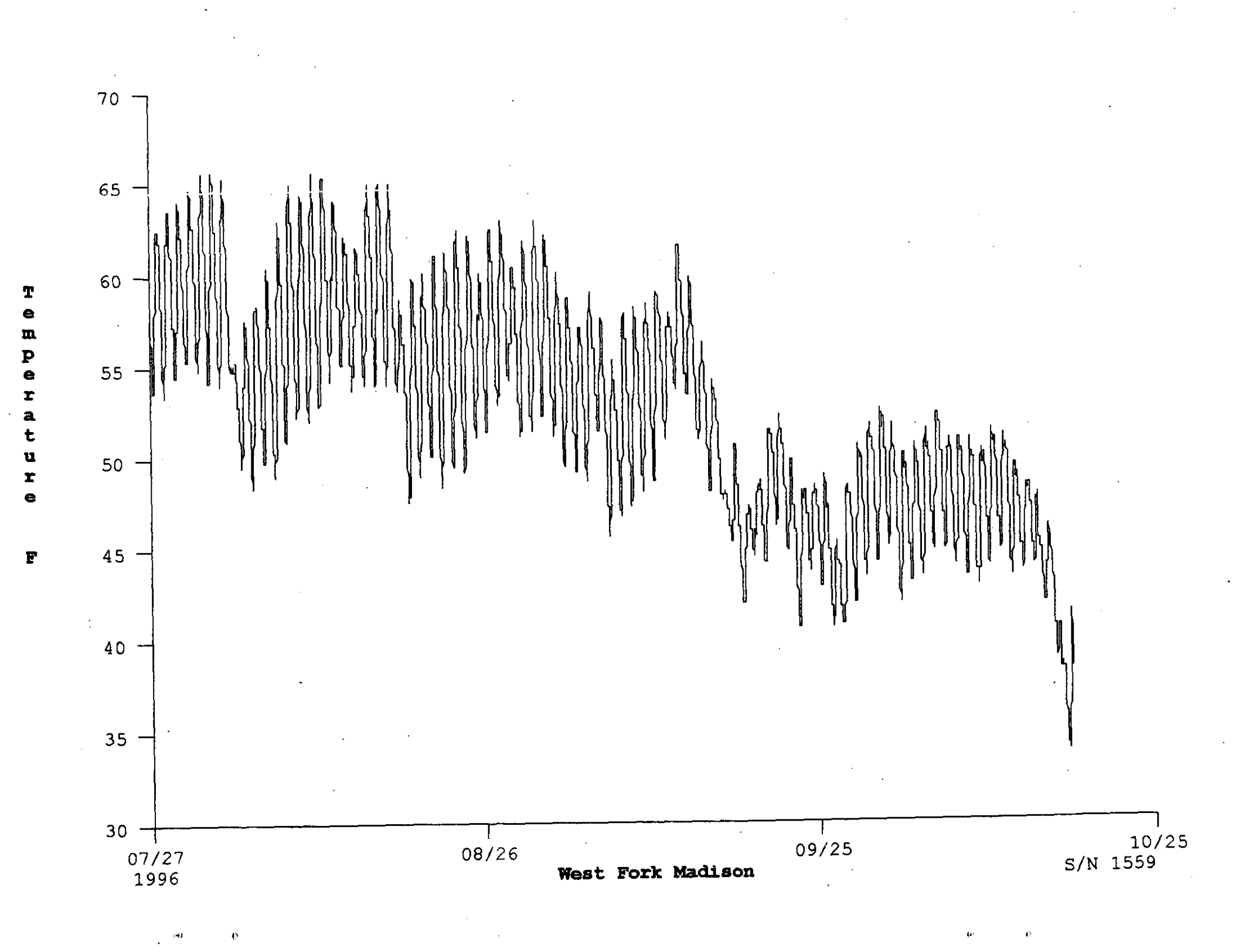

Temperature F
64
62
60
58
56
54
52
50
48
46
44
07/27
1996
08/26
09/25
10/25
Quake outlet
S/N 74169

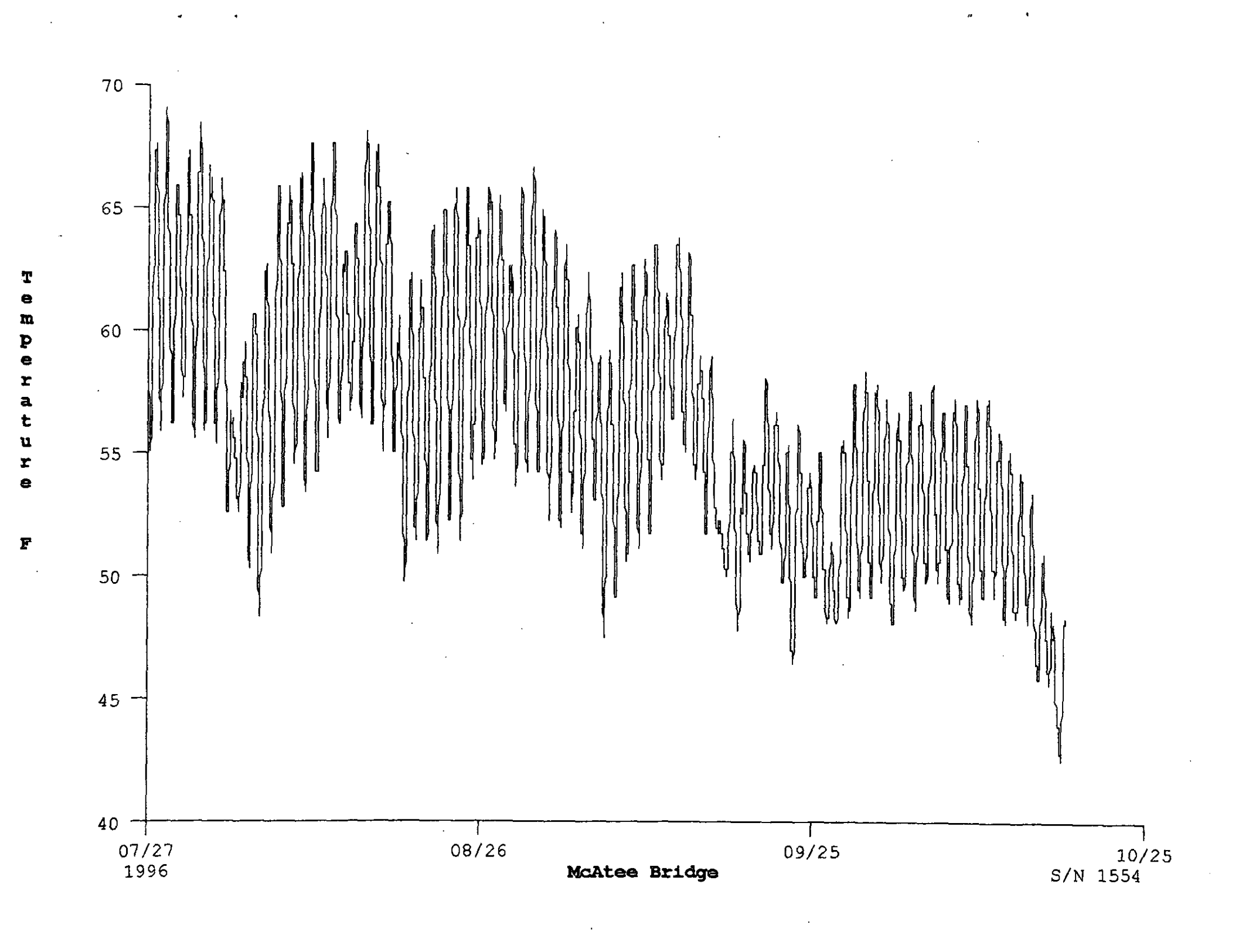

Temperature F
100
90
80
70
60
50
40
30
20
07/27
1996
08/06
08/16
08/26
09/05
Slide Store
S/N 2390

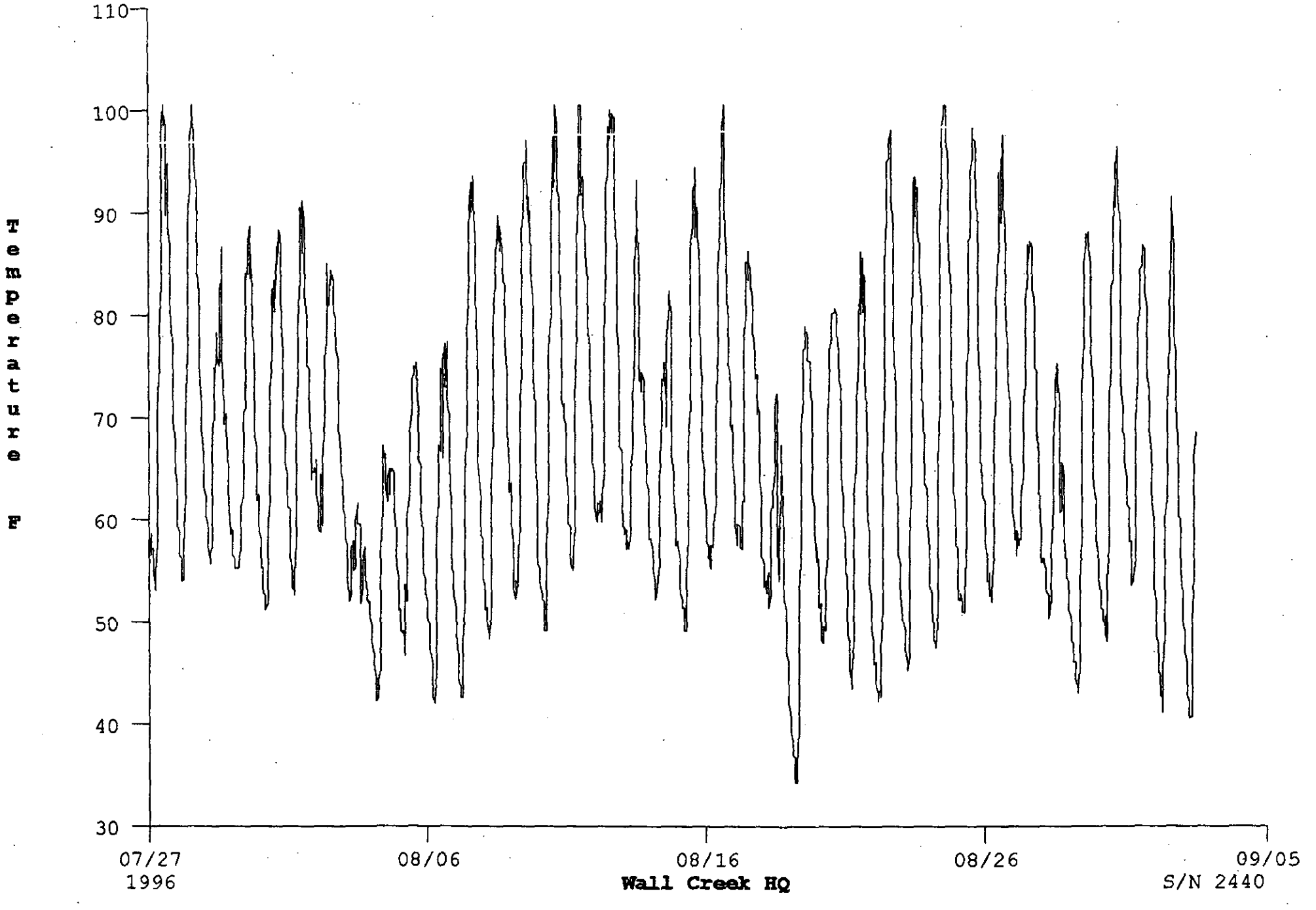

Temperature F
90
80
70
60
50
40
30
20
08/31
1996
09/10
09/20
09/30
10/10
10/20
Slide Store
S/N 2389

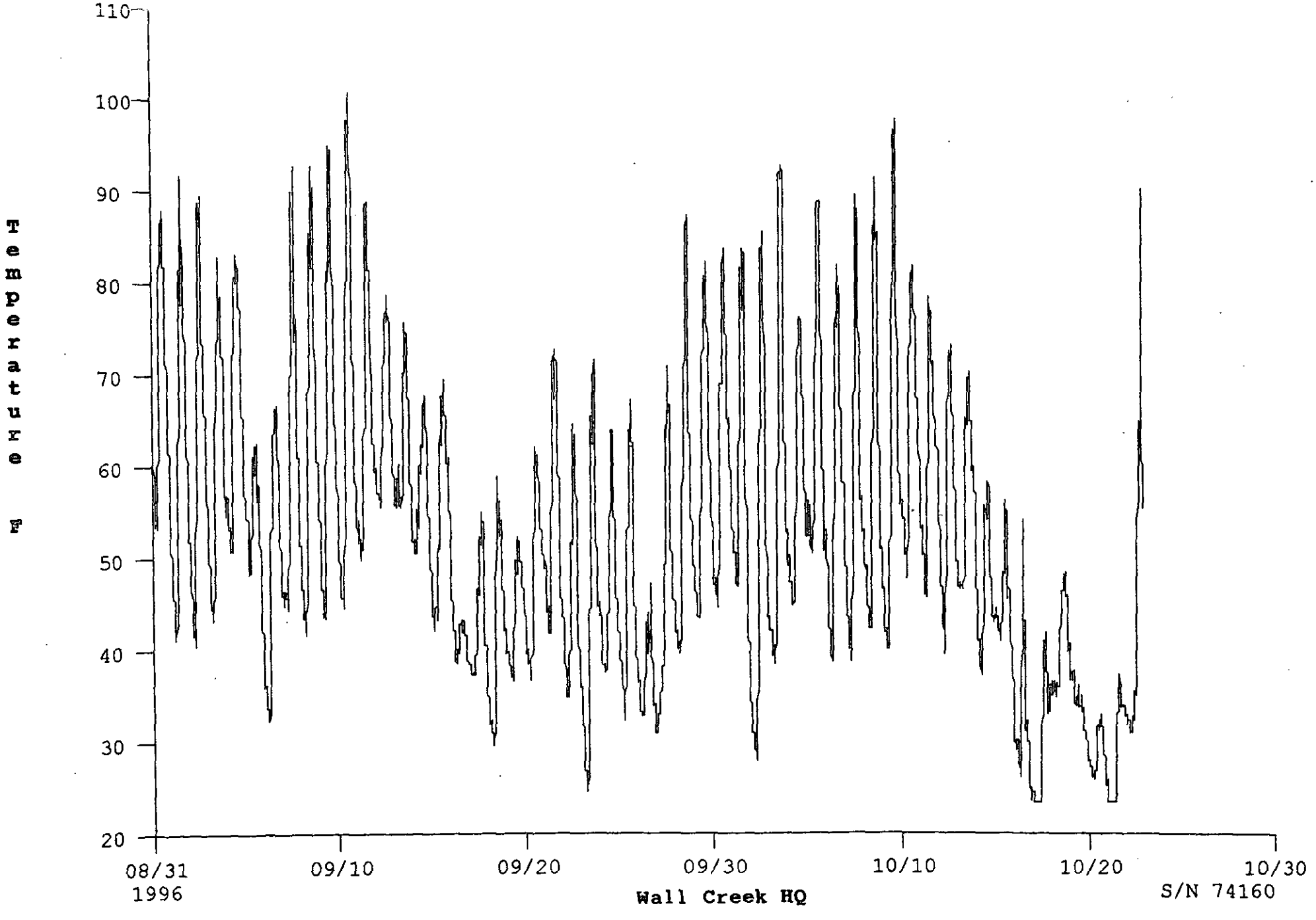

Temperature F
66
64
62
60
58
56
54
52
50
48
07/27
1996
08/26
09/25
10/25
Raynolds Bridge
S/N 1084

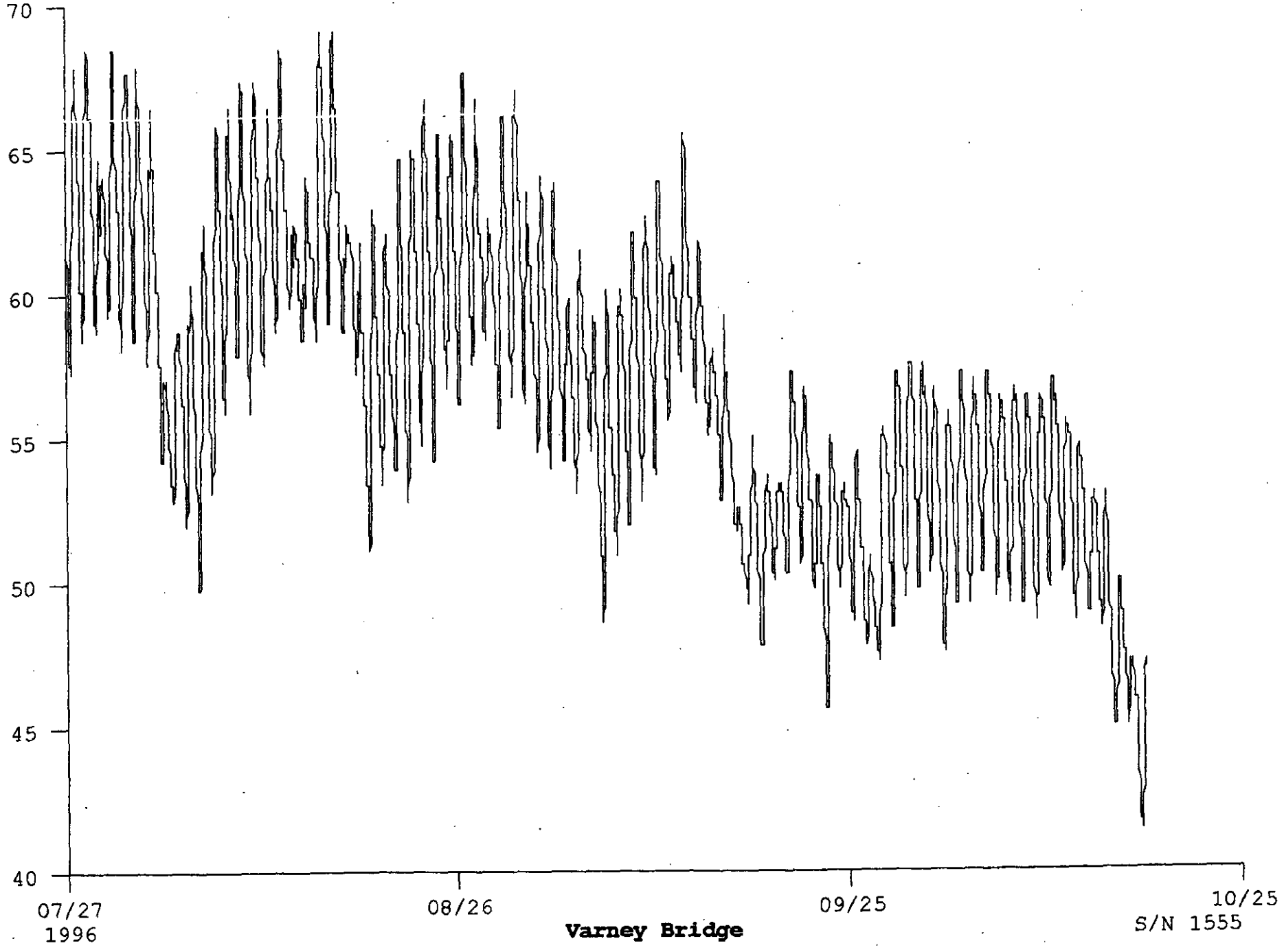

70
65
60
55
50
45
Temperature F
07/27
1996
08/26
09/25
10/25
Kirby USGS
S/N 1553

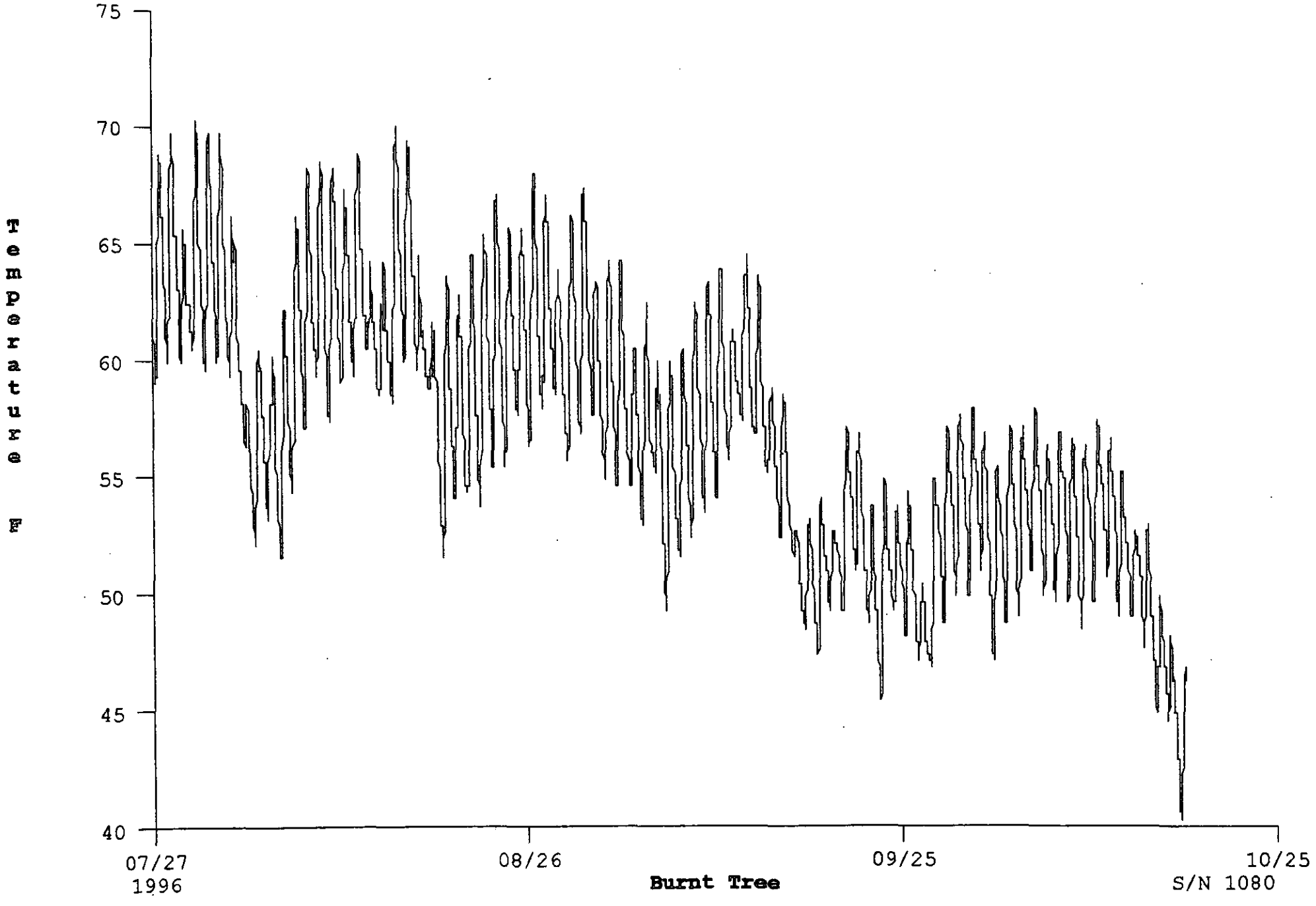

Temperature F
70
65
60
55
50
45
40
35
30
07/27
1996
08/26
09/25
10/25
S/N 1559
West Fork Madison

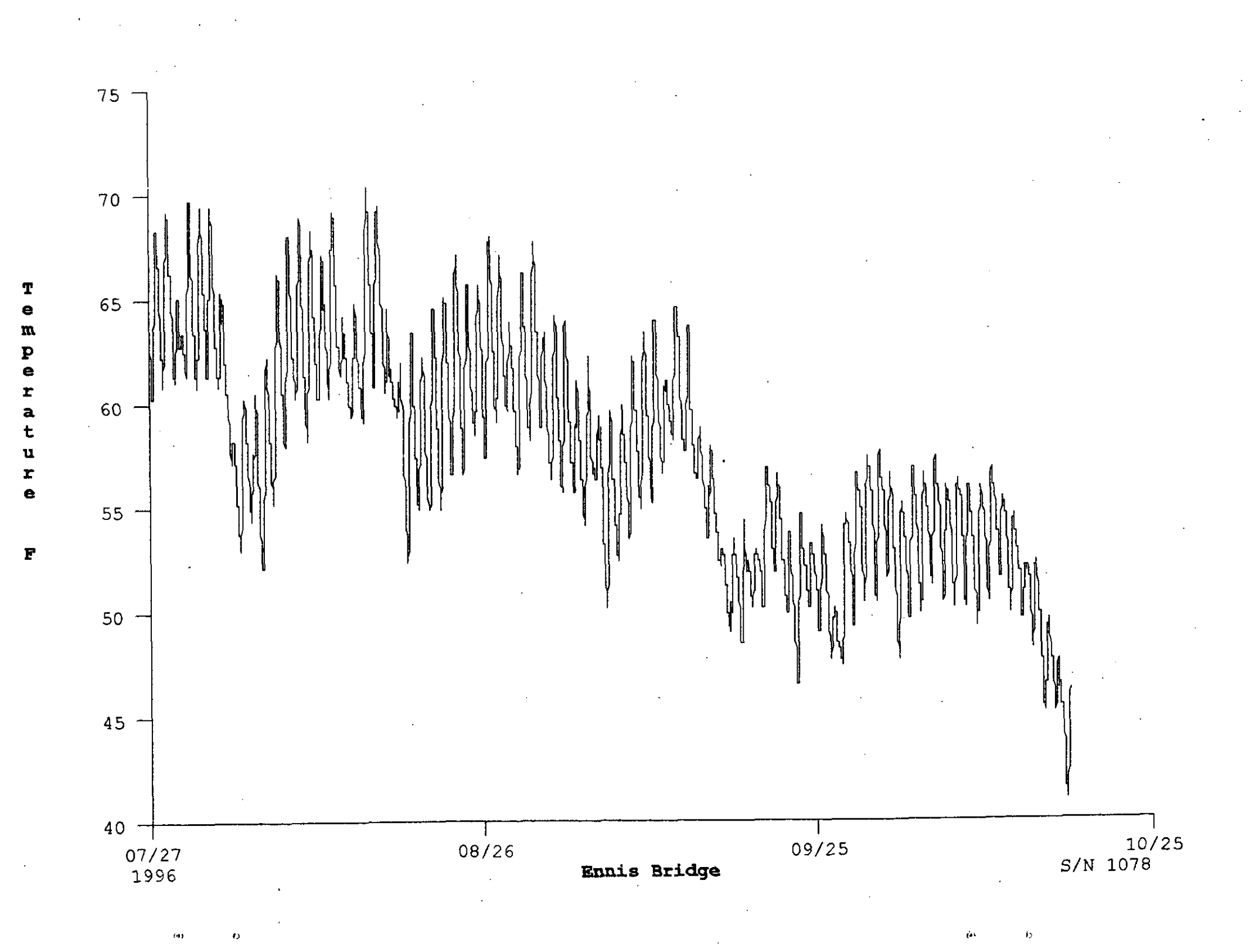

70
65
60
55
50
45
40
Temperature F
07/27
1996
08/26
09/25
10/25
McAtee Bridge
S/N 1554

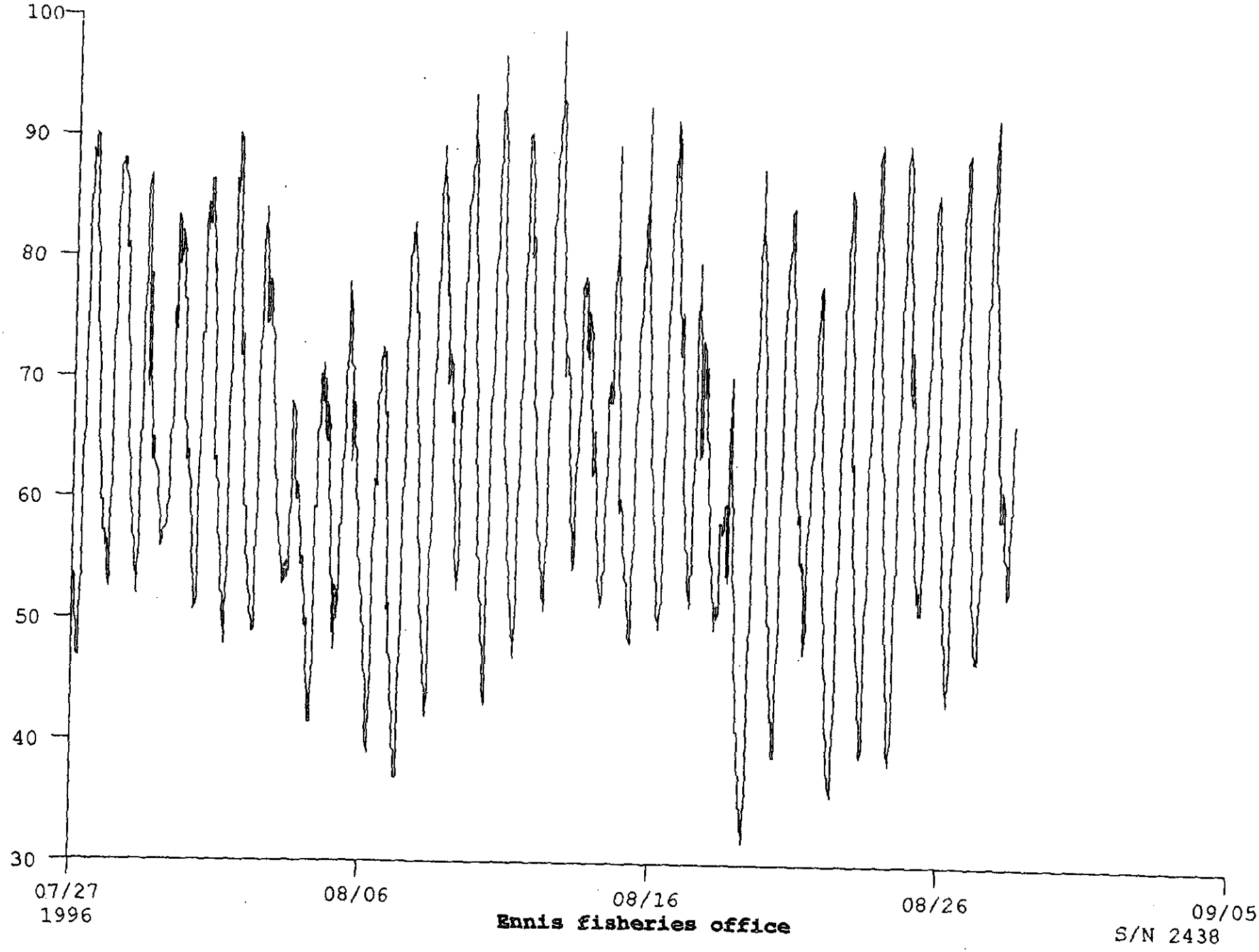

Temperature F
110
100
90
80
70
60
50
40
30
07/27
1996
08/06
08/16
08/26
09/05
Wall Creek HQ
S/N 2440

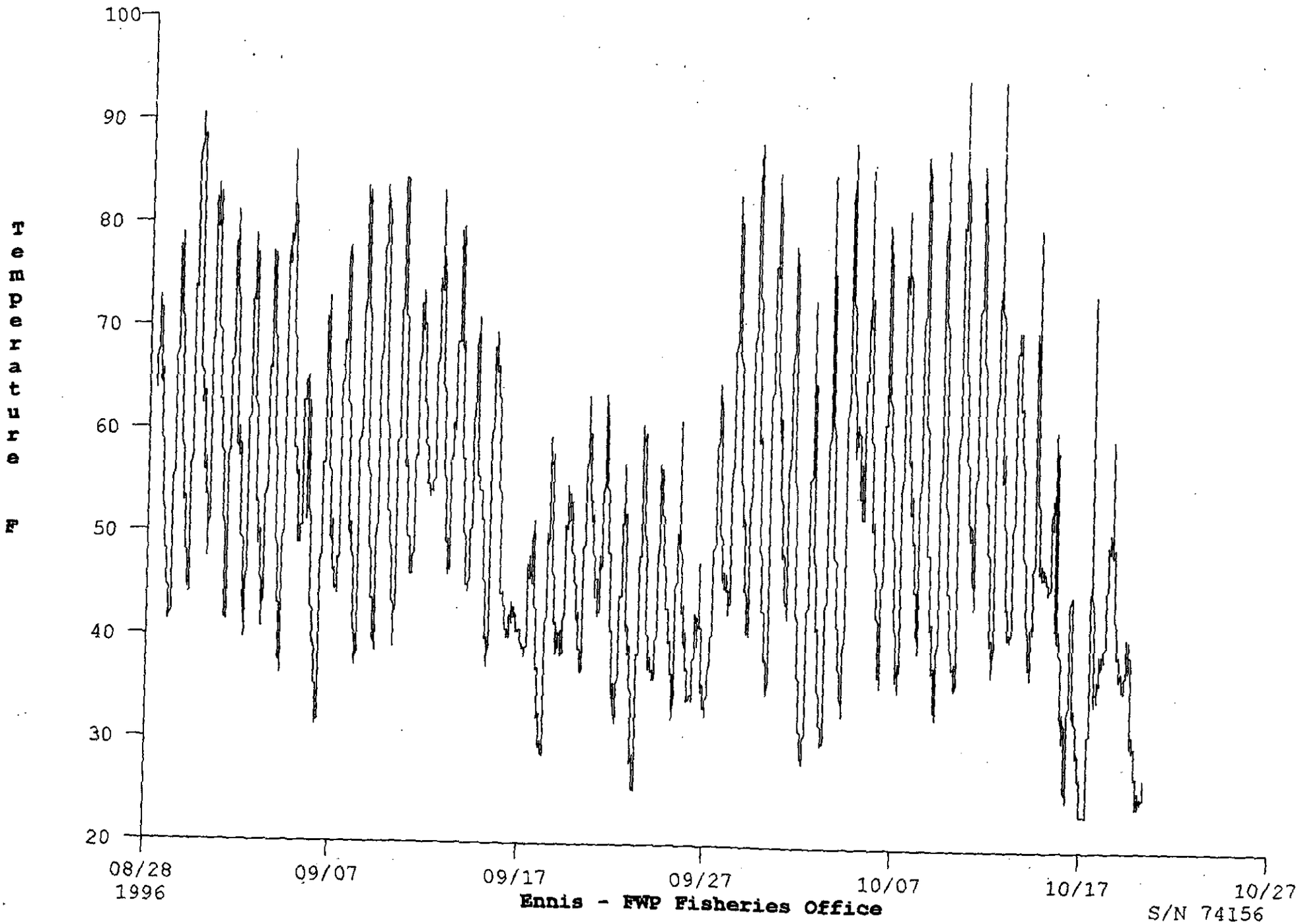

Temperature F
110
100
90
80
70
60
50
40
30
20
08/31
1996
09/10
09/20
09/30
10/10
10/20
10/30
Wall Creek HQ
S/N 74160

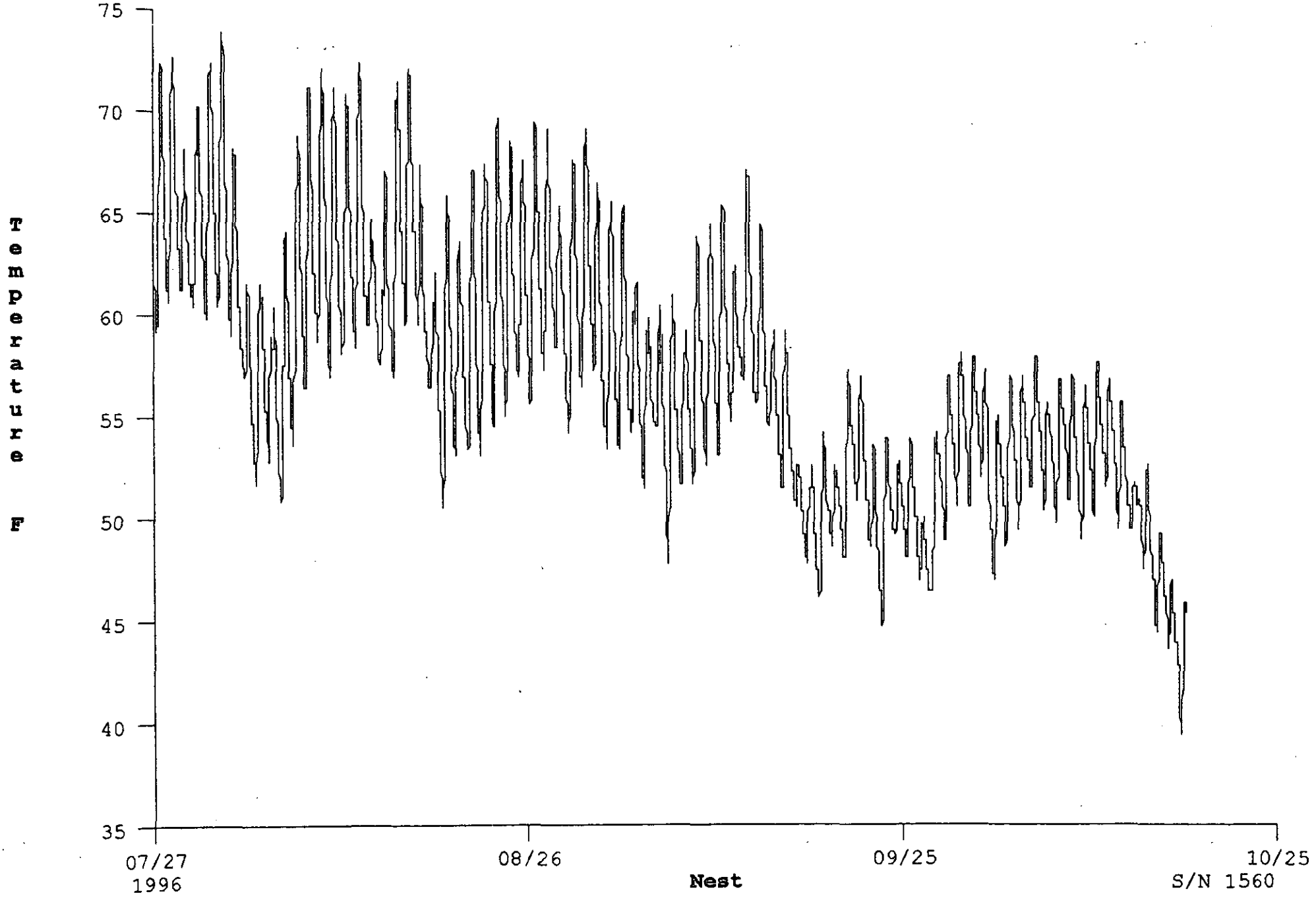

70
65
60
55
50
45
40
Temperature F
07/27
1996
08/26
09/25
10/25
Varney Bridge
S/N 1555

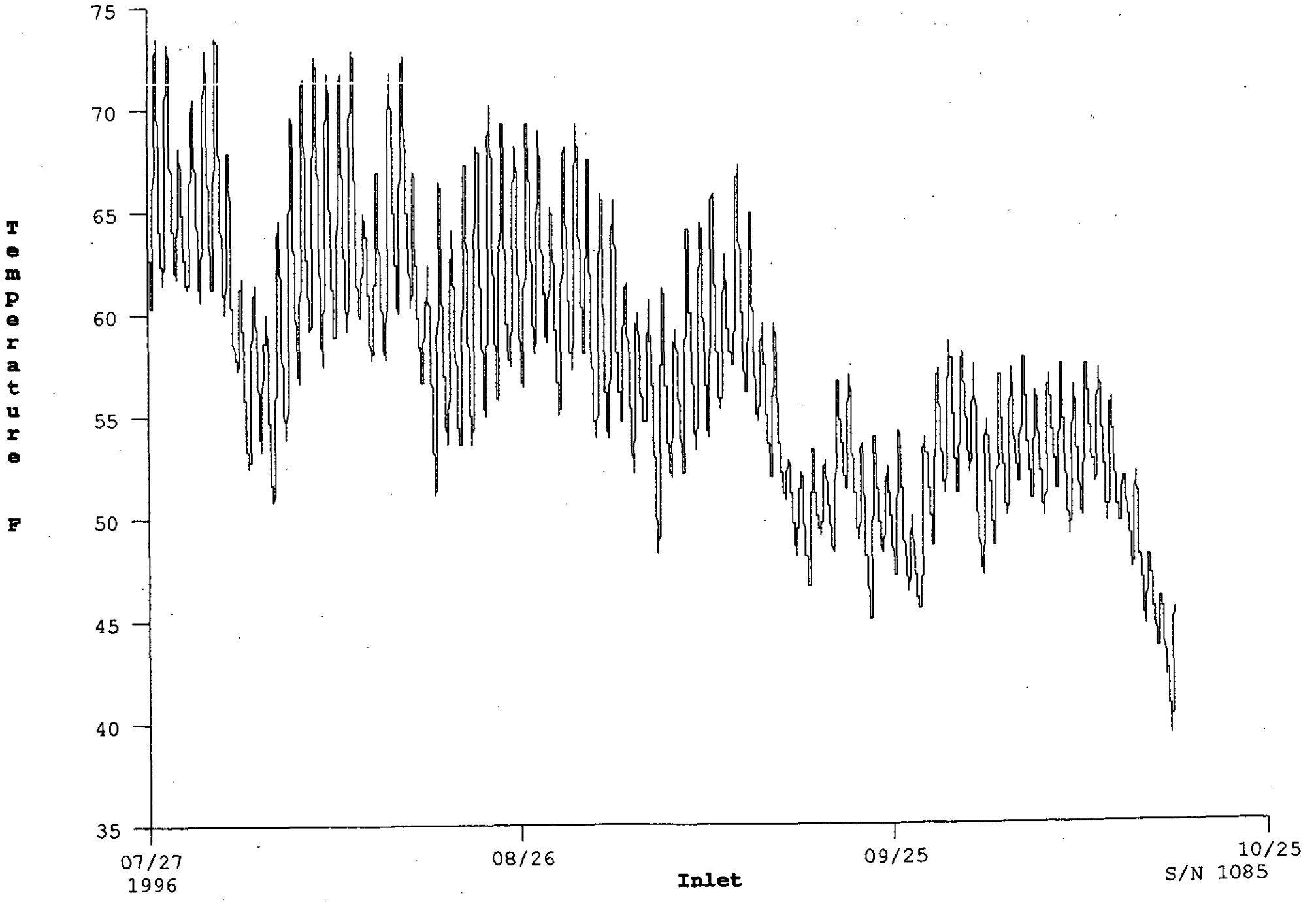

Temperature F
75
70
65
60
55
50
45
40
07/27
1996
08/26
09/25
10/25
Burnt Tree
S/N 1080

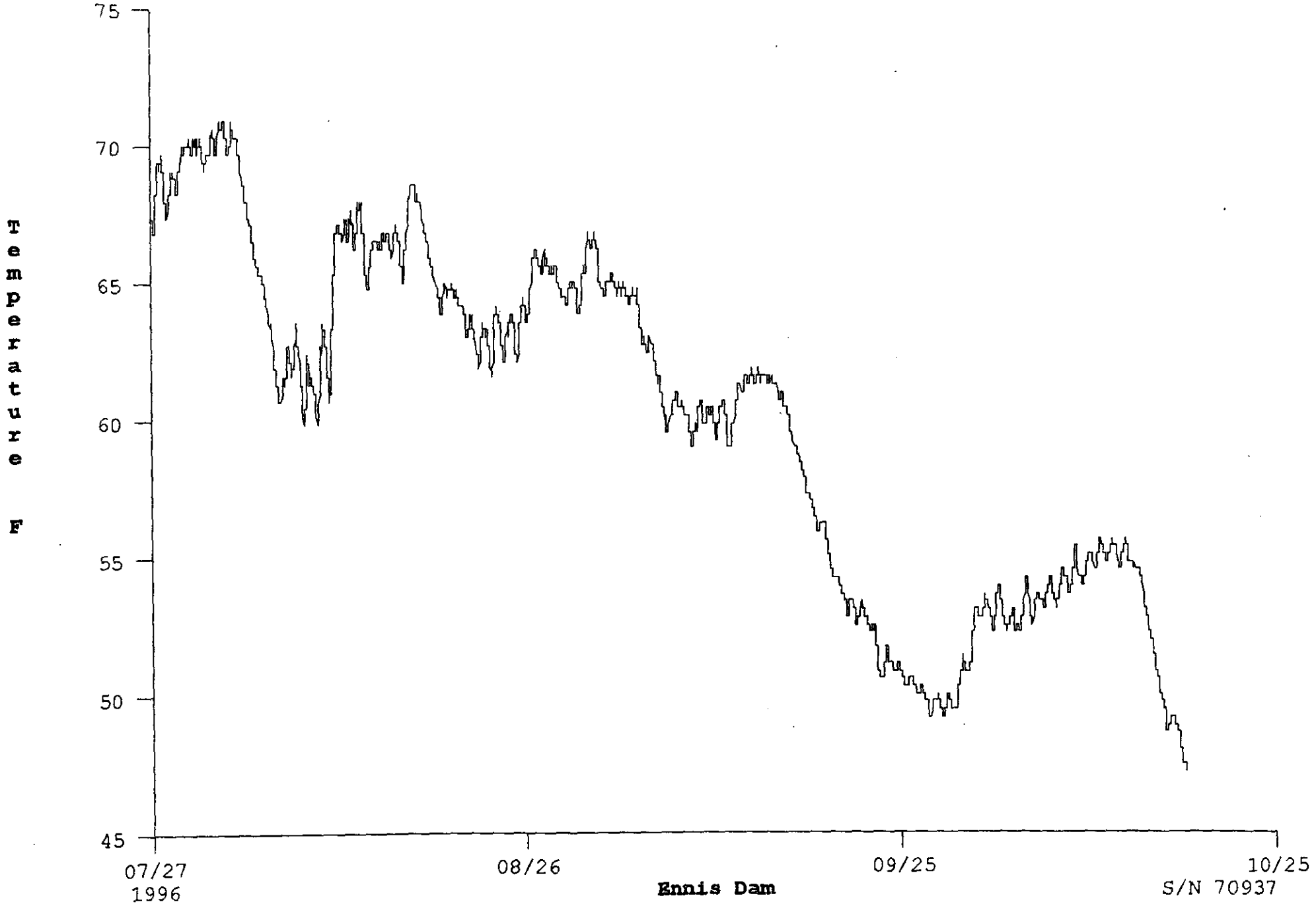

Temperature F
75
70
65
60
55
50
45
40
07/27
1996
08/26
09/25
10/25
Ennis Bridge
S/N 1078

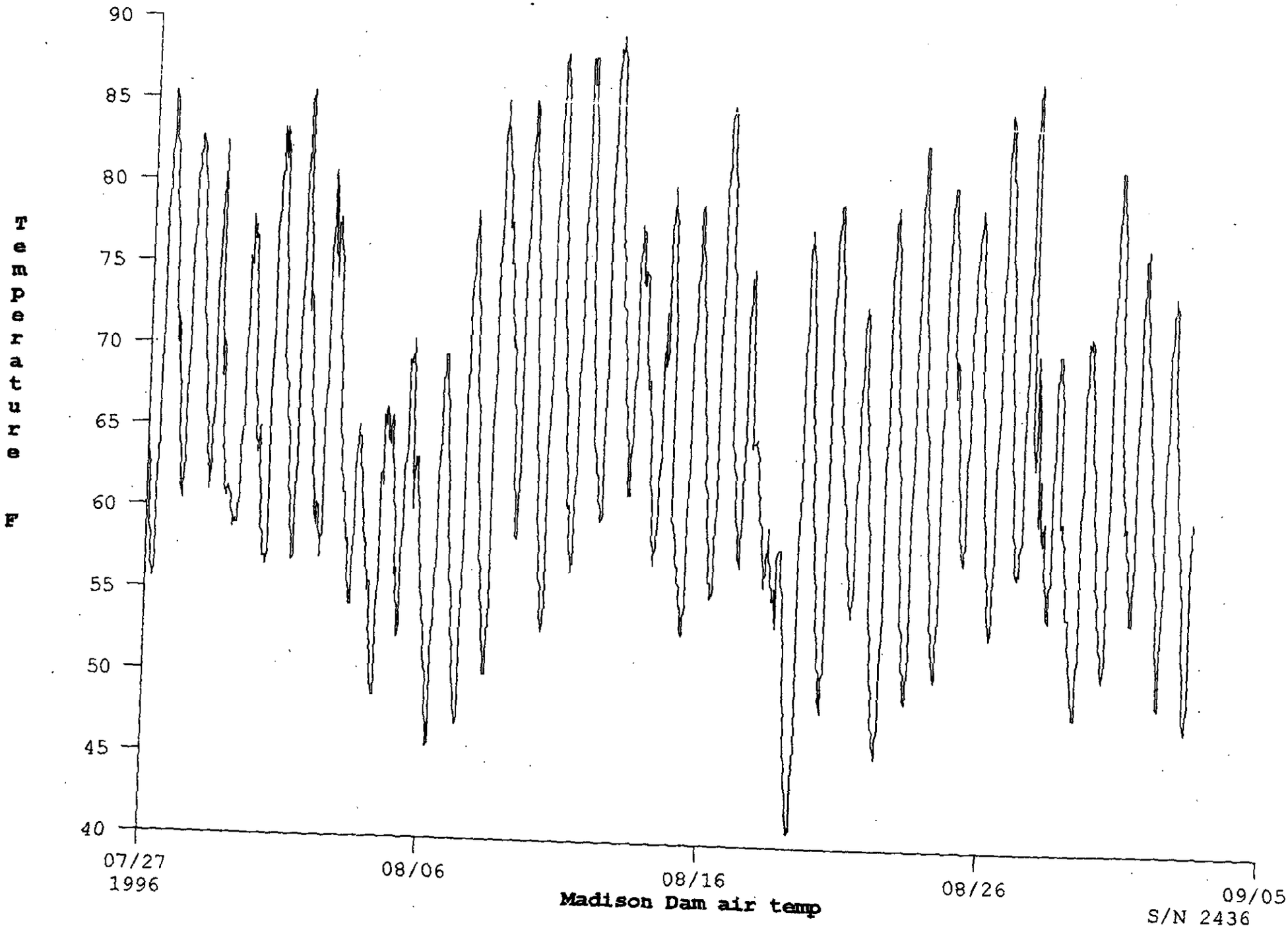

100
90
80
70
60
50
40
30
Temperature F
07/27
1996
08/06
08/16
08/26
09/05
Ennis fisheries office
S/N 2438

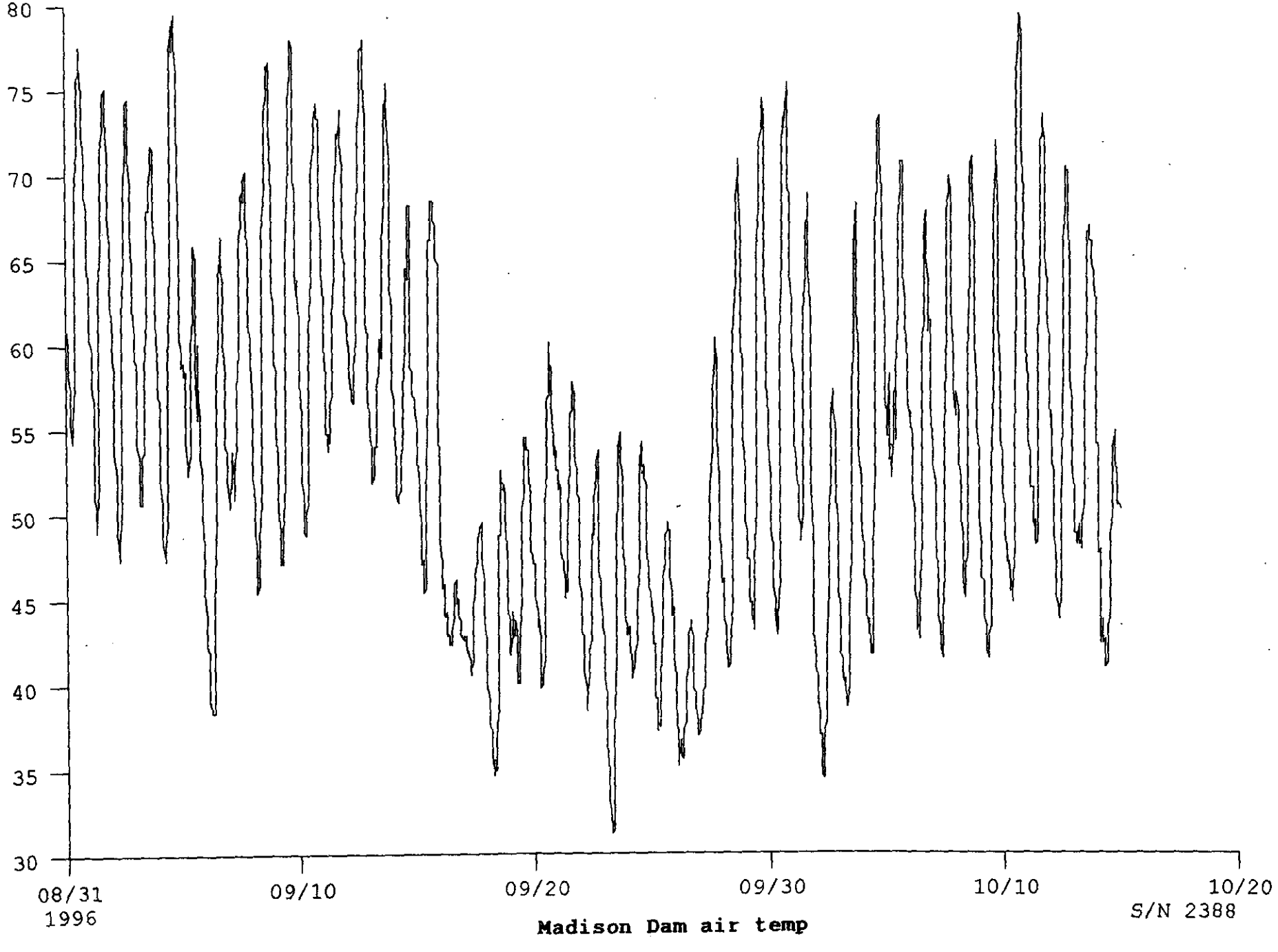

Temperature F
100
90
80
70
60
50
40
30
20
08/28
1996
09/07
09/17
09/27
10/07
10/17
10/27
Ennis - FWP Fisheries Office
S/N 74156

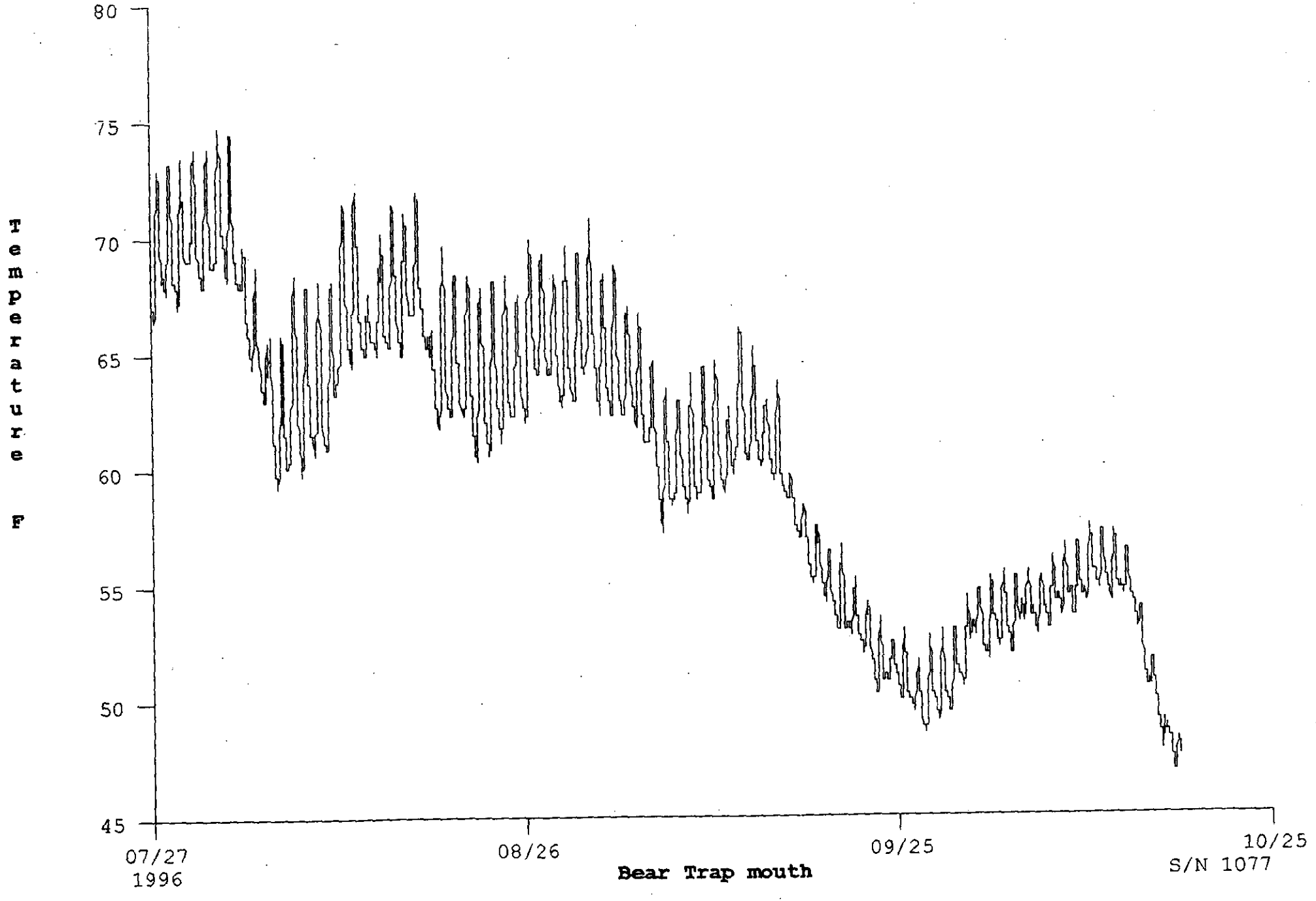

Temperature F
75
70
65
60
55
50
45
40
35
07/27
1996
08/26
09/25
10/25
Nest
S/N 1560

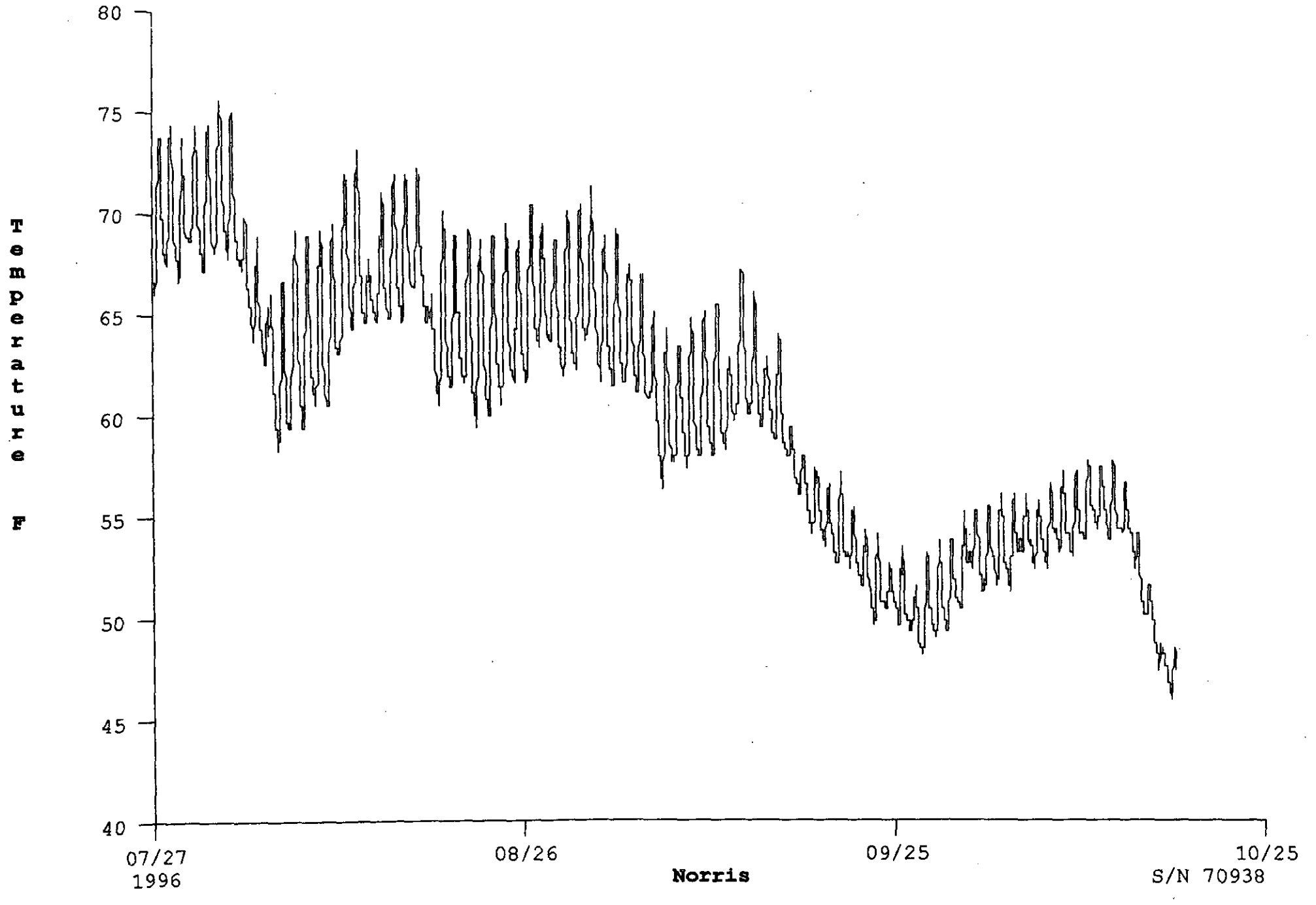

75
70
65
60
55
50
45
40
35
Temperature F
07/27
1996
08/26
09/25
10/25
Inlet
S/N 1085

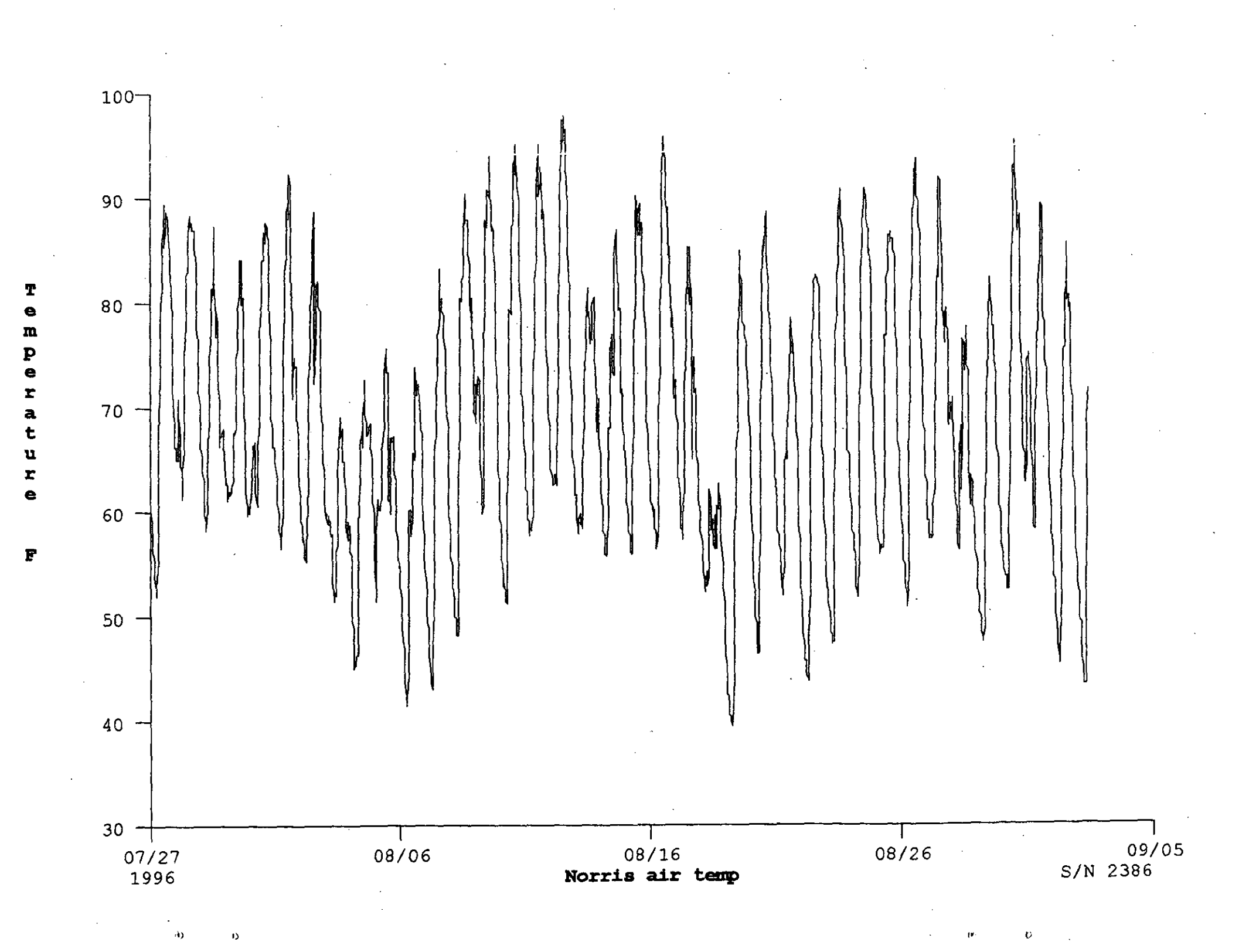

Temperature F
75
70
65
60
55
50
45
07/27
1996
08/26
09/25
10/25
Ennis Dam
S/N 70937

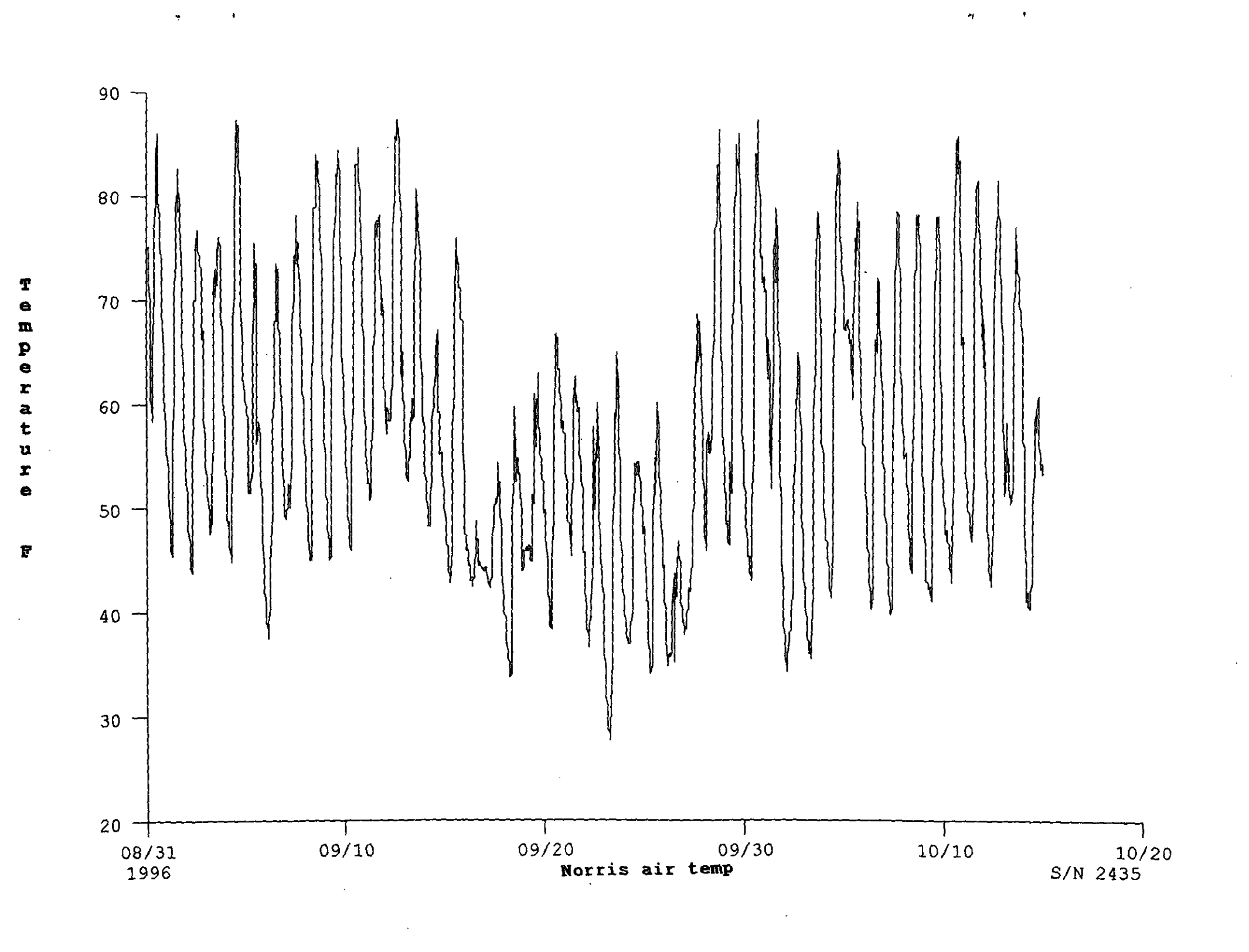

90
85
80
75
70
65
60
55
50
45
40
Temperature F
07/27
1996
08/06
08/16
08/26
09/05
Madison Dam air temp
S/N 2436

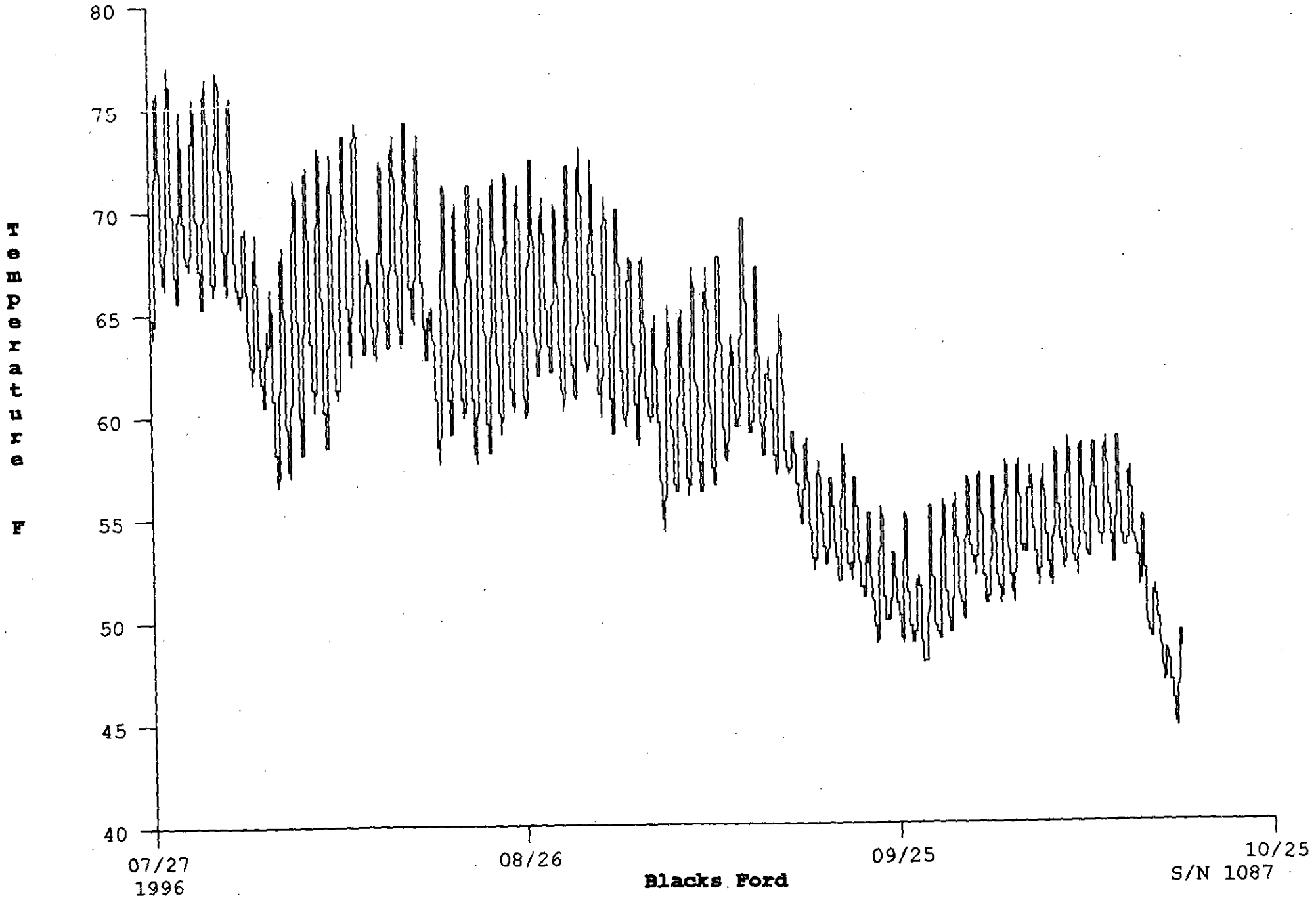

Temperature F
80
75
70
65
60
55
50
45
40
35
30
08/31
1996
09/10
09/20
09/30
10/10
10/20
S/N 2388
Madison Dam air temp

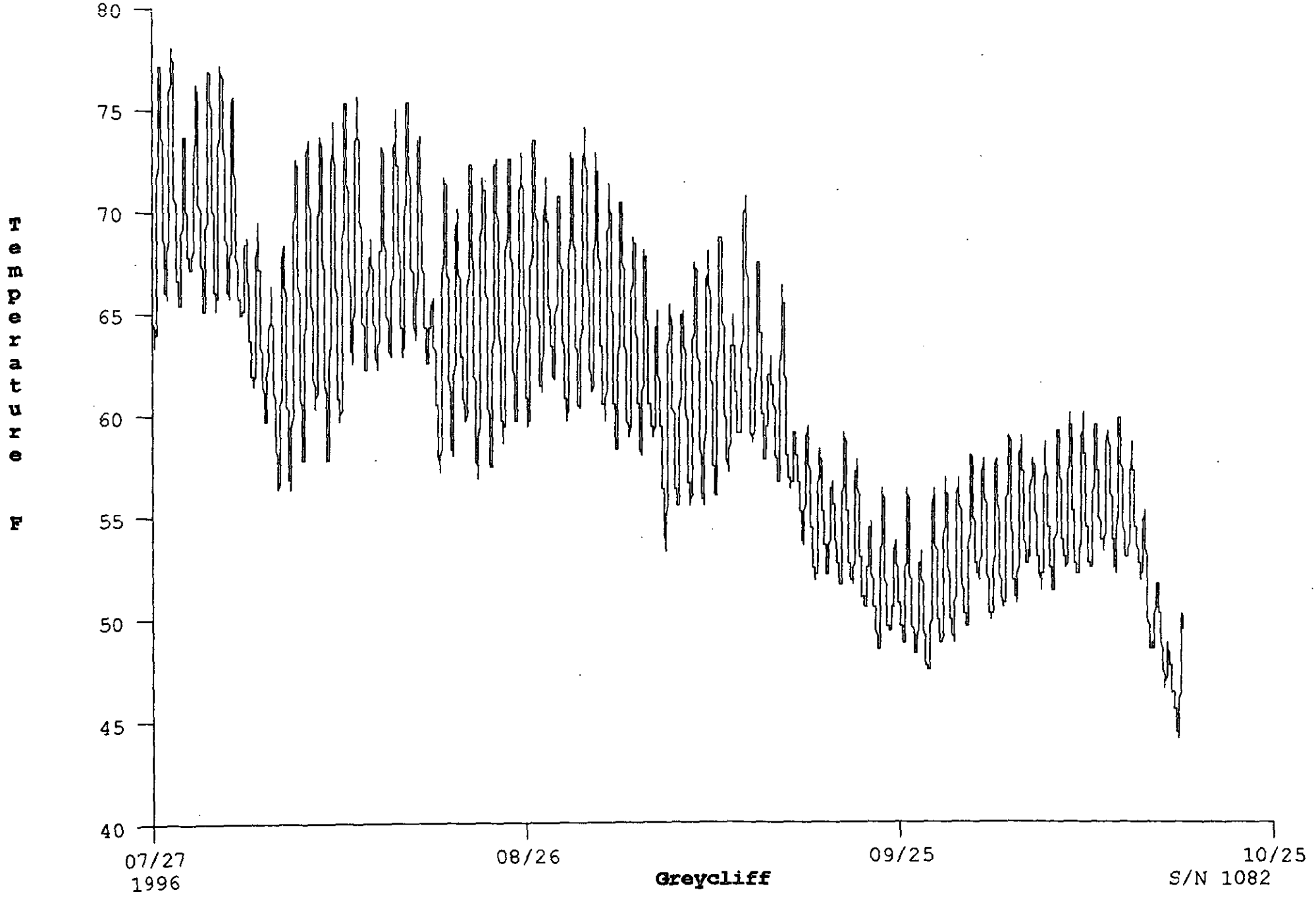

80
75
70
65
60
55
50
45
Temperature F
07/27
1996
08/26
09/25
10/25
Bear Trap mouth
S/N 1077

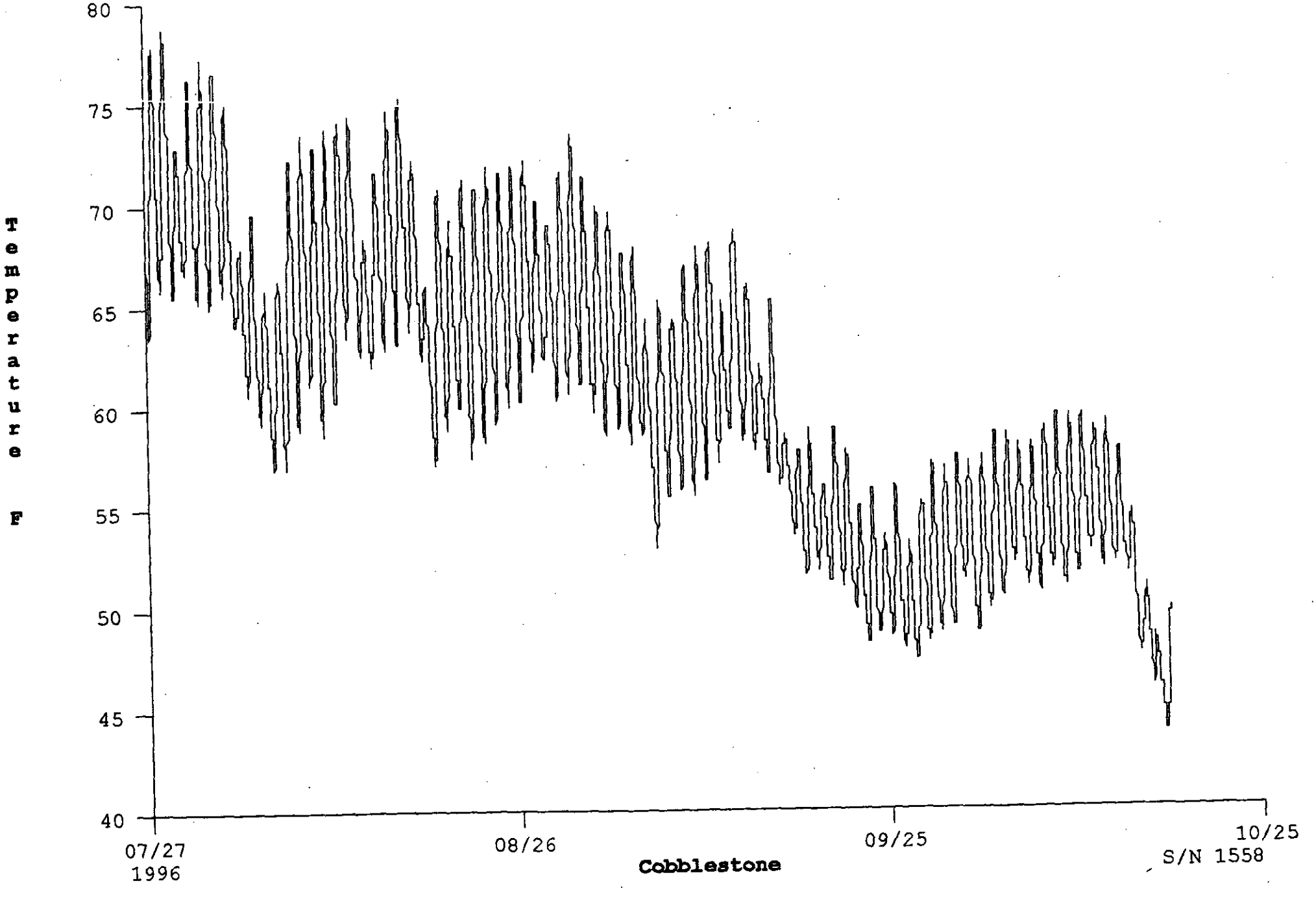

80
75
70
65
60
55
50
45
40
Temperature F
07/27
1996
08/26
09/25
10/25
Norris
S/N 70938

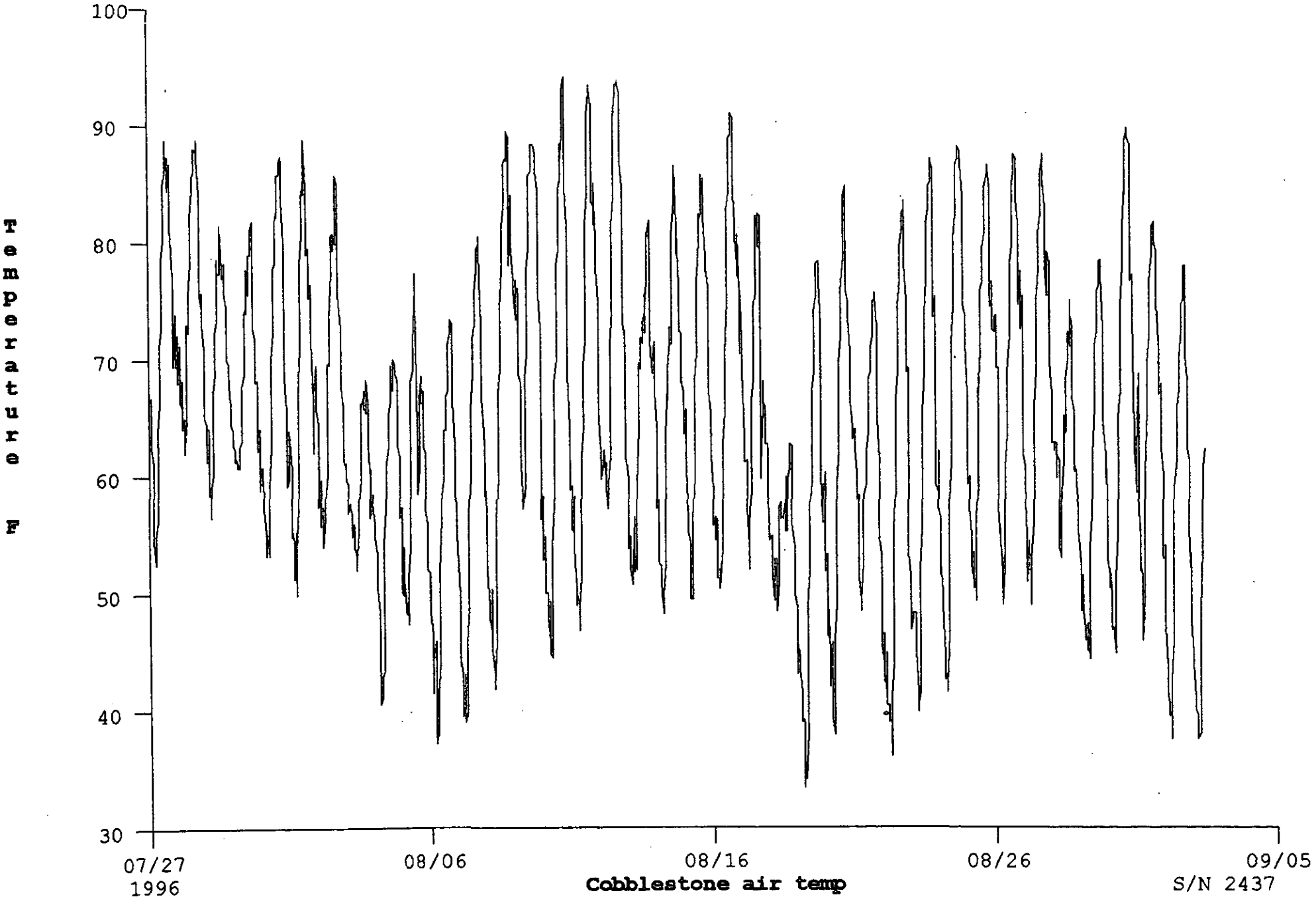

Temperature F
100
90
80
70
60
50
40
30
07/27
1996
08/06
08/16
08/26
09/05
Norris air temp
S/N 2386

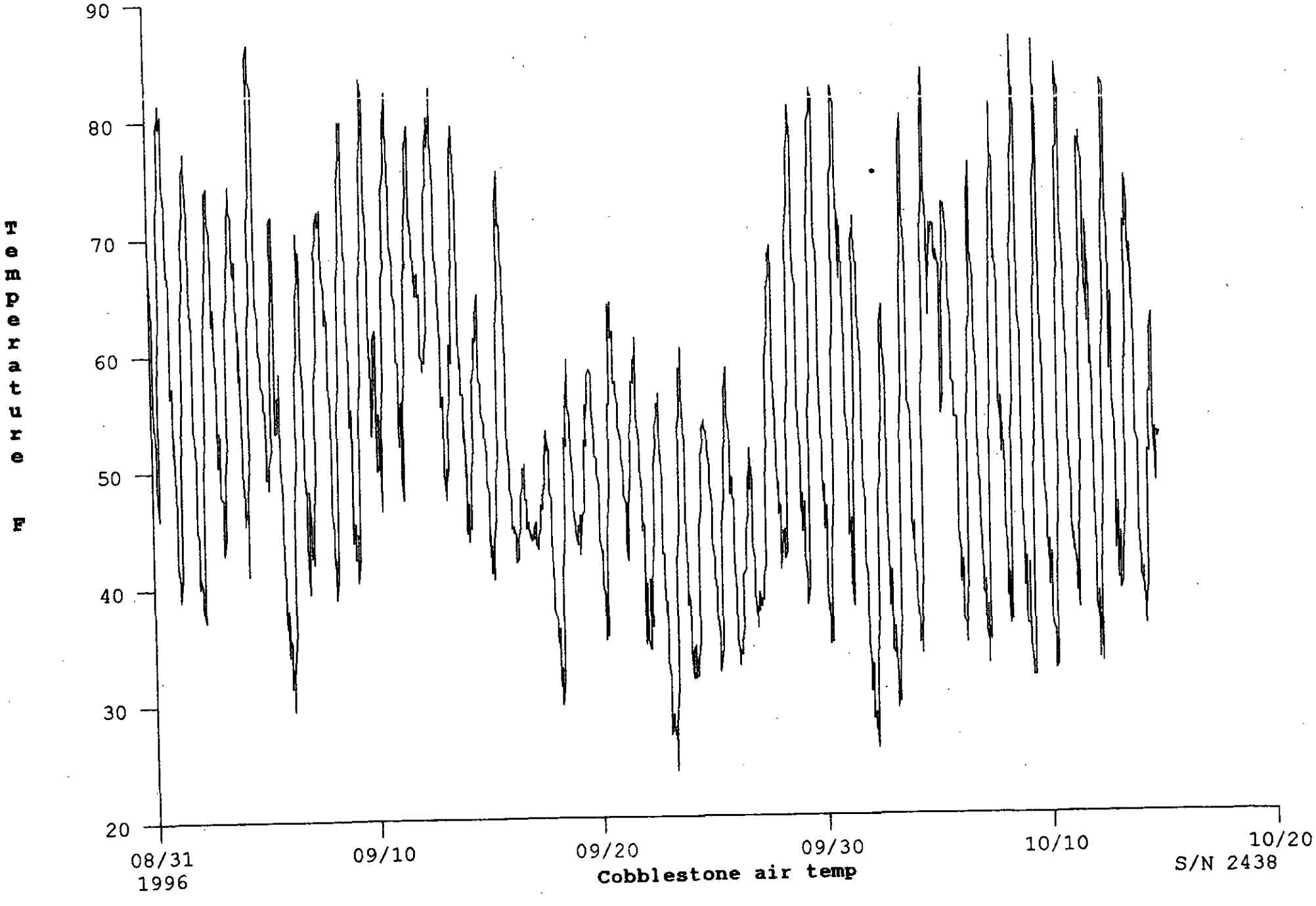

Temperature F
90
80
70
60
50
40
30
20
08/31
1996
09/10
09/20
09/30
10/10
10/20
Norris air temp
S/N 2435

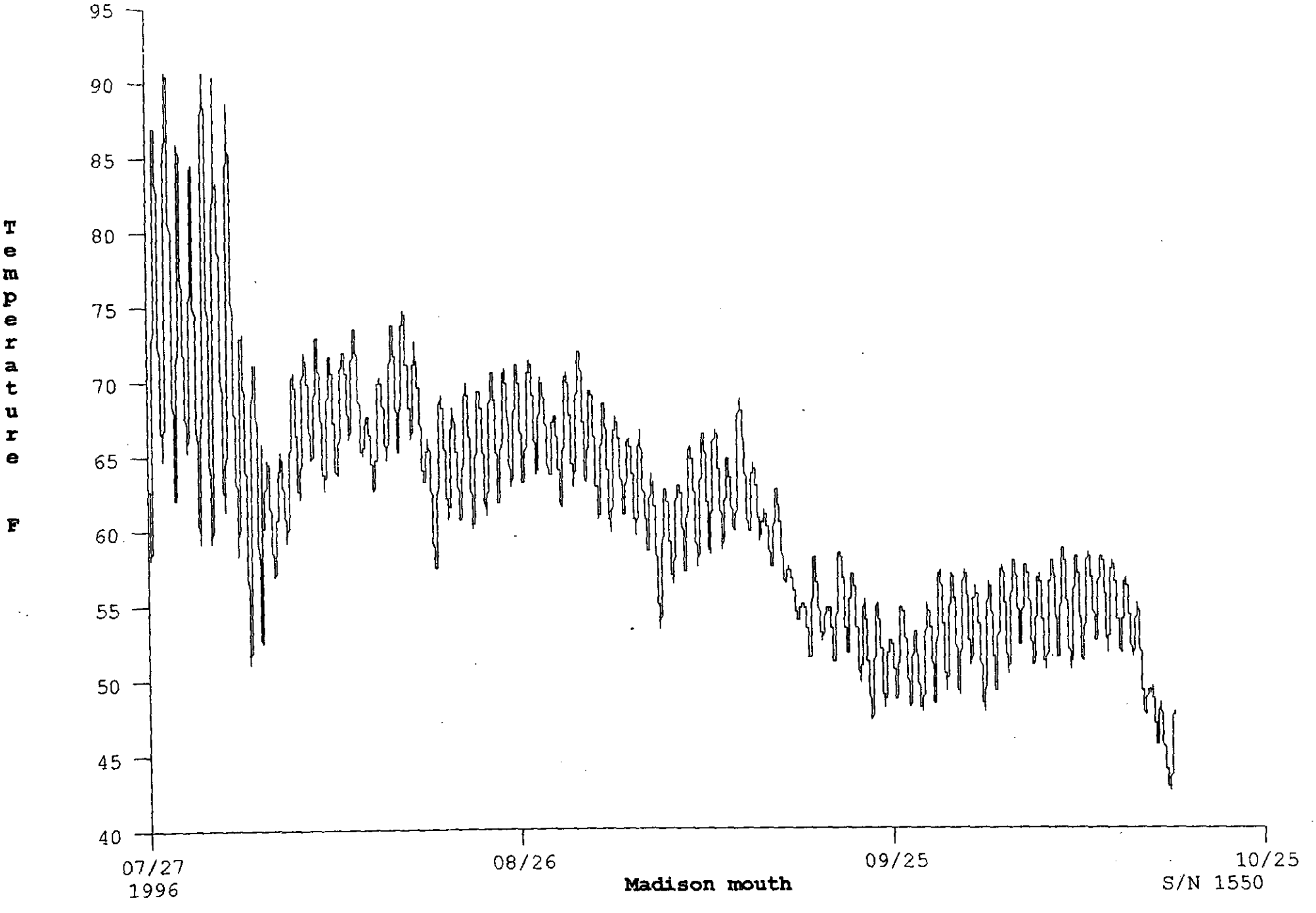

Temperature F
80
75
70
65
60
55
50
45
40
07/27
1996
08/26
09/25
10/25
S/N 1087
Blacks Ford


Temperature F
80
75
70
65
60
55
50
45
40
07/27
1996
08/26
09/25
10/25
Greycliff
S/N 1082


80
75
70
65
60
55
50
45
40
Temperature F
07/27
1996
08/26
09/25
10/25
Cobblestone
S/N 1558


Temperature F
100
90
80
70
60
50
40
30
07/27
1996
08/06
08/16
08/26
09/05
Cobblestone air temp
S/N 2437


Temperature F
90
80
70
60
50
40
30
20
08/31
1996
09/10
09/20
09/30
10/10
10/20
Cobblestone air temp
S/N 2438


Temperature F
95
90
85
80
75
70
65
60
55
50
45
40
07/27
1996
08/26
09/25
10/25
Madison mouth
S/N 1550

Appendix Table E1. Maximum daily temperature (°F) during fall stepdown, Madison River drainage, September 13-17, 1996.

Site	9/13	9/14	9/15	9/16	9/17
Hebgen discharge	60.64[2/]	60.93	61.50	59.22[2/]	59.50
Quake inlet	61.79	58.10[2/]	59.24	52.52[2/]	55.03
Quake outlet[1/]	61.54	60.40	59.27	58.14	57.30
Slide Store[3/]	70.52	62.93	62.65	39.93[2/]	47.48
Raynolds Bridge	62.07	60.65	60.36	57.54	58.10
Kirby	63.47	61.18	60.61	54.71[2/]	58.06
West Fork	59.79	56.13	54.18	48.05[2/]	50.56
Wall Cr. HQ[3/]	75.47	67.64	69.41	43.06[2/]	54.79
McAtee Bridge	63.23	58.95[2/]	58.95	52.23[2/]	56.41
Varney Bridge	61.79	58.10[2/]	59.24	52.52[2/]	55.03
Burnt Tree	63.54	58.69	58.41	52.54[2/]	53.10
Ennis Bridge	63.61	58.77[2/]	57.92	52.91[2/]	53.47
Ennis[3/]	79.49	71.16	69.67	43.32[2/]	51.40
Nest	64.34	59.18	59.18	52.45[2/]	52.45
Inlet	64.88	59.42	59.42	52.70[2/]	52.14
Dam[1/]	61.82	61.53	61.24	60.38	58.39
Dam[3/]	75.37	68.15	68.44	46.10[2/]	49.44
Beartrap mouth	65.19	62.87	63.74	59.73	58.31
Norris	65.96	62.75	63.91	59.33	57.91
Norris[3/]	80.70	66.99	75.99	48.60	54.46
Black's Ford	67.05	62.70	64.72	59.01	58.73
Greycliff	67.43	62.78	66.27	59.09	59.37
Cobblestone	66.02	61.97[2/]	65.14	58.54[2/]	57.69
Cobblestone[3/]	79.43	64.96	75.37	50.28	53.06
Headwaters S.P. (Madison mouth)	64.31[2/]	61.15[2/]	62.58	57.46[2/]	54.96[2/]

1/ The Hebgen discharge, Quake Lake outlet and Ennis Dam sites showed relatively continuous declines over the period, not exhibiting a diurnal cycle.

2/ Higher temperatures were measured in the early morning hours, but were "residual" from the previous day.

3/ FWP air temperature monitoring locations.