SECTION D
RIPARIAN FUNCTION

INTRODUCTION

An assessment was conducted of riparian function in the Albion River Watershed Analysis Unit (WAU) in 1998. This assessment is divided into two groups: 1) the potential of the riparian stand to recruit large woody debris (LWD) to the stream channel along with the level of concern of current LWD conditions in the stream, and 2) a canopy closure and stream temperature assessment. The LWD potential assessment evaluates short-term LWD recruitment, the next 2-3 decades. It tells MRC what general condition of the riparian stands for generating LWD for stream habitat or stream channel stability. Field observations of current LWD levels in the stream channels are also presented along with the level of concern about the current condition of LWD in the stream compared to the riparian stand's ability to recruit LWD. The canopy closure and stream temperature assessment presents what the current canopy closure conditions are and what it means in context to the stream temperature monitoring which has been conducted by L-P. These evaluations are to provide baseline information on the current status of riparian stand function in the Albion WAU.

Much of the analysis of riparian function in this 2004 update is the same as was reported in 1998. The difference is MRC has developed minimum size criteria for LWD measured in the stream (at least 4 inches in diameter and 10 feet in length, except buried LWD, associated with an accumulation or with attached rootwads). The LWD data presented in this update reflects this minimum size criterion. Further stream shade and LWD quality ratings have been developed for major tributaries and rivers of the Mendocino Redwood Company lands and are presented in this update. Also, additional stream temperature monitoring has been conducted since 1998 and reported here (through 2003).

Large Woody Debris Recruitment

Large woody debris (LWD) is widely recognized as an important part of the aquatic ecosystem (i.e. Swanson and Lienkaemper, 1978; Bilby and Likens, 1979; Bisson et. al., 1978). LWD has been recognized as a vital component of high quality habitat for anadromous fish (Bisson et. al., 1978). LWD provides an organic energy source for aquatic organisms, controls the routing of sediment through stream systems, and provides structure to the streambed and banks (Swanson and Lienkaemper, 1978; Bilby and Likens, 1979). Forest harvesting activities have affected large woody debris recruitment by removal of vegetation which could have been delivered to watercourses or salvage of downed LWD from the watercourse or adjacent banks. Furthermore, removal of LWD log jams throughout all of the Class I watercourses of the Albion WAU was done in the 1960's (California Department of Fish and Game, 1966)(see Appendix D for specific locations). At that time large LWD accumulations were considered adverse to fish habitat and passage. Assessment of the riparian condition in the Albion WAU is done to ensure future forest management provides maximum opportunity for LWD recruitment.

LARGE WOODY DEBRIS RECRUITMENT METHODS

Short-term LWD recruitment potential (next 20-30 years) was evaluated on the designated stream segments within the Albion WAU. Stream segments were designated in the stream channel condition assessment and are shown on map E-1. Generally a stream segment was designated on any watercourse with less than a 20 percent gradient. In this assessment LWD recruitment is assumed to be influenced by the vegetation type, size and density with the best riparian vegetation for LWD recruitment to the watercourse being large conifer trees.

To determine the LWD recruitment potential, riparian stands were classified using 1996 aerial photographs and field observations from the summer of 1998. The riparian stands were evaluated for a distance of approximately one tree height on either side of the watercourse. Riparian stands were evaluated separately for each side of the watercourse. The following vegetation classification scheme for the MRC timber inventory was used to classify the riparian stands:

Vegetation Classes

RW - greater than 75% of the stand basal area in coast redwood.
RD - combination of Douglas-fir and coast redwood basal area exceeds 75% of the stand, but neither species alone has 75% of the basal area.
MH - mix of hardwood basal area exceeds 75% of the stand, but no one hardwood species has 75% of the basal area.
CH - mix of conifer and hardwood basal area exceeds 75% of the stand, but no one hardwood or conifer species has 75% of the basal area.
Br - Brush

Vegetation Size Classes

1 - < 8 inches dbh
2 - 8 to 15.9 inches dbh
3 - 16 to 23.9 inches dbh
4 - 24 to 31.9 inches dbh
5 - > 32 inches dbh

The size class is determined by starting with the proportion of basal area in size class 5 and summing the percentage of basal area in each lower size class. The size class that the sum exceeds 50% of the total basal area is the size class for the stand.

Vegetation Density

O - 5-20% tree canopy cover range
L - 20-40% tree canopy cover range
M - 40-60% tree canopy cover range
D - 60-80% tree canopy cover range
E - >80% tree canopy cover

The codes for vegetation classification of the condition of the riparian areas are based on the three classes listed above. The vegetation code is a string of the classes with the vegetation class first, the size class second, and the vegetation density last. For example, the vegetation code for a redwood stand with greater than 50% of the basal area with 16-23.9 inch dbh or larger and 60-80% canopy cover would be classified RW3D.

In this assessment LWD recruitment is assumed to be influenced by the vegetation type, size and density with the best riparian vegetation for LWD recruitment to the watercourse being large conifer trees. The LWD recruitment potential ratings reflect this. The following table presents the vegetation classifications codes for the different LWD recruitment potential ratings (Table D-1).

Table D-1. Description of LWD Recruitment Potential Rating by Riparian Stand Classification for the Albion WAU.

Vegetation Type	**Size and Density Classes**					
	Size Classes 1-2 (Young)		**Size Class 3 (Mature)**		**Size classes 4-5 (Old)**	
	Sparse (O,L)	**Dense (M, D, E)**	**Sparse (O,L)**	**Dense (M, D, E)**	**Sparse (O,L)**	**Dense (M, D, E)**
RW	Low	Low	Moderate	High	High	High
RD	Low	Low	Moderate	High	High	High
CH	Low	Low	Low	Moderate	High	High
MH	Low	Low	Low	Moderate	Moderate	Moderate

LWD was inventoried in watercourses during the stream channel assessment. All “functional” LWD was tallied within the active channel and the bankfull channel for each sampled stream segment. Functional LWD is LWD which is providing some habitat or morphologic function in the stream channel (i.e. pool formation, scour, debris dam, bank stabilization, or gravel storage). The minimum size requirement for functional LWD is 4 inches (10 cm) in diameter and 10 feet (3 m) in length. LWD with rootwads attached, are buried or are associated with an debris accumulations only need to meet the diameter criteria to be counted as functional LWD. The dimensions of the LWD were recorded by diameter (within ± 2 inches) and length (within ± 1 foot for pieces under 20 feet, and within ± 5 feet for pieces greater than 20 feet). The LWD is classified by tree species class, either redwood, fir (Douglas fir, hemlock, grand fir), hardwood (alder, tan oak, etc.), or unknown (if tree species is indeterminable). LWD associated with an accumulation of 3 pieces or more, is recorded and the number of LWD accumulations in the stream survey reach is tallied. The LWD is further classified as a key LWD piece if it meets the following size requirement:

Table D-2. Key LWD Piece Size Requirements

Bankfull width (ft)	Diameter (in.)	Length (ft)
0-20	12	20
20-30	18	30
30-40	22	40
40-60	24	60

The quantity of LWD observed is normalized by distance, for comparison through time or to other similar areas, and is presented as a number of LWD pieces per 100 meters. This is done by dividing the total number of LWD pieces in a survey segment by the length of the segment then by 100 meters. This normalized quantity, by distance, is performed for functional LWD within the active channel, within the bankfull channel and for key LWD pieces within the active channel and bankfull channel. A qualitative descriptions about the LWD in the stream survey reach is made of the approximate percentage of old relic LWD versus recently recruited LWD is estimated.

An in-stream LWD demand is identified in addition to the riparian stand recruitment potential, discussed previously. The in-stream LWD demand is an indication of what level of concern there is for in-stream LWD for stream channel morphology and fish habitat associations within the Albion WAU. This in-stream LWD demand is determined by stream segment considering the overall LWD recruitment potential from both sides of the watercourse, the stream segment LWD sensitivity rating (as determined in the Steam Channel and Fish Habitat Assessment for stream geomorphic units), and the level of LWD currently in the stream segment (sparse, common or abundant). Table D-3 shows how these three factors are used to determine the in-stream LWD demand.

Table D-3. In-stream LWD Demand

Channel LWD Sensitivity Rating

Recruitment Potential Rating	**LWD Present (common or abundant)** / **LWD Absent (sparse)**	**LOW**	**MODERATE**	**HIGH**
LOW	LWD Present	LOW	MODERATE	HIGH
	LWD Absent	LOW	HIGH	HIGH
MODERATE	LWD Present	LOW	MODERATE	MODERATE
	LWD Absent	LOW	HIGH	HIGH
HIGH	LWD Present	LOW	MODERATE	MODERATE
	LWD Absent	LOW	HIGH	HIGH

Low In-stream LWD Demand - this classification suggests that current riparian LWD recruitment conditions and in-stream LWD are at levels which are sufficient for LWD function in these stream channel types.

Moderate In-stream LWD Demand - this classification suggests that current riparian LWD recruitment conditions and in-stream LWD are at levels which are moderately sufficient for fish habitat and stream channel morphology requirements. Consideration must be given to these areas to improve the LWD recruitment potential of the riparian stand. These areas may also be considered for supplemental LWD or stream structures placed in the stream channel.

High In-stream LWD Demand - this classification suggests that current riparian LWD recruitment conditions and in-stream LWD are at levels which are not sufficient for LWD function in these stream channel types. These areas must consider improvement of the LWD recruitment potential of the riparian stand. These areas should be the highest priority for supplemental LWD or stream structures placed in the stream channel.

Major streams and stretches of river within each Calwater Planning Watershed were further evaluated for meeting target conditions. Within each hydrologic watershed of the stream segment analyzed, the percentage of watercourses with low or moderate LWD demand and the percentage of watercourses with an appropriate number of key LWD pieces determine the overall quality rating of watercourse LWD in each stream or stream segment of a Calwater planning watershed. Under this scheme, LWD quality falls into the following categories:

ON TARGET – >80% of watercourses have low or moderate LWD demand, and >80% of stream segments have appropriate number of key LWD pieces.

MARGINAL – 50-80% of watercourses have low or moderate LWD demand, and stream segments have significant functional LWD and are approaching the number of key LWD pieces desired

DEFICIENT – <50% of watercourses have low or moderate LWD demand, and little functional or key LWD.

The percentages that define the break between each of the LWD quality ratings have the intent of realizing that streams and watersheds are dynamic. LWD loadings are naturally found to be variable. Therefore a target of 100% of stream segment meeting LWD quality demand would be inappropriate. However, it seems that if less than half of the watercourses (50%) do not meet LWD demand than a LWD deficiency is assumed.

We consider key LWD for determination of both instream LWD demand and overall LWD quality to help ensure that enough key LWD exists at both small (i.e., stream segment) and large (i.e., planning watershed) spatial scales.

LARGE WOODY DEBRIS RECRUITMENT RESULTS

The large woody debris recruitment potential and in-stream LWD demand for the Albion WAU is illustrated in Map D-1. The large woody debris recruitment potential and in-stream LWD demand provides baseline information on the structure and composition of the riparian stand and the level of concern about current LWD conditions in the stream and associated riparian recruitment potential. This map provides a tool for prioritizing riparian and stream management for improving LWD recruitment and in-stream LWD. These areas must be monitored over time to ensure that the recruitment potential is improving and that large woody debris is providing the proper function to the watercourses.

Current large woody debris loading is shown in Table D-4. Large woody debris was determined to be sparse to common in the channel segments of the mainstem Albion River. Most sections of the mainstem are large channels with high stream power as evidenced by bedrock dominated beds. In these sections of the mainstem of the Albion River very large woody debris pieces or large debris jams are required to keep the LWD in the channel during high flow events. Recruiting and keeping large woody debris in the mainstem channel of Albion River will be a challenge.

Large woody debris was determined to be sparse to abundant in the channel segments of the South Fork of the Albion River. In the sections where LWD was determined to be sparse, in the South Fork of the Albion River, recruitment or restoration work needs to be emphasized to ensure high quality fish habitat requirements are meet. LWD in the South Fork of the Albion River should be not be as difficult to maintain in the channel as the mainstem Albion. The South Fork of the Albion River is a smaller river than the mainstem. However, key LWD will still need to be fairly large.

The tributaries of the Albion River vary from having common to abundant large woody debris in their channel segments. These tributaries have smaller channels, than the mainstem, and a higher probability of large woody debris remaining in the channel during high flows. LWD recruited in the tributary channels will have a higher probability of success than along the mainstem Albion River.

As shown in Table D-4, there is still a need for more large woody debris in many of the channel segments of the Albion River tributaries. The channel segments with sparse large woody debris will need to be the priority for monitoring future recruitment or restoration work. Likewise, the channel segments with common and abundant large woody debris must have these levels maintained to ensure large woody debris is providing fish habitat and morphological function in the stream channels.

Currently in the Albion WAU most of the streams are in the moderate in-stream LWD demand classification. Portions of the South Fork Albion River, Albion River and North Fork Albion River are in the high in-stream LWD demand classification (Map D-1). The increased in-stream LWD demands in the Albion WAU are primarily from low levels of LWD in the stream channels.

Table D-4. Large Woody Debris Pieces and Volumes for Select Stream Segments of the Albion WAU.

Stream Segment Name	ID#	Total LWD Pieces	Total LWD (#/328ft)	Key LWD Pieces	Key LWD (#/328ft)	Total Volume (yd^3)	Total Vol/328ft (yd^3)	% Vol. in Key Pieces	% of Total Volume By Species w/o Jams					Percent Current/Relic Recruitment
									Redwood	Fir	Alder	Hardwood	Unknown	
Albion	43-1	13	3.4	0	0.0	16.1	4.2	0	40	27	24	9	0	100/0
Albion	43-2	18	4.8	1	0.3	39.3	10.6	14	61	22	11	0	6	n/a
Albion	3-1	67	20.9	1	0.3	66.0	20.6	11	30	6	21	16	27	80/20
Albion	3-2	45	14.4	7	2.2	98.9	31.7	64	40	27	24	9	0	80/20
Albion	44	28	9.3	4	1.3	74.2	24.5	54	71	11	7	4	7	60/40
North Fork Albion	114	15	6.0	5	2.0	27.1	10.9	62	53	33	0	0	13	70/30
South Fork Albion	76	10	4.0	1	0.4	15.0	6.1	81	10	0	10	0	80	20/80
South Fork Albion	77	10	4.1	4	1.6	59.3	24.0	94	70	20	0	0	10	25/75
Railroad Gulch	4	23	16.0	3	2.1	36.5	25.4	60	61	0	0	13	26	50/50
Railroad Gulch	5	24	17.1	4	2.8	37.7	26.8	57	88	0	13	0	0	40/60
Tom Bell Creek	50	6	5.5	2	1.8	15.8	14.4	82	83	0	17	0	0	60/40
Pleasant Valley Creek	15	49	38.4	8	6.3	43.9	34.4	60	96	2	2	0	0	20/80
Duck Pond Gulch	20	16	14.0	2	1.7	12.7	11.1	56	88	6	6	0	0	n/a
South Fork Albion	78	33	18.3	6	3.3	42.6	23.7	60	55	6	0	3	36	20/80
South Fork Albion	79	21	16.8	1	0.8	11.0	8.8	7	43	5	0	24	29	20/80
Railroad Gulch	6	26	20.5	9	7.1	50.8	40.2	80	73	12	12	0	4	30/70
East Railroad Gulch	45	26	11.9	8	3.7	47.6	21.8	88	81	15	0	0	4	80/20
Little North Fork	91	44	31.9	7	5.1	77.0	55.8	67	64	27	0	2	7	30/70
Duck Pond Gulch	21	27	27.8	2	2.1	12.1	12.4	54	63	11	0	4	22	10/90
South Fork Albion	80	31	12.7	6	2.5	49.9	20.5	77	87	6	0	3	3	60/40

Table D-5 shows the instream LWD quality rating for major streams and sections of stream or river in individual Calwater planning watersheds. This quality rating will provide a tool to monitor the quality of the LWD in major streams over time. Currently the majority of the streams have a marginal LWD quality rating, with the one being deficient. Only one of the major streams in the Albion WAU received an on target rating.

Table D-5. Instream LWD Quality Ratings for Major Streams and Sections of Streams or Rivers in Calwater Planning Watersheds for the Albion WAU.

Stream Name	Calwater Planning Watershed	LWD Quality Rating
Albion River (Lower PWS)	Lower Albion	Marginal
Albion River (Middle PWS)	Middle Albion	Marginal
Albion River (Upper PWS)	Upper Albion	Marginal
Railroad Gulch	Middle Albion	Marginal
Pleasant Valley Crk.	Lower Albion	Marginal
Deadman Gulch	Lower Albion	Marginal
Slaughterhouse Gulch	Lower Albion	Marginal
Duckpond Gulch	Lower Albion	Marginal
S.F. Albion River	South Fork Albion	Marginal
Norden Gulch	South Fork Albion	Marginal
Little N.F. S.F. Albion River	South Fork Albion	Marginal
Bull Team Gulch	South Fork Albion	Marginal
Kaison Gulch	Middle Albion	On Target
E. Railroad Gulch	Middle Albion	Marginal
Tom Bell Crk.	Middle Albion	Marginal
N.F. Albion R.	Upper Albion	Deficient

CANOPY CLOSURE AND STREAM TEMPERATURE METHODS

Canopy closure, over watercourses, was estimated for Class I and II streams in the Albion WAU during development of Louisiana-Pacific's Sustained Yield Plan for Coastal Mendocino (SYP). In the development of the SYP three canopy closure classes were determined using aerial photographs. These classes are: 1) 0-40% canopy closure, 2) 40-70% canopy closure, and 3) >70% canopy closure. A map was produced for the SYP based on the aerial photograph interpretations.

Field measurements of canopy closure over select stream channels were performed in 1998. The field measurements were taken during the stream channel assessments in the Albion WAU. The field measurements consisted of estimating canopy closure over a watercourse using a spherical densiometer. The densiometer estimates were taken at approximately 3-5 evenly spaced intervals along a channel sample segment. The results of the densiometer readings were averaged across the channel to represent the percentage of canopy closure for the channel segment.
Stream canopy cover measurements were taken along the lower one mile of the South Fork Albion River in 1991. The mean shade canopy closure in this area was compared to current shade canopy to determine if any differences exist.

Stream temperature has been monitored in fish bearing watercourses (Class I) in the Albion WAU since 1992; one year of data was collected on Class II watercourses in 2001. Stream temperature monitoring has been conducted with electronic temperature recorders (Stowaway, Onset Instruments) that monitor the water temperature continuously at 2 hour intervals. Stream temperatures are monitored during the summer months when the water temperatures are highest. The stream temperature recorders were placed in shallow pools (<2 ft. in depth) directly downstream of riffles. Map D-2 shows the temperature monitoring locations and Table D-6 (a.) and (b) describes the temperature monitoring locations.

Table D-6 (a). Stream Temperature Monitoring Locations and Time Periods in the Albion WAU (see Map D-2) for Class I Watercourses 1992-2003.

Temperature Monitoring Station	**Segment Number**	**Stream/River Name**	**Years Monitored**
78-1	3	Albion River	94, 95, 97, 99, 00, 01, 02, 03
78-2	3	Albion River	93
78-3	76	South Fork Albion	93, 94, 96, 97, 99, 00, 01, 02, 03
78-4	79	South Fork Albion	92, 93, 94, 96, 99, 00, 01, 03
78-5	43	Albion River	92, 93, 94, 96, 97, 99, 00, 01, 02, 03
78-6	44	Albion River	93, 94, 96, 97, 00, 02, 03
78-7	32	Deadman Gulch	01, 02, 03
78-8	37	Unnamed	00, 01, 03
78-9	4	Railroad Gulch	01, 02, 03
78-10	20	Duck Pond	01, 03
78-11	15	Pleasant Valley Creek	01, 02, 03
78-12	12	East Railroad Gulch	93, 02, 03
78-13	3	Albion River	02, 03

Table D-6(b). Stream Temperature Monitoring Locations for Select Class II Watercourses, Summer 2001.

Temperature Monitoring Station	**Segment Number**	**Stream Name**
78-20	20	Deadman Gulch (upper)
78-21	21	Slaughterhouse Gulch
78-22*	137	Tributary to Buckhorn
78-24	87	Gunari Gulch
78-25	81	Anderson Gulch

*- also monitored in 2002.

Temperature graphs were prepared for each temperature monitoring site and year (see appendix). Maximum weekly average temperature (MWAT), and maximum weekly maximum temperature (MWMT) were calculated for each temperature monitoring site and year.

CANOPY CLOSURE AND STREAM TEMPERATURE RESULTS

Canopy closure over watercourses was observed to be very good. Most stream segments in the Albion WAU had greater than 80% canopy closure. Only the mainstem of the Albion River and one segment of Railroad Gulch had canopy closure less than 80% (Table D-7 and Map D-2).

The mainstem of the Albion River has a wide channel due to high river flows. This wider channel makes it more difficult for streamside trees to provide cover over the entire river channel. Though the canopy closure on the mainstem Albion is less than other stream segments throughout the Albion WAU, it is above 70% stream canopy closure. The exception to the 70% canopy closure standard is the area sampled on segment 44 which was observed to have a 67% mean canopy closure. Again this segment is part of the mainstem of the Albion River which has a wide channel due to the larger river flow. The close proximity of the Comptche/Ukiah road, which at times runs directly next to this segment is also a reason for a lack of streamside shade. When in close proximity the road removes much of the potential riparian vegetation growing space, which could provide stream canopy cover.

Table D-7. 1998 Field Observations of Stream Shading for Select Stream Channel Segments in the Albion WAU (see Appendix D of this module for thermographs).

Stream Name	Segment Number	Mean Shade Canopy	Stream Name	Segment Number	Mean Shade Canopy
Albion	3 lower	71%	South Fork Albion	76	86%
Albion	3 upper	73%	South Fork Albion	77	87%
Albion	43 lower	75%	South Fork Albion	78	87%
Albion	43 upper	84%	South Fork Albion	79	85%
Pleasant Valley Gulch	15	88%	South Fork Albion	80	86%
Duck Pond Gulch	20	88%	Little North Fork	91	88%
Duck Pond Gulch	21	86%	North Fork Albion	114	84%
Railroad Gulch	4	77%	Tom Bell	50	88%
Railroad Gulch	5	81%	East Railroad Gulch	45	85%
Railroad Gulch	6	82%	Albion	44	67%

Mean stream canopy closure measurements from 1991 for the lower South Fork Albion, segment number 76, was 87 percent. The 1998 mean stream canopy closure measurements for the lower South Fork Albion, segment number 76, was 86 percent. The stream canopy closure for the South Fork Albion is almost exactly the same for the last 7 years.

The high amount of stream canopy closure and the close proximity to the Pacific Ocean are reflected in the stream temperatures of the Albion WAU. Stream temperature in the Albion WAU, from 1992-2003, are at levels that are not of significant concern for salmonids (Tables D-8, D-9, D-10, D-11) (see Appendix of this module for specific thermographs). For Coho salmon the maximum weekly average temperature (MWAT) has been reported to be between 17 and 18^{o}C (Brett, 1952 and Becker and Genoway, 1979). The stream temperatures are currently at levels below this threshold (Tables D-9, D-10, and D-11). However, care must be taken with future forest management activities to ensure that the high stream canopy levels which currently exist in the Albion WAU are not lowered, possibly creating higher stream temperatures.

Table D-8. Maximum Daily Temperature in the Albion WAU; Temperatures Presented in Degrees Celsius.

Station No.	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
78-1	**	**	20.2	17.0	**	19.9	**	19.5	20.6	21.7	**	20.2
78-2	**	16.9	**	**	**	**	**	**	**	**	**	**
78-3	**	17.3	19.6	**	17.9	16.7	**	18.0	18.5	17.1	17.5	17.9
78-4	16.2	17.6	15.3	**	17.4	**	**	17.0	17.8	15.2	**	15.6
78-5	18.0	18.0	17.5	**	18.0	17.9	**	24.1	19.1	18.0	17.9	18.7
78-6	**	18.0	17.0	**	18.2	16.8	**	**	18.2	**	16.8	17.9
78-7	**	**	**	**	**	**	**	**	**	14.2	14.2	14.5
78-8	**	**	**	**	**	**	**	**	15.6	14.5	**	**
78-9	**	**	**	**	**	**	**	**	**	15.6	15.2	15.2
78-10	**	**	**	**	**	**	**	**	**	21.7	**	21.3
78-11	**	**	**	**	**	**	**	**	**	14.8	15.2	14.9
78-12	**	15.7	**	**	**	**	**	**	**	**	16.8	19.0
78-13	**	**	**	**	**	**	**	**	**	**	17.5	**

Table D-9. Mean Weekly Average Temperature (MWAT) in the Albion WAU; Temperatures Presented in Degrees Celsius.

Station No.	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
78-1	**	**	15.5	16.6	**	16.8	**	16.4	16.2	20.3	**	16.7
78-2	**	n/a	**	**	**	**	**	**	**	**	**	**
78-3	**	16.0	16.3	**	15.8	15.5	**	15.6	15.8	14.9	15.1	15.5
78-4	15.4	15.5	14.1	**	15.4	**	**	15.1	14.6	13.8	**	14.6
78-5	16.3	16.4	15.3	**	16.1	16.7	**	17.2	16.0	16.1	15.7	16.2
78-6	**	16.1	15.2	**	16.0	16.0	**	**	16.1	**	15.0	16.0
78-7	**	**	**	**	**	**	**	**	**	13.3	13.0	13.6
78-8	**	**	**	**	**	**	**	**	14.0	13.4	**	**
78-9	**	**	**	**	**	**	**	**	**	14.1	13.6	14.3
78-10	**	**	**	**	**	**	**	**	**	16.7	**	15.6
78-11	**	**	**	**	**	**	**	**	**	13.8	13.4	13.8
78-12	**	14.5	**	**	**	**	**	**	**	**	14.1	15.1
78-13	**	**	**	**	**	**	**	**	**	**	15.8	**

Table D-10. Mean Weekly Maximum Temperature (MWMT) in the Albion WAU; Temperatures Presented in Degrees Celsius.

Station No.	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
78-1	**	**	19.8	16.9	**	19.2	**	18.7	19.4	21.1	**	19.4
78-2	**	n/a	**	**	**	**	**	**	**	**	**	**
78-3	**	16.6	16.6	**	17.2	16.2	**	17.1	17.0	16.4	16.3	17.1
78-4	15.9	16.6	14.9	**	16.5	**	**	16.3	16.9	14.7	**	15.3
78-5	17.7	17.3	16.9	**	17.6	17.5	**	23.3	17.5	17.2	17.0	17.7
78-6	**	17.2	16.9	**	17.3	16.4	**	**	17.1	**	16.1	17.2
78-7	**	**	**	**	**	**	**	**	**	13.8	13.6	14.2
78-8	**	**	**	**	**	**	**	**	15.1	14.1	**	**
78-9	**	**	**	**	**	**	**	**	**	15.1	14.5	14.9
78-10	**	**	**	**	**	**	**	**	**	20.5	**	20.7
78-11	**	**	**	**	**	**	**	**	**	14.4	14.5	14.5
78-12	**	15.3	**	**	**	**	**	**	**	**	15.8	17.8
78-13	**	**	**	**	**	**	**	**	**	**	16.6	**

Table D-11. Maximum, Maximum Weekly Average Temperature (MWAT), and Maximum Weekly Maximum Temperature (MWMT) for Class II Watercourses, summer 2001 and select 2002-2003; Temperatures Presented in Degrees Celsius.

Station No.	Maximum	MWAT	MWMT
78-20	13.7	12.8	13.3
78-21	13.7, 14.1*, 14.9**	13.0, 12.9*, 13.7**	13.5, 13.6*, 14.5**
78-22	13.3	12.5	12.8
78-24	14.5	13.7	14.2
78-25	13.7	13.2	13.4

*- 2002 observation.
**- 2003 observation

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Appendix D
Riparian Function Appendix

Figure T78-01. Maximum Daily Air Temperature and Mean and Maximum Daily Stream Temperatures During Summer 2003 at Albion River (Site T78-01), Mendocino County, California.

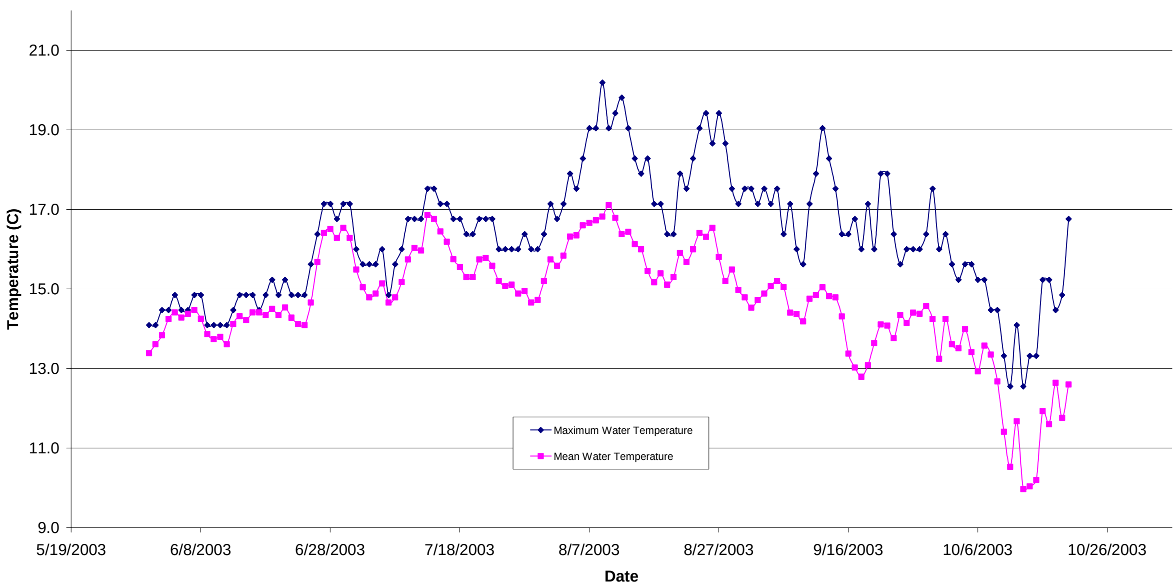


Figure T72-01. Maximum Daily Air Temperature and Mean and Maximum Daily Stream Temperatures During Summer 2003 at Doyle Creek (Site T72-01 and T72-01a), Mendocino County, California.

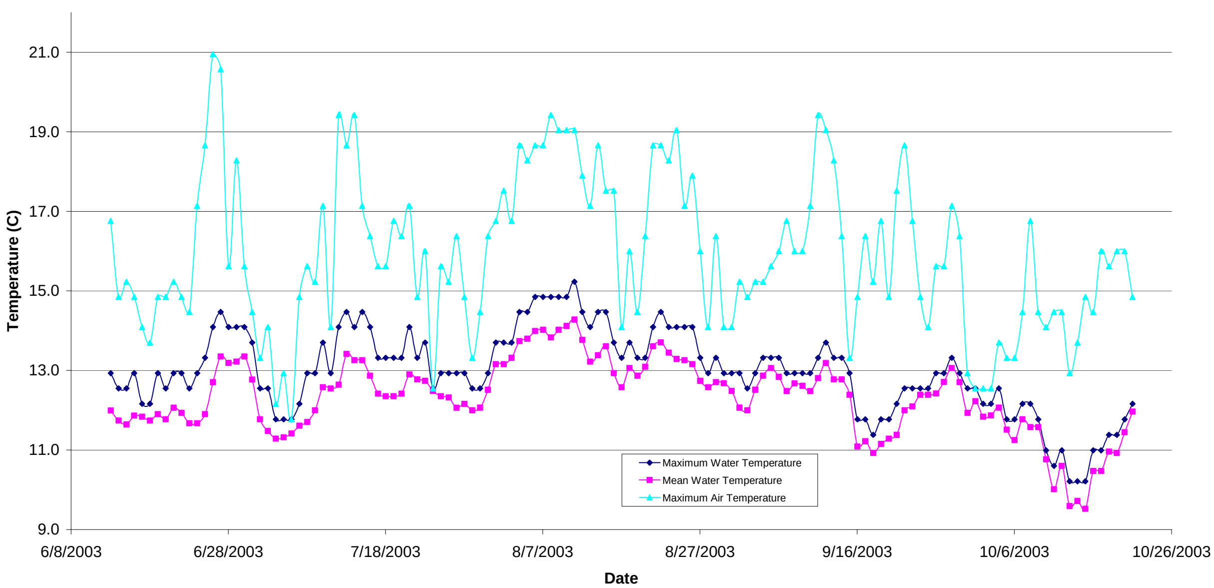


Figure T78-03. Mean and Maximum Daily Stream Temperatures During Summer 2003 at South Fork Albion River (Site T78-03), Mendocino County, California.

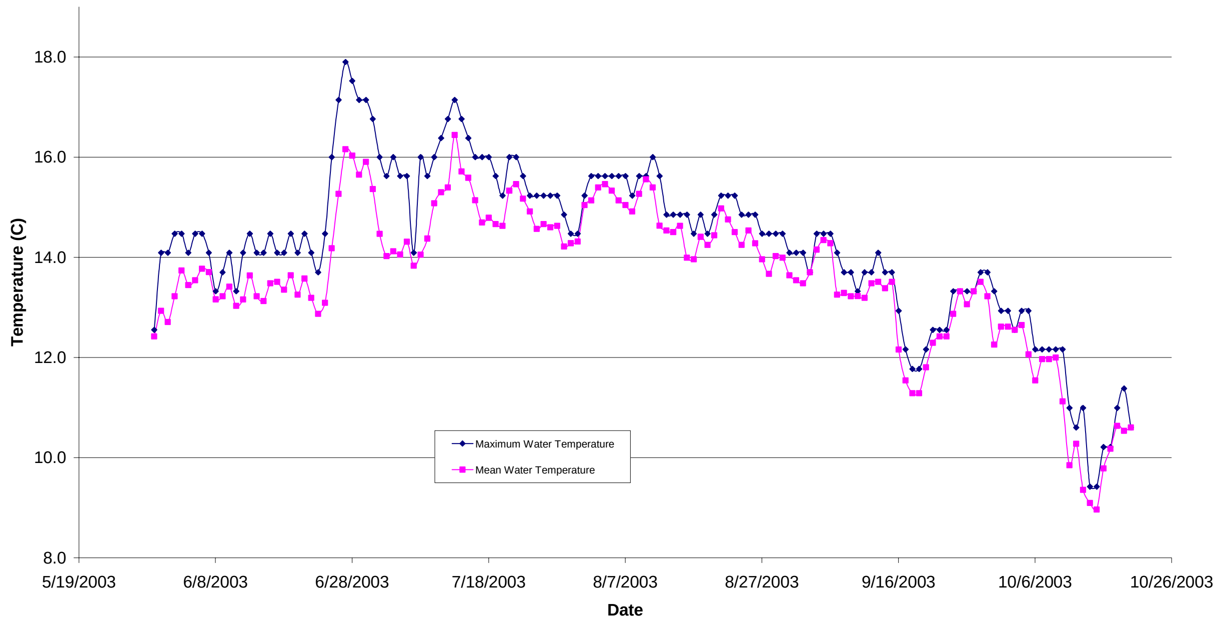


Figure T78-04. Maximum Daily Air Temperature and Mean and Maximum Daily Stream Temperatures During Summer 2003 at South Fork Albion River (Site T78-04), Mendocino County, California.

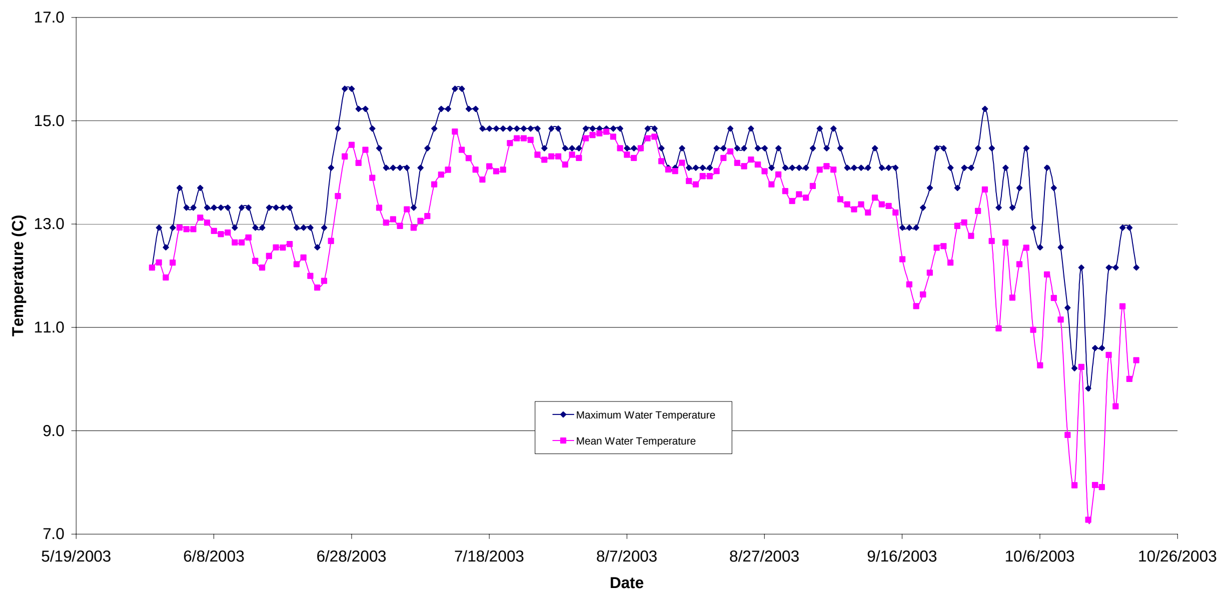


Figure T78-05. Mean and Maximum Daily Stream Temperatures During Summer 2003 at Albion River (Site T78-05), Mendocino County, California.

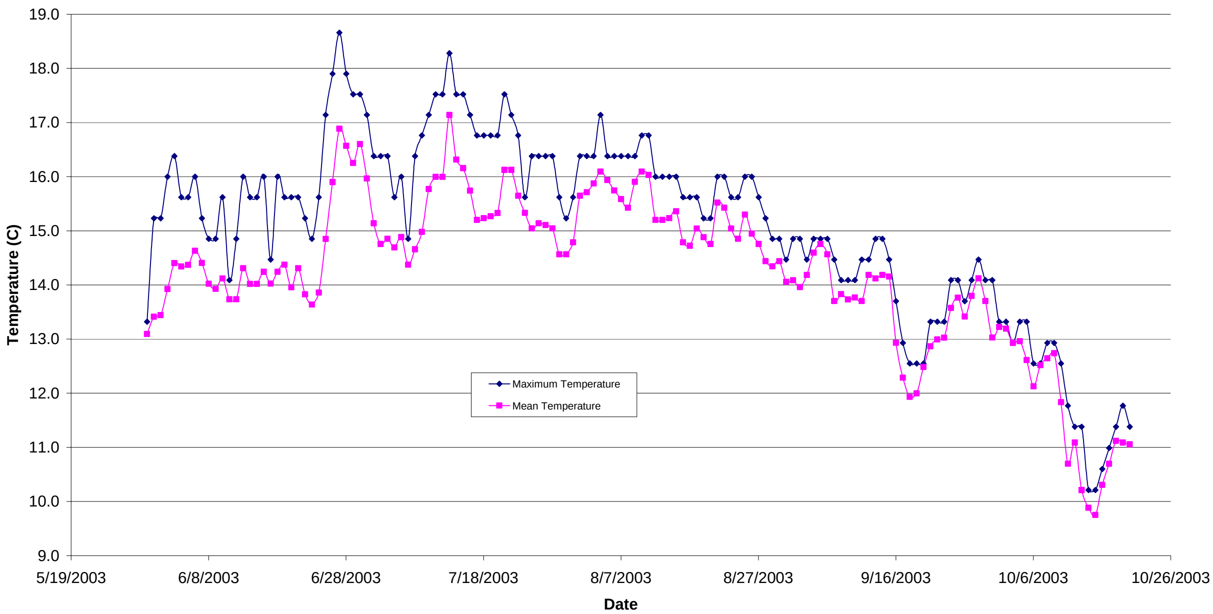


Figure T78-06. Mean and Maximum Daily Stream Temperatures During Summer 2003 at Albion River (Site T78-06), Mendocino County, California.

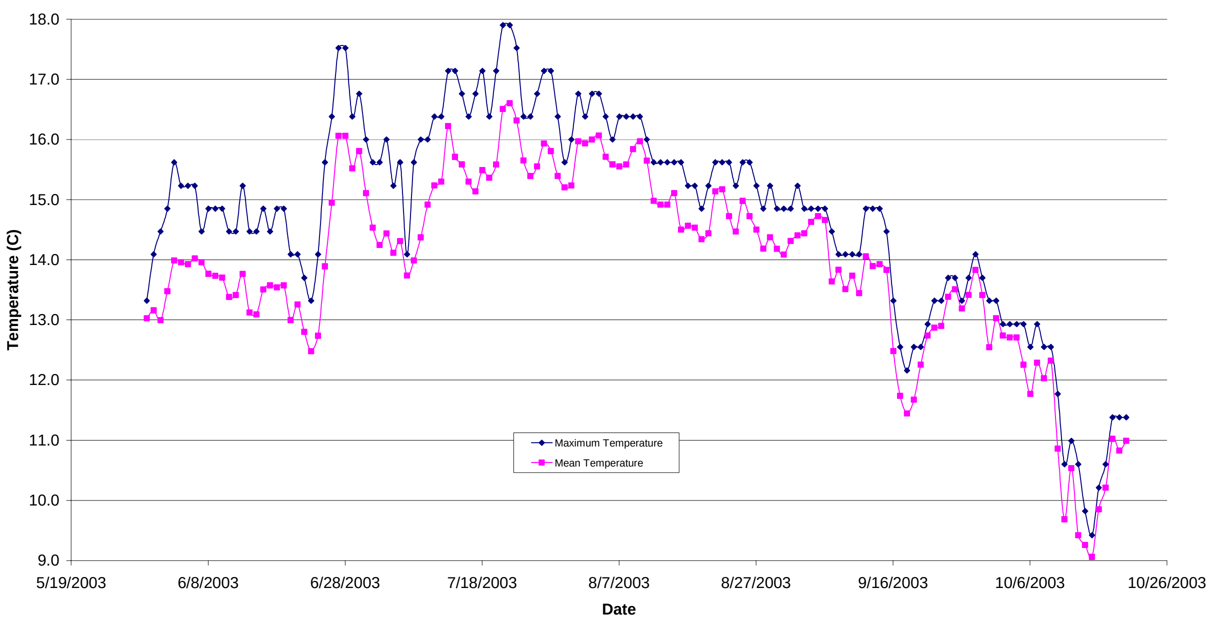


Figure T78-07. Mean and Maximum Daily Stream Temperatures During Summer 2003 at Deadman Gulch (Site T78-07), Mendocino County, California.

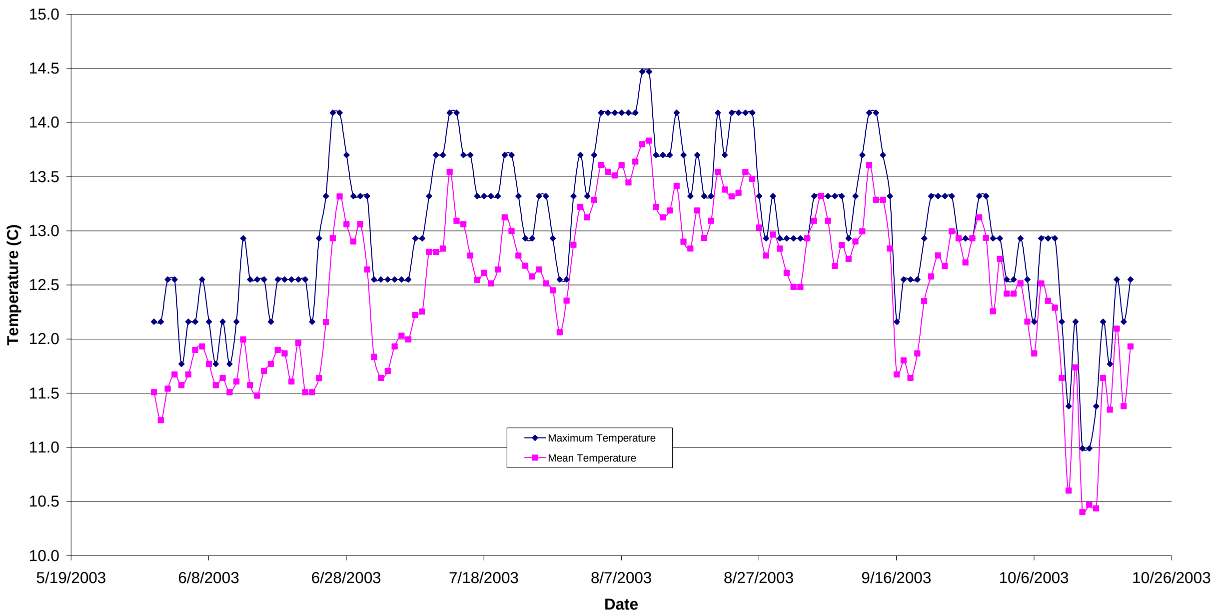


Figure T78-09. Mean and Maximum Daily Stream Temperatures During Summer 2003 at Railroad Gulch (Site T78-09), Mendocino County, California.

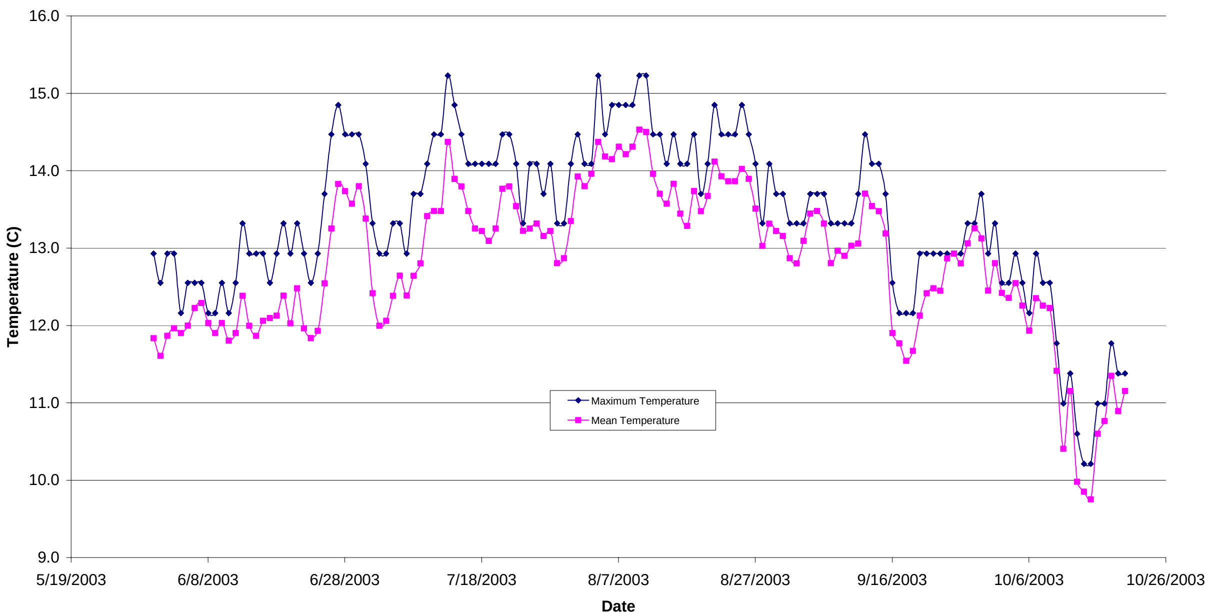


Figure T78-10. Maximum Daily Air Temperature and Mean and Maximum Daily Stream Temperatures During Summer 2003 at Duckpond Gulch (Site T78-10), Mendocino County, California.

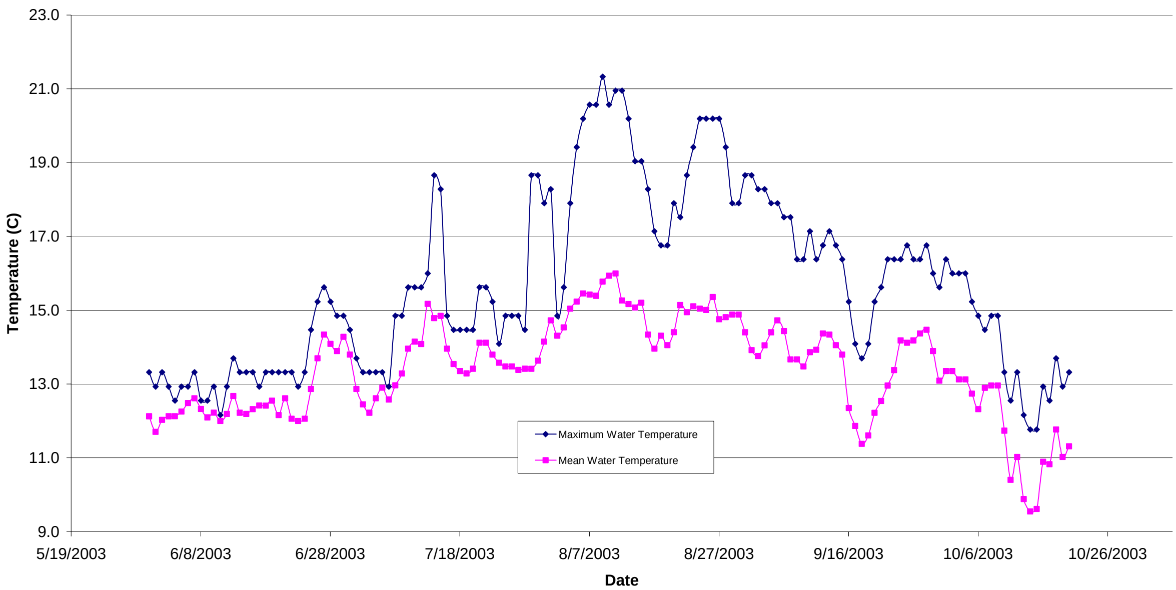


Figure T78-11. Mean and Maximum Daily Stream Temperatures During Summer 2003 at Pleasant Valley Creek (Site T78-11), Mendocino County, California.

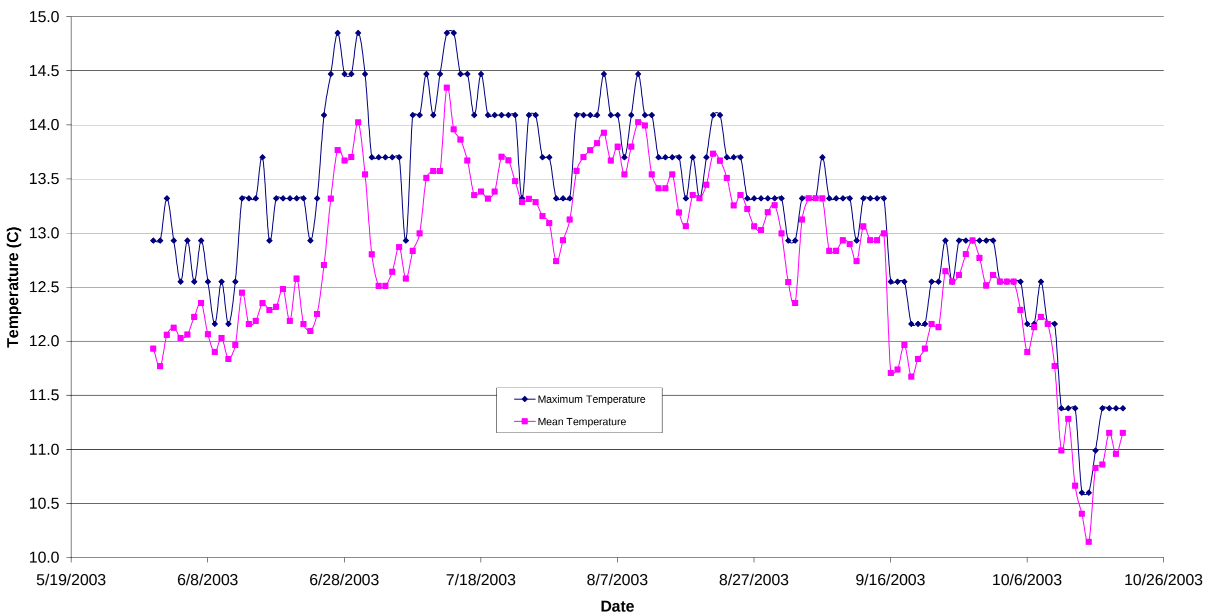


Figure T78-12. Mean and Maximum Daily Stream Temperatures During Summer 2003 at East Railroad Gulch (Site T78-12), Mendocino County, California.

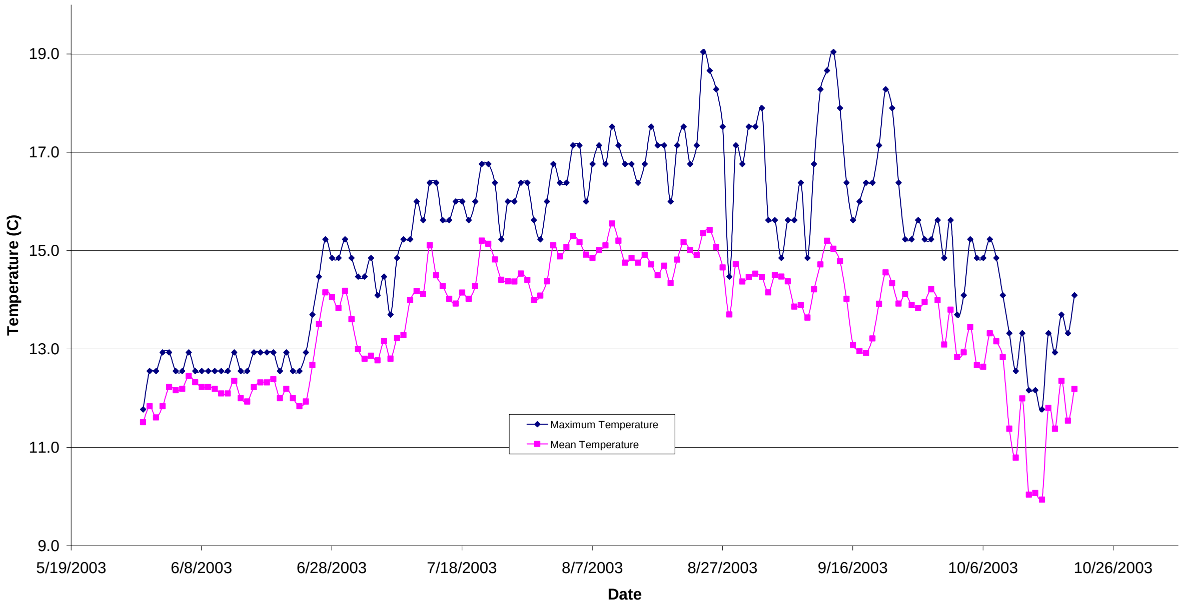


Figure T78-21. Mean and Maximum Daily Stream Temperatures During Summer 2003 at Slaughterhouse Gulch (Site T78-21), Mendocino County, California.

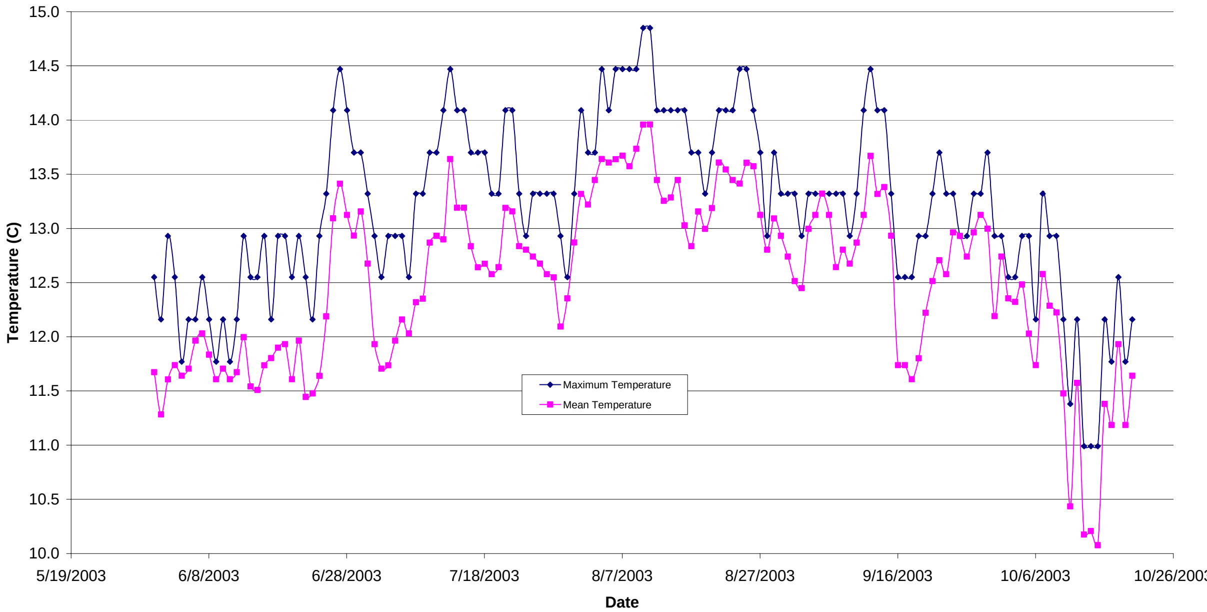


Figure T78-03. Maximum Daily Air Temperature and Mean and Maximum Daily Stream Temperatures During Summer 2002 at South Fork Albion River (Site T78-03), Mendocino County, California.

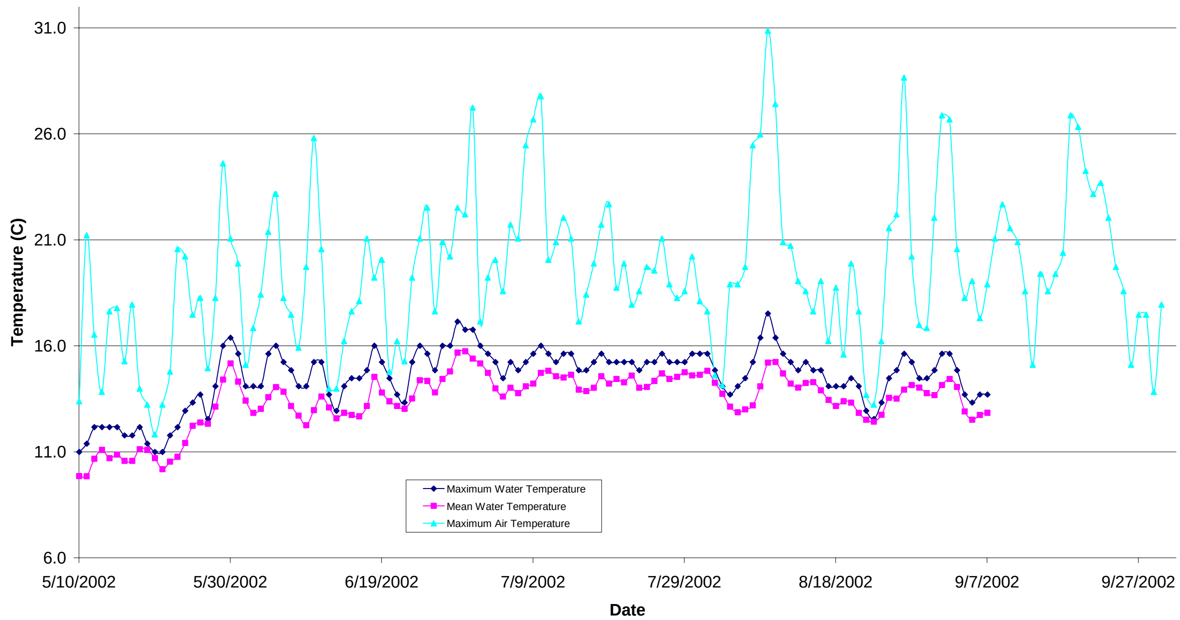


Figure T78-05. Mean and Maximum Daily Stream Temperatures During Summer 2002 at Albion River (Site T78-05), Mendocino County, California.

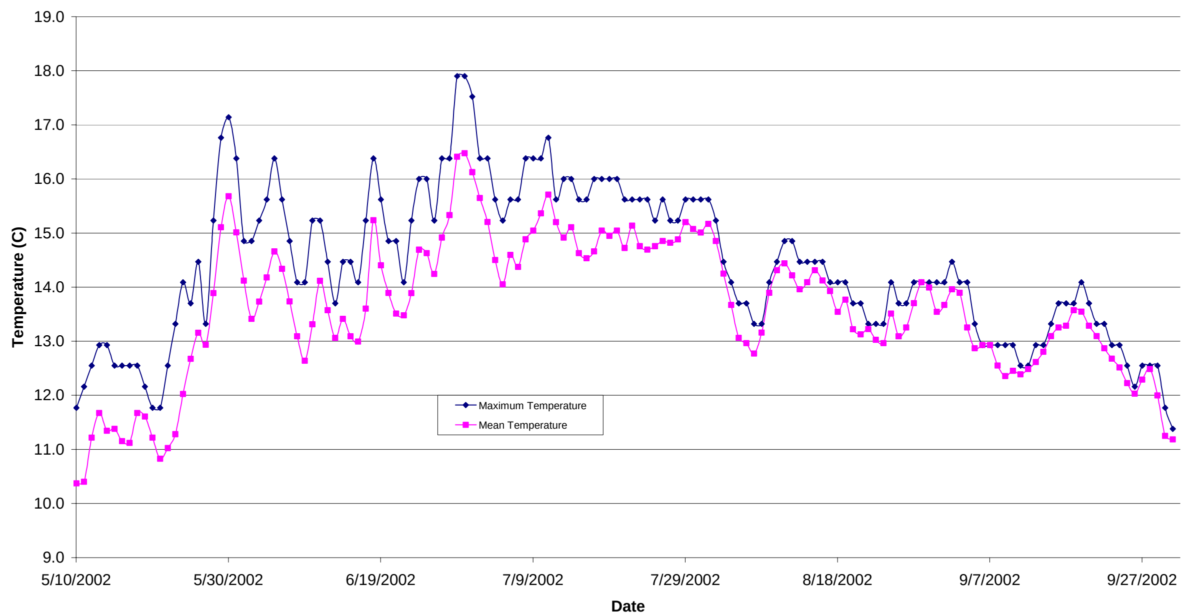


Figure T78-06. Mean and Maximum Daily Stream Temperatures During Summer 2002 at Albion River (Site T78-06), Mendocino County, California.

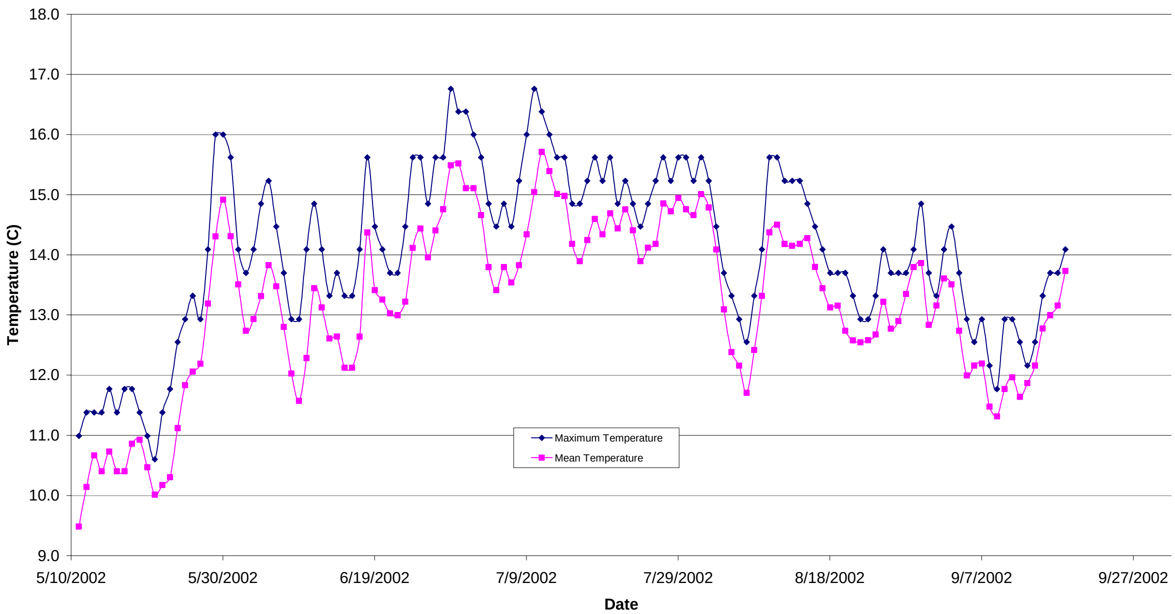


Figure T78-07. Mean and Maximum Daily Stream Temperatures During Summer 2002 at Deadman Gulch (Site T78-07), Mendocino County, California.

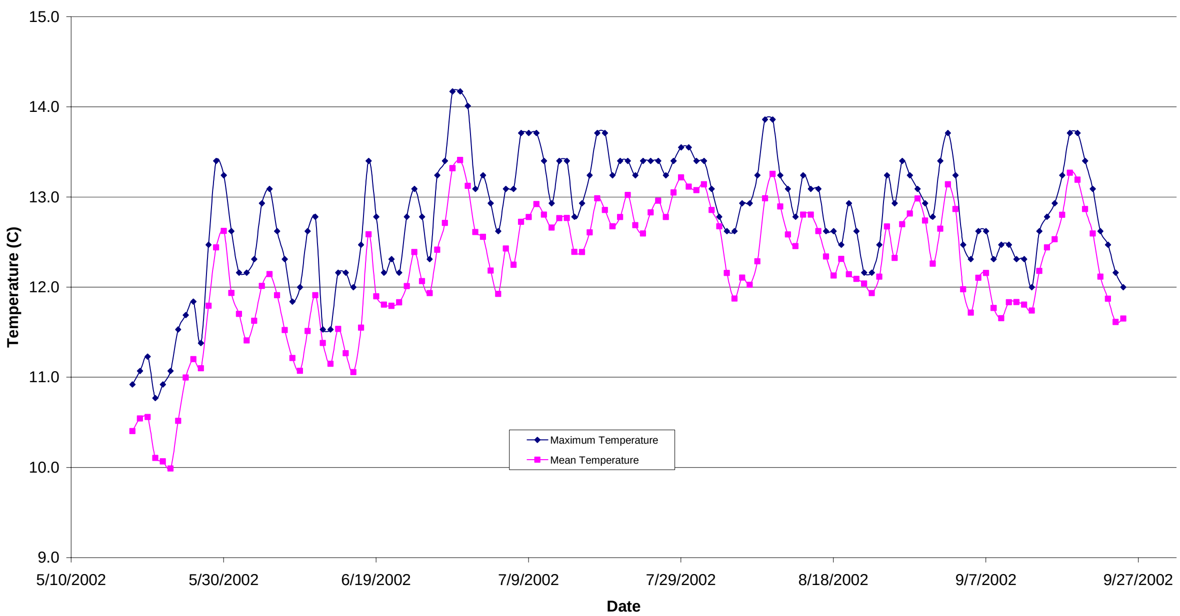


Figure T78-09. Mean and Maximum Daily Stream Temperatures During Summer 2002 at Railroad Gulch (Site T78-09), Mendocino County, California.

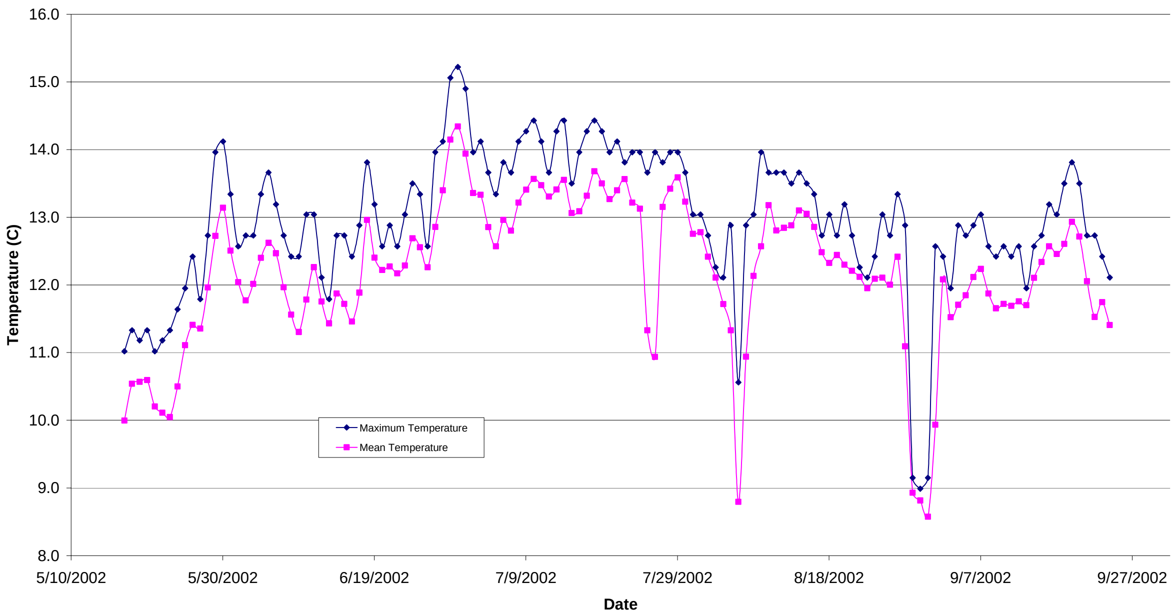


Figure T78-11. Mean and Maximum Daily Stream Temperatures During Summer 2002 at Pleasant Valley Creek (Site T78-11), Mendocino County, California.

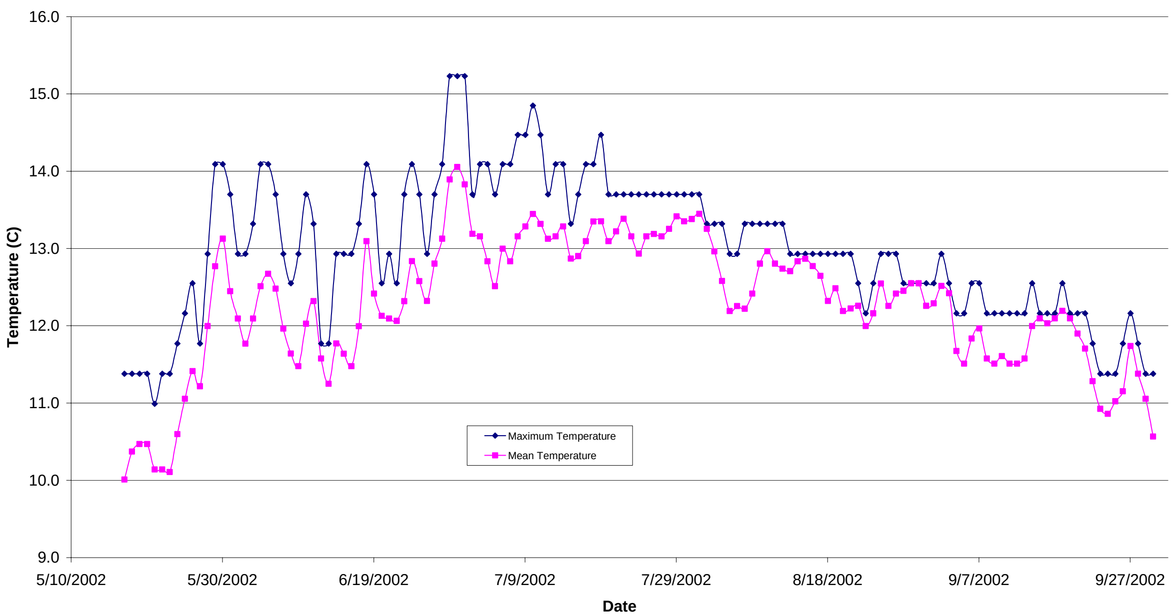


Figure T78-12. Mean and Maximum Daily Stream Temperatures During Summer 2002 at East Railroad Gulch (Site T78-12), Mendocino County, California.

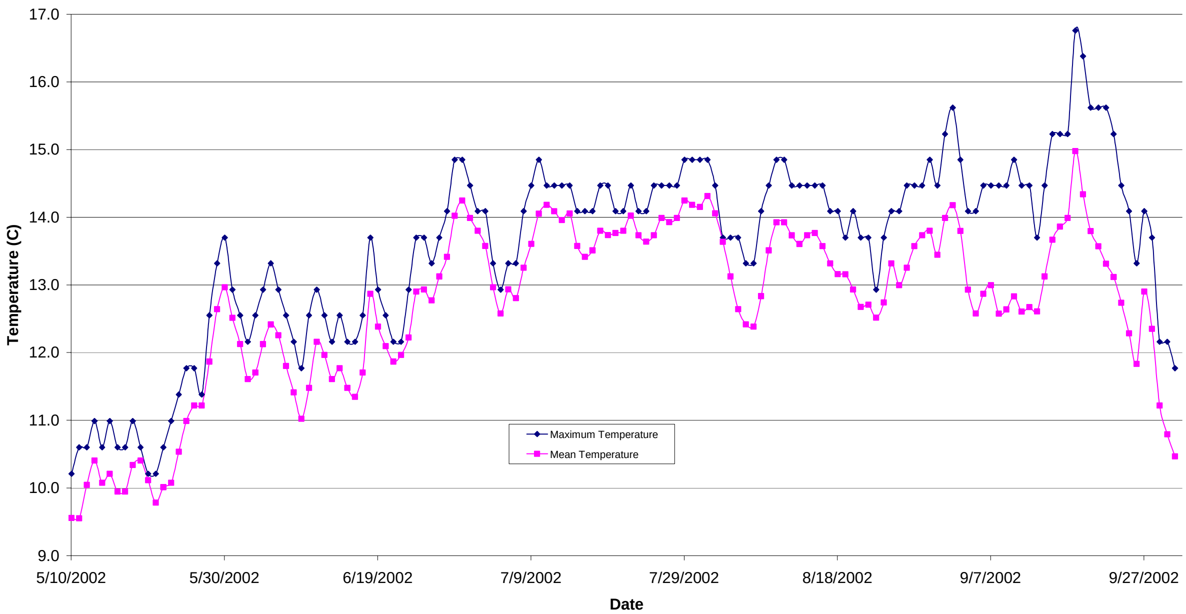


Figure T78-13. Mean and Maximum Daily Stream Temperatures During Summer 2002 at Albion River (Site T78-13), Mendocino County, California.

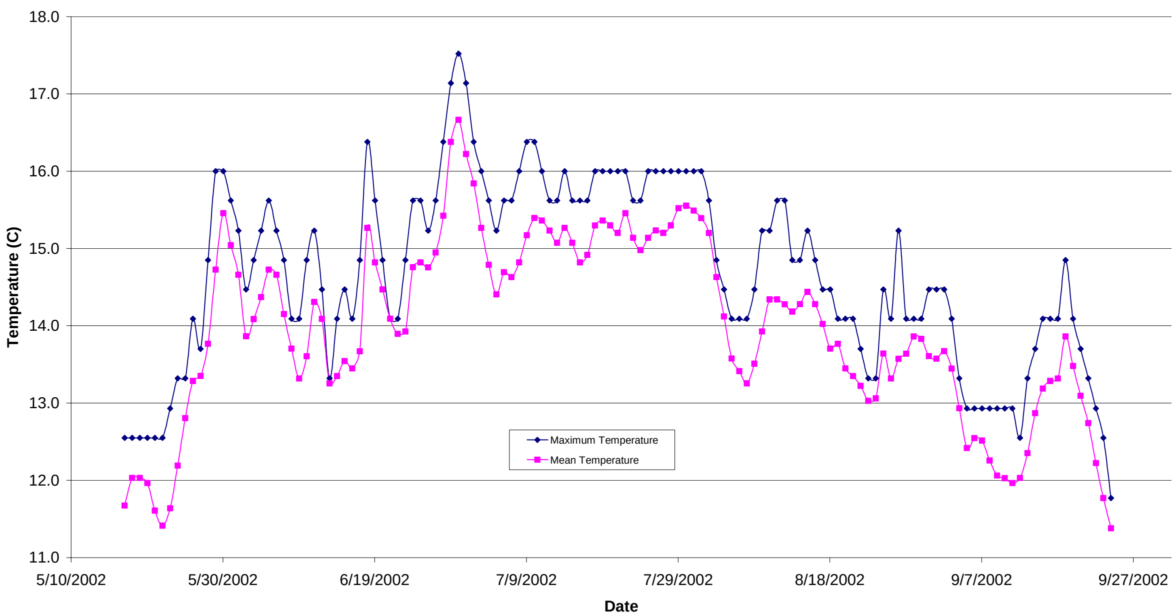


Figure T78-21. Mean and Maximum Daily Stream Temperatures During Summer 2002 at Slaughterhouse Gulch (Site T78-21), Mendocino County, California.

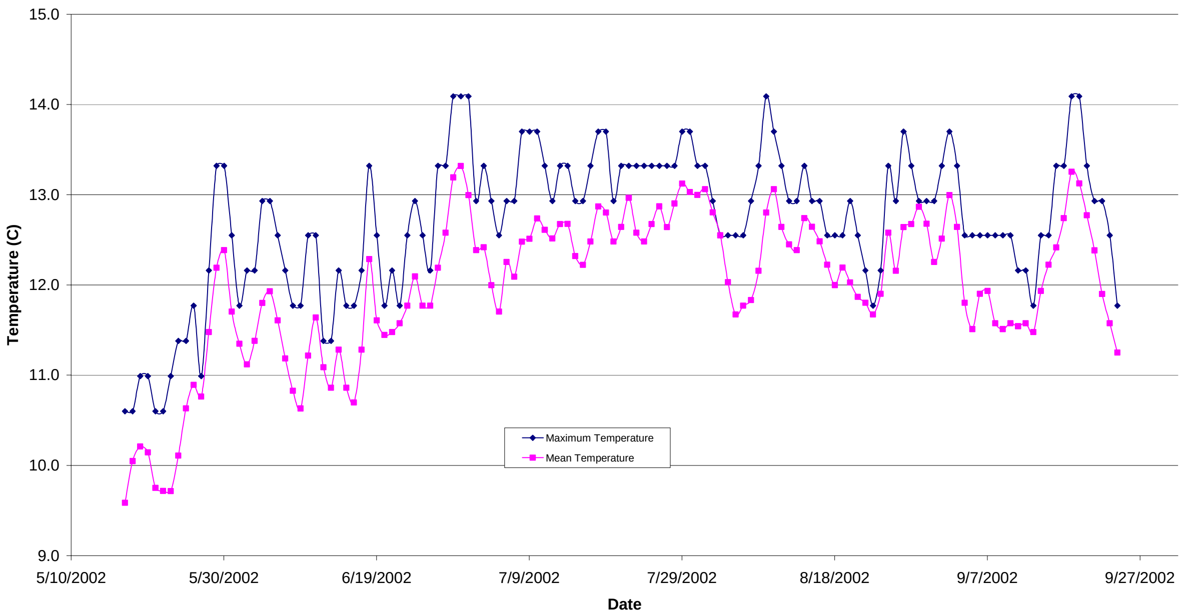


Figure 64. Mean and Maximum Daily Stream Temperatures During Summer 2001 at Albion River (Site 78-1), Mendocino County, California.

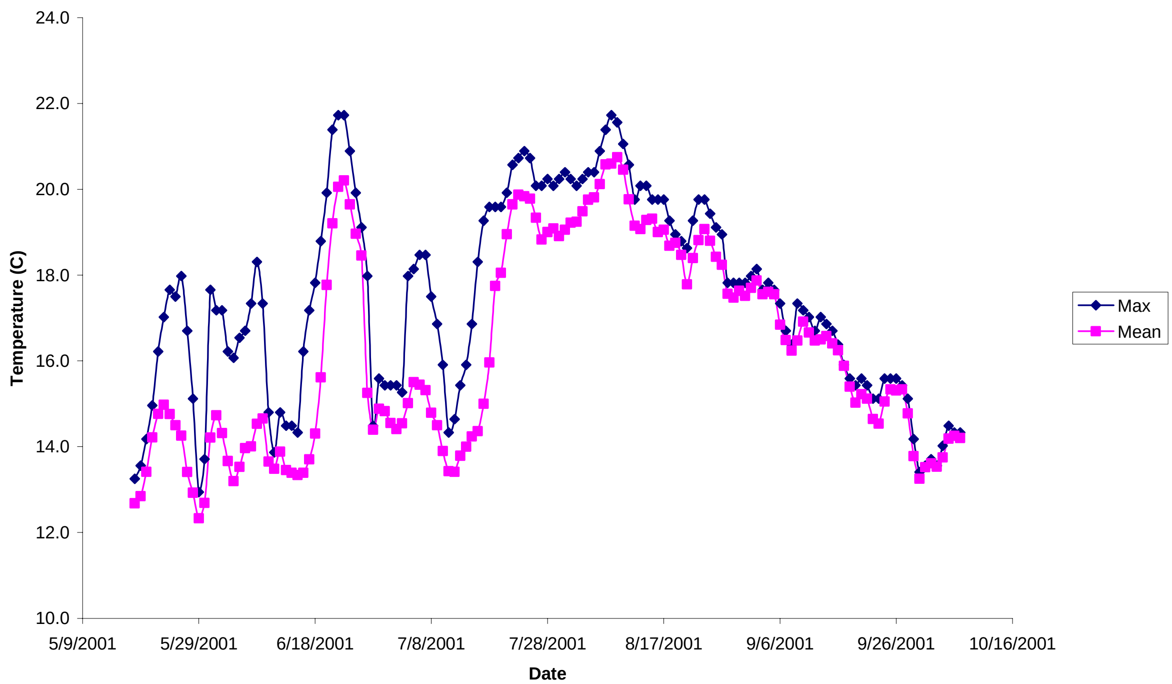


Figure 67. Mean and Maximum Daily Stream Temperatures During Summer 2001 at Albion River (Site 78-5), Mendocino County, California.

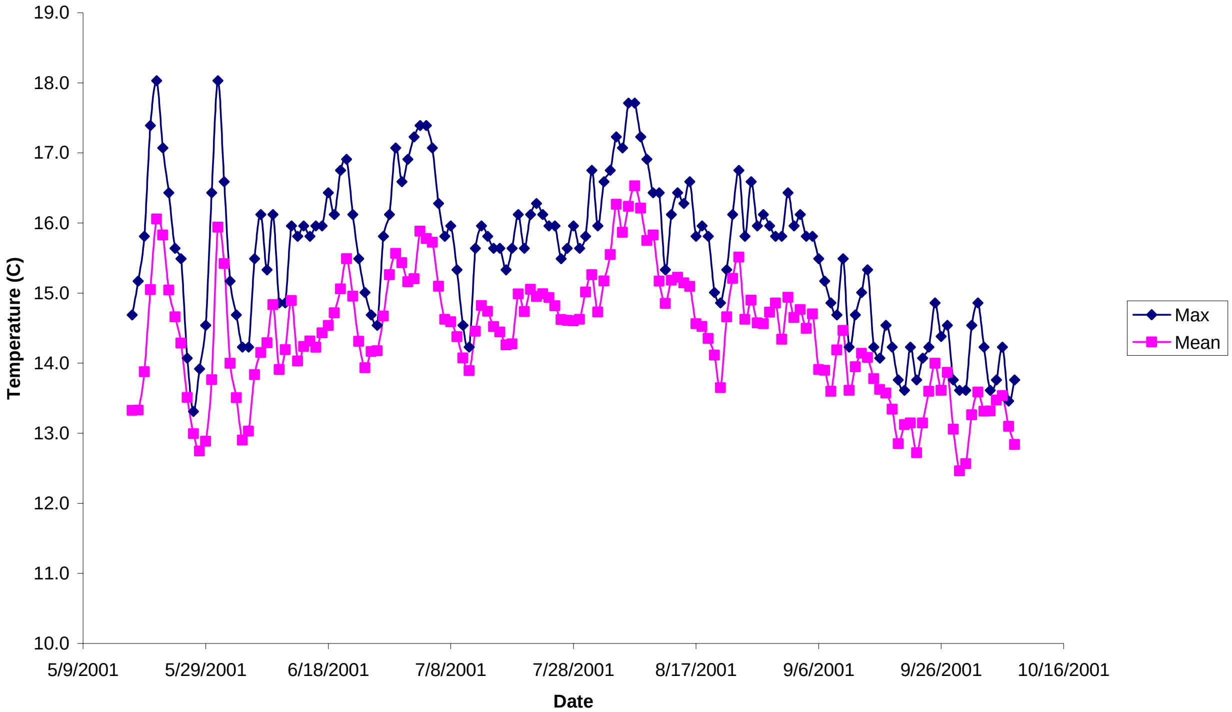


Figure 68. Mean and Maximum Daily Stream Temperatures During Summer 2001 at Deadman Gulch (Site 78-7), Mendocino County, California.

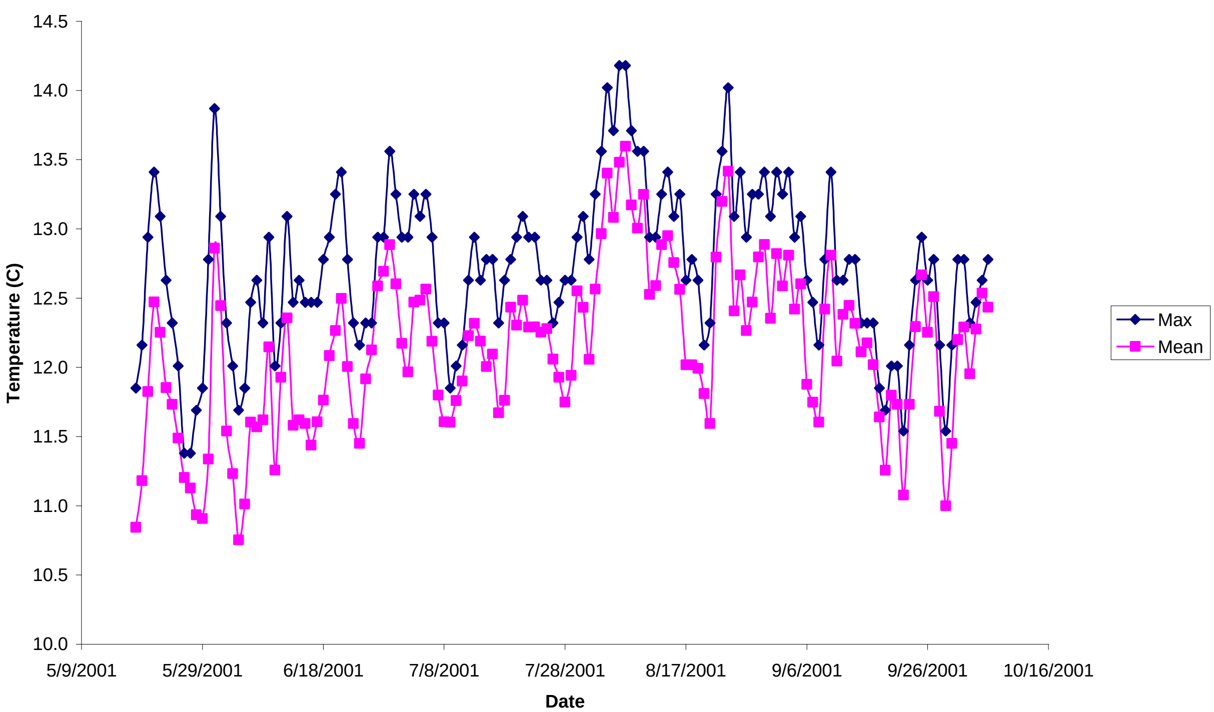


Figure 70. Mean and Maximum Daily Stream Temperatures During Summer 2001 at Duckpond Gulch (78-10), Mendocino County, California.

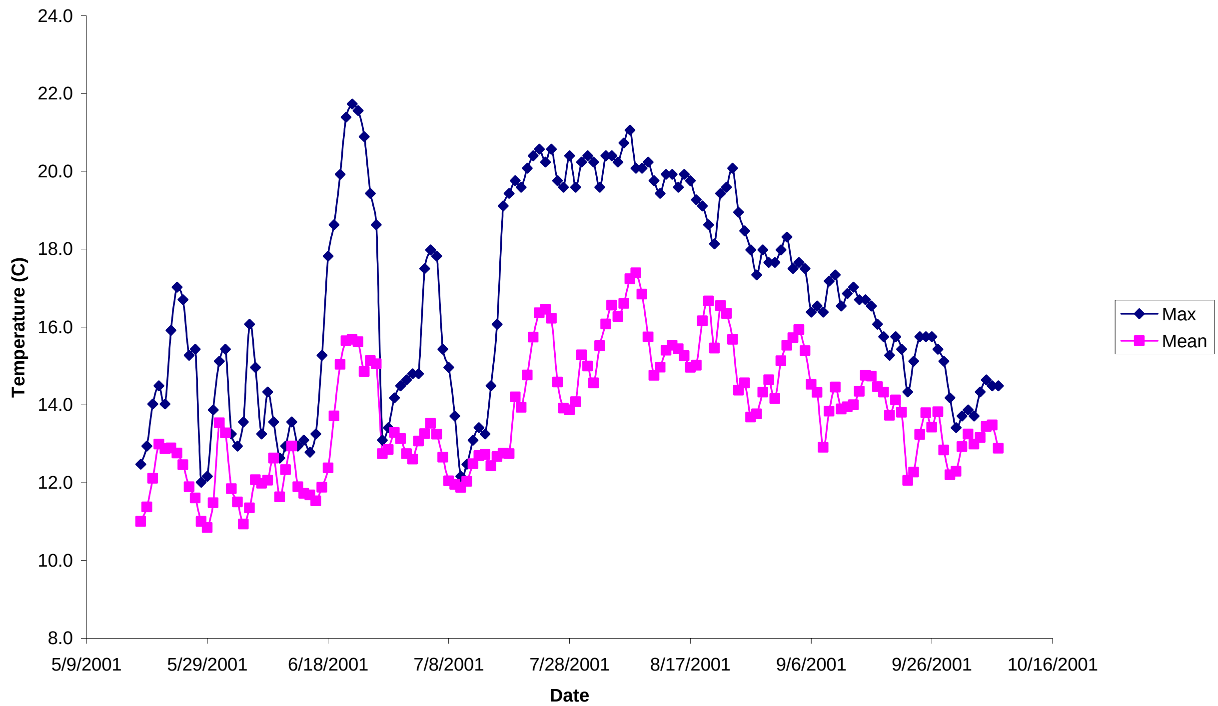


Figure 71. Mean and Maximum Daily Stream Temperatures During Summer 2001 at Pleasant Valley Creek (Site 78-11), Mendocino County, California.

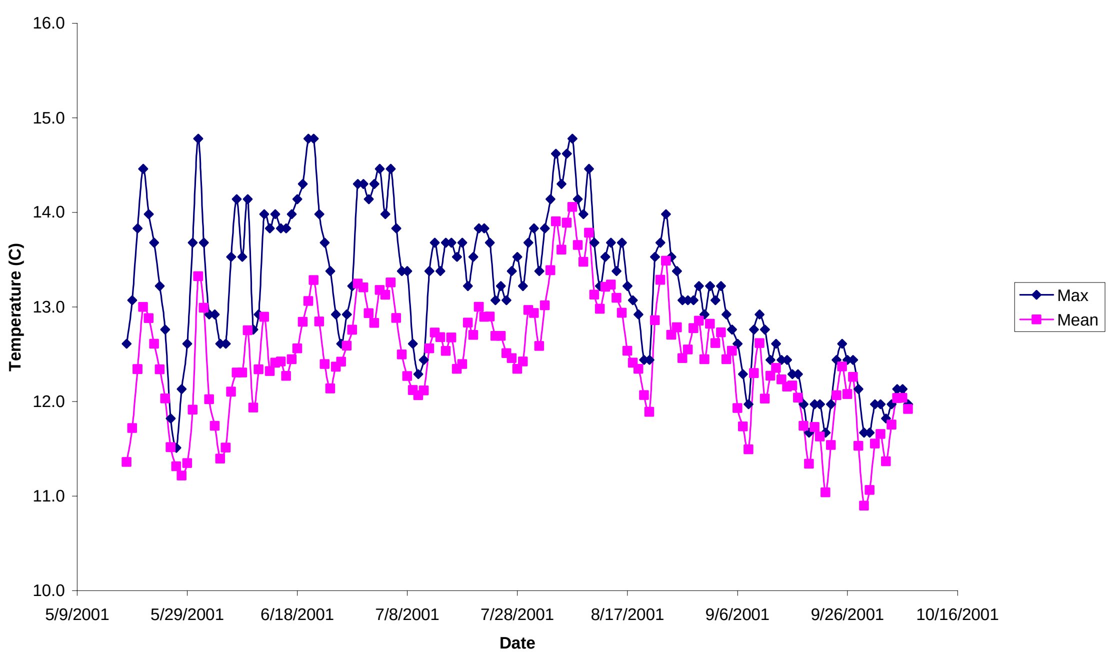


Figure 69. Mean and Maximum Daily Stream Temperatures During Summer 2001 at Railroad Gulch (Site 78-9), Mendocino County, California.

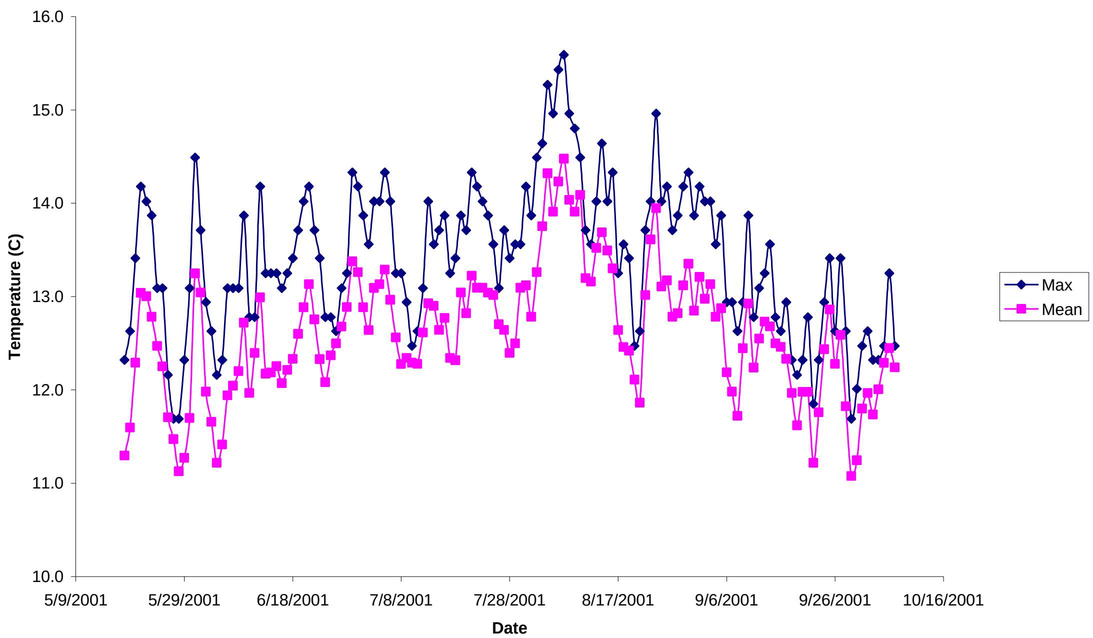


Figure 66. Mean and Maximum Daily Stream Temperatures During Summer 2001 at South Fork Albion River (Site 78-4), Mendocino County, California.

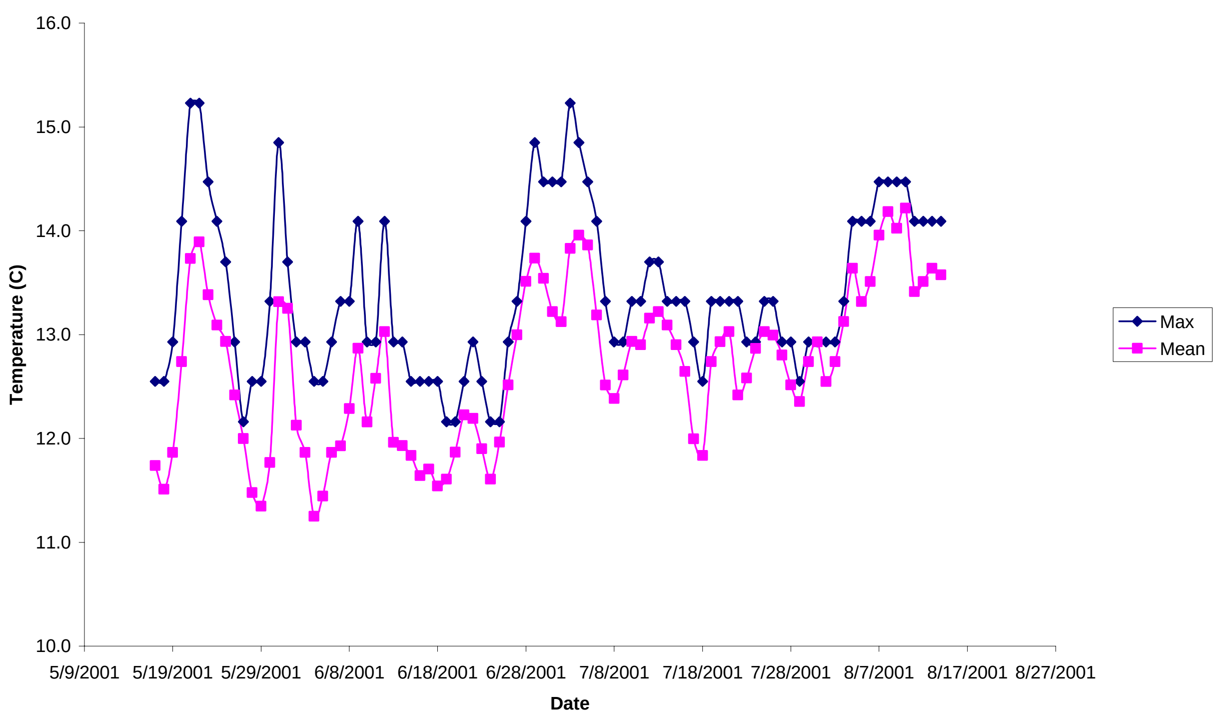


Figure 65. Mean and Maximum Daily Stream Temperatures During Summer 2001 at South Fork Albion River (78-3), Mendocino County, California.

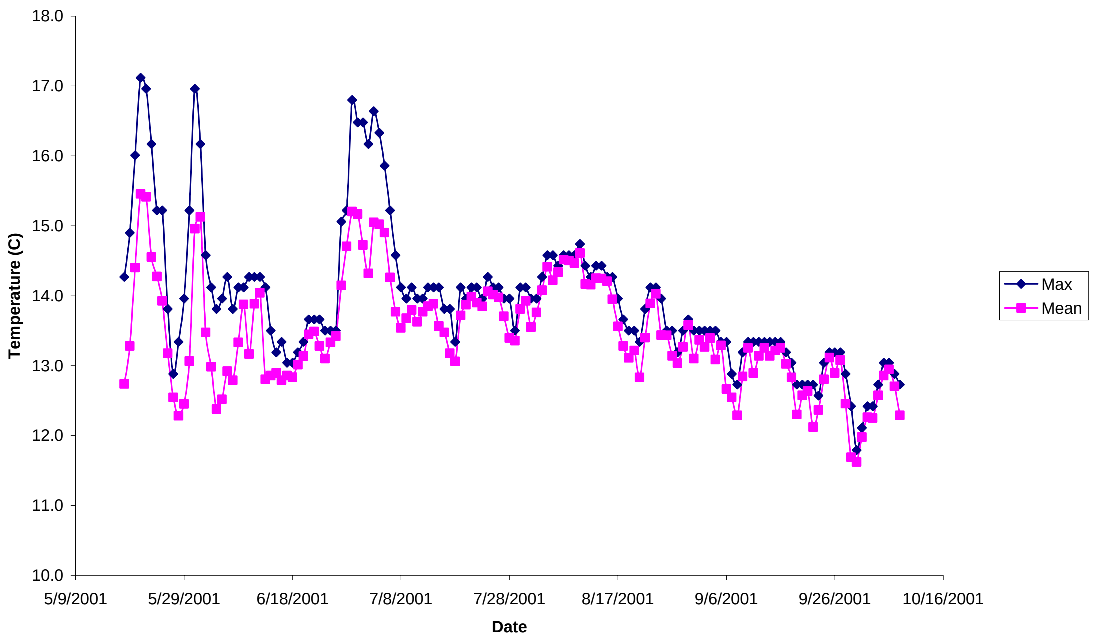


Figure 72. Mean and Maximum Daily Stream Temperatures During Summer 2001 at Deadman Gulch (Site 78-20), Mendocino County, California.

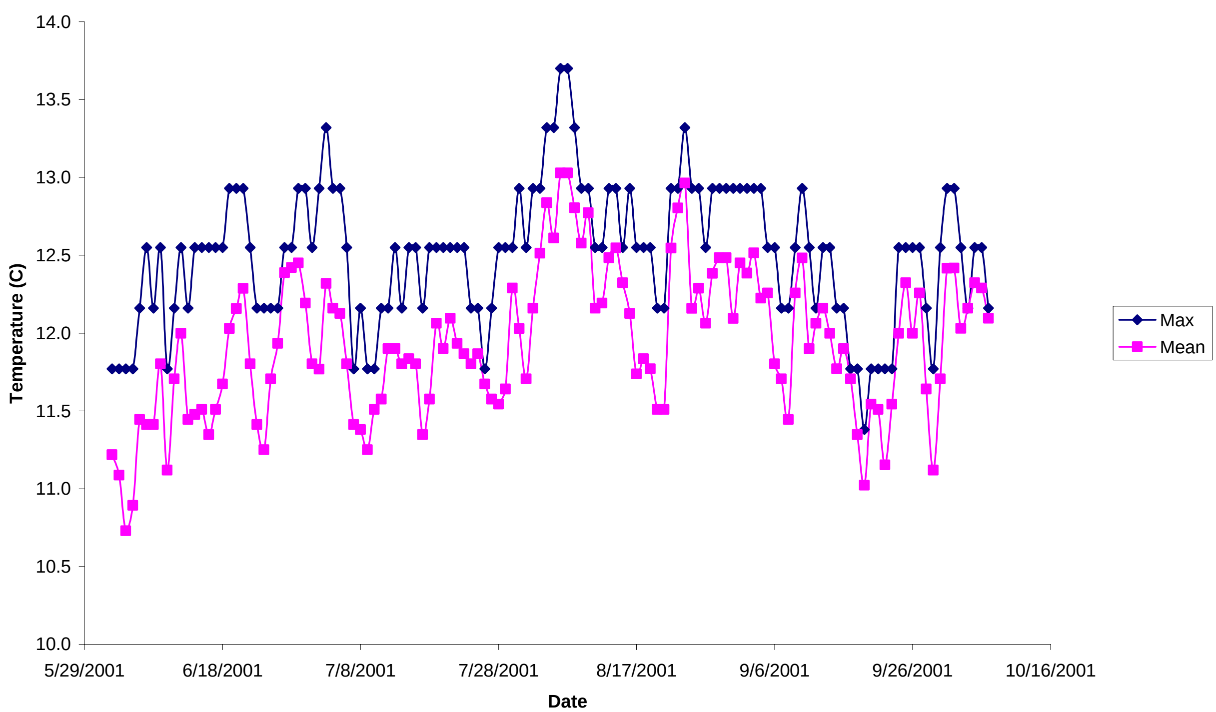


Figure 73. Mean and Maximum Daily Stream Temperatures During Summer 2001 at Slaughterhouse Gulch (Site 78-21), Mendocino County, California.

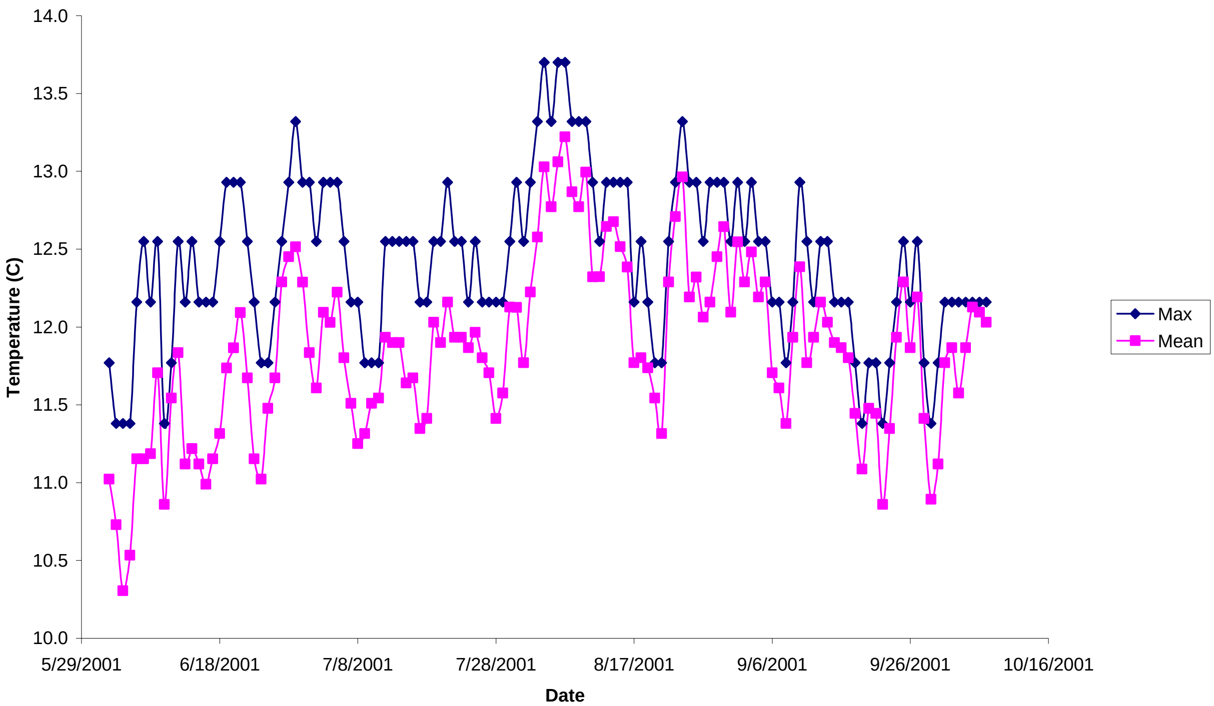


Figure 74. Mean and Maximum Daily Stream Temperatures During Summer 2001 at Tributary to Buckhorn Creek (Site 78-22), Mendocino County, California.

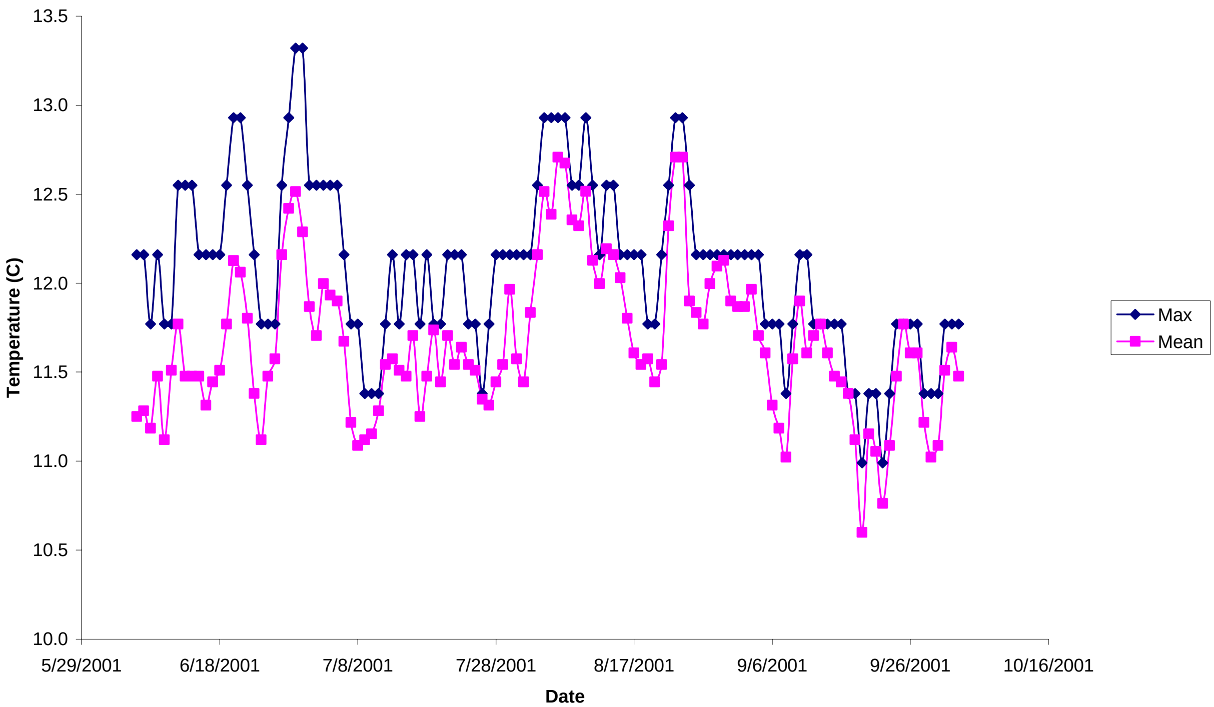


Figure 75. Mean and Maximum Daily Stream Temperatures During Summer 2001 at Unnamed Tributary to Albion River (Site 78-23), Mendocino County, California.

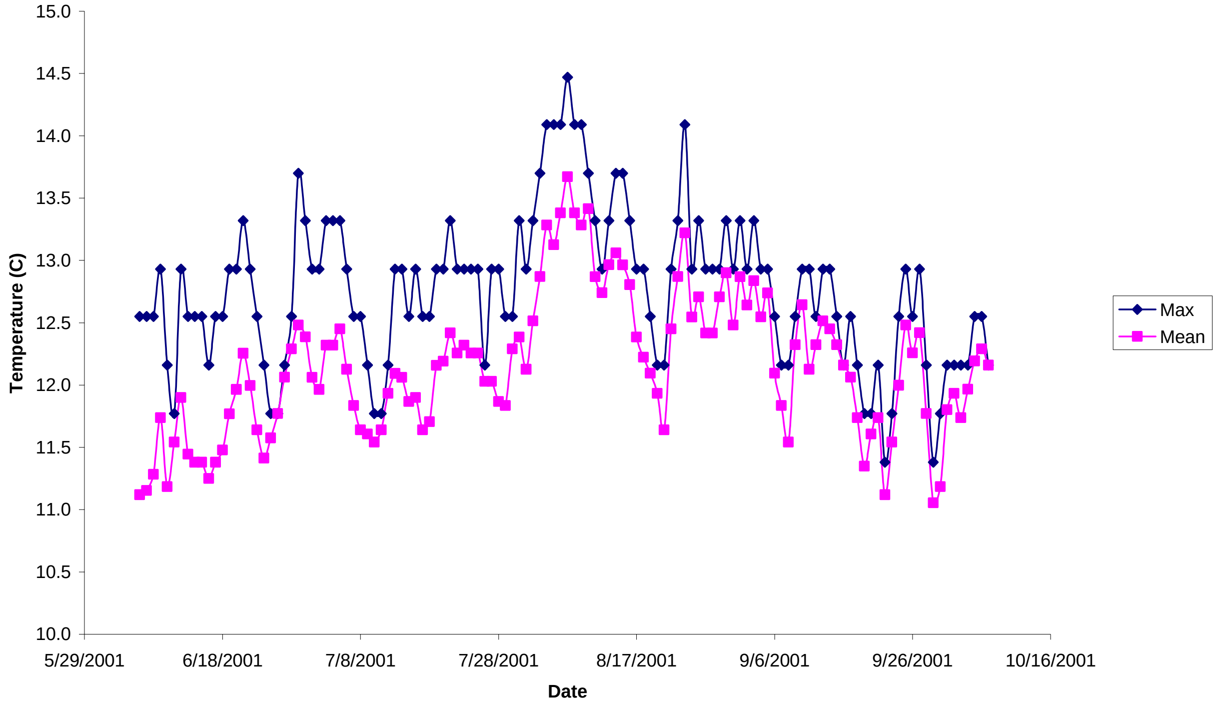


Figure 76. Mean and Maximum Daily Stream Temperatures During Summer 2001 at Gunari Gulch (Site 78-24), Mendocino County, California.

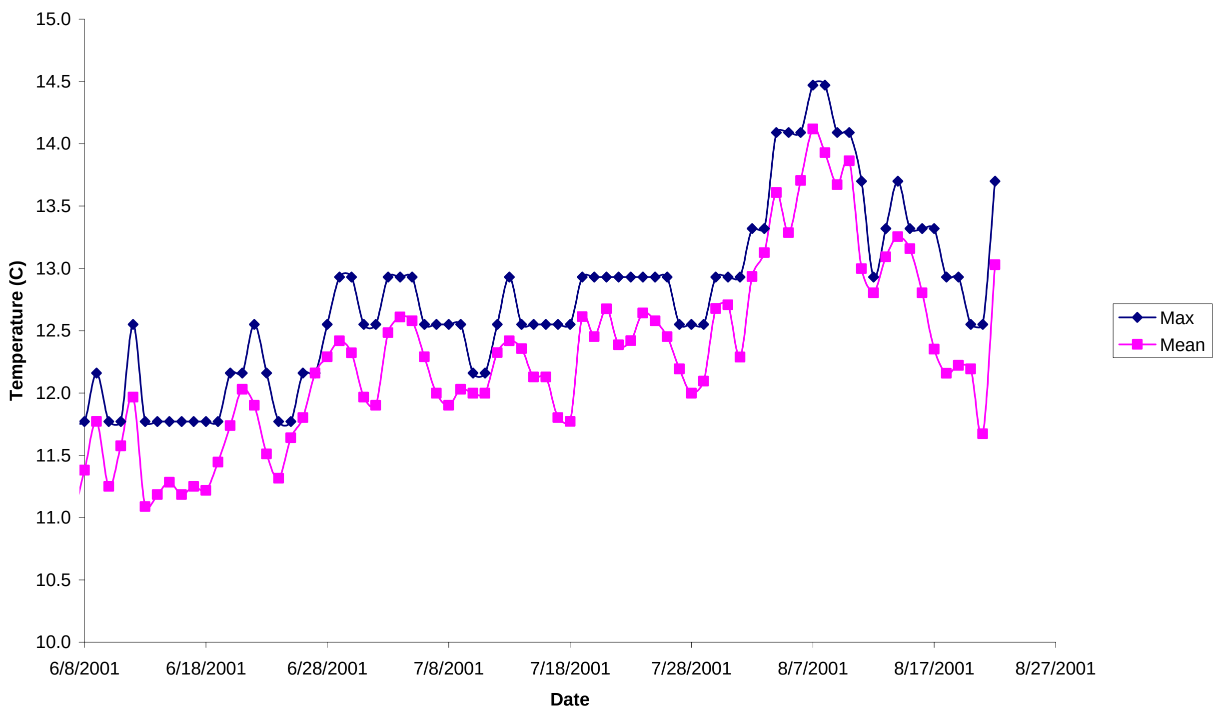


Figure 77. Mean and Maximum Daily Stream Temperatures During Summer 2001 at Anderson Gulch (Site 78-25), Mendocino County, California.

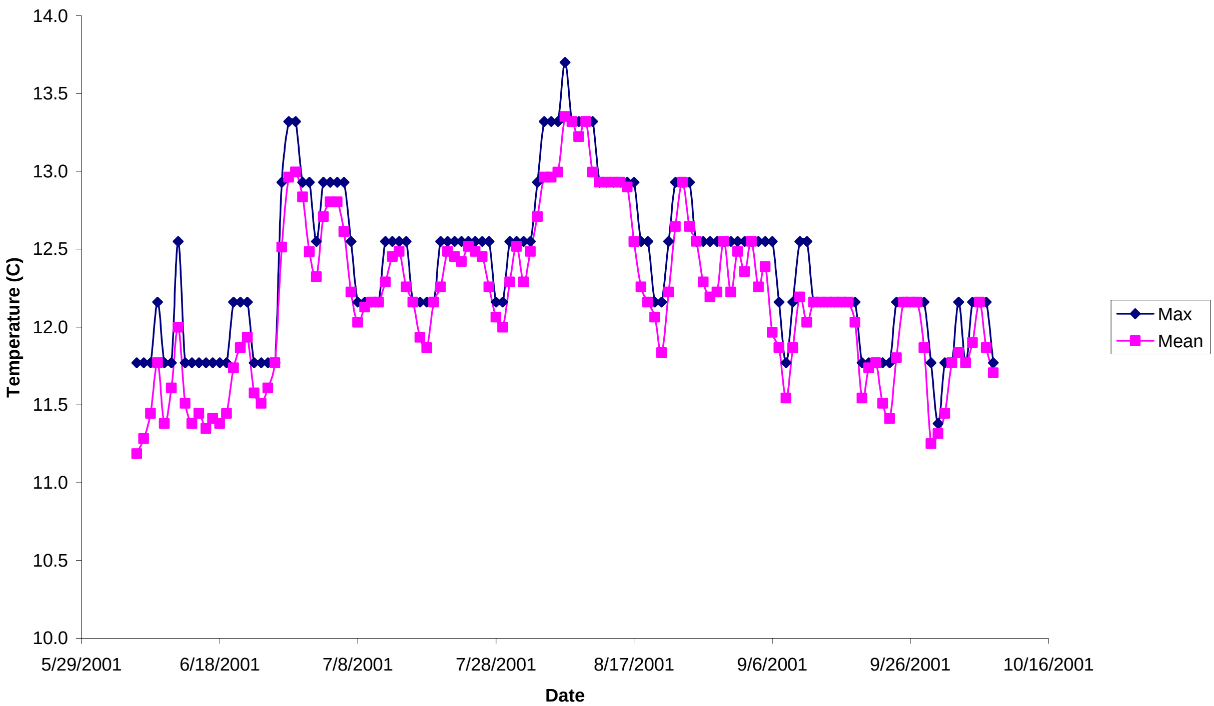


Figure 76. Mean and Maximum Daily Stream Temperatures During Summer 2000 at Albion River (Site 78-1), Mendocino County, California.

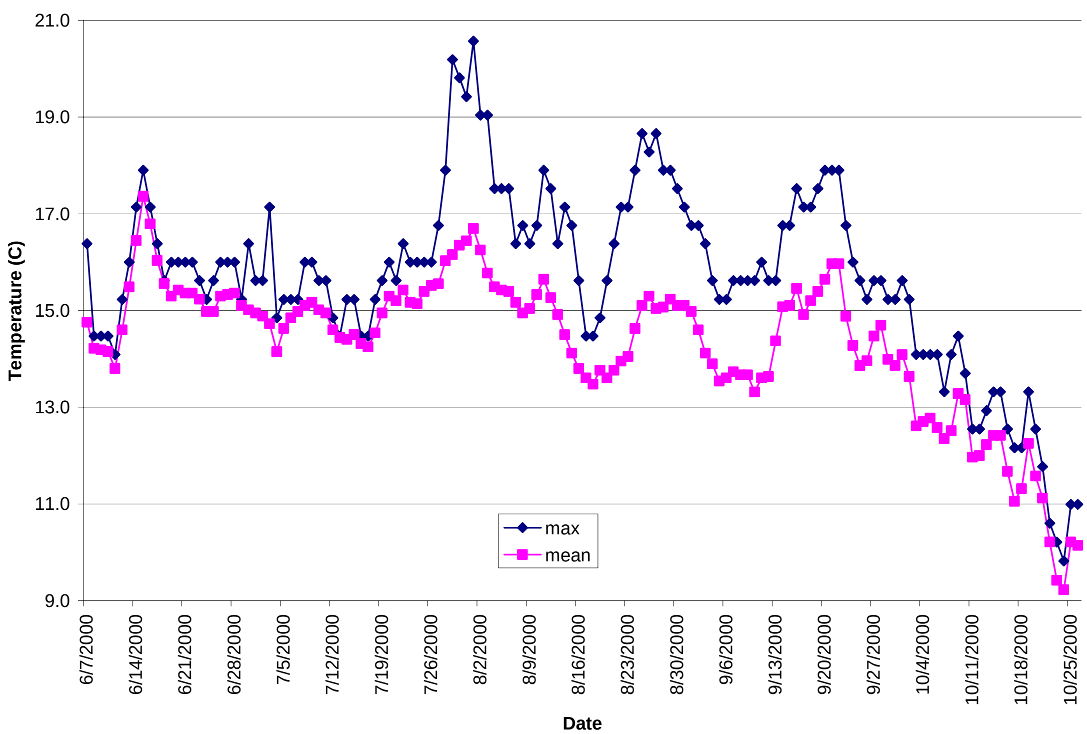


Figure 79. Mean and Maximum Daily Stream Temperatures During Summer 2000 at South Fork Albion River (Site 78-3), Mendocino County, California.

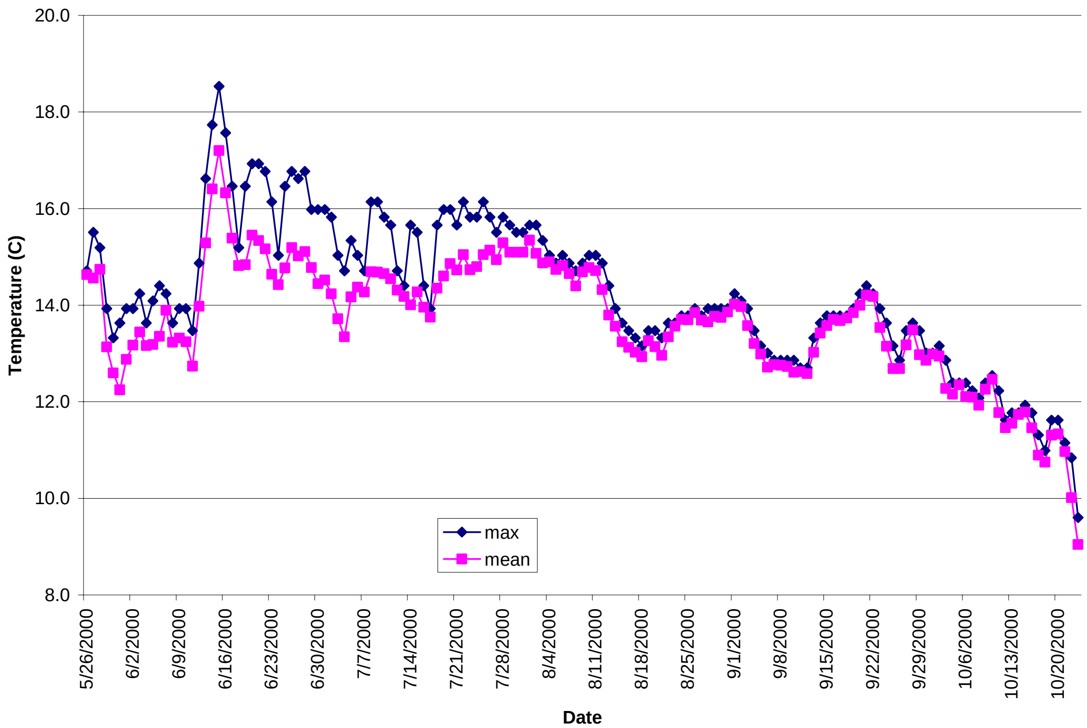


Figure 81. Mean and Maximum Daily Stream Temperatures During Summer 2000 at South Fork Albion River (Site 78-4), Mendocino County, California.

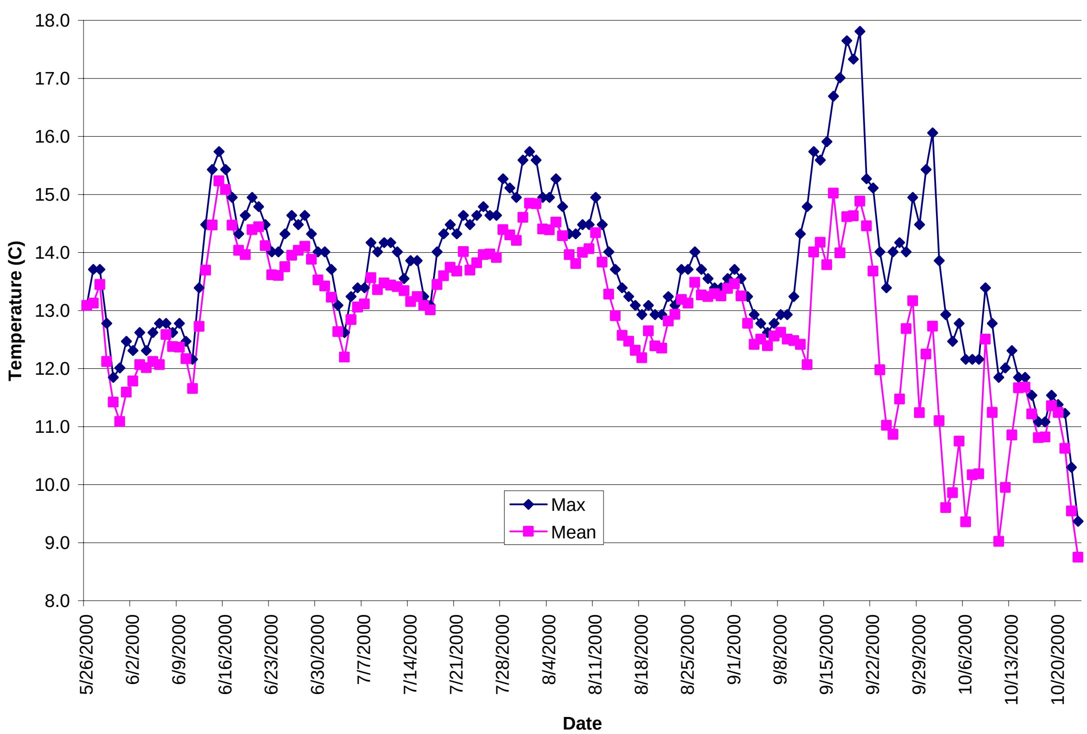


Figure 84. Mean and Maximum Daily Stream Temperatures During Summer 2000 at Albion River (Site 78-5), Mendocino County, California.

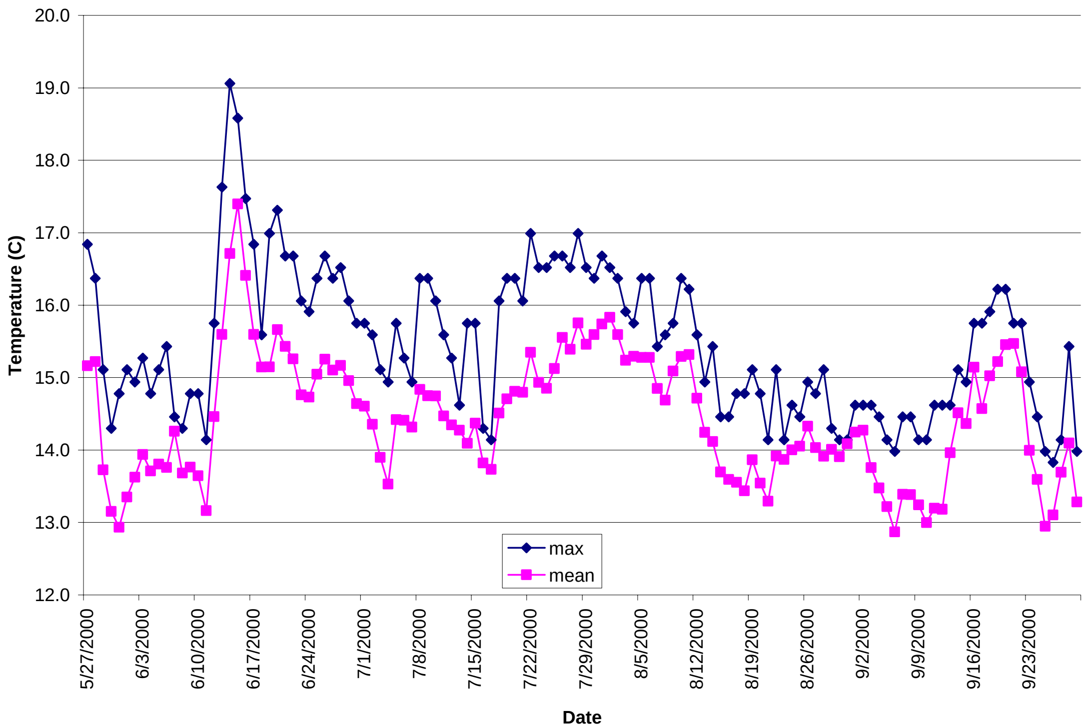


Figure 86. Mean and Maximum Daily Stream Temperatures During Summer 2000 at Albion River (Site 78-6), Mendocino County, California.

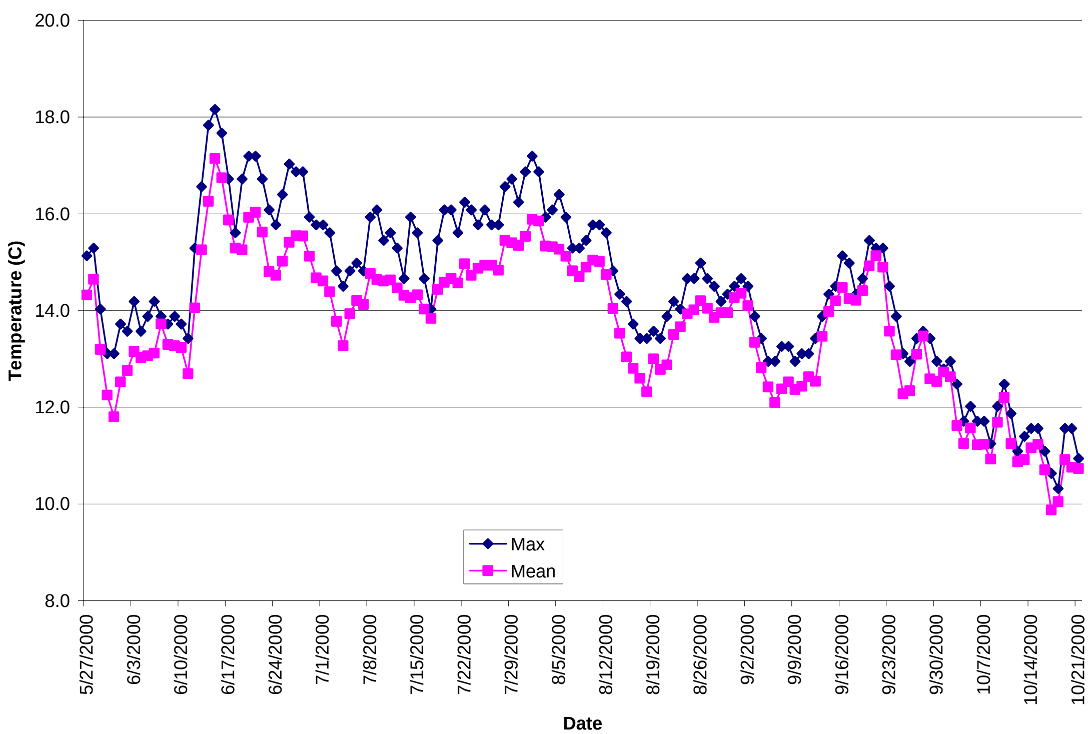


Figure 87. Mean and Maximum Daily Stream Temperatures During Summer 2000 at Tributary to Albion River (Site 78-8), Mendocino County, California.

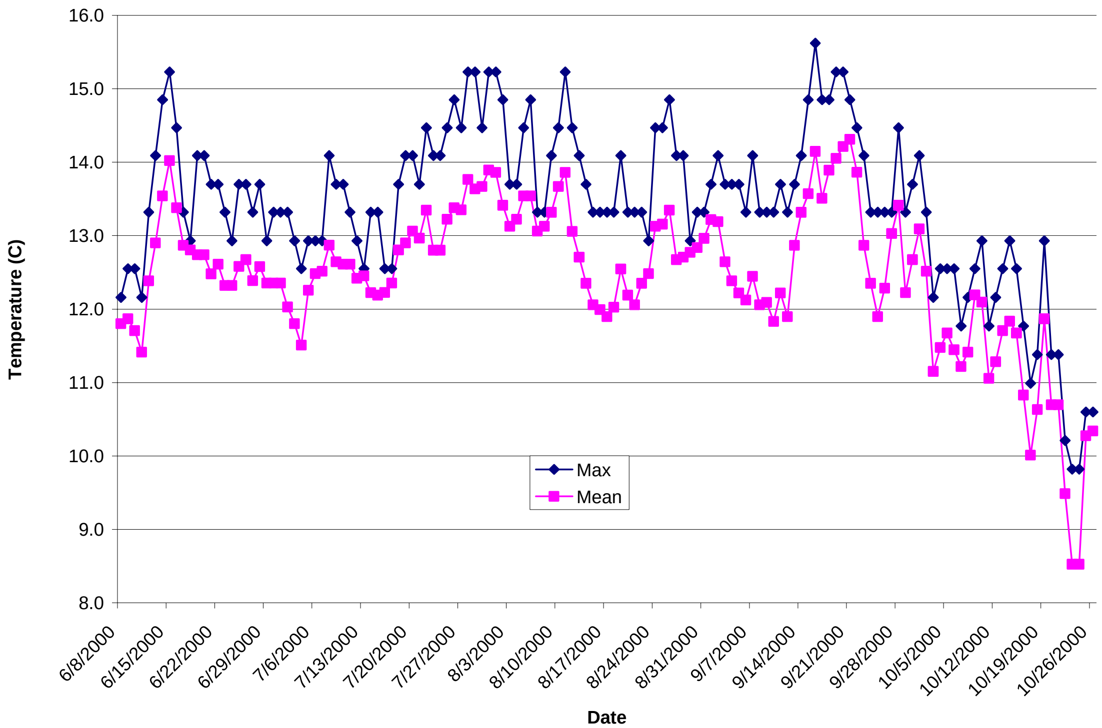


Figure 75. Mean and Maximum Daily Stream Temperatures During Summer 1999 at Albion River (Site 78-1), Mendocino County, California.

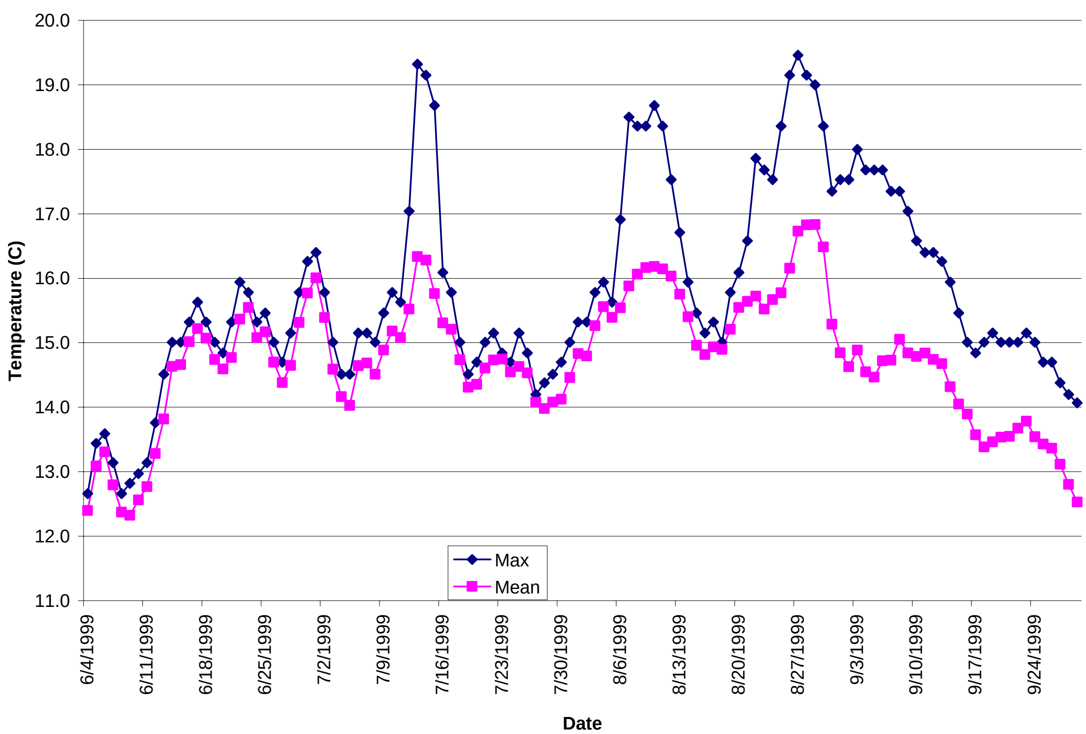


Figure 78. Mean and Maximum Daily Stream Temperatures During Summer 1999 at South Fork Albion River (Site 78-3), Mendocino County, California.

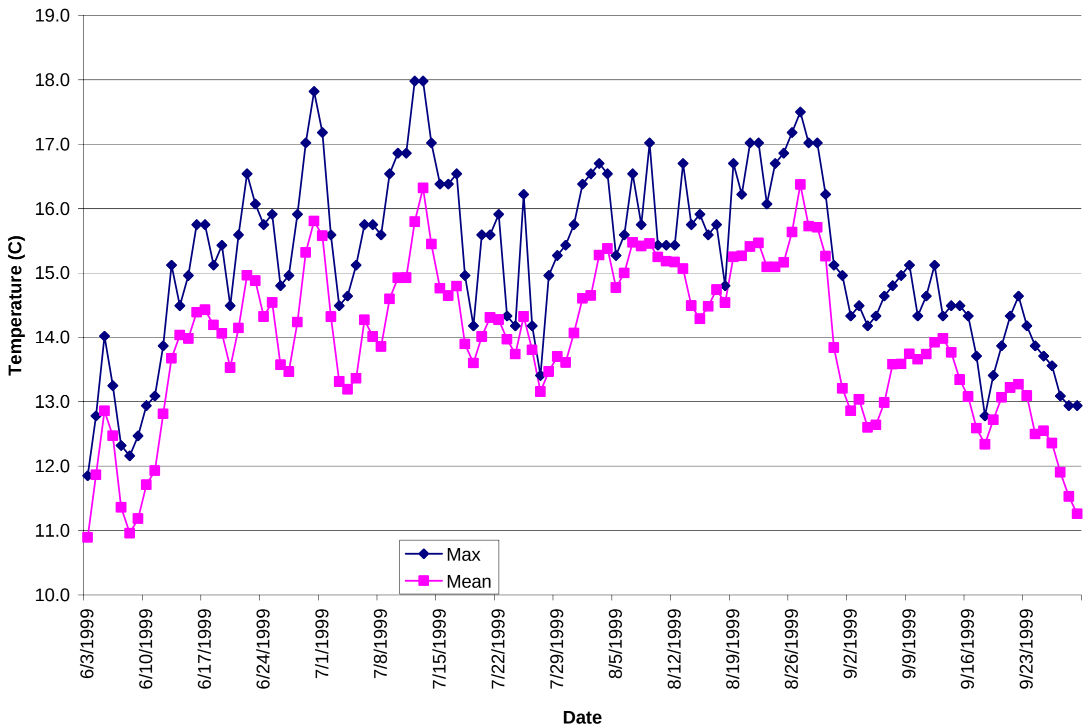


Figure 80. Mean and Maximum Daily Stream Temperatures During Summer 1999 at South Fork Albion River (Site 78-4), Mendocino County, California.

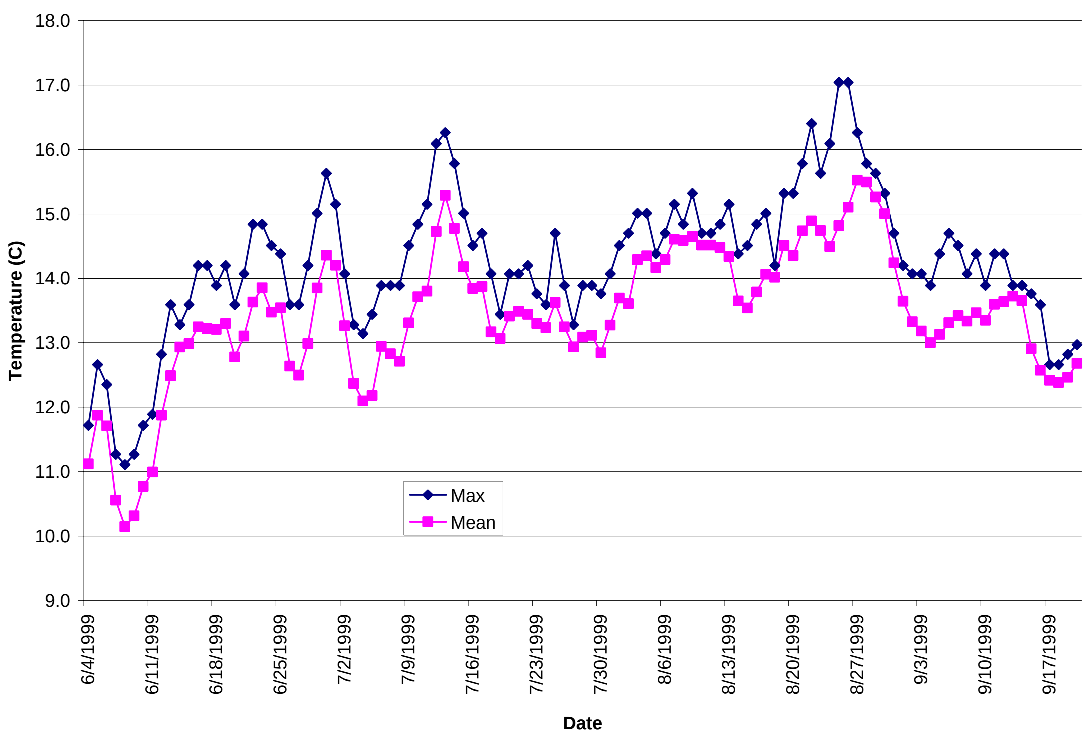


Figure 83. Mean and Maximum Daily Stream Temperatures During Summer 1999 at Albion River (Site 78-5), Mendocino County, California.

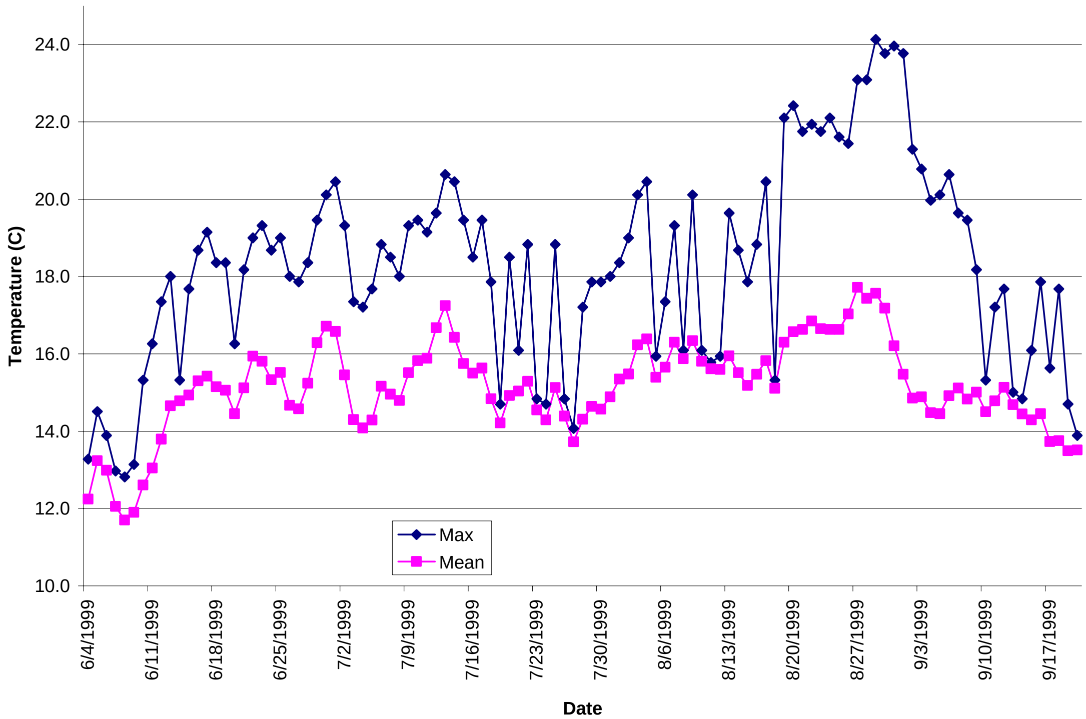


Figure 74. Mean and Maximum Daily Stream Temperatures During Summer 1997 at Albion River (Site 78-1), Mendocino County, California.

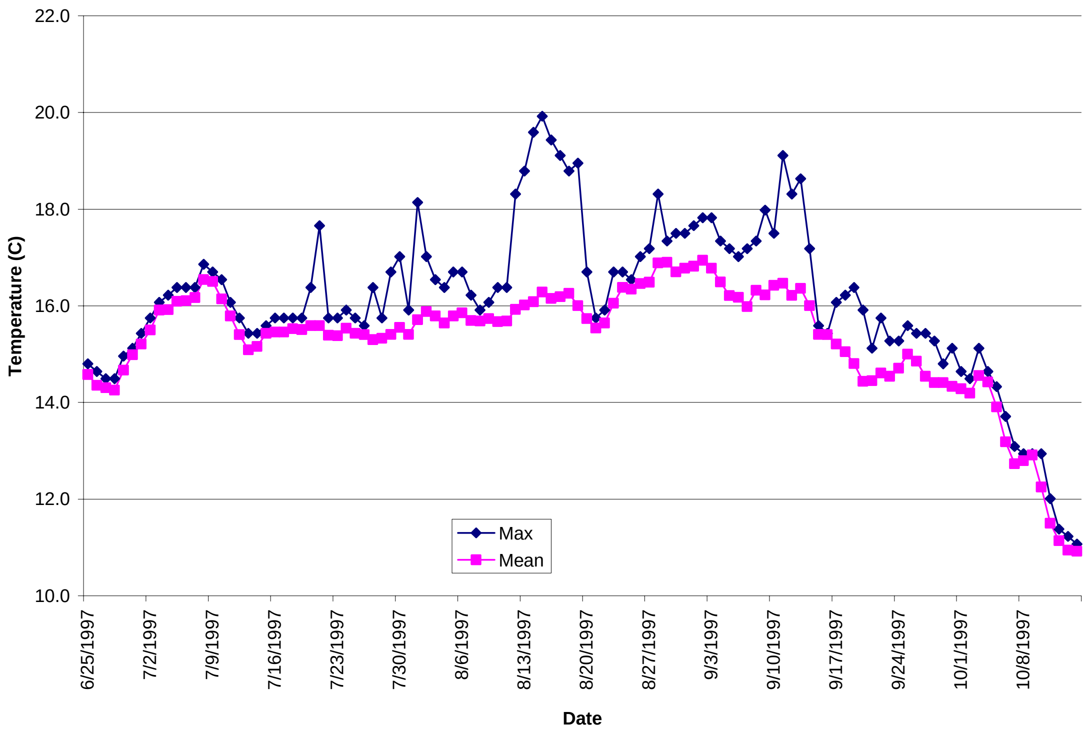


Figure 77. Mean and Maximum Daily Stream Temperatures During Summer 1997 at South Fork Albion River (Site 78-3), Mendocino County, California.

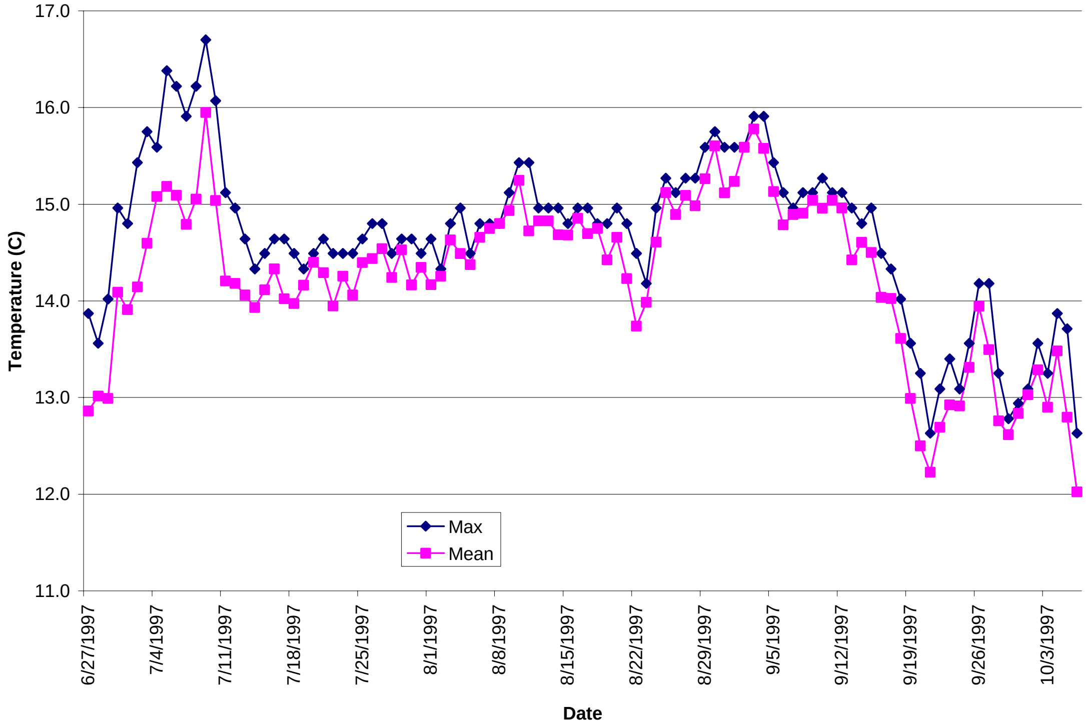


Figure 82. Mean and Maximum Daily Stream Temperatures During Summer 1997 at Albion River (Site 78-5), Mendocino County, California.

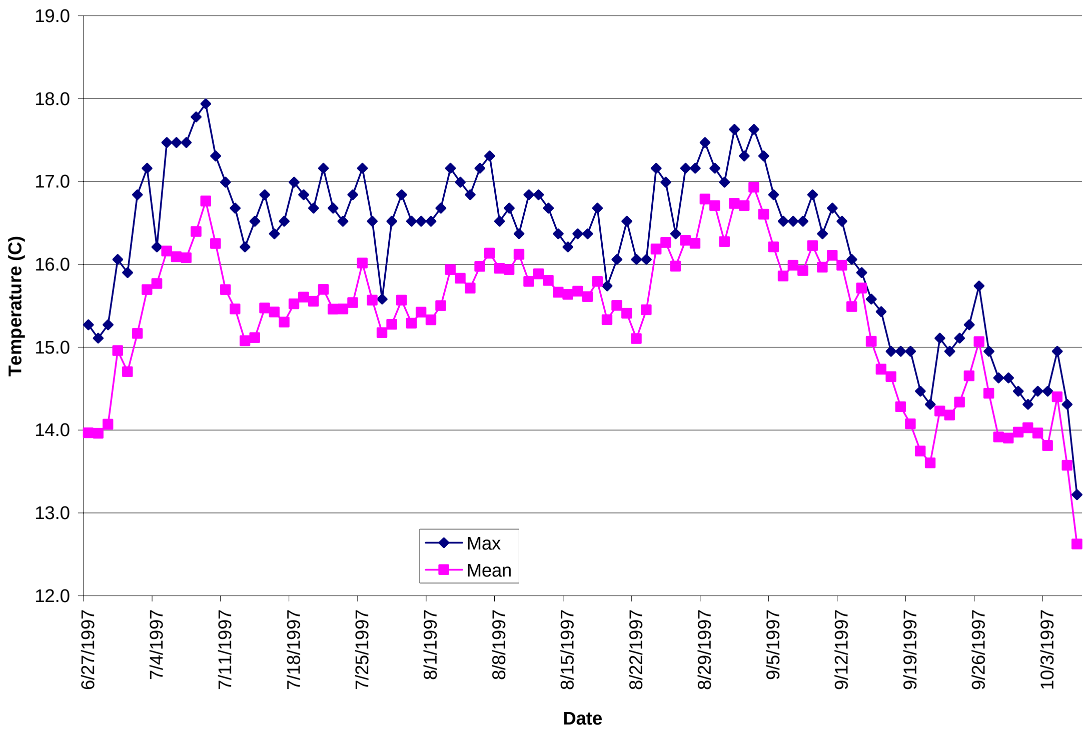


Figure 85. Mean and Maximum Daily Stream Temperatures During Summer 1997 at Albion River (Site 78-6), Mendocino County, California.

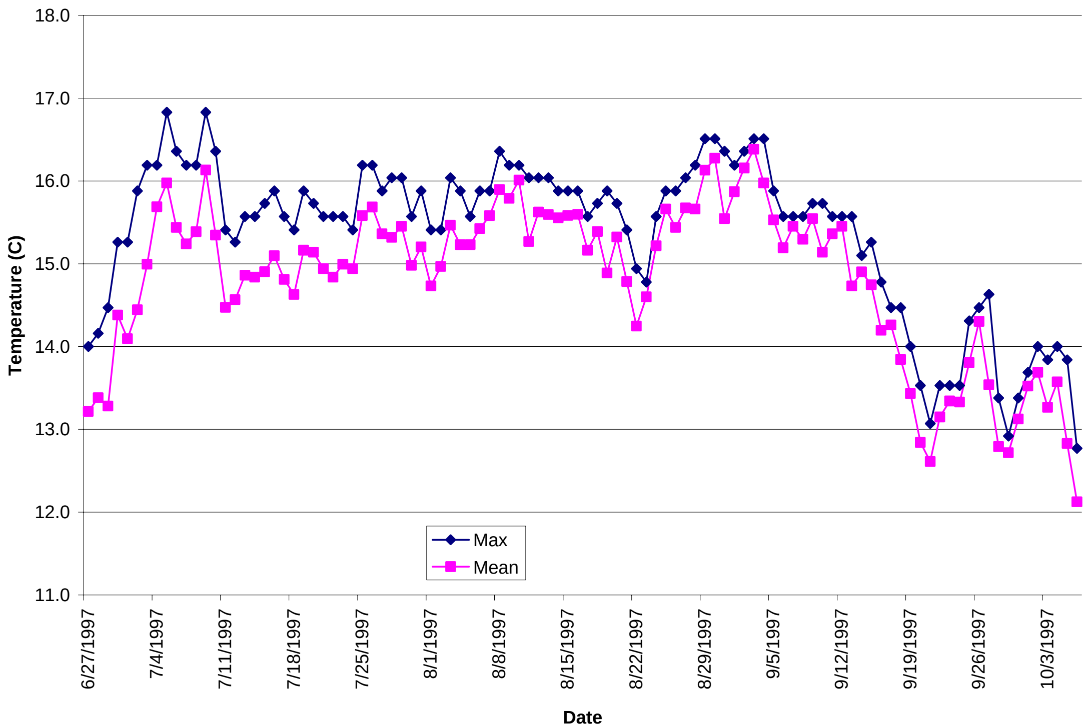


FIGURE 63. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1996) AT SOUTH FORK ALBION RIVER (MAP NO. 10; MONITORING SITE NO. 78-3), MENDOCINO CO., CALIFORNIA

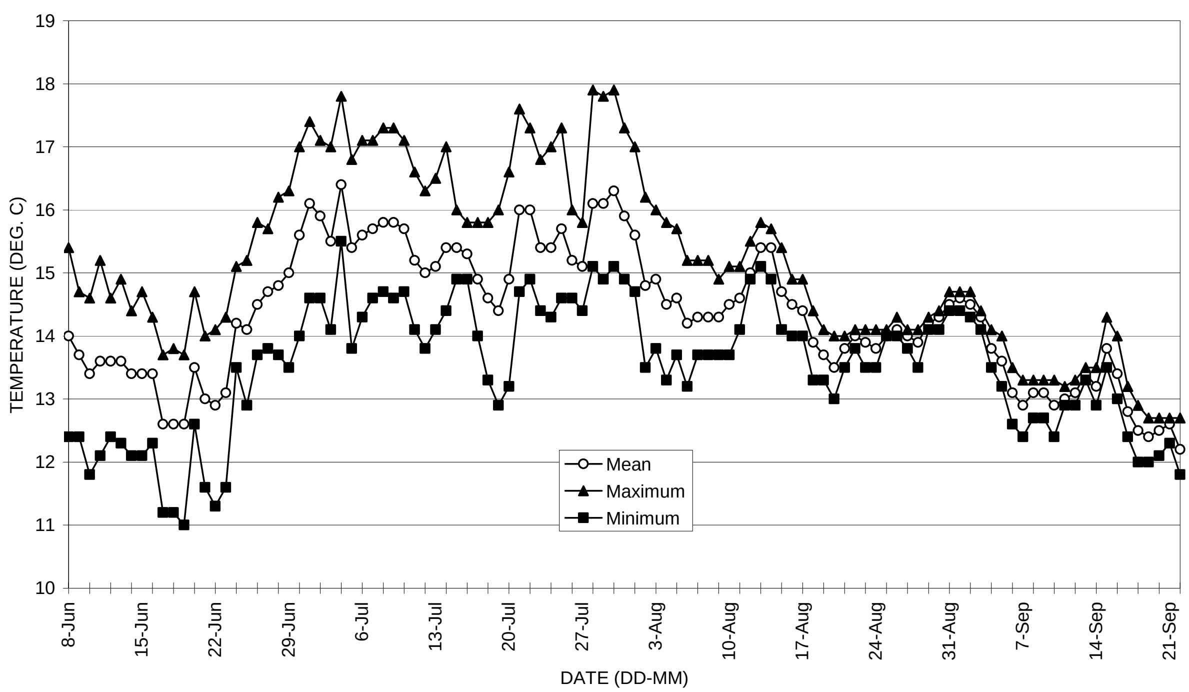


FIGURE 65. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1996) AT SOUTH FORK ALBION RIVER (MAP NO. 11; MONITORING SITE NO. 78-4), MENDOCINO CO., CALIFORNIA.

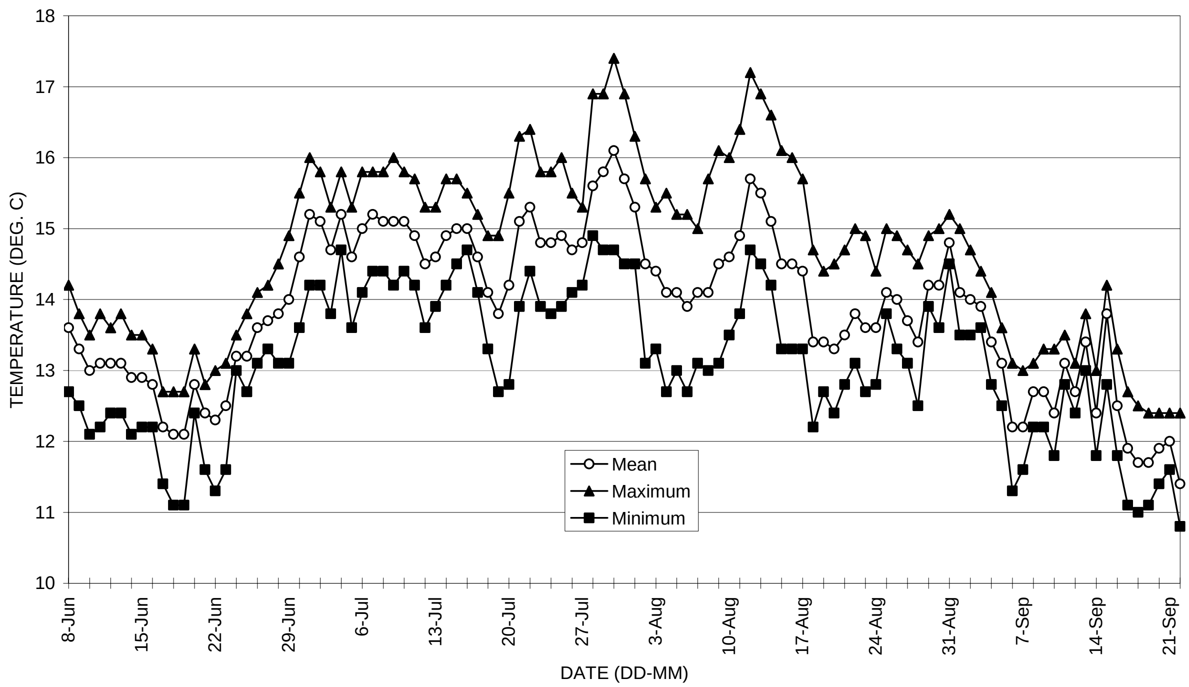


FIGURE 67. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1996) AT ALBION RIVER (MAP NO. 10; MONITORING NO.78-5). MENDOCINO CO., CALIFORNIA.

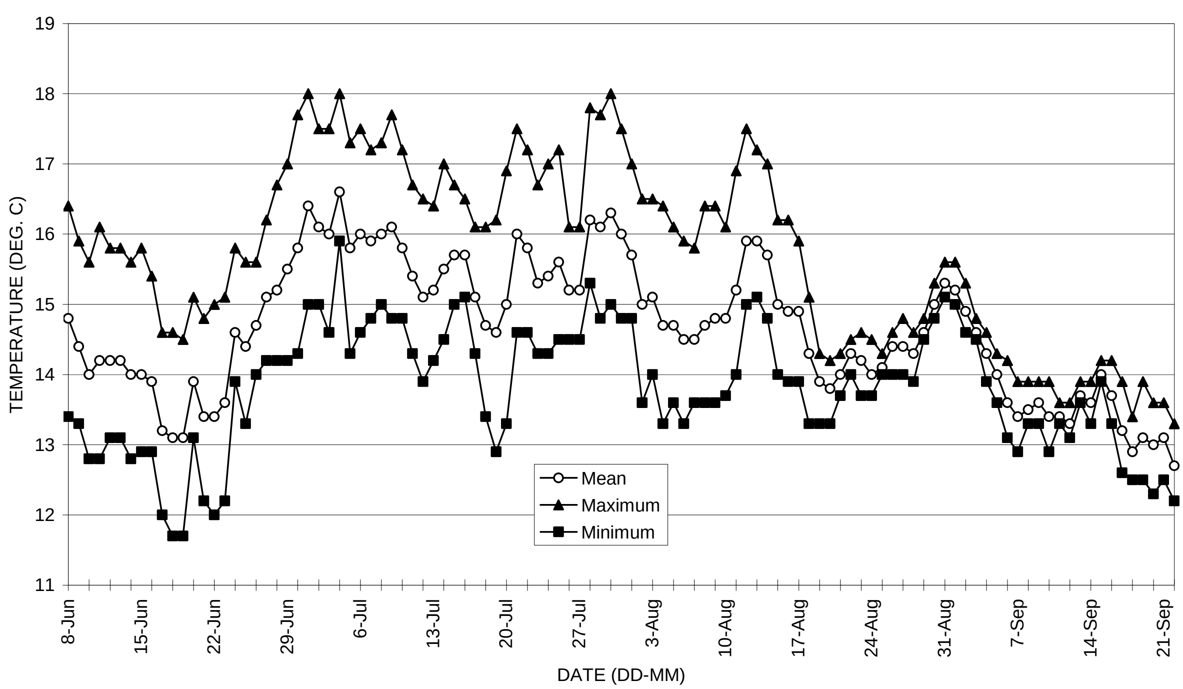


FIGURE 69. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1996) AT ALBION RIVER (MAP NO. 11; MONITORING SITE NO. 78-6), MENDOCINO CO., CALIFORNIA.

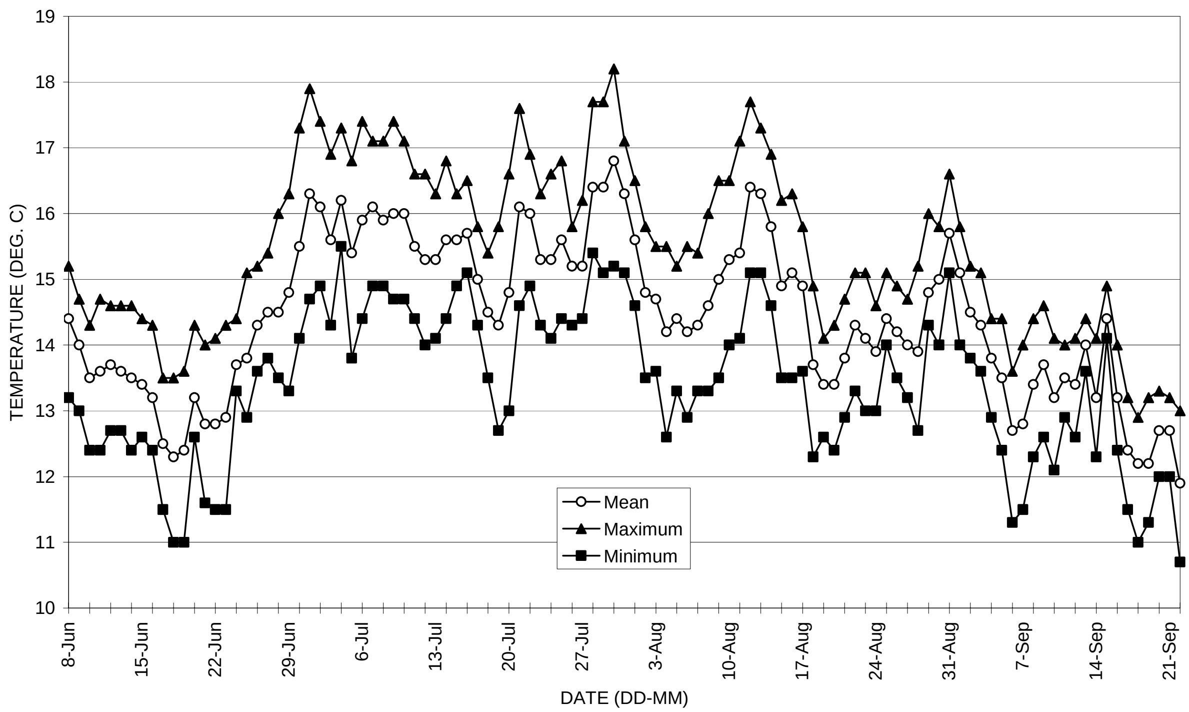


FIGURE 61. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JULY-SEPTEMBER 1995) AT ALBION RIVER (MAP NO. 10; MONITORING SITE NO. 78-1), MENDOCINO CO., CALIFORNIA.

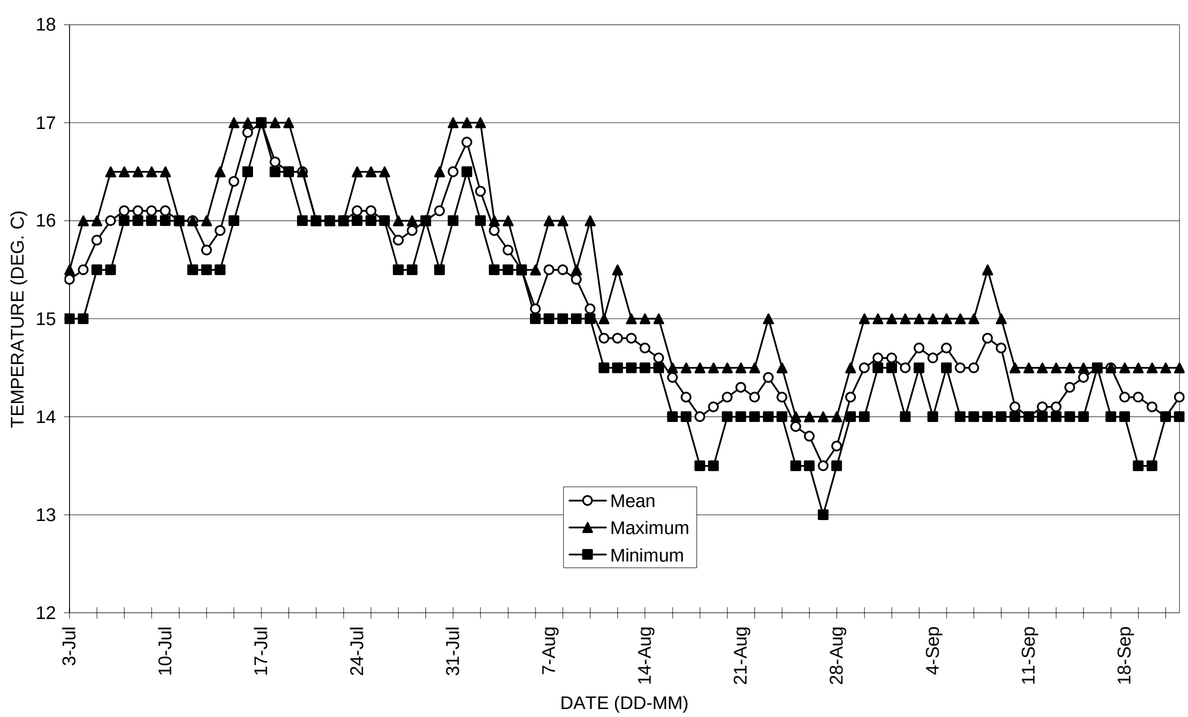


FIGURE 60. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1994) AT ALBION RIVER (MAP NO. 10 ; MONITRING SITE NO. 78-1), MENDOCINO CO., CALIFORNIA.

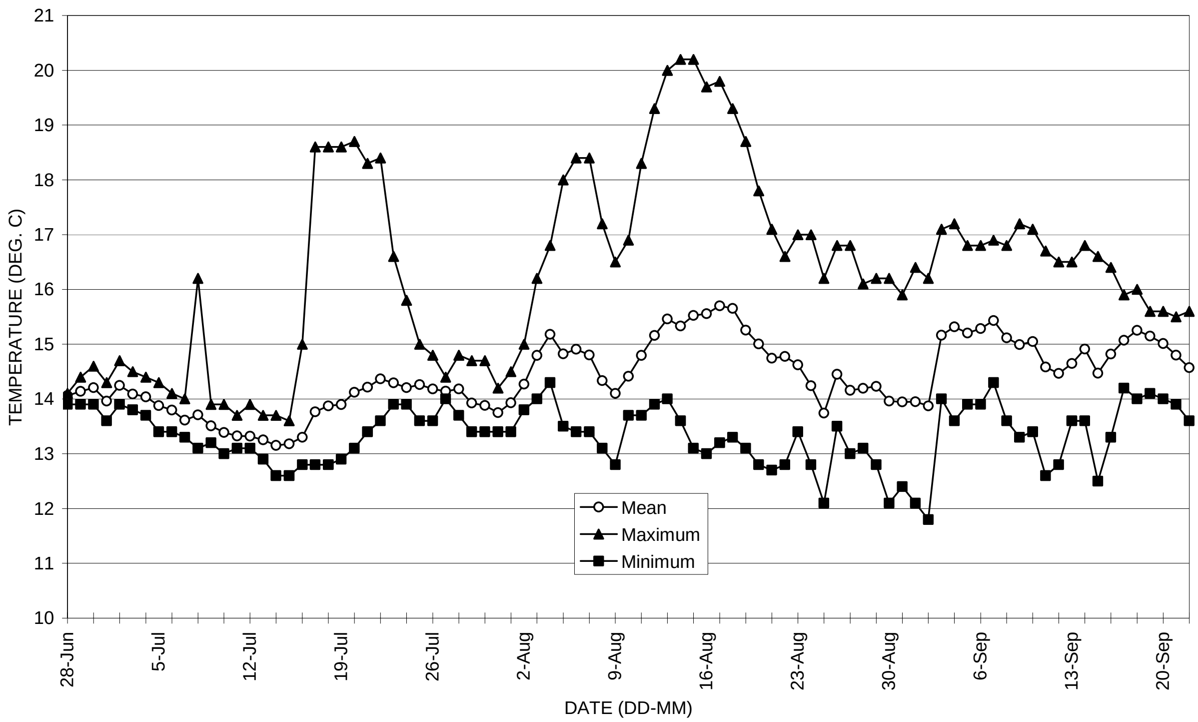


FIGURE 62. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1994) AT SOUTH FORK ALBION RIVER (MAP NO. 10; MONITORING SITE NO. 78-3), MENDOCINO CO., CALIFORNIA.

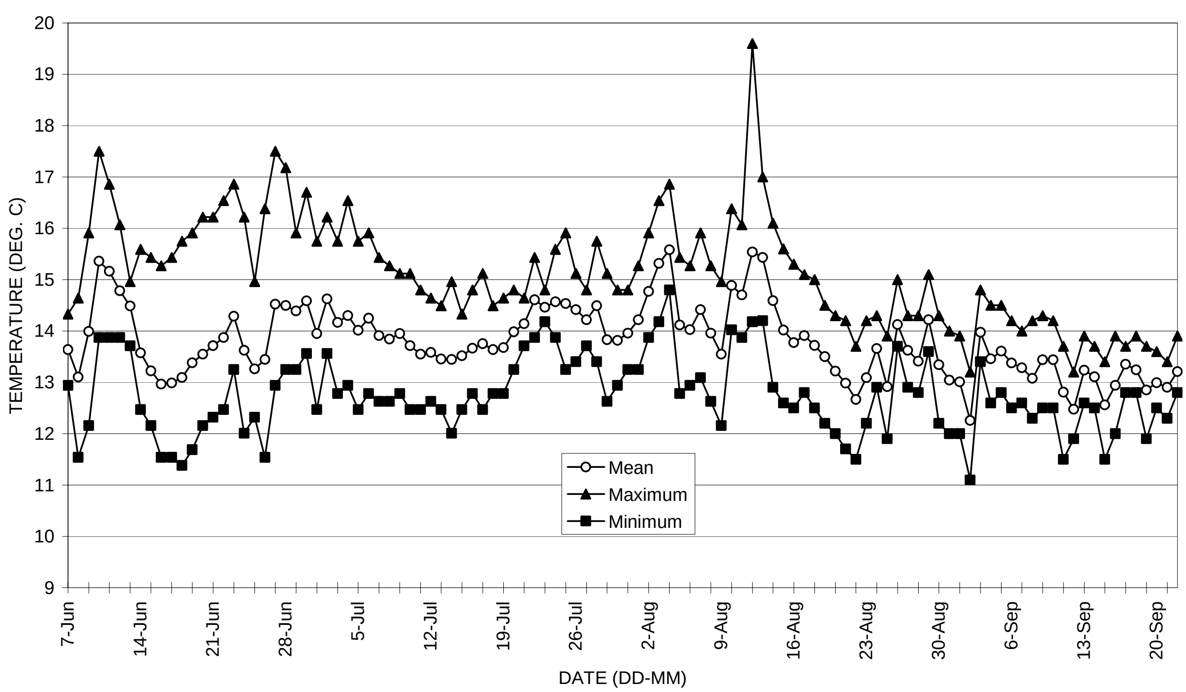


FIGURE 64. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1994) AT SOUTH FORK ALBION (MAP NO. 11; MONITORING SITE NO.78-4), MENDOCINO CO., CALIFORNIA.

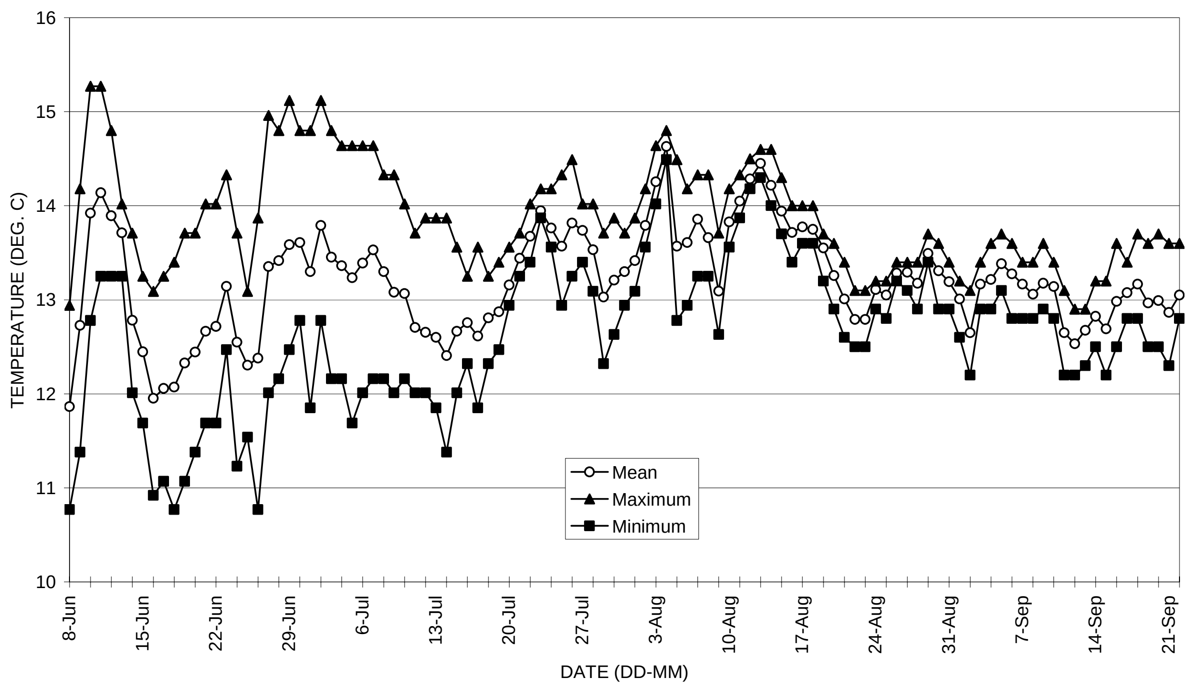


FIGURE 66. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1994) AT ALBION RIVER (MAP NO. 10; MONITORING SITE NO. 78-5), MENDOCINO CO., CALIFORNIA.

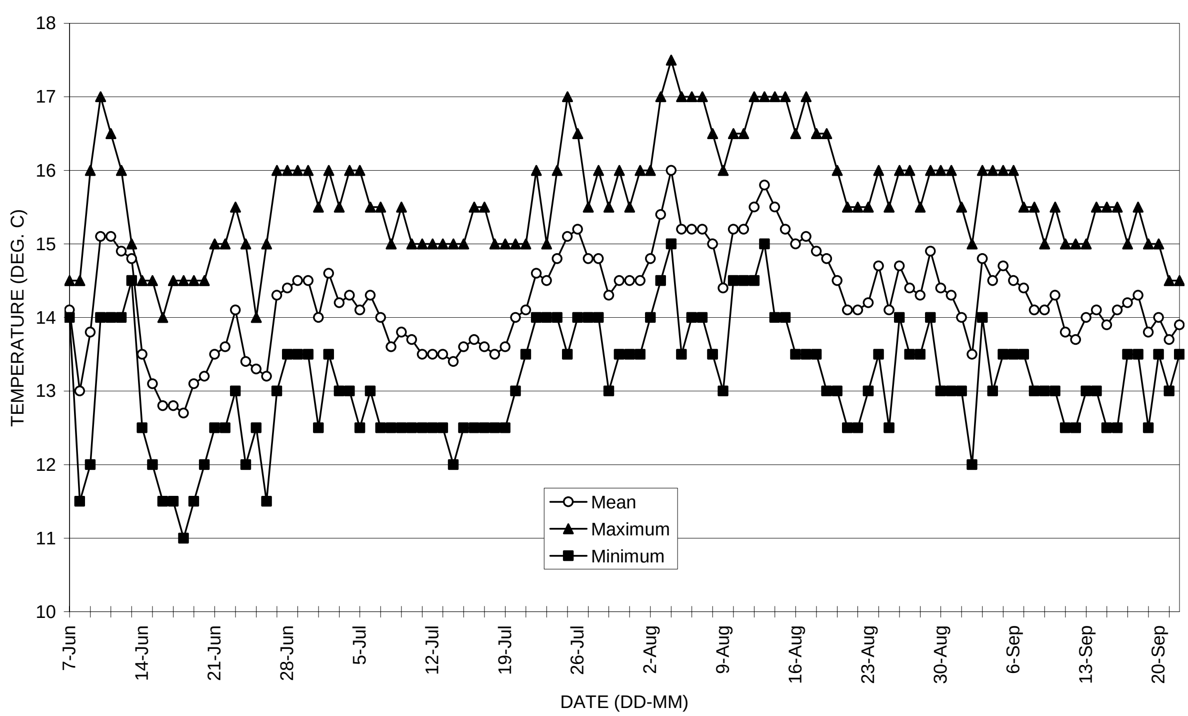


FIGURE 68. MEAN, MAXIMUM, AND MINIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1994) AT ALBION RIVER (MAP NO. 11; MONITORING SITE NO. 78-6), MENDOCINO CO., CALIFORNIA.

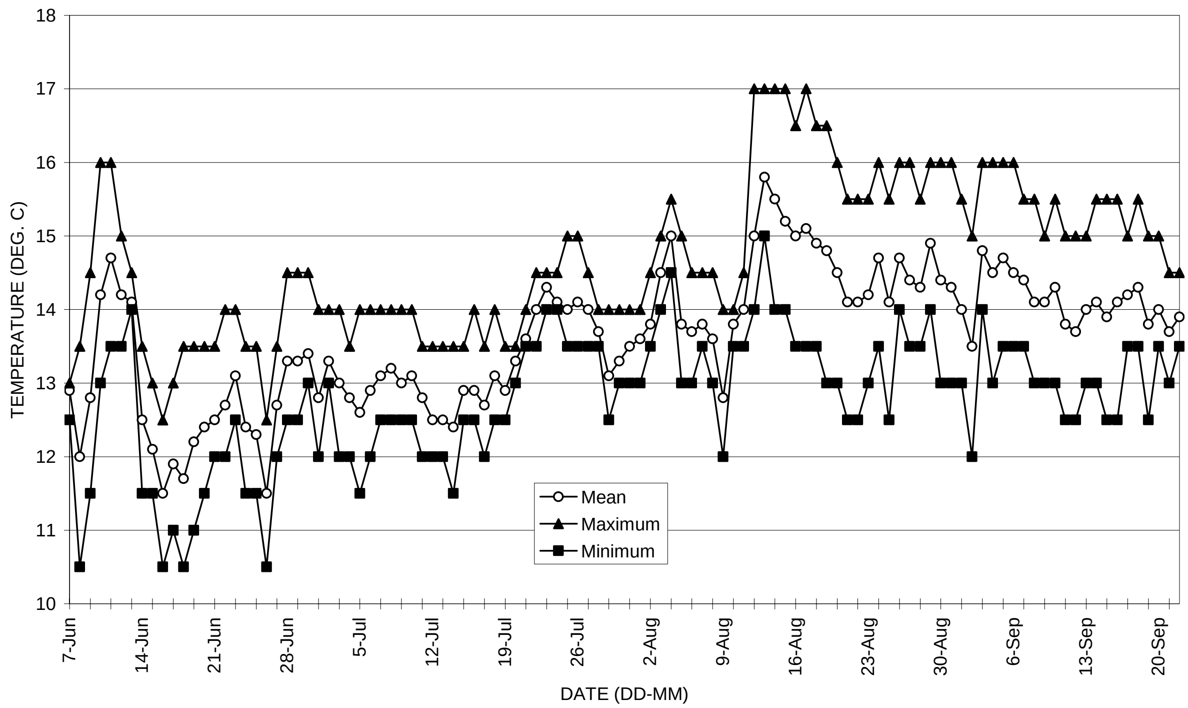


FIGURE 19. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1993) AT ALBION RIVER (MAP NO. 6; MONITORING SITE NO. 1), MENDOCINO CO., CALIFORNIA.

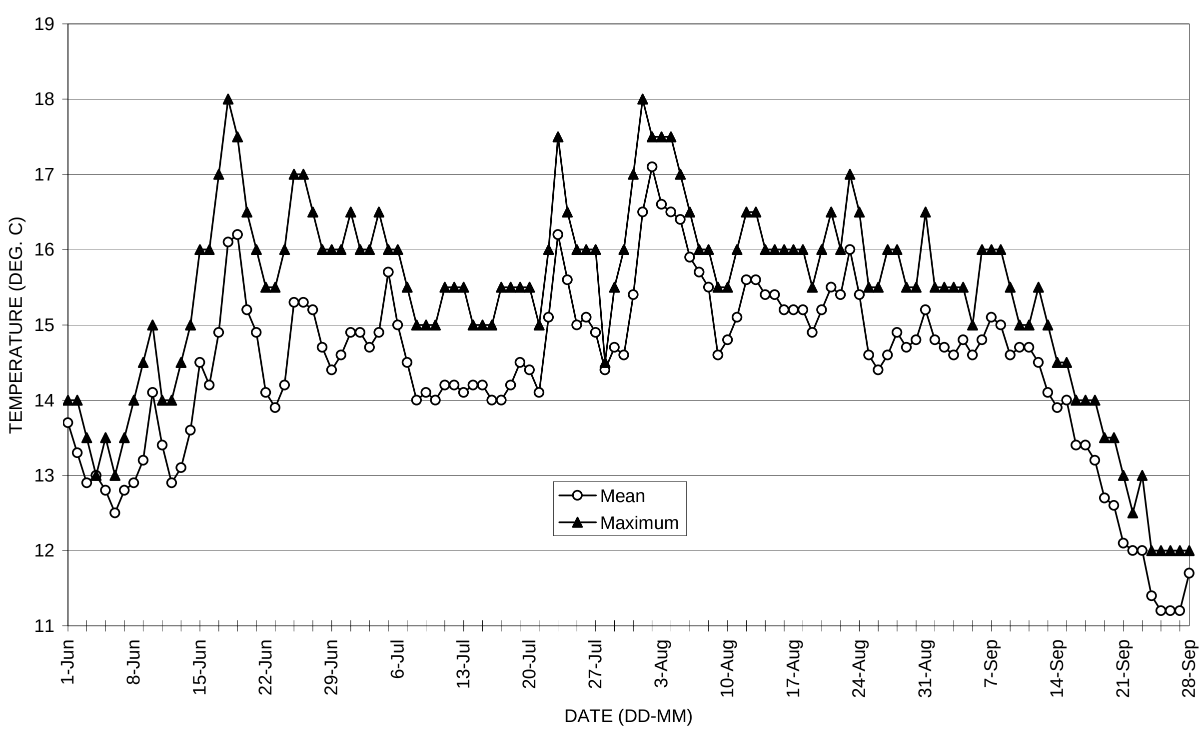


FIGURE 20. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1993) AT SOUTH FORK ALBION RIVER (MAP NO. 6; MONITORING SITE NO. 3), MENDOCINO CO., CALIFORNIA.

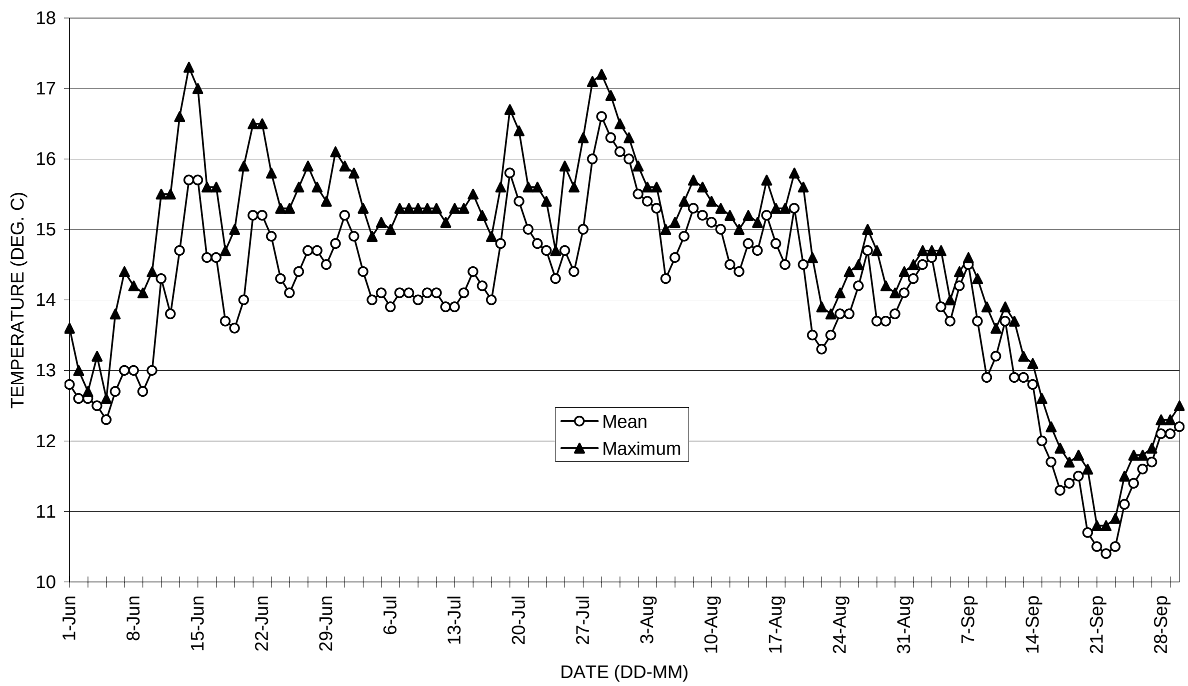


FIGURE 23. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1993) AT SOUTH FORK ALBION RIVER (MAP NO. 7; MONITORING SITE NO. 4), MENDOCINO CO., CALIFORNIA.

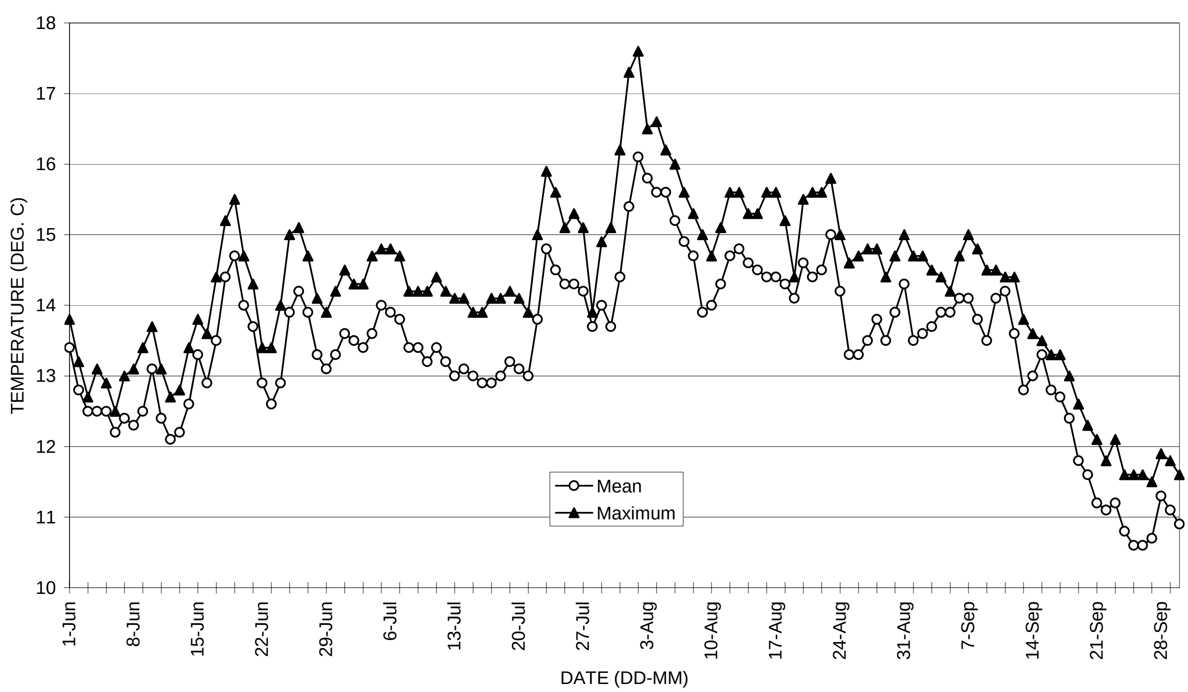


FIGURE 21. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1993) AT NORTH FORK ALBION RIVER (MAP NO. 7; MONITORING SITE NO. 2), MENDOCINO CO., CALIFORNIA.

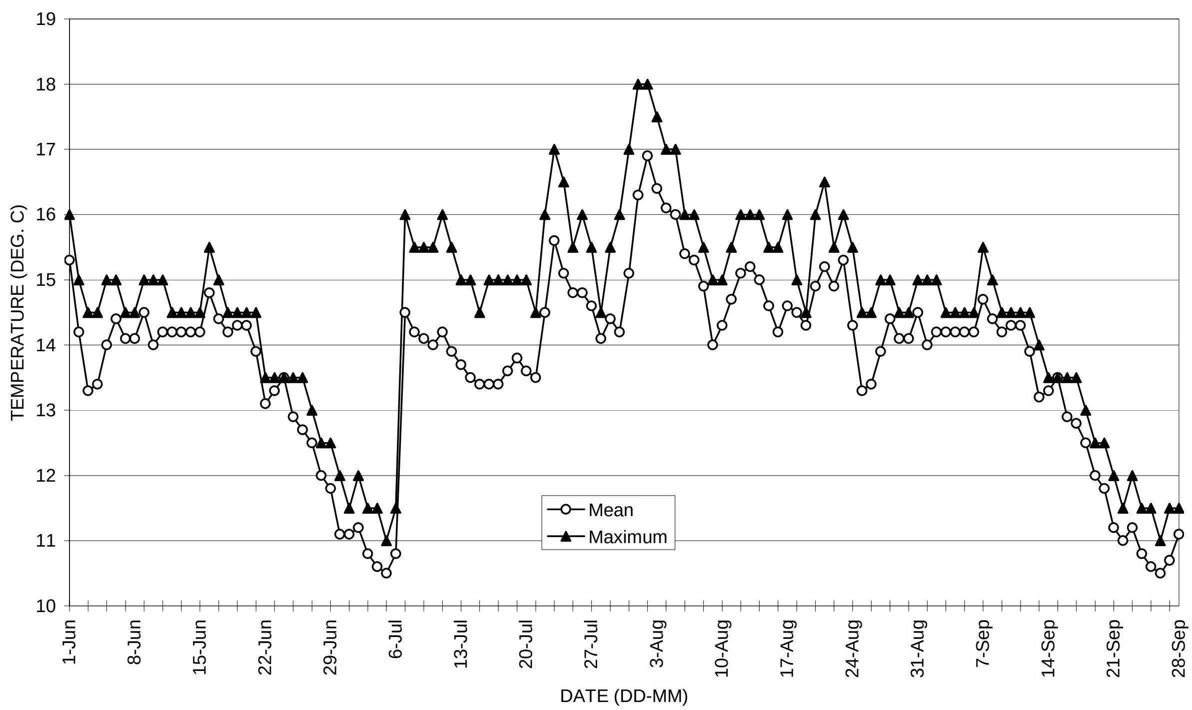


FIGURE 24. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JULY-SEPTEMBER 1993) AT RAILROAD GULCH (MAP NO. 7; MONITORING SITE NO. 7), MENDOCINO CO., CALIFORNIA.

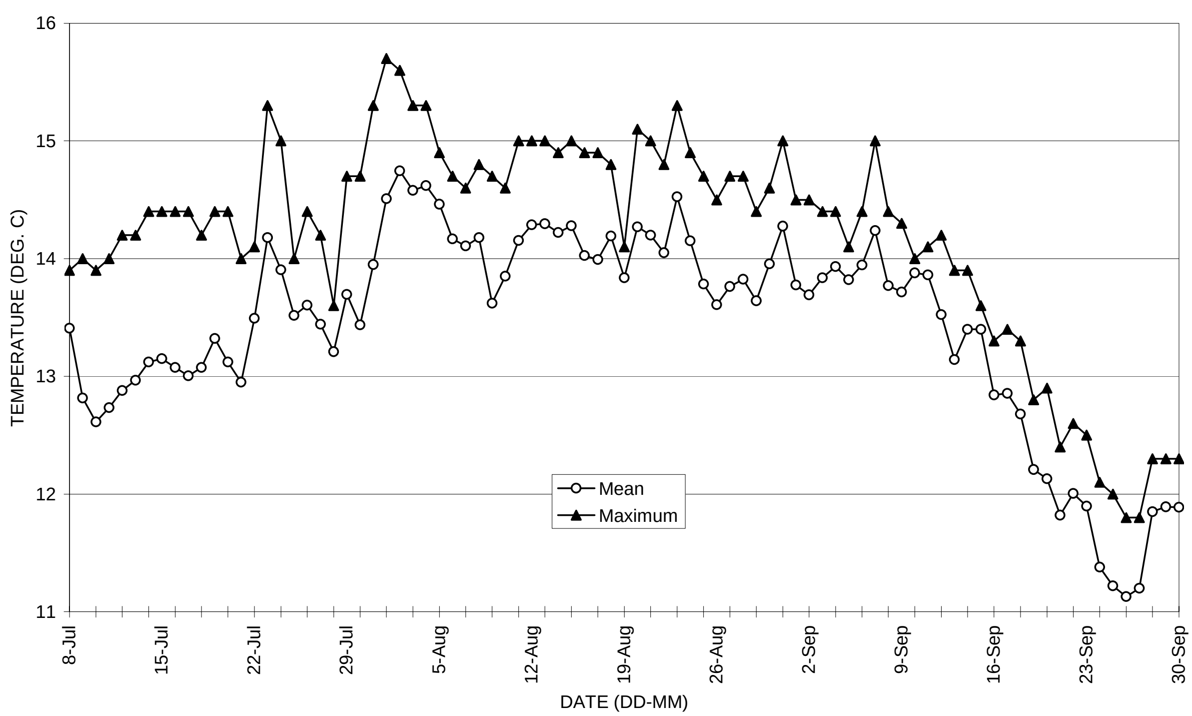


FIGURE 18. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1992) AT ALBION RIVER (MAP NO. 6; MONITORING SITE NO. 1), MENDOCINO CO., CALIFORNIA.

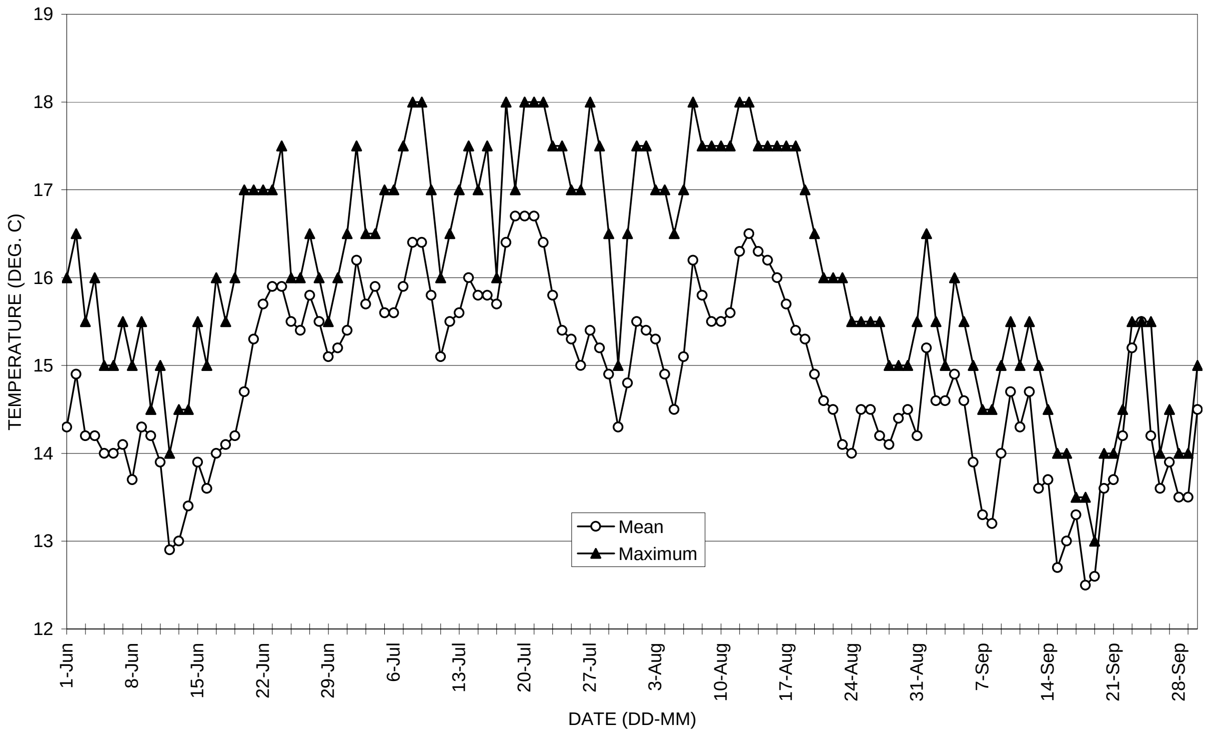
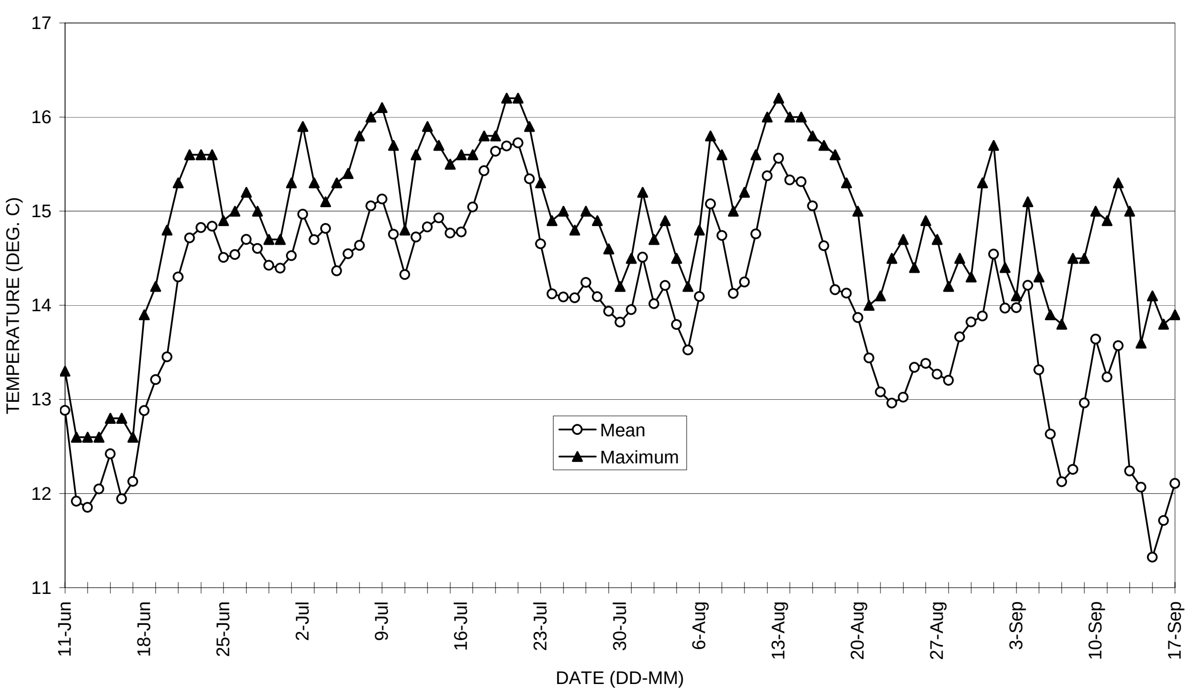


FIGURE 22. MEAN AND MAXIMUM DAILY STREAM WATER TEMPERATURES DURING SUMMER (JUNE-SEPTEMBER 1992) AT SOUTH FORK ALBION RIVER (MAP NO. 7; MONITORING SITE NO. 4), MENDOCINO CO., CALIFORNIA.



STREAM CLEARANCE PROJECT

INDIVIDUAL STREAM BARRIER DATA

MENDOCINO COUNTY COASTAL PROJECT
RIVER

STREAM ALBION RIVER

Section Classification	V	Class
Classification Rate Cost/Mile	$80.00	/Mile
Miles of Stream to be Improved	14.00	Miles
Travel Time/Day	2	Hours
Travel Time Rate Cost/Mile	$30.06	/Mile
Equipment Cost/Mile	$20.00	/Mile

Section Classification		Class
Classification Rate Cost/Mile		/Mile
Miles of Stream to be Improved		Miles
Travel Time/Day		Hours
Travel Time Rate Cost/Mile		/Mile
Equipment Cost/Mile		/Mile

Stream Clearance Cost	1120.00
Equipment Rental Cost	280.00
Travel Time Cost	420.84
ESTIMATED TOTAL STREAM CLEARANCE COSTS	1820.84

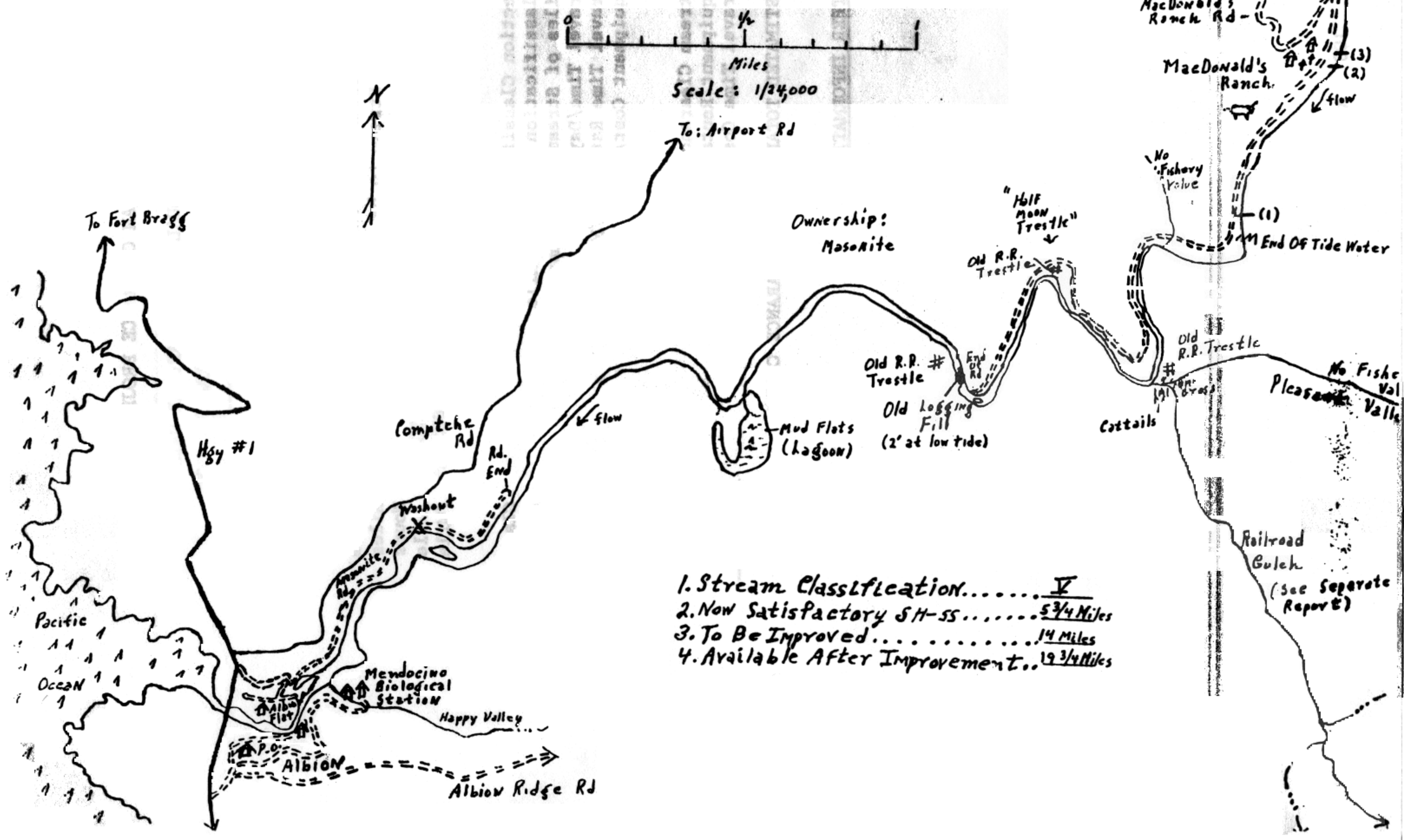
OTHER INFORMATION

40011
40010

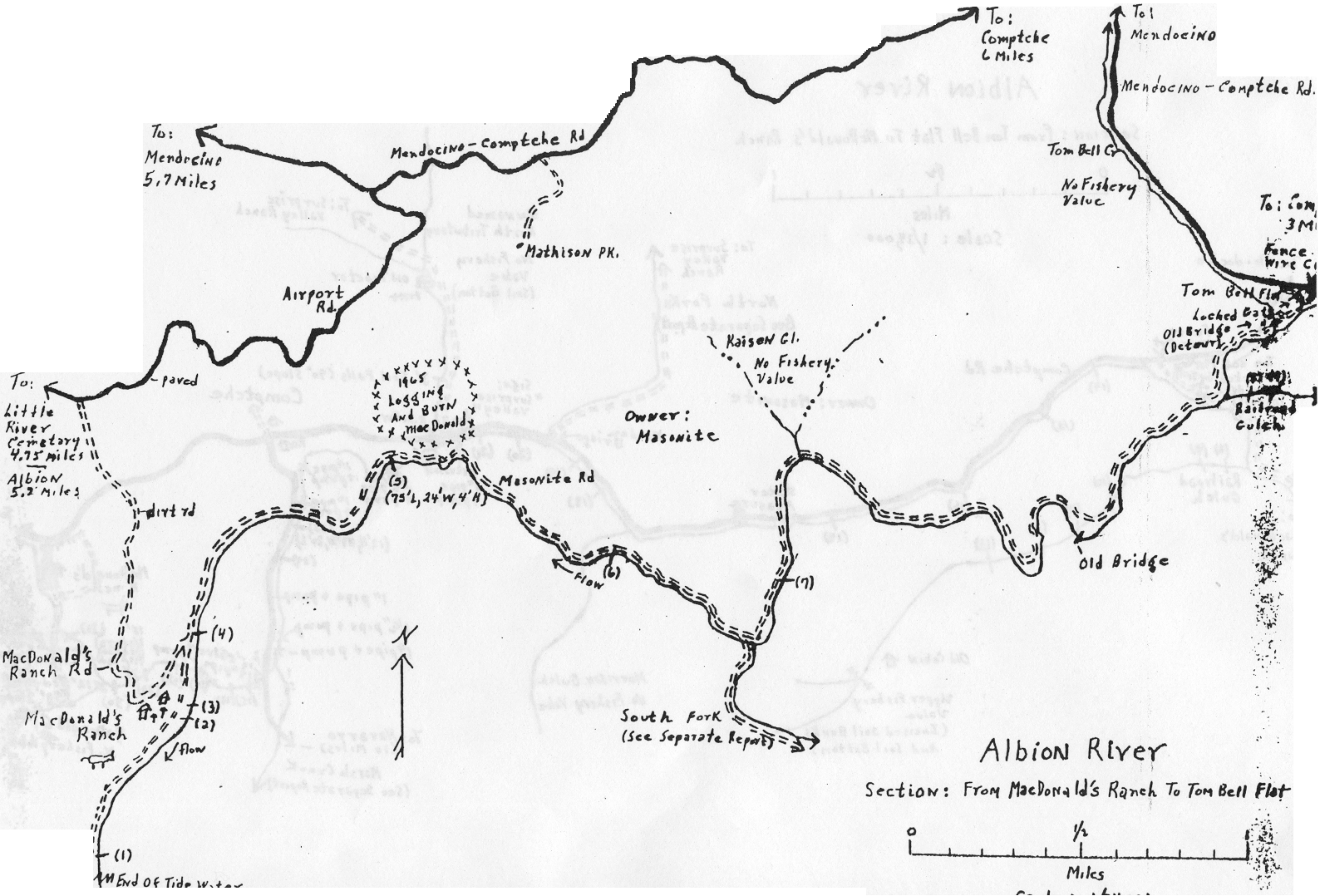
WWAA 78 13.40013

Albion River

Sections: From Mouth To MacDonald's Ranch

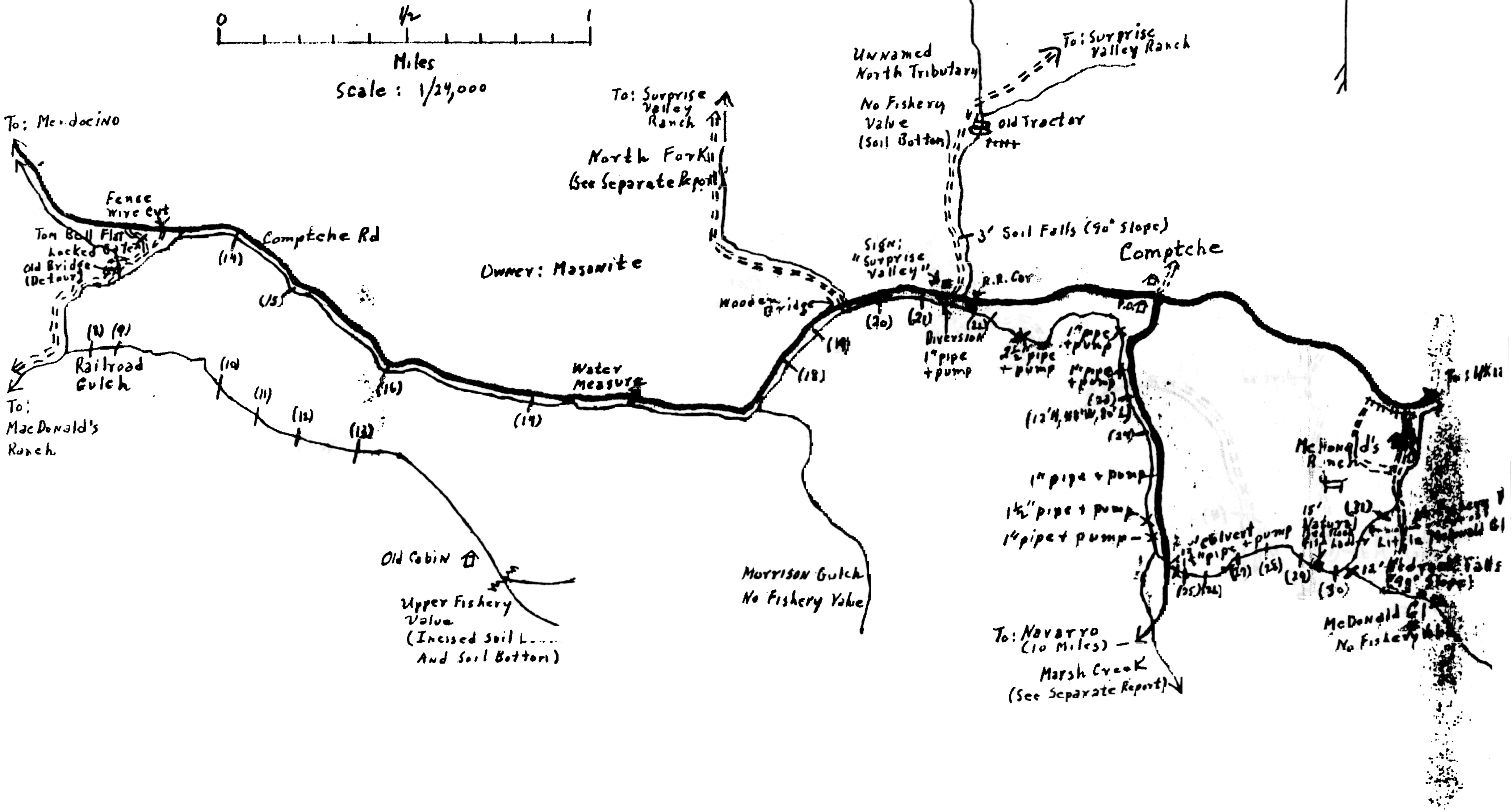


1. Stream Classification....... V
2. Now Satisfactory SH-SS....... 5 3/4 Miles
3. To Be Improved............ 14 Miles
4. Available After Improvement.. 19 3/4 Miles


To: Comptche 6 Miles
To: Mendocino
Mendocino - Comptche Rd.
To: Mendocino 5.7 Miles
Mendocino - Comptche Rd
Tom Bell Cr
No Fishery Value
Mathison PK.
Airport Rd.
To: Little River Cemetary 4.75 miles
Albion 5.2 Miles
paved
dirt rd
1965 Logging And Burn MacDonald
Owner: Masonite
Kaisen Gl.
No Fishery Value
Masonite Rd
(5)
(75'L, 24'W, 4'H)
(6)
Flow
(7)
(4)
(3)
(2)
(1)
MacDonald's Ranch Rd
MacDonald's Ranch
flow
End Of Tide Water
South Fork (See Separate Report)
Old Bridge
Old Bridge (Detour)
Locked Gate
Tom Bell Flat
Railroad Gulch
N
Albion River
Section: From MacDonald's Ranch To Tom Bell Flat
0
1/2
Miles

Albion River

Section: From Tom Bell Flat To McDonald's Ranch



A.bion River

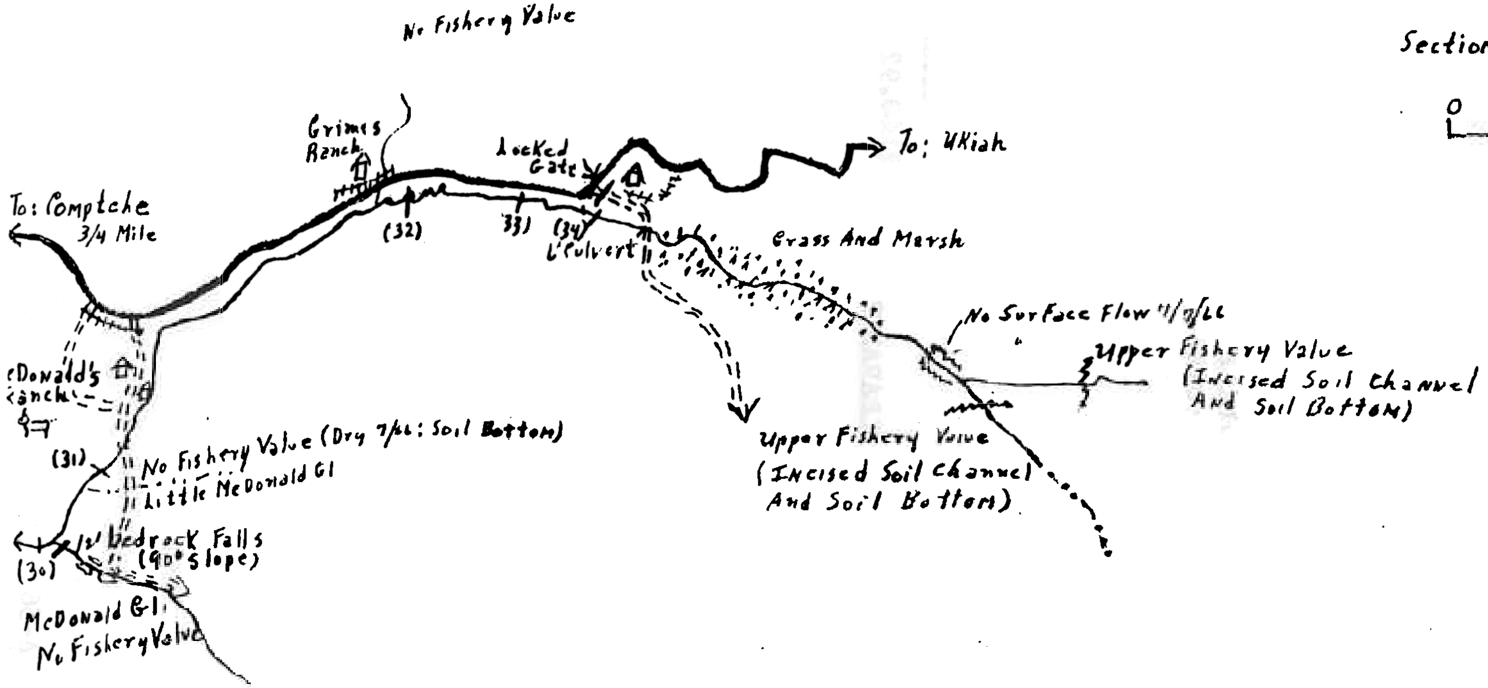
Section: From McDonald's Ranch To Headwaters

0 1/2 1

Miles

Scale: 1/24,000

N



STREAM CLEARANCE PROJECT

INDIVIDUAL STREAM BARRIER DATA

NORTH FORK ALBION RIVER RIVER

STREAM NORTH FORK ALBION RIVER

Section Classification	V Class
Classification Rate Cost/Mile	$80.00 /Mile
Miles of Stream to be Improved	1.00 Miles
Travel Time/Day	2.5 Hours
Travel Time Rate Cost/Mile	40.92 /Mile
Equipment Cost/Mile	20.00 /Mile

Section Classification	Class
Classification Rate Cost/Mile	/Mile
Miles of Stream to be Improved	Miles
Travel Time/Day	Hours
Travel Time Rate Cost/Mile	/Mile
Equipment Cost/Mile	/Mile

Stream Clearance Cost	80.00
Equipment Rental Cost	20.00
Travel Time Cost	40.92
ESTIMATED TOTAL STREAM CLEARANCE COSTS	$140.92

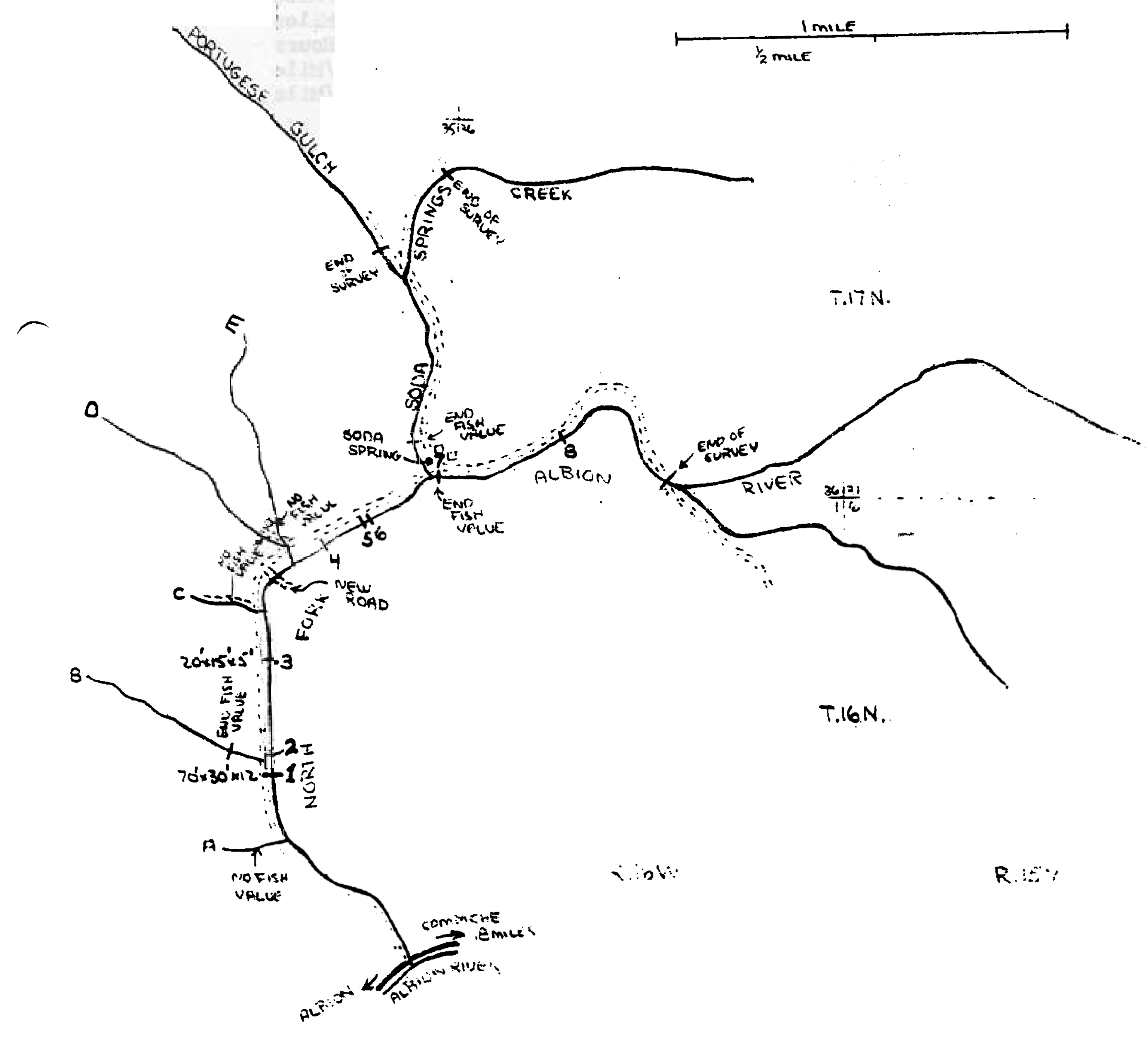
OTHER INFORMATION

STREAM CLASSIFICATION	V
NOW SATISFACTORY	.75
TO BE IMPROVED	1.00
TOTAL AFTER IMPROVEMENT	1.75

WWAA 78 113.40011

NORTH FORK ALBION RIVER

SCALE 1-24000



STREAM CLEARANCE PROJECT

INDIVIDUAL STREAM BARRIER DATA

Mendocino County Coastal Streams RIVER

STREAM South Fork Albion River

Section Classification	V	Class
Classification Rate Cost/Mile	$80.00	/Mile
Miles of Stream to be Improved	5.75	Miles
Travel Time/Day	2.5	Hours
Travel Time Rate Cost/Mile	40.92	/Mile
Equipment Cost/Mile	20.00	/Mile

Section Classification		Class
Classification Rate Cost/Mile		/Mile
Miles of Stream to be Improved		Miles
Travel Time/Day		Hours
Travel Time Rate Cost/Mile		/Mile
Equipment Cost/Mile		/Mile

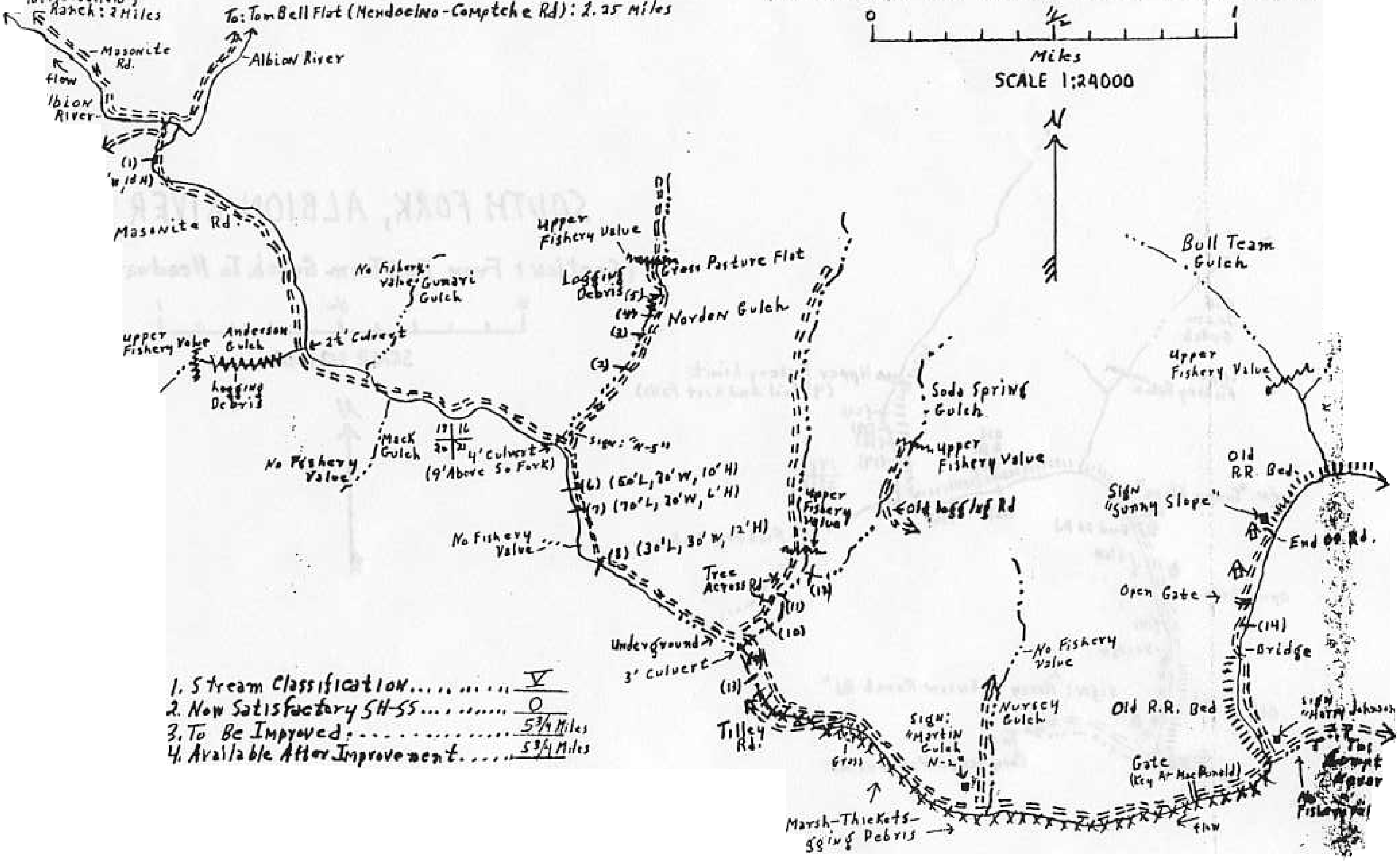
Stream Clearance Cost	460.00
Equipment Rental Cost	115.00
Travel Time Cost	235.29
ESTIMATED TOTAL STREAM CLEARANCE COSTS	$810.29

OTHER INFORMATION

WWAA 7 3 40012

SOU H FORK A B ON RIVER

(Section: From Mouth To Bull Team Gulch)



1. Stream Classification.......... V
2. Now Satisfactory SH-SS.......... 0
3. To Be Improved.................. 5 3/4 Miles
4. Available After Improvement..... 5 3/4 Miles

SOUTH FORK, ALBION RIVER

(Section: From Bull Team Gulch To Headwaters)