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ASSESSMENT OF THE MIDDLE FORK SAN JOAQUIN RIVER TROUT FISHERY
WITHIN THE DEVILS POSTPILE NATIONAL MONUMENT

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ABSTRACT

Trout populations sampled in the Devils Postpile National Monument (Monument) between 1986 and 1991 averaged 5,455 fish/mile. Combined brown, rainbow, and brook trout populations ≥ 6 inches ranged from 1,194 to 4,736 fish/mile. During a 1988 creel survey, anglers fished an estimated 9,222 hours and caught 12,902 trout at an averaged rate of 1.40 trout/hour. Wild brown, rainbow, and brook trout comprised 49%, 29%, and 11% of the catch. Stocked rainbow migrating downstream into the Monument accounted for the remaining 11% of the catch. Comparisons are made with other California fisheries. The stream within the Monument is recommended for inclusion in the statewide Wild Trout Program.

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TABLE OF CONTENTS

	Page
INTRODUCTION	4
DESCRIPTION OF THE STUDY AREA	4
Location of the Monument	4
Access and Accommodations	6
The Monument	8
Stream Habitat	8
Wild Trout Fishery	11
METHODS	11
Fish Population Surveys	11
Creel Survey	14
RESULTS AND DISCUSSION	16
Trout Population Surveys	16
Trout Densities	16
Trout Biomass	17
Densities of 6-inch and Larger Trout	19
Comparisons with Other West Slope Streams	19
Creel Survey	22
Estimated Total Angling Effort and Success	22
Angling Effort and Success by Month	22
Comparison of Angling Effort and Success by Section.	24
Section 1	24
Section 2	24
Section 3	24
Section 4	27
Comparison of Angling Effort and Success by	
Angling Method	27
Bait Anglers	27
Lure Anglers	29
Fly Anglers	29
Lengths of Trout Caught	29
Anglers' Area of Residence	31
Comparisons with Other California Trout Streams	31
CATCH-AND-RELEASE ANGLING REGULATIONS	31
RECOMMENDATIONS	34
ACKNOWLEDGMENTS	36
REFERENCES	37
APPENDICES	38-44

INTRODUCTION

In 1971, the California Fish and Game Commission directed the California Department of Fish and Game (Department) to initiate a program to identify, designate, manage, and protect streams capable of producing quality wild trout angling^{5/}. In 1986, the Department, as part of a statewide inventory to identify potential quality wild trout fisheries, surveyed trout populations in the upper Middle Fork San Joaquin River. The initial survey included a river reach within the Monument and a trailside reach further upstream. Trout densities in both reaches were high, resulting in the Middle Fork being classified as a stream warranting further study.

During the next five years, three additional trout population monitoring sites were established and a season-long creel survey was conducted. The follow-up surveys in the Monument were done in cooperation with Wymond Eckhardt, Monument Ranger and Superintendent. This report describes the fishery, presents results of the Department's fishery assessment, discusses the potential use of catch-and-release angling regulations, and makes general management recommendations.

Because the Monument is administered as a distinct area, and managers and visitors desire information on that specific area, this report is limited to the fishery within the Monument. Results from the trailside reach above the Monument are presented in a separate report entitled "Assessment of the Wild Trout Fishery in the Upper Middle Fork San Joaquin River" (Deinstadt et al. 1995).

DESCRIPTION OF THE STUDY AREA

Location of the Monument

The Monument is located in the east central Sierra Nevada about 7 miles west of the community of Mammoth Lakes and approximately 20 miles south of Mono Lake. Bishop, the largest community in the area, is about 40 miles to the southeast (Figure 1).

^{5/} Quality wild trout angling is defined as ... "an opportunity to fish in aesthetically pleasing and environmentally productive waters over trout populations whose numbers and sizes are largely unaffected by the angling process" (Page 522, California Fish and Game Code).

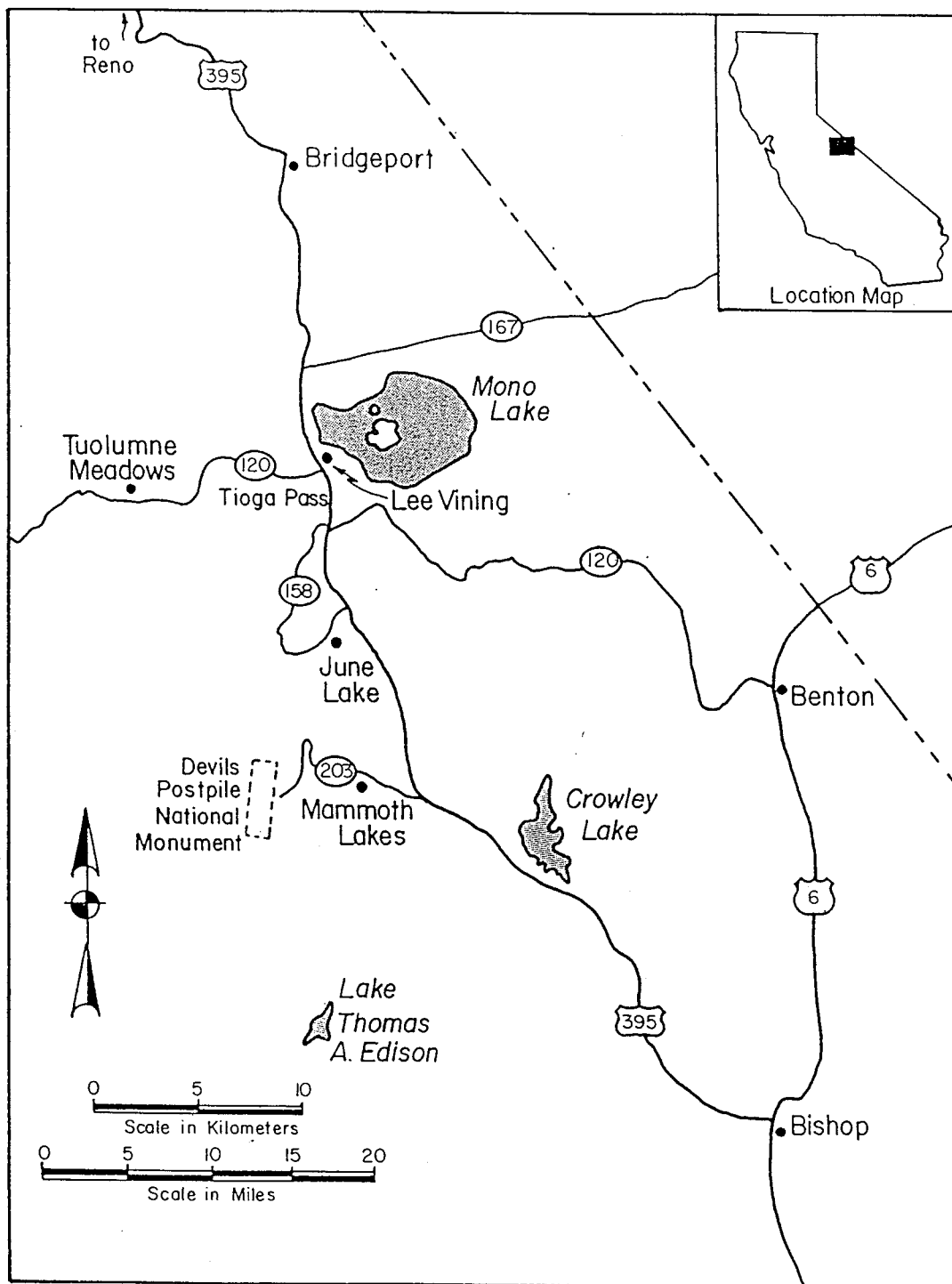


FIGURE 1. General location and access to the Devils Postpile National Monument.

Access and Accommodations

The Monument is accessible from U.S. Highway 395, which parallels the east slope of the Sierras from Reno to the southern end of the range below Bishop (Figure 1). State Route 203 connects U.S. 395 to the community of Mammoth Lakes and continues west past the Mammoth Mountain Ski Resort to the top of Minaret Summit. From this point, the Minaret Summit Road drops down into the valley of the Middle Fork San Joaquin River and dead ends at Reds Meadow. A short spur road just above the Meadow leads to the Ranger Station and other facilities forming the Monument Headquarters.

Minaret Summit Road generally opens in June. The upper 3 miles are steep and narrow, requiring downhill drivers to yield to uphill traffic. To reduce the number of vehicles on the road, a shuttle service has been established. From a parking area at the Mammoth Mountain Ski Resort, the shuttle provides transportation to and from the Monument and Reds Meadow with stops at each of the other points of interest along the way. Shuttle service is excellent requiring no more than a 15- to 20-minute wait between rides.

The 3.6-mile study reach of the Middle Fork lies mostly within the Monument. Major access points to this reach of stream are the parking lots at the Ranger Station and Rainbow Falls Trailhead near Reds Meadow (Figure 2). A trail from the Ranger Station runs the full length of the study reach to Lower Falls, just beyond the southern boundary of the Monument.

Three trails from the Rainbow Falls Trailhead connect to the main trail (Figure 2). One lateral trail diagonals northwest to the Devils Postpile, another diagonals southwest toward Rainbow Falls, and a third, the well-known John Muir Trail (Trail), runs west crossing the river in about the middle of the study reach. A second bridge, approximately 1/4-mile below the Ranger Station, provides access to the west side of the river.

Most anglers access the river from the main parking area near the Ranger Station. The trail south runs close to the river for about the first 1/2-mile, then follows a route to the east of the stream (Figure 2). Above Rainbow Falls, the trail again comes near the river and remains close until its terminus at Lower Falls. Except for a series of stairs below Rainbow Falls, little change in elevation occurs along the trail.

Anglers who desire more solitude may access the river near the Trail crossing. Access just below the Devils Postpile is treacherous, as the stream drops into a sheer-walled gorge.

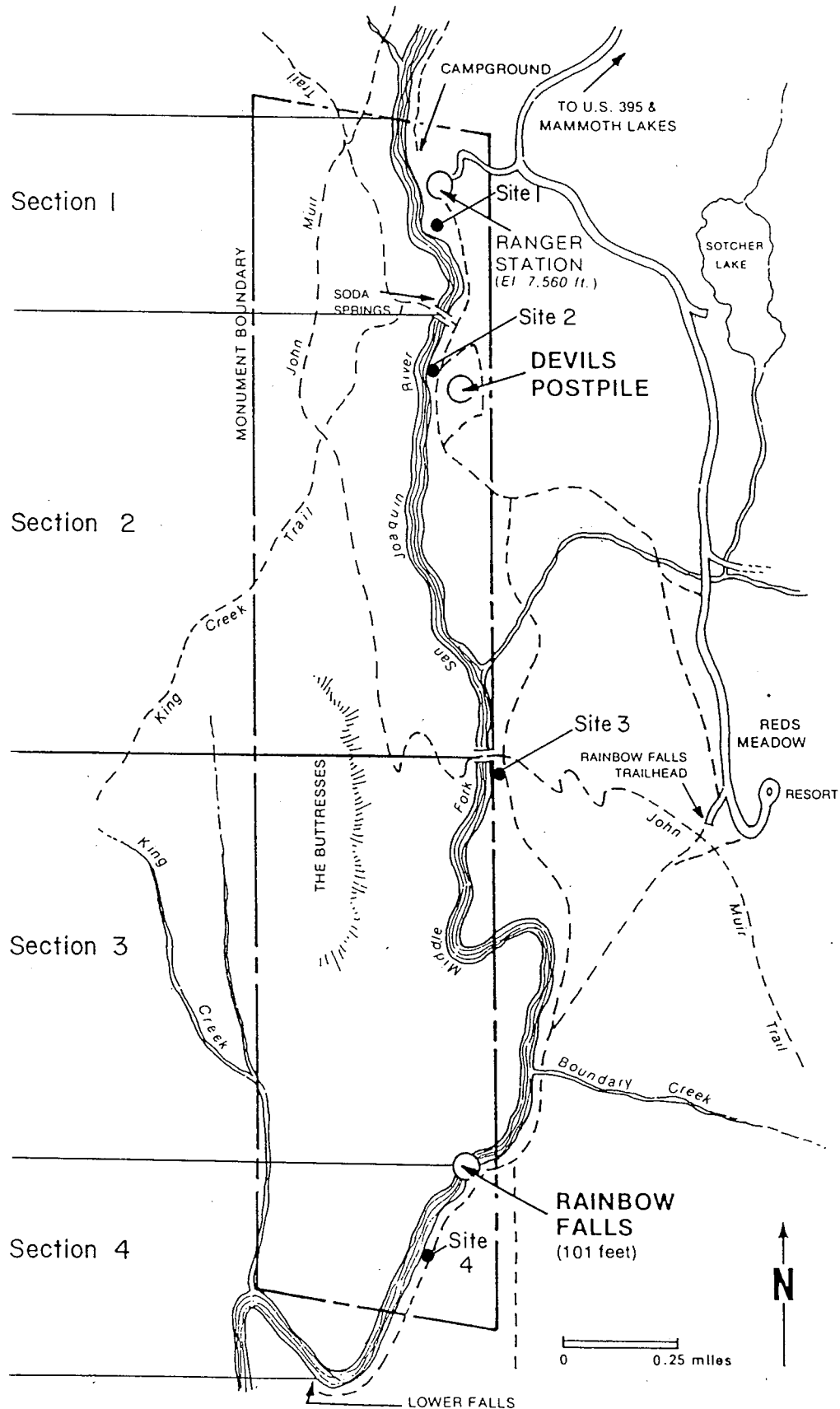


FIGURE 2. Devils Postpile National Monument, including angler survey sections and trout population sampling sites.

Access to the middle portion of the stream, though requiring some scrambling up and down hillsides and/or sometimes through brush, is considered easier from the Trail crossing.

Several campgrounds are available from Agnew Meadows, at the north end of the Minaret Summit Road, to Reds Meadow, including one at the upper end of the Monument. A small store and restaurant are located at the Reds Meadow Resort and numerous accommodations and services are available at Mammoth Lakes.

The Monument

The Monument was created in 1911 to preserve a volcanic formation known as the Devils Postpile. The Monument also contains two other features of particular interest--the 101-foot high Rainbow Falls and Soda Springs. Another aesthetic and recreational attraction is the Middle Fork. The stream, with the exception of a short reach just above Rainbow Falls, runs the full length of the Monument (Figure 2). The 2-1/2-mile long by 1/2-mile wide Monument encompasses 800 acres (Huber and Eckhardt 1985).

The Monument is administered by the Sequoia-Kings Canyon National Park. The Ranger Station near the main access and parking areas is an information and small natural history center.

Stream Habitat

The 3.6-mile study reach of the Middle Fork drops from an elevation of approximately 7,555 feet at the north boundary of the Monument to 7,200 feet at Lower Falls. The lowest gradient (0.6%) is in the stream reach above Soda Springs. The highest gradient (2.1%) (excluding Rainbow Falls) is in the reach from the Postpile to the Trail bridge crossing (Don Rowan, graduate student Monument employee, personal communication). The average stream width is about 40 feet.

Near the Ranger Station, the flat terrain allows the river to form a large semicircle (Figure 3). Not far downstream, just below the Postpile formation, the river drops into a narrow, steep gorge with surrounding canyon walls rising sharply from 100 to 150 feet above the stream (Figure 4). As the river continues south toward the Trail crossing, it gradually opens up with gentler terrain on one or both sides.

Below the arch bridge forming the Trail crossing, the surrounding landscape again flattens and the river moves through some sweeping meanders (Figure 5). Just before Rainbow Falls, it flows over a large expanse of volcanic bedrock, then plunges the 101 feet onto the rocks below (Figure 6). After emerging from the steep surrounding walls adjoining the falls, the river

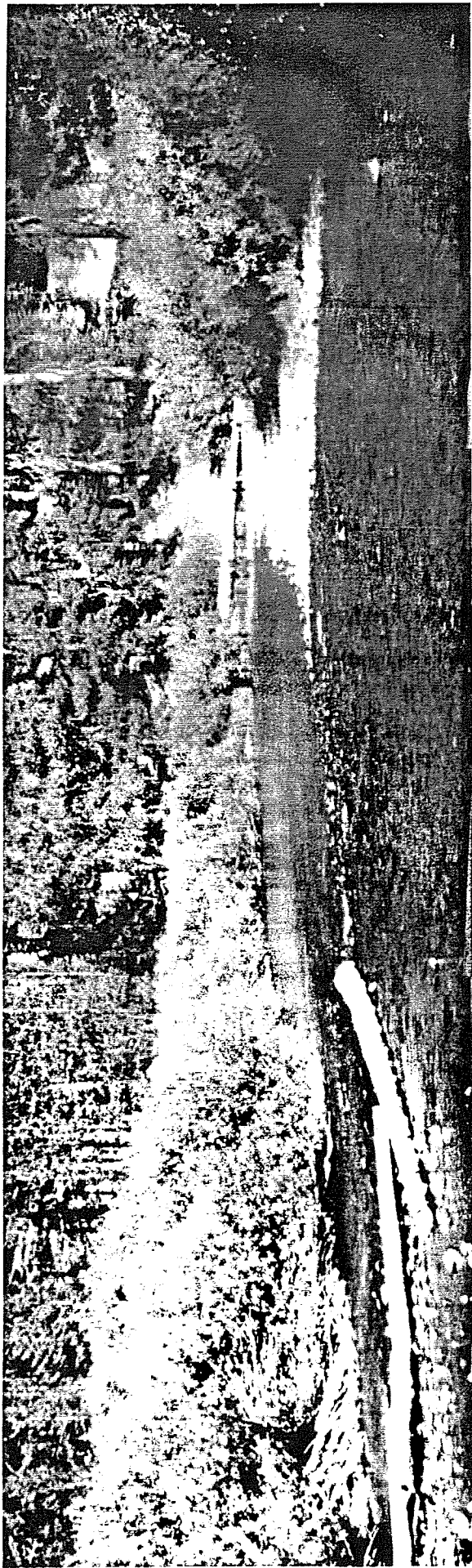


FIGURE 3. Section 1, deep runs with cobble substrate and overhanging willows at the lower end of a large meander above Soda Springs.

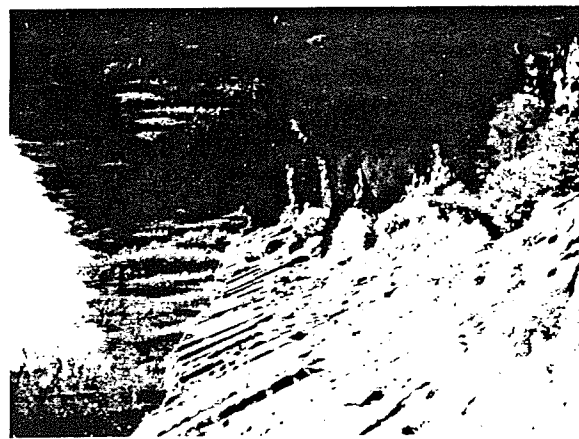


FIG. 4. Section 2, Gorge below Postpile.



FIGURE 5. Section 3, river between John Muir Trail bridge crossing and Rainbow Falls.



FIG. 6. Section 4, below Rainbow Falls.

returns to a southerly direction. On the west is a precipitous ridge known as the Buttress and on the east a more open and gentler sloping hillside. After flowing south for about 1/2-mile, the river abruptly swings west around the lower end of the Buttress and drops over 25-foot high Lower Falls.

In its upper reaches, part of the surrounding vegetation is a well-developed fir and lodgepole forest, with the riparian zone varying in width. A thicket of willows, mixed with grass, lines the large curve near the Ranger Station. Waterbirch dominates the stream edge opposite the Postpile and as the river descends through the gorge. Within the gorge, the riparian area is narrow, sporadically lining the banks, with pine and fir dotting the cliffs above. As the terrain flattens, pines and firs again meet the willows and waterbirch lining the banks. Cottonwoods are common downstream from the Trail bridge. Waterbirch continues to line the banks, along with some fir and aspen. Sedges, grasses, and various herbaceous plants intermittently soften the streambanks.

Some riparian vegetation between Rainbow Falls and Lower Falls was burned in 1992. Other stands of vegetation on the bluffs above the stream were also burned during the fire.

During the fall 1988 trout population surveys, stream flows ranged from 7.9 to 11.0 cfs. Much higher flows are usually present during the spring and early summer. The low and high water temperatures recorded during the June through October 1988 creel survey were 44° F at the end of October and 66° F in mid-July. During the fall surveys, pH readings averaged 7.5, conductivity averaged 53 umhos/cm³, and alkalinity averaged 36 mg/l. Upstream, the same measurements averaged 7.1, 14 umhos/cm³, and 13 mg/l (Deinstadt et al. 1995). These readings indicate that the stream becomes somewhat enriched between the headwaters and the Monument.

Based on a habitat survey conducted by Don Rowan in 1994, the Middle Fork in the study area consists of 43% riffle, 43% flatwater, and 14% pool habitat. Riffles are the major habitat component in the reach between the Trail bridge crossing and Lower Falls. In the upper reach near the Ranger Station, the majority of the stream is made up of flat water. Pools comprise a minor part of the stream in all reaches except the gorge section below Soda Springs, where they account for nearly 30% of the habitat.

General observations during the fall trout population surveys indicated substrates in the riffle and run sections were about 40% cobble, 30% boulder, 15% gravel, with the balance fines and bedrock. Pools and pocket water had a higher percentage of

finer. Boulders, surface turbulence, and, to a lesser extent, overhanging vegetation provided most of the trout cover at the survey sites.

Wild Trout Fishery

Rainbow trout (*Oncorhynchus mykiss*, ssp.), brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*) and, possibly golden trout (*Oncorhynchus mykiss aguabonita*) are the only fish species known to be present in the Middle Fork within the Monument. Whether pure golden trout, which migrate into the river from upstream sources, are present in the Monument is uncertain. Fish in the Monument that resemble golden trout are generally considered hybrids between golden and rainbow trout. In this report, all such fish were called rainbow trout. Due to the probable presence of downstream barriers, rainbow trout may not be native to the Monument. The other salmonids present were introduced.

While the fishery is primarily sustained by natural reproducing populations of rainbow, brown, and brook trout, part of the catch in the Monument consists of stocked, catchable-size rainbow trout. These fish migrate downstream from several planting sites adjacent to campgrounds above the Monument. Though the Middle Fork within the Monument has not been directly stocked since 1971, these downstream migrants remain, at least seasonally, a significant component of the fishery.

The Monument attracts a large variety of anglers, from individual fly fishermen who have fished there for many years, to families who fish mostly during their annual vacations. A California fishing license is required to fish in the Monument. There are no special gear or size regulations. The limit is five trout per day and ten trout in possession.

METHODS

Fish Population Surveys

The initial 1986 sampling site opposite the Devils Postpile formation was selected primarily because of its proximity to vehicle access at the Ranger Station (Figure 2). The next two population sampling sites were located in the middle and lower portions of the Monument in 1987. In order to obtain at least two years of baseline data at each site, the area below Rainbow Falls and below the Trail bridge crossing along with the initial site at the Postpile were surveyed again in 1988. A fourth site was also established in 1988 in the upper part of the Monument just below the Ranger Station (Figures 7 through 10). Although a second year of data had not been obtained from this uppermost

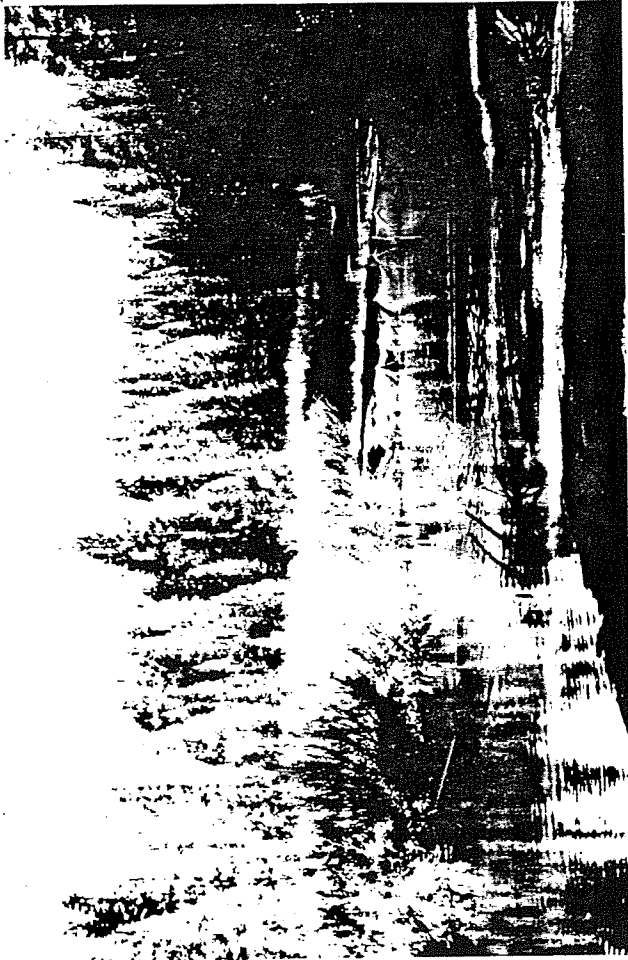


FIGURE 7. Site 1, deep runs with overhanging willows near the Ranger Station.



FIGURE 8. Site 2, low cascade and run habitat at the upper end of the sampling site near the Postpile.



FIGURE 9. Site 3, low gradient riffle/run below the John Muir Trail bridge crossing.



FIGURE 10. Site 4, high gradient, shallow riffle and runs below Rainbow Falls.

site, we decided that the areas at the Trail crossing and below the Ranger Station would become the long-term monitoring sites. The current trout population monitoring program began at these two sites in 1991.

Typically, a five- to six-member Department crew accompanied by volunteers went to a pre-determined reach of stream and selected a 250- to 300-foot sample section containing various fish habitat types. Block seines were installed at the lower and upper ends of the section to isolate the fish population. The multiple-pass removal method was used to estimate the population (Zipfin 1958). Depending upon the width of the sample section, fish were captured by two to four persons using Smith-Root Type VII backpack electrofishers, assisted by two to four or more netters. Other members of the crew followed behind with livecars. Trout collected were identified by species, measured to the nearest millimeter fork length, and, in most instances, weighed to the nearest gram. After processing, trout were carefully redistributed throughout the sample site.

Trout population density estimates and 95% confidence intervals were calculated using the maximum likelihood model (Platts et al. 1983). We used a modification of the computer program developed by Platts et al. (1983) to calculate other estimates, including a subroutine to process two-pass depletions (Seber & LeCren 1967) and a second subroutine for estimating biomass and fish-per-mile.

Trout biomass at a sample site was estimated for each species by multiplying the mean weight of the fish sampled by the population estimate for that species. At some sites where a subsample of weights were taken, mean weight was predicted from a length-weight regression program. The standing crop estimate was calculated by dividing the biomass estimate by the sample site surface area and converting the resultant value to lb/surface acre. Trout-per-mile estimates are calculated from the population estimate per sample site length expanded to one mile. Data on trout populations are given in English units in this report. Metric units, with some English equivalents, will be included in a later, more detailed inventory report. Fork lengths used in this report are approximate conversions of 25 mm size classes to inch groups (less than 6 inches is less than 150 mm, 6.0 to 7.9 inches is 150 mm to 199 mm, 8.0 to 8.9 inches is 200 mm to 249 mm, etc.).

Physical and biological data are summarized and presented in the stream habitat section of this report. Data collection methods are in other stream inventory reports (Deinstadt et al. 1985, and Deinstadt et al. 1990). Individual data from each of the four sample sites in the Monument will be presented later in an inventory report on west slope Sierra Nevada streams.

Population estimates from the sample sites serve as index points to measure trends. They may not accurately estimate the trout populations throughout the Monument, because the habitats surveyed may not reflect the true distribution of habitat types found in the entire study area. The objective of the sampling program, beginning with the follow-up surveys, was to collect baseline data from which trends in the fish populations could be established using the data from the same sites in succeeding years. Trend data derived at specified intervals are intended to alert the Department to major changes in the condition of stream habitat and/or help the Department document the impact of such changes. When combined with angler surveys, the fish population data are also intended to indicate whether current fishing regulations are effective.

Creel Survey

The study area was divided into four sections (Figure 2 and Table 1). Creel surveys were conducted from June 12 (shortly after the Minaret Summit Road opened) through the end of October. Data were collected on a monthly basis and divided into weekday and weekend-day strata. Three randomly chosen weekdays and three weekend days were surveyed each month (30 total days during the season). From June through August, survey days were divided into a morning, early afternoon, late afternoon, and, for the uppermost section, evening period. The Department employee taking the survey started at the north boundary of the Monument and walked downstream counting and interviewing anglers as he went. Where the trail was not adjacent to the river, the surveyor walked cross country along the east bank. Due to easier access, the majority of the anglers were on that side of the river. Anglers were not interviewed on the return trip. In September and October, survey days were divided into three periods (morning, mid-day, and late afternoon).

Data collected from individual anglers included county of residence, section fished, hours fished, angling method, and the species, number, and length of trout kept or released. Each angler was assigned a number which allowed separation of the data collected during successive interviews on a single day. Angling effort, whether complete or incomplete, was noted. Trout kept were measured to the nearest millimeter fork length and subsequently converted to inches. Anglers were asked to estimate the lengths of trout they released by size group: <6.0, 6.0 to 7.9, 8.0 to 9.9, 10.0 to 11.9, 12.0 to 13.9, and ≥ 14 inches.

Angling effort was estimated by calculating the mean number of anglers/count in a given day x the number of angling hours in the day. Effort by section and angling method (bait, lure, and fly)

TABLE 1. Description of the Four Sections Used during the 1988 Creel Survey of the Monument Reach of the Middle Fork San Joaquin River.

<u>Section</u>	<u>Boundaries</u>	<u>Length (Miles)</u>	<u>Gradient (Percent)</u>
1	Northern end of the Monument to the bridge just below the Soda Springs	0.6 <u>a/</u>	0.6 <u>b/</u>
2	Bridge just below the Soda Spring to the John Muir Trail bridge crossing	1.0	2.1
3	John Muir Trail bridge crossing to Rainbow Falls	1.3	1.6
4	Rainbow Falls to Lower Falls	0.7	1.5
Total		3.6	

a/ Distances determined by hip-chain measurements taken by Don Rowan.

b/ Approximate gradients taken from USGS topographical map. Don Rowan stated that the base map dates back to 1911 and field studies in 1994 suggest some of the contour lines may be inaccurate.

were calculated separately. These figures were in turn multiplied by the number of days in the stratum and the two strata combined to obtain a monthly estimate of effort.

Catch rates were calculated by section, angling method, and trout species kept or released. Estimated numbers of trout caught per month were calculated by multiplying the mean catch rate for each of these values by the estimated angling effort for the respective values.

RESULTS AND DISCUSSION

Trout Population Surveys

Trout Densities

Estimated trout densities ranged from 2,508 fish/mile at the Trail bridge crossing to 11,133 fish/mile near the Ranger Station (Figure 11 and Appendix Table 1). Samples from just below the bridge and near the Ranger Station consistently produced the lowest and highest estimated populations, respectively. Combined densities averaged 5,455 trout/mile.

Rainbow trout was the most abundant species at Site 4, comprising 69% of the 1987 sample and 63% of the 1988 sample (Figure 11). Brown trout comprised the majority of the population at the other three sites. Brook trout were a minor part of the populations at all four sites. Mean densities of brown, rainbow, and brook trout populations were 3,442, 1,831, and 182 fish/mile, respectively. Rainbow trout abundance in Site 4 is attributed to their greater preference for fast flows present in that shallow, high-gradient section (Figure 10).

The greatest difference in total trout densities at one site was between the 1986 and 1988 samples in Site 2. Here, the brown trout population increased from an estimated 2,220 to 4,269 fish/mile (Figure 11). Based on length frequencies, the major increase was in the density of age 1 fish. The estimated age 1 brown trout population increased from about 850 fish/mile in 1986 to almost 2,500 fish/mile in 1988.

The unusually high densities of brown trout from Site 1 appear directly related to differences in stream habitat. Riffles and shallow, boulder-strewn runs comprise most of the habitat in the lower three sampling sections (Figures 8, 9 and 10). Boulders provided an estimated 50% to 80% of the trout cover available in these sites. Site 1 is primarily run habitat which was 1 to 1-1/2 feet deeper than the run habitat sampled at the downstream sites. Few boulders were present in the upper site and,

virtually all of the cover was provided by overhanging willows (Figures 3 and 7). Therefore, the exceptional brown trout density at Site 1 appears to be a product of deeper, presumably slower-flowing habitat, with an abundance of overhanging willows.

The lower stream flows accompanying the recent, prolonged drought may account for the increases found in brown trout densities from 1986 to 1991. While there were decreases in the estimated abundance of trout in the lower two sites between 1987 and 1988, a third survey of Site 3 in 1991 showed an increase over the 1987 level (Figure 11). At Sites 1 and 2, there were small to major increases in total trout densities. At three of the four sites, rainbow trout populations declined while, at all four sites, brown trout either remained fairly constant or increased. Brown trout populations also increased during the drought at two sites sampled in the trailside reach upstream from the Monument (Deinstadt et al. 1995). Other studies indicate that decreases in stream flows improve brown and sometimes decrease rainbow trout production (Eric Gerstung, California Department of Fish and Game biologist, Sacramento, personnel communication; Deinstadt and Parmenter, 1993; and, Deinstadt and Pert, unpublished data).

Stocked catchable-size rainbow trout were not included in the estimates presented in either Figure 11 or Appendix Table 1. Based on their size and appearance (primarily characterized by eroded fins), stocked fish were present during all of the surveys at the upper two sites. Catchable trout densities ranged from an estimated 15 fish/mile at the uppermost site in 1991 to 415 fish/mile at the Postpile site in 1986. The average density of stocked rainbow trout in the upper two sites was about 200 fish/mile. Since the fall sampling occurred after most of the hatchery plants were made, we assumed that higher densities may have been present in the upper portion of the Monument earlier in the season.

Trout Biomass

Trout biomass ranged from 62.6 to 214.8 lb/acre (Figure 12 and Appendix Table 2). The average total biomass for the nine surveys was 110.4 lb/acre. Average standing crops of brown, rainbow, and brook trout were 85.4, 22.9, and 2.1 lb/acre.

Surveys conducted in 1987 and 1988 below Rainbow Falls and the Trail bridge and opposite the Postpile in 1986 and 1988 produced similar results. The average differences between the two surveys at each of these sites was 8.1 lb/acre (Figure 12). The differences between the estimates derived from the 1988 and 1991 samples at the Trail bridge and Ranger Station sites were 40.7 and 50.1 lb/acre, respectively.

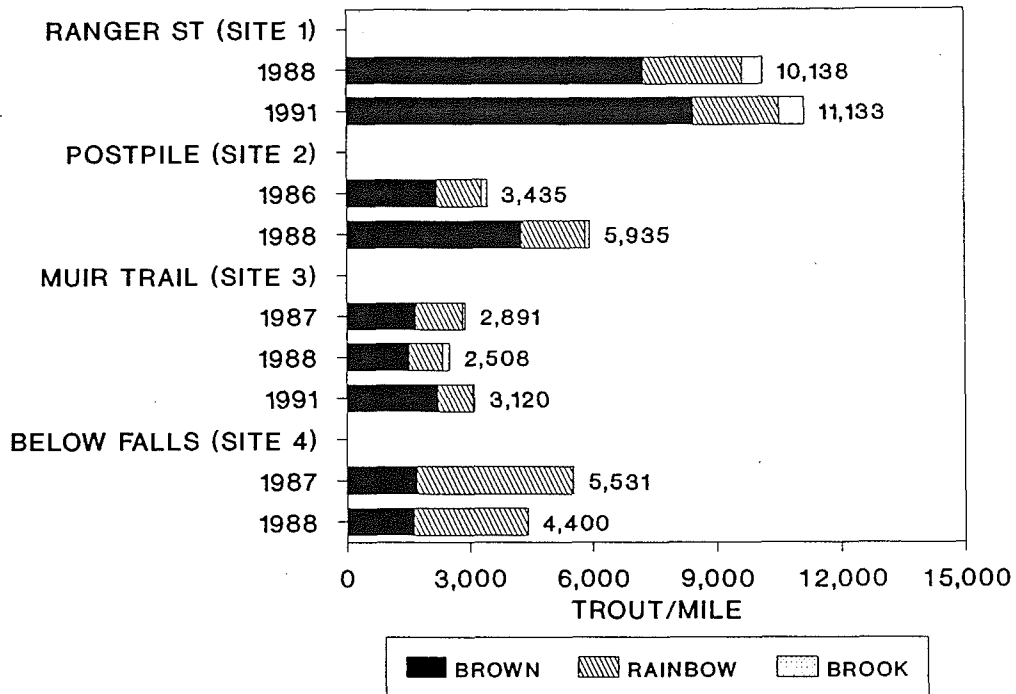


FIGURE 11. Trout densities at four sites on the M. F. San Joaquin River sampled between 1986 and 1991.

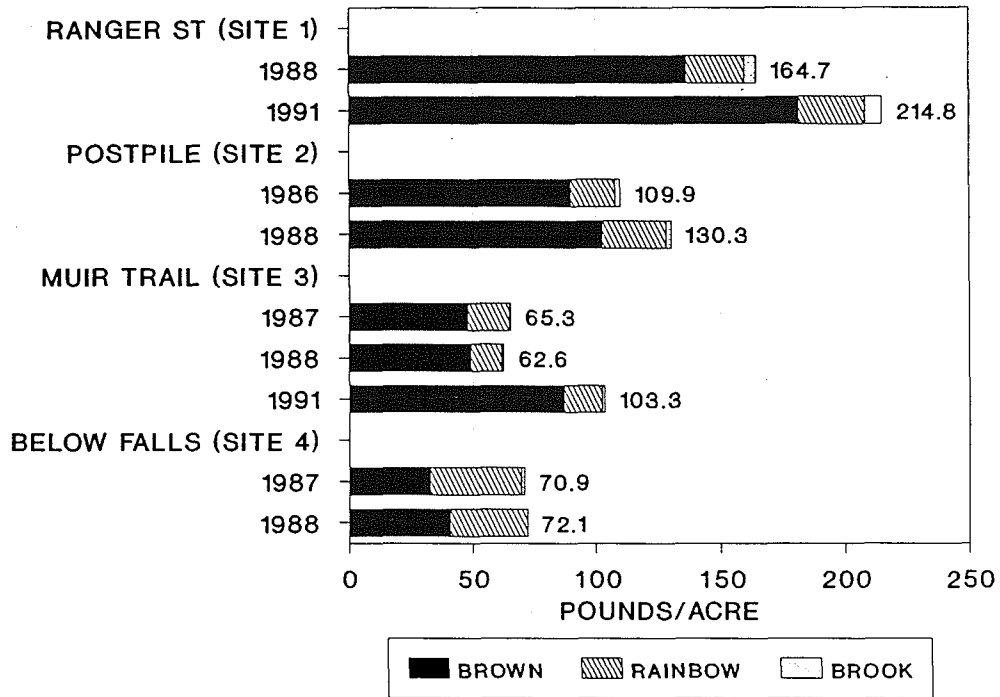


FIGURE 12. Trout biomass at four sites on the M. F. San Joaquin River sampled between 1986 and 1991.

The small difference in densities at the Trail bridge in 1988 and 1991 verses the wider difference in biomass for those years was a product of the age and size classes of brown trout in the samples (Figure 12). The same is true of the wide difference between densities at the Postpile in 1986 and 1991 and the small difference in biomass. The brown trout population increase at the Trail site involved primarily age 2 fish, while the increase at the Postpile site involved mostly age 1 fish. Though length frequency separation of year classes is more difficult at the Ranger Station site, there were fewer young-of-the-year in the 1991 sample and, it appears, more age 1 and age 2 brown trout.

Densities of 6-inch and Larger Trout

Densities of 6-inch and larger trout at the lower three sample sites ranged from 1,194 to 1,784 fish/mile and averaged 1,524 fish/mile (Figure 13 and Appendix Table 3). Below the Ranger Station, densities of trout in this size class were about two to three times higher. The average trout density for all sites combined was 2,079 trout/mile.

For the combined population, average densities of 6 to 7.9-, 8 to 9.9-, 10 to 11.9-, and 12-inch and greater trout were 1,280, 709, 75, and 15 trout/mile, respectively. The estimated numbers of trout in these four size classes were similar to the estimated numbers in the trailside reach above the Monument. Upstream, densities in these size classes were 1,102, 439, 53, and 12 trout/mile (Deinstadt et al. 1995).

Brown trout comprised 75%, rainbow trout 23%, and brook trout 2% of the population of fish 6 inches and greater in length. Again, the results from the upstream reach were similar, with brown, rainbow, and brook trout comprising 67%, 29%, and 4% of the trout in this size class (Deinstadt et al. 1995). Sixty-four percent of the estimated population of 6 to 7.9-inch, 91% of the 8 to 9.9-inch, 96% of the 10 to 11.9-inch, and 87% of the 12-inch and greater fish in the Monument were brown trout (Figure 14). Rainbow and brook comprised relatively small percentages of the 8-inch and larger trout (Figures 15 and 16).

Comparisons with Other West Slope Streams

Based on a report comparing the trout populations in 30 different reaches of west slope Sierra Nevada streams (Deinstadt et al. 1986), the Middle Fork within the Monument ranked second in total trout density, third in trout biomass, and first in the number of 6-inch and larger trout/mile (Figures 17, 18, and 19).

The reach of stream above the Monument, when compared with the other 29 reaches was sixth in total trout abundance, third in

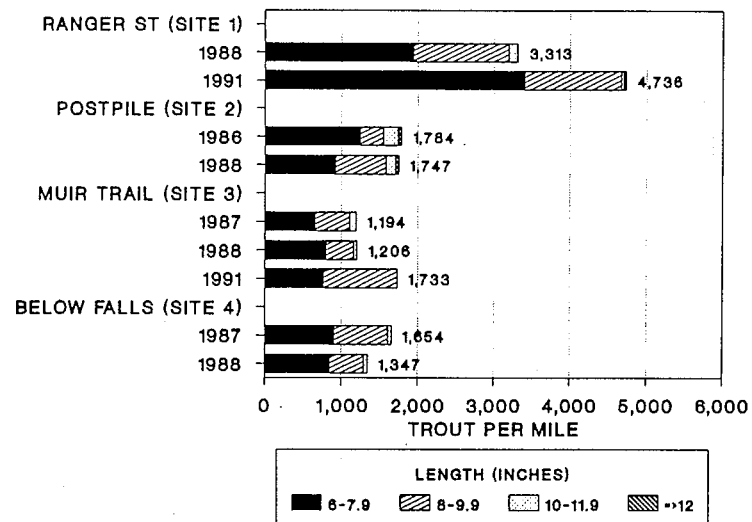


FIGURE 13. Densities of trout ≥ 6 inches at four sites in the study area sampled between 1986 and 1991.

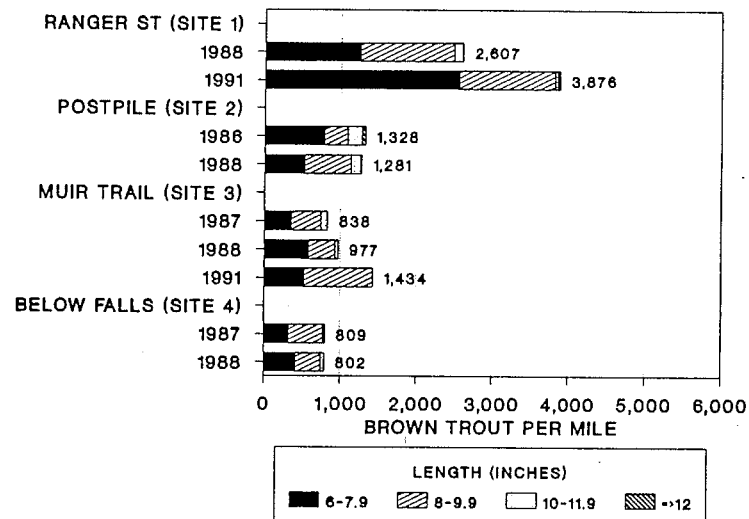


FIGURE 14. Densities of brown trout ≥ 6 inches at four sites in the study area sampled between 1986 and 1991.

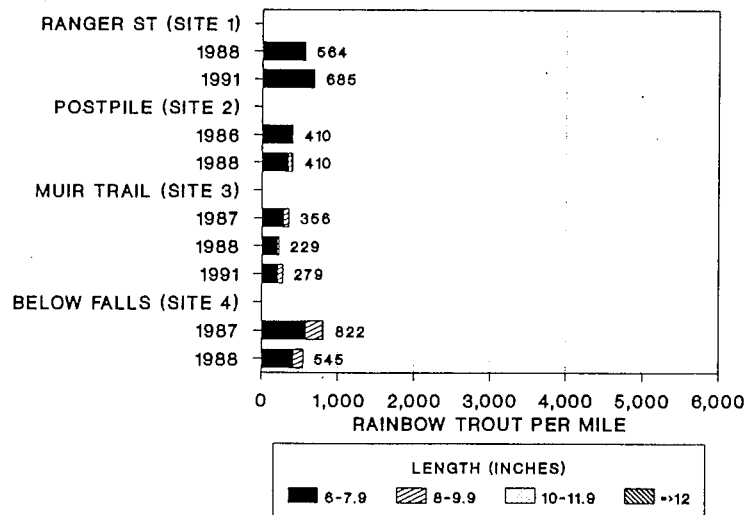


FIGURE 15. Densities of rainbow trout ≥ 6 inches at four sites in the study area sampled between 1986 and 1991.

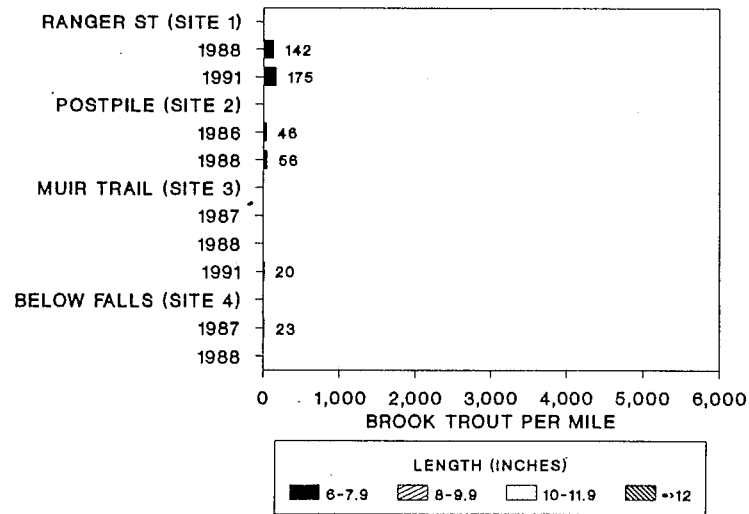


FIGURE 16. Densities of brook trout ≥ 6 inches at four sites in the study area sampled between 1986 and 1991.

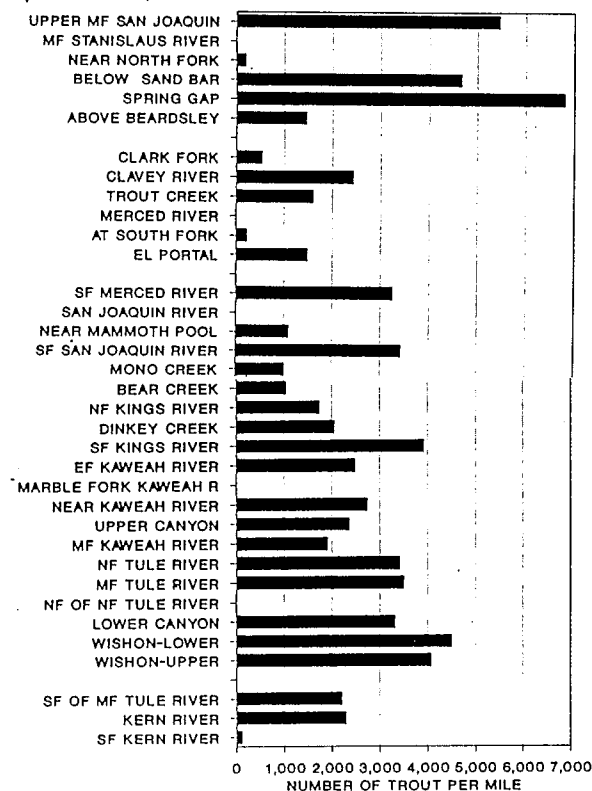


FIGURE 17. Comparison of trout densities in the study area and 29 other west slope Sierra Nevada streams.

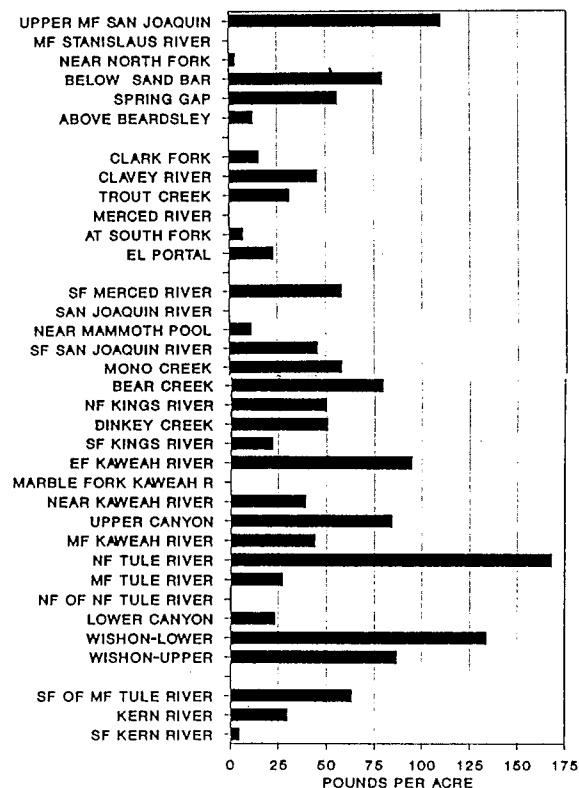


FIGURE 18. Comparison of the biomass of trout in the study area and 29 other west slope Sierra Nevada streams.

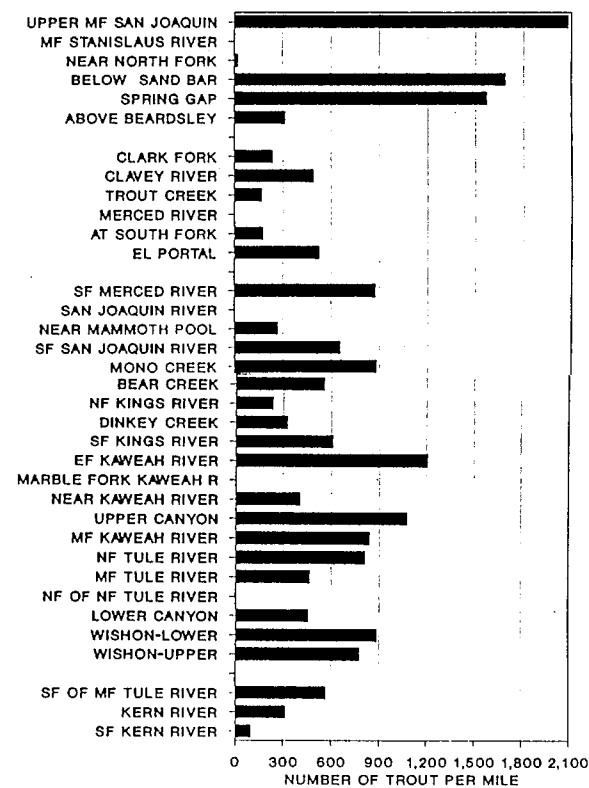


FIGURE 19. Comparison of the densities of trout ≥ 6 inches in the study area and 29 other west slope Sierra Nevada streams.

biomass, and also first in trout 6 inches or greater in length (Deinstadt et al. 1995). When the two reaches of the Middle Fork are compared directly, the area within the Monument is higher in all three categories. Neither reach ranked especially high in the density of 10-inch and larger trout.

Based on these data, the reach of the Middle Fork within the Monument sustains one of the highest densities of small- to medium-size trout present in any west slope Sierra Nevada stream.

Creel Survey

Estimated Total Angling Effort and Success

During 1988, June through October effort totaled 9,222 hours. Anglers landed 12,902 trout, keeping 3,258 and releasing 9,644. An estimated 400 of the trout released and 1,040 of the trout kept were stocked, catchable-size rainbow trout. Fifty-five percent of the wild fish landed were brown trout, 33% rainbow trout, and 12% brook trout. Average catch rates for wild trout, hatchery trout, and total trout landed (kept and released combined) were 1.24, 0.16, and 1.40 fish/hour, respectively.

Angling Effort and Success by Month

Summer effort was spread fairly evenly through June, July, and August, accounting for 77% of the total (Figure 20 and Appendix Table 4). Use declined in September and then dropped off sharply in October.

Eighty-four percent of the trout caught were landed during the three summer months (Figure 20). The highest catch rate was in July. Catch rates during June, August, and October were similar, averaging from 1.26 to 1.48 trout/hour. The lowest average (0.67 trout/hour) occurred in September.

The early season fishery was sustained largely by wild brown trout (Figure 21). Of the estimated 6,265 total brown trout caught, 4,343 were landed in June and July. The numbers of brown trout caught declined steadily in August, September and October. Catch rates for brown trout also declined in August and September, but improved in October (Figure 22).

The number of wild rainbow trout landed was low in June and then increased, reaching a peak in August (Figure 21). Catch rates for wild rainbow trout increased from June through August, dropped off in September, and then rose to the highest level of the season in October (Figure 22).

Wild brook trout were caught in June and July and then essentially disappeared from August through October (Figure 21).

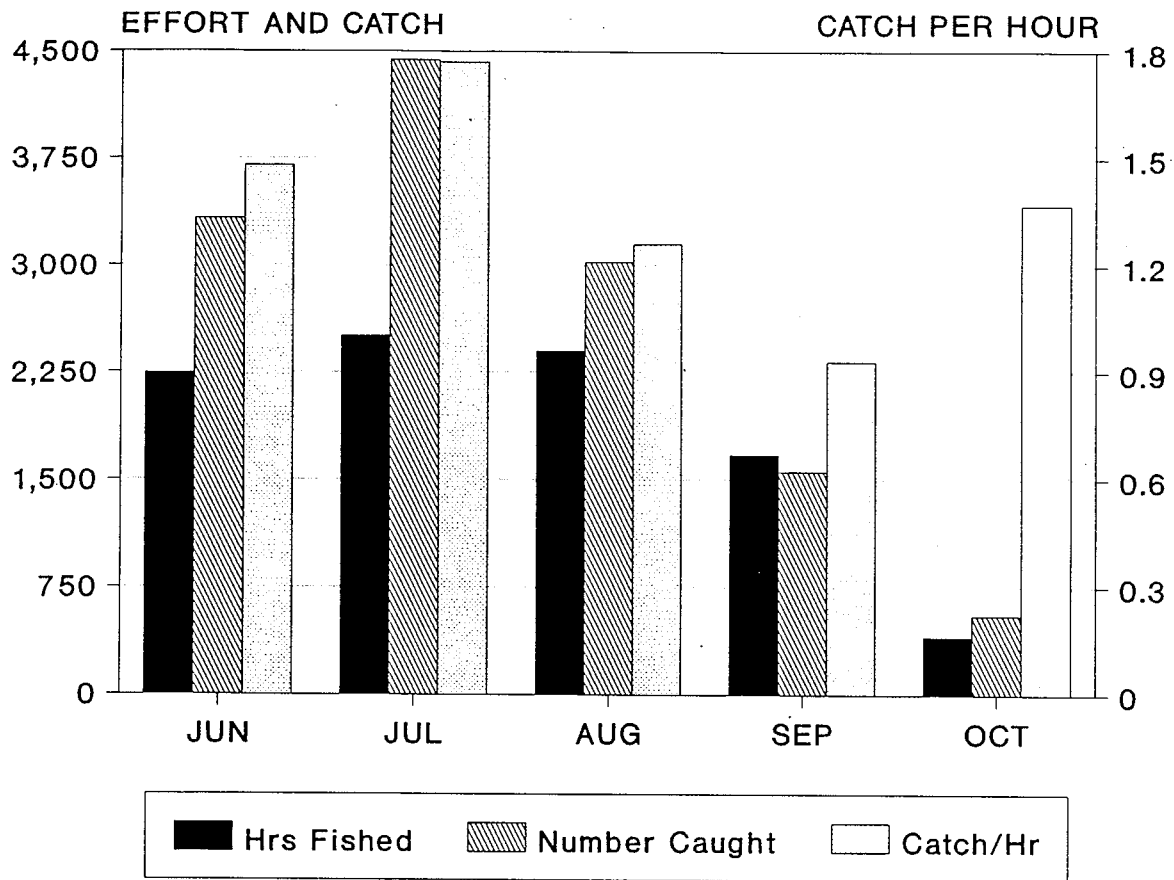


FIGURE 20. Estimated angling effort and success by month in the study area during 1988.

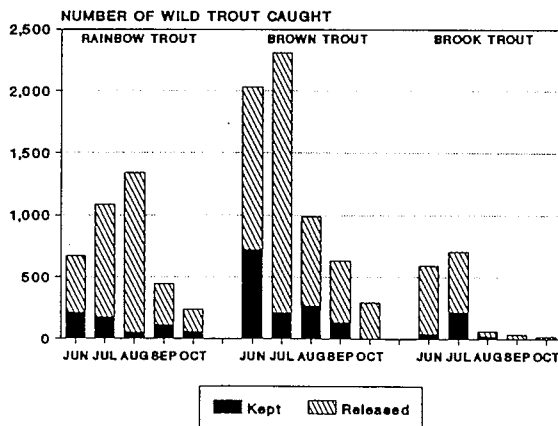


FIGURE 21. Number of wild rainbow, brown, and brook trout caught by month in the study area during 1988.

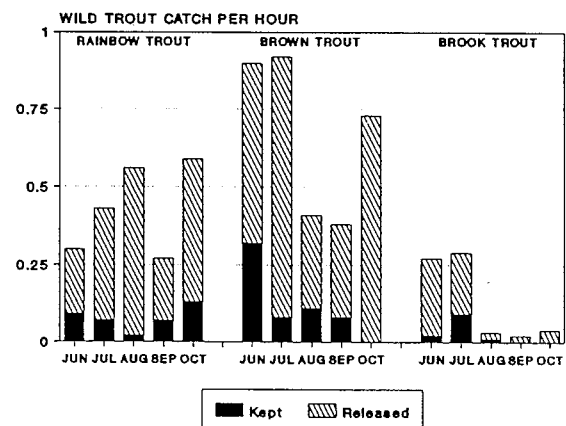


FIGURE 22. Catch/hour for wild rainbow, brown, and brook trout by month in the study area during 1988.

Stocked catchable-size rainbow trout were caught largely in July, August, and September (Appendix Table 4). Few were caught in June and none were reported in October. While stocked trout made only a minor contribution to the total number of trout released during the July through September period (about 5% of the total), they comprised a major part of the trout kept. About 23% of the trout kept in July and 60% of the trout kept in August and September were hatchery fish.

Comparison of Angling Effort and Success by Section

Section 1. Section 1, near the Ranger Station, was the most popular fishing area in the Monument with anglers spending 5,697 hours (over 60% of their total effort) in this reach (Figure 23 and Appendix Table 5). More wild rainbow and brown trout were caught in this section than in the other three sections combined (Figure 24). All but six of the stocked rainbow trout reported during the season were landed in this section. Altogether, 55% of the wild trout and over 99% of the hatchery trout caught in the Monument were landed in Section 1.

Average catch rates for wild and stocked trout were 1.11 and 0.25 trout/hour. The combined catch rate, 1.36 trout/hour, was slightly lower than the average for the entire study area. Anglers kept 72% of the stocked rainbow and 13% of the wild trout landed in Section 1 (Figures 24 and 25).

Section 2. Due to the more difficult access just beyond the Postpile formation and the greater distance from the main parking area, angling effort in Section 2 was only one-fourth of that recorded in Section 1 (Figure 23). The combined catch rate for wild trout, 1.14 fish/hour, was similar to the rate for Section 1. Those attracted to this section were primarily catch-and-release anglers who kept only 172 (11%) of the 1,582 trout they landed (Figure 24). Other than the level of effort, the major difference between Sections 1 and 2 was the number of stocked trout caught. Only six (<1%) of the estimated 1,440 hatchery trout reported during the season were landed in Section 2.

Section 3. Effort in Section 3 (1,342 hours) was almost identical to that recorded in Section 2 (Figure 23). Section 3 had by far the highest average catch rate and the highest percentage of wild trout kept (Figures 24 and 25). Average catch rates for trout kept, released, and total landed were 0.85, 1.38, and 2.23 fish/hour, respectively. No stocked trout were recorded in this section. The reasons why this section attracts a greater number of harvest-oriented anglers are unknown. Whether or not harvest and higher catch rates are related is also uncertain.

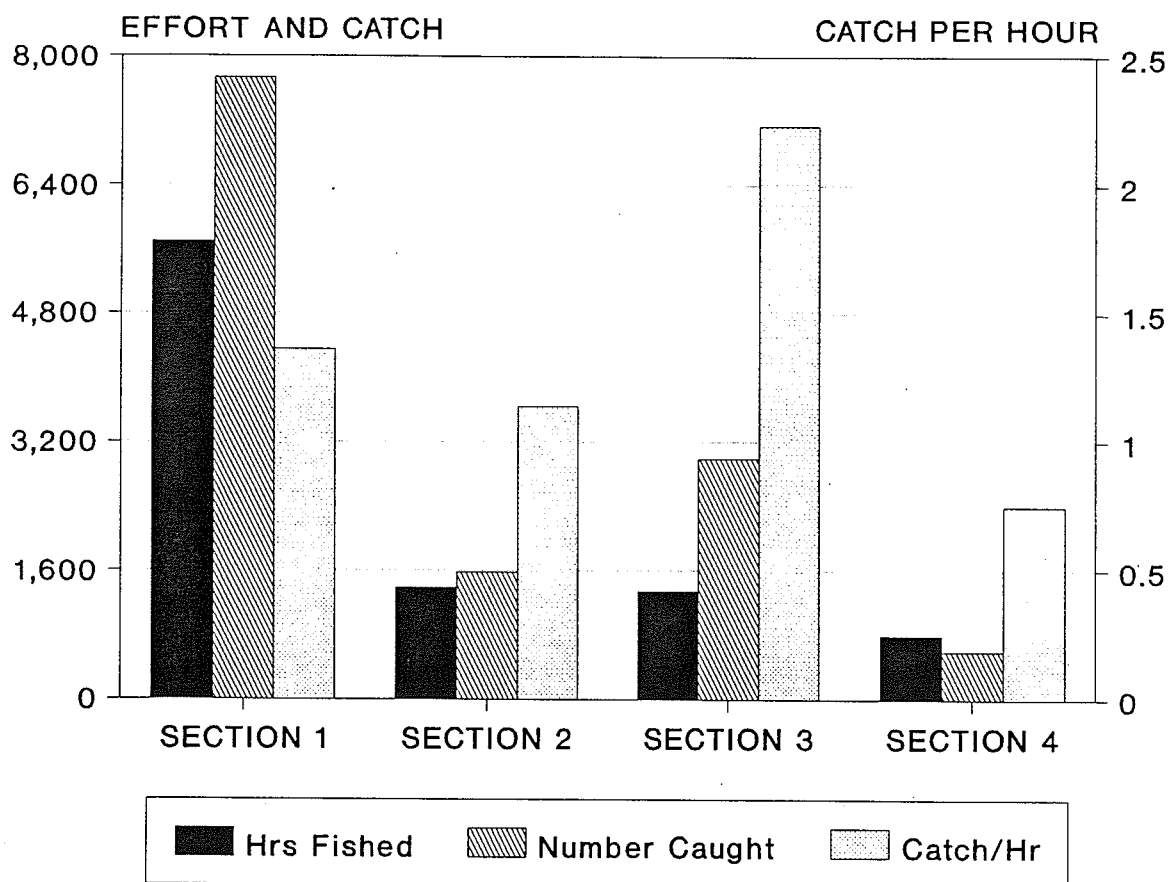


FIGURE 23. Estimated angling effort and success by section in the study area during 1988.

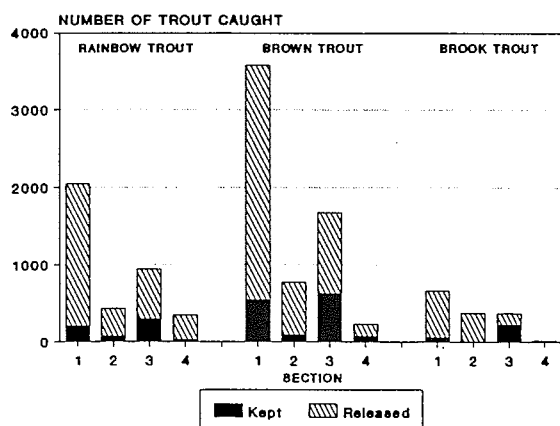


FIGURE 24. Number of wild rainbow, brown, and brook trout caught by section in the study area during 1988.

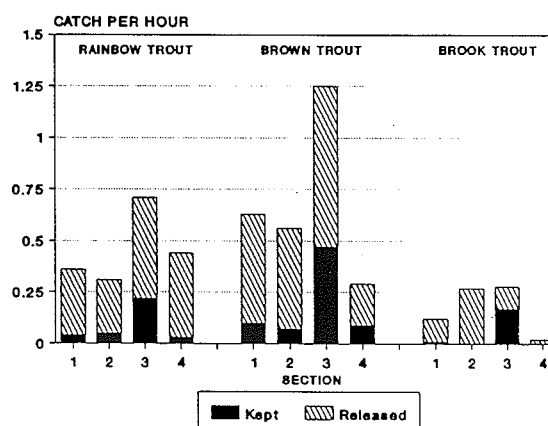


FIGURE 25. Catch/hour for wild rainbow, brown, and brook trout in the study area during 1988.

Section 4. Section 4, between Rainbow and Lower Falls, received the least use, had the poorest catch rate, and the lowest total number of trout caught in the study area (Figure 23). An estimated 347 rainbow, 231 brown, and 16 brook trout were landed. This is the only section where more rainbow than brown trout were caught (Figure 24). By far, the lowest brook trout catch was reported here.

Comparison of Angling Effort and Success by Angling Method

Bait Anglers. Bait angling was the most popular method of fishing (Figure 26 and Appendix Table 6). Bait anglers landed and kept a higher percentage of trout (40%) than either lure or fly anglers (Figure 27). Their rate for trout kept (0.45 fish/hour) was higher than that of the other two groups of anglers (Figure 28). Total catch rates for bait anglers, however, were lower than for lure or fly anglers, but still a very acceptable 1.11 trout/hour (Figure 26).

Bait anglers spent about 70% of their time fishing near the Ranger Station. The balance of their effort was spread between the other three sections with Section 3 receiving slightly more use (Figure 29).

Of the 12,902 trout landed in the Monument during 1988, 5,655 (44%) were caught by bait anglers fishing in Section 1 (Figure 29). Stocked trout comprised 20% of the total bait-caught fish in Section 1. Altogether, 849 (82%) of the total 1,040 hatchery trout kept were caught by bait anglers in Section 1. The highest catch rate for bait anglers was 1.97 trout/hour in Section 3. The lowest catch rate was 0.71 trout/hour in Section 2. Relatively small numbers of wild trout were landed by bait anglers in Sections 2 and 4 (Figure 30). While bait anglers caught about half as many wild trout in Section 3 as in Section 1, they kept a greater number from Section 3.

The large numbers of stocked trout kept by bait anglers in Section 1 was not considered detrimental to the quality of the fishery. Eighty-three percent of the fish caught by lure anglers in Section 1 and 97% of the fly-caught fish were wild trout. Most fly anglers and, presumably, many lure anglers prefer wild trout. Aside from these factors, the current Park Service management policy prohibits the stocking of hatchery-reared catchables in their waters. Keeping rather than releasing stocked trout is assumed to be a practice preferred by Monument personnel.

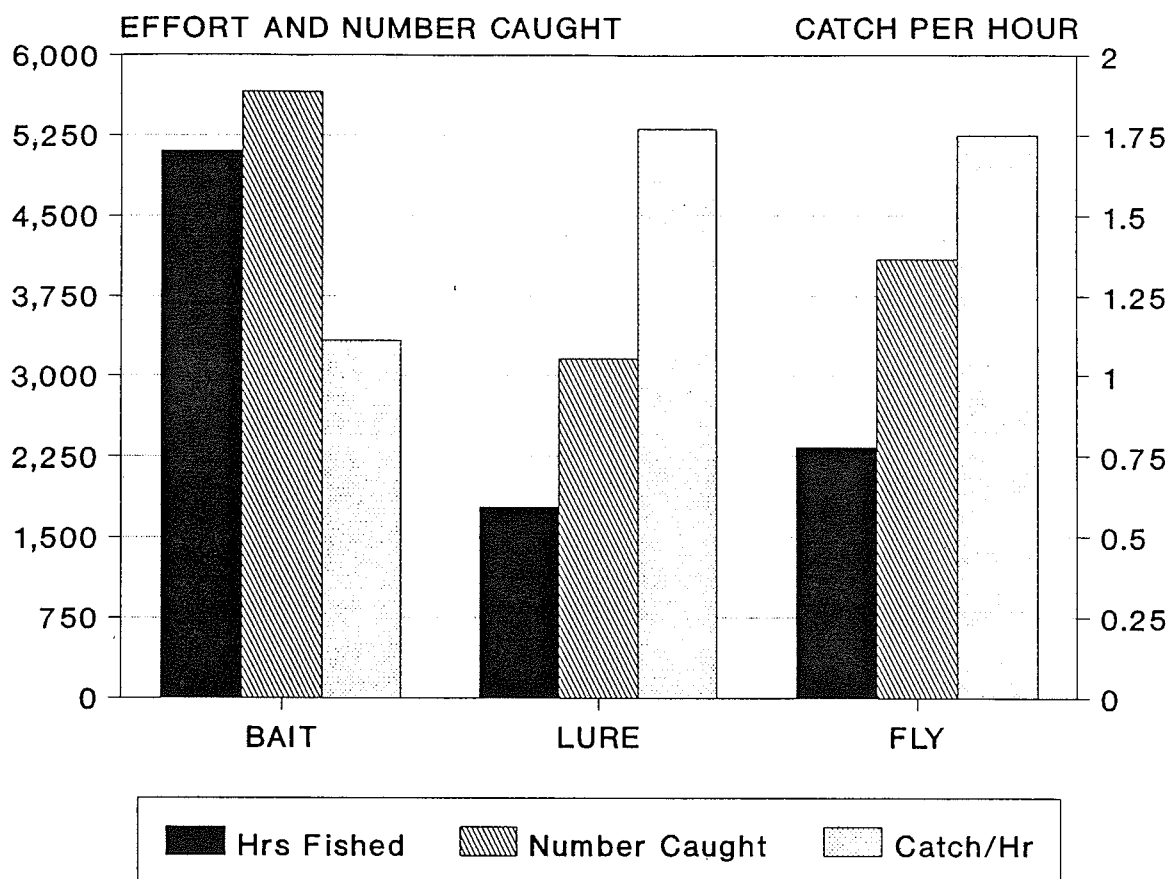


FIGURE 26. Estimated effort and success by bait, lure, and fly anglers in the study area during 1988.

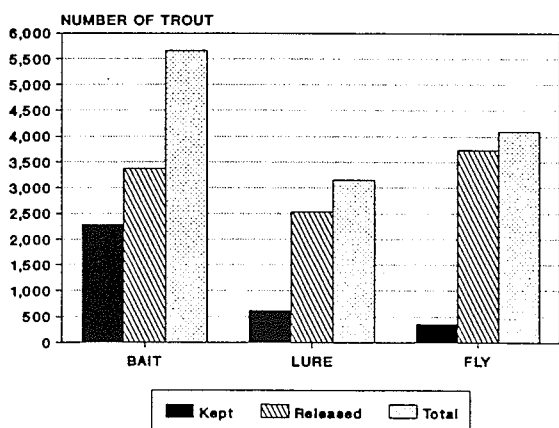


FIGURE 27. Number of trout kept/released by bait, lure, and fly anglers in the study area during 1988.

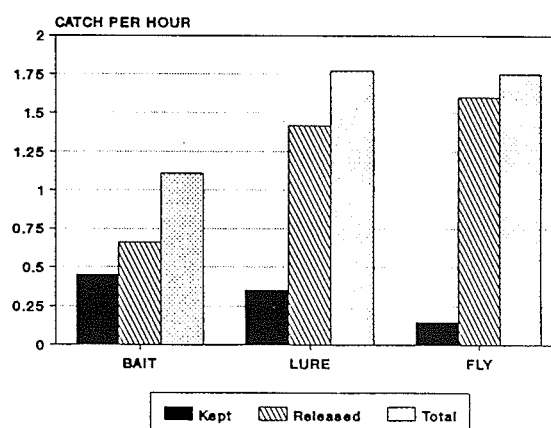


FIGURE 28. Catch/hour for trout kept/released by bait, lure, and fly anglers in the study area during 1988.

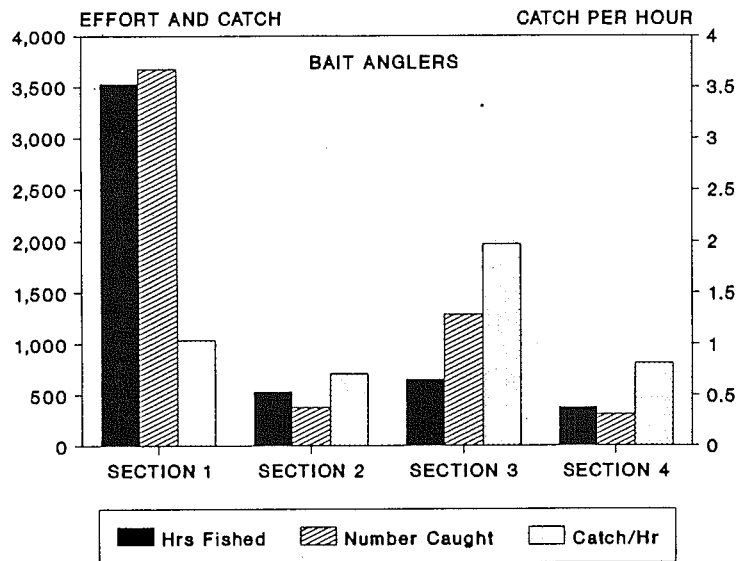


FIGURE 29. Effort and success by bait anglers in Sections 1-4 during 1988.

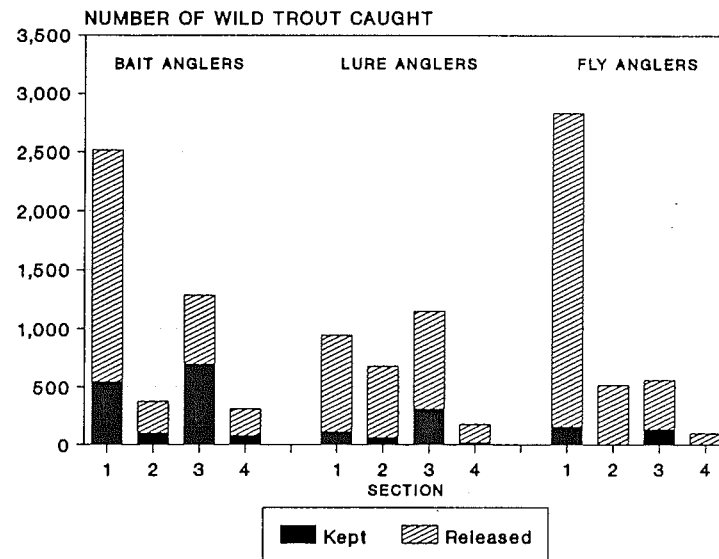


FIGURE 30. Number of wild trout kept/released by bait, lure, and fly anglers in Sections 1-4 during 1988.

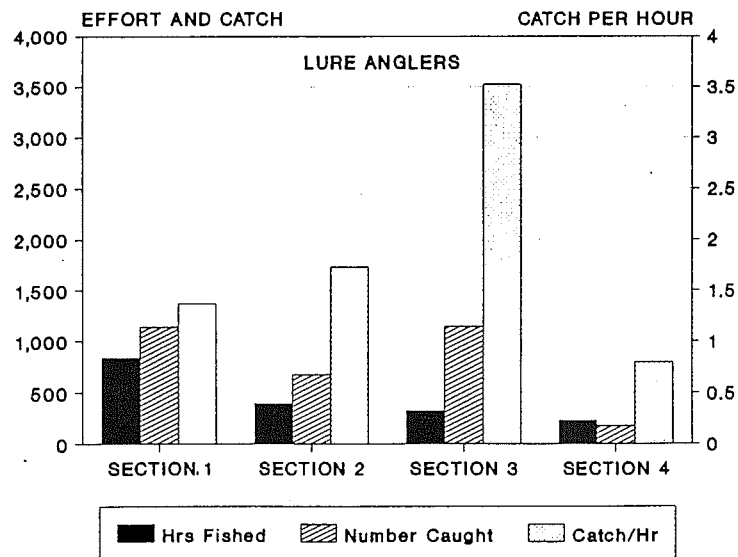


FIGURE 31. Effort and success by lure anglers in Sections 1-4 during 1988.

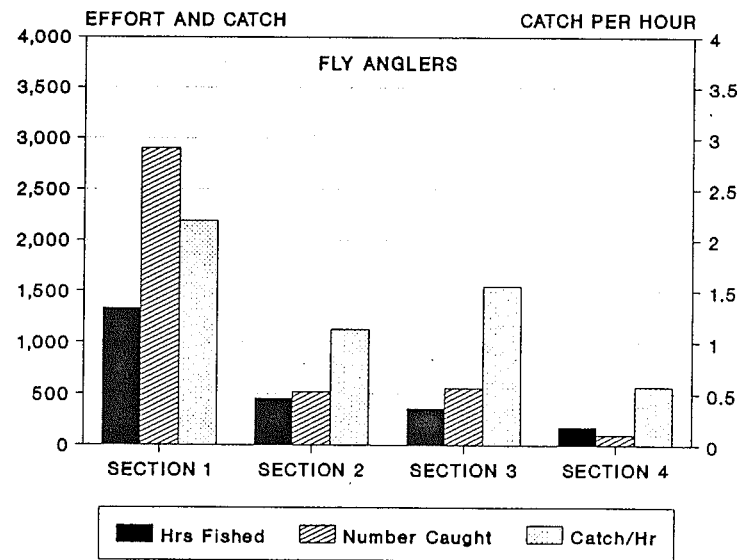


FIGURE 32. Effort and success by fly anglers in Sections 1-4 during 1988.

Lure Anglers. Lure anglers spent about one-third as much time as bait anglers fishing in the Monument during 1988 (Figure 26). The overall average catch rate for lure anglers (1.77 trout/hour) was the highest recorded for the three angling methods.

Almost equal numbers of trout were caught by lure anglers in Sections 1 and 3 (Figure 31). However, the catch rate for lure anglers in Section 3 (3.52 trout/hour) was highest for any method and/or section. As with bait anglers, lure anglers kept more trout from Section 3 than elsewhere (Figure 30). Contrary to the other methods of angling, lure anglers had their second highest catch rate in Section 2.

Fly Anglers. Fly angling was the second most popular method of fishing in the Monument (Figure 26). Fly anglers had an average catch rate just under the high recorded for lure anglers. Like bait and lure anglers, fly fishers preferred the reach of stream nearest the Ranger Station (Figure 32). Almost 3,000 of the approximately 4,000 trout they landed were caught there. Fly anglers landed and kept the fewest numbers of stocked trout (Appendix Table 7). As has been found on most streams throughout California, they also kept the lowest percentage of wild trout.

The distribution of fly fishing effort in Sections 2 through 4 was almost identical to that of lure anglers (Figures 31 and 32). Fly anglers enjoyed their second highest catch rate in Section 3. As with lure anglers, Section 4 attracted the fewest fly fishers, produced their poorest catch rates, and accounted for the lowest numbers of trout caught in any section.

Lengths of Trout Caught

The fishery within the Monument consists largely of small- to medium-size trout. Eighty-three percent of the wild trout landed during the 1988 study were less than 10 inches in length (Figure 33). Of the fish 10 inches and greater in length landed, anglers reported that 71% were brown, 22% were rainbow, and 7% were brook trout. Trout 10 to 11.9, 12 to 13.9, and 14 inches and greater comprised 12.6, 3.6, and 0.8 percent of the catch, respectively.

None of the brown trout under 6-inches in length and very few of the rainbow and brook trout in that size class were kept (Figures 34, 35, and 36). For all three species, the most frequently kept trout were in the 8 to 9.9-inch size class. Anglers reported keeping 447 (31%) of the 10 to 11.9-inch trout, 139 (33%) of the 12 to 13.9-inch trout, and 13 (14%) of the ≥ 14 -inch trout.

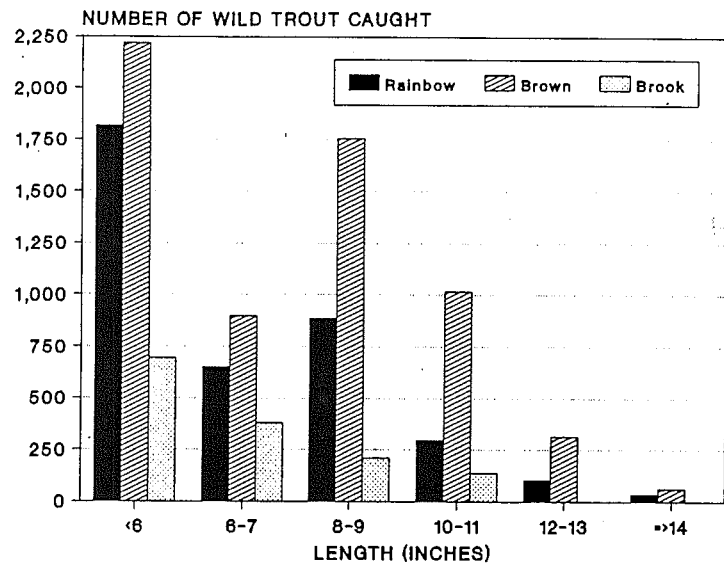


FIGURE 33. Number and lengths of wild rainbow, brown, and brook trout anglers reported catching during 1988.

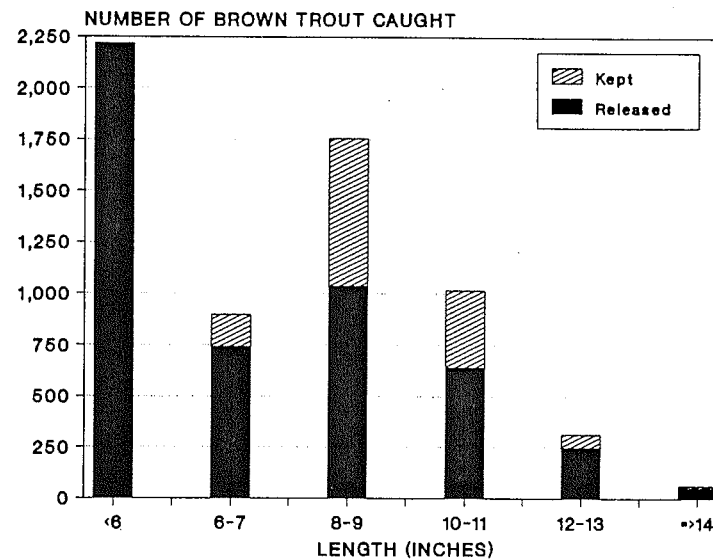


FIGURE 34. Number and lengths of wild brown trout anglers reported keeping or releasing during the 1988 season.

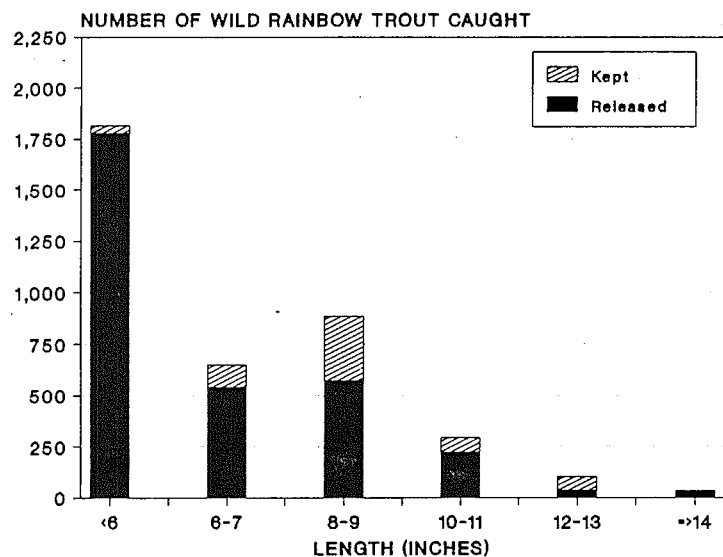


FIGURE 35. Number and lengths of rainbow trout anglers reported keeping or releasing during the 1988 season.

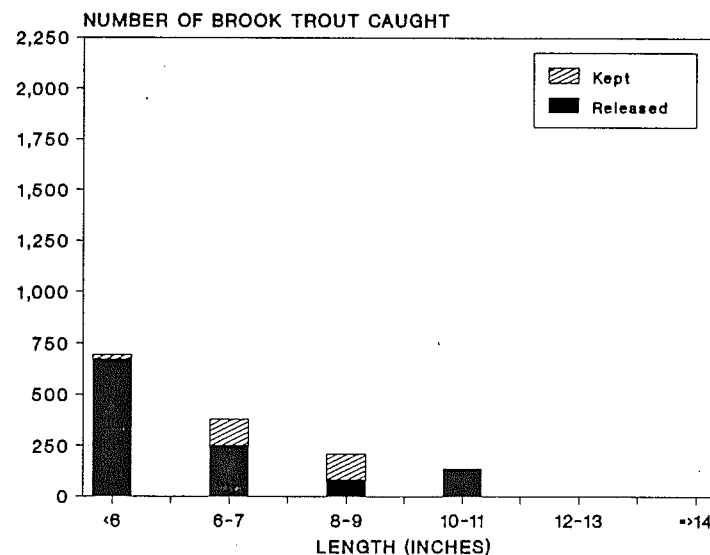


FIGURE 36. Number and lengths of brook trout anglers reported keeping or releasing during the 1988 season.

Generally, anglers keep a higher percentage of the large trout. This was the case in the upstream trailside reach (Deinstadt et al. 1995). Why a higher percentage of 8 to 9.9-inch (40%) than 10-inch and larger trout were kept is uncertain.

Anglers' Area of Residence

Eighty-five percent of the anglers interviewed during the 1988 study were from Southern California. The balance of the anglers came mostly from Central California (7%), the eastern Sierras (4%) and the Bay Area (3%).

Comparisons with Other California Trout Streams

In comparison to nine other California candidate or designated Catch-and-Release or Wild Trout streams on which season-long creel censuses have been conducted, the Middle Fork within the Monument ranked fifth in hours fished/mile/month (Figure 37). Based on the numbers of wild trout only, the Middle Fork ranked third in the number of trout caught/mile/month and second in the average season-long catch rate (Figures 38 and 39).

Only Hot Creek and Hat Creek, probably the two best known and heavily fished wild trout streams in California, provided a higher number of wild trout landed/mile (Figure 38). Based on available season-long creel census results, the Middle Fork produced a higher catch rate than these two waters (Figure 39). Both of the other streams, however, offer anglers a greater opportunity to land 12- to 15-inch trout.

CATCH-AND-RELEASE ANGLING REGULATIONS

Satisfaction with the number and size of trout caught were not evaluated during the 1988 creel census. These two parameters have been evaluated in the upstream reach and, given the similarity of the two fisheries, the results are assumed to be indicative of anglers in the Monument. There were, however, some notable differences in the fisheries. Upstream, fly anglers accounted for 55% of the total effort and bait anglers 39% (Deinstadt et al. 1995). Downstream, 55% of the effort came from bait anglers and 24% from fly anglers (Figure 26). In the Monument, part of the catch consists of stocked rainbow trout, especially in the reach most commonly used by bait anglers. Presumably, small numbers of catchables are landed in the upstream area.

Sixty-four percent of the upstream anglers reporting during the 1990-93 seasons were satisfied with the number of trout they landed. Forty-six percent of the upstream anglers were satisfied with the size of trout they landed, but within this group, only 14% were highly satisfied (Deinstadt et al. 1995). It is assumed

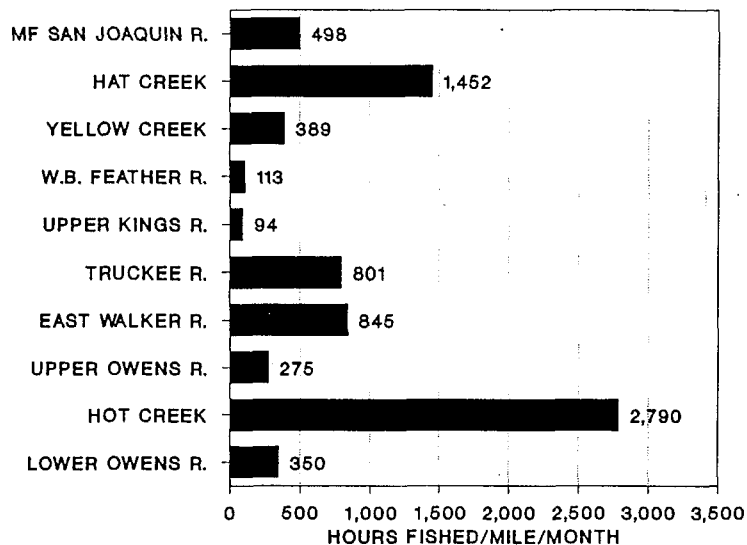


FIGURE 37. Comparison of the hours fished/mile/month in the study area and nine other California trout streams.

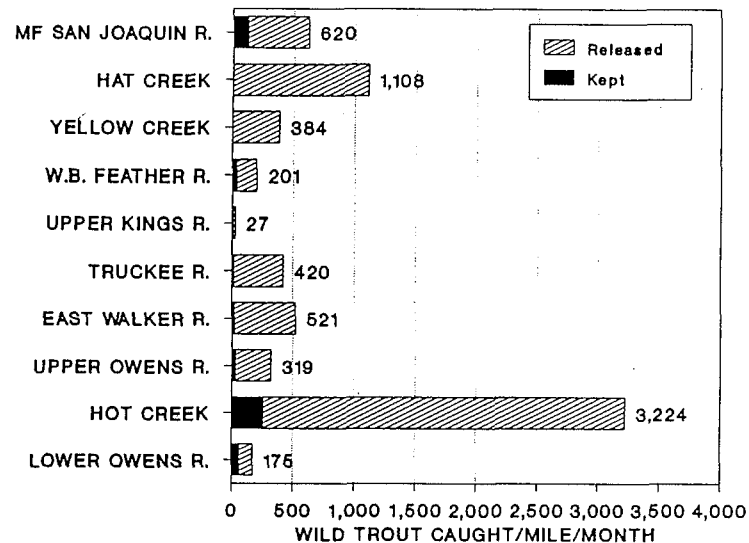


FIGURE 38. Comparison of wild trout caught/mile/month in the study area and nine other California trout streams.

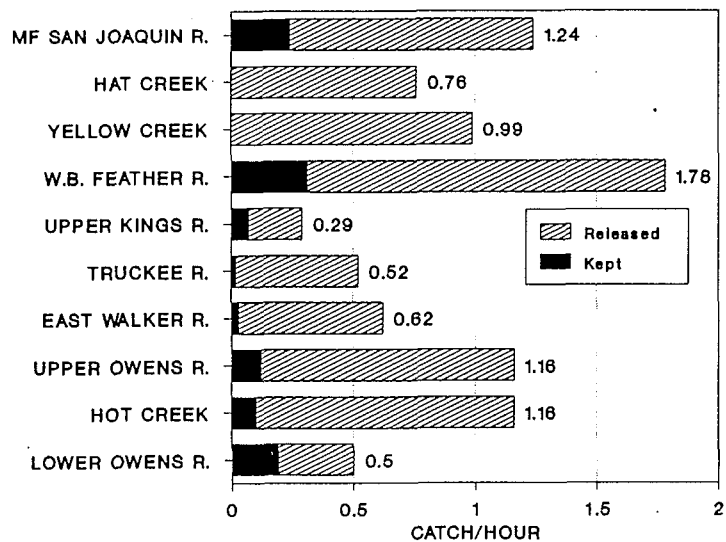


FIGURE 39. Comparison of the catch/hour in the study area and nine other California trout streams.

that most of the anglers in the Monument were, likewise, satisfied with the number of trout they landed, but perhaps not with the size of trout landed.

Following the 1988 season and the compilation of the angler and population survey data collected that year, a thorough discussion of the potential need for special angling regulations was held with Mr. Eckhardt, long-time manager of the Monument. Several considerations were discussed during the meeting, most of which are covered below.

Considered one of the most important factors was the potential to increase the size of trout based on an examination of length frequency data available from population surveys. An examination of the 1986 through 1988 data (including upstream sections) showed that only 0.3% of the estimated population exceeded 12 inches. Adding in the data collected since 1988, but excluding the upstream sections, trout in that size class averaged 15 fish/mile (0.3%). In 1988, the percentage of the population in the 10 to 11.9-inch range was 1.7%. With the additional data, it is 1.4%. Ninety-eight percent of the trout in both the 1988 and 1991 databases were under 10 inches in length. Most California streams with a potential to be managed for larger trout have at least moderate numbers of these fish present in the population surveys. The small percentages of larger trout present in the samples suggest a limited potential to produce significant numbers of these fish in the Middle Fork.

Another consideration was the impact of special regulations on anglers who currently fish the Monument. Most of the regulations designed to increase the size of trout would require releasing fish under or over a given length. This in turn, generally prohibits the use of bait due to the high mortality rate accompanying the release of bait-caught fish. That would mean, based on the 1988 census, that the majority of the anglers now attracted to the Monument could no longer use their preferred method of fishing. Those bait anglers who do not fish with any other method would be denied access to this fishery.

The presence of stocked rainbow trout was also considered. Though, given Park Service resource management policies, it is preferable not to have planted catchables in the Monument, there is no practical way to continue stocking and eliminate downstream migration. Fishing is presumed to be one of the primary recreational activities of those vacationing in upstream campgrounds. The Department, therefore, wants to continue the stocking program. If bait fishing were prohibited, it is assumed that the downstream migrants now removed from Section 1 would build up during the season and become a major part of the

population in that reach of the river. Allowing bait anglers to enjoy catching these fish and, in turn, remove and utilize them, is considered a positive way of handling the problem.

During the discussions, two other aspects of managing the Monument were considered. One was that fishing, though a desirable part of activities there, was not the Monument's primary purpose. That purpose is to preserve the Postpile and have visitors see and, hopefully, gain some appreciation of its geological history. A secondary purpose may be to provide a similar experience at Rainbow Falls. Imposing special angling regulations (ie., lures and flies only) sometimes attracts many more anglers than were present before these regulations were in place. Attracting more anglers, especially in the area around the Ranger Station, could conflict with the Monument's primary purpose.

Concern was also expressed regarding the enforcement of special angling regulations. If used, Monument personnel would feel a strong obligation to enforce these regulations, which could mean additional patrols and issuing citations. Both activities, and any follow-up court appearances, would again conflict with the primary purpose of the Monument.

It was agreed that the fishery would be monitored and, if warranted, special angling regulations sought. Though no additional angler monitoring was done between 1989 and 1993, data available from a program instituted in the Monument in 1994 indicate catch rates are similar to the high levels recorded in the upstream reach.

RECOMMENDATIONS

1. The Middle Fork San Joaquin River from the northern boundary of the Monument to Lower Falls be recommended for designation as a "Wild Trout Stream" in the fall of 1994.

The fishery assessment work completed by the Department indicates the reach of the Middle Fork recommended for designation has trout populations capable of sustaining an excellent "fast-action" fishery. The California Fish and Game Commission has specifically directed the Department to include such streams in the statewide Wild Trout Program. National Park Service personnel support the designation and, from the experience of Department biologists, would be fully supportive of a cooperative management program designed to maintain a quality wild trout fishery within the Monument.

2. The Department, in cooperation with the Monument, survey trout populations in Middle Fork during the fall of 1995.

Under the Department's current informal management program, trout populations within the Monument are scheduled to be monitored every three to five years. The monitoring program, established in 1991, involves two population sampling sites-- the site near the Ranger Station and the site just below the Trail bridge crossing. The upstream site is in the most heavily fished reach of stream, and the downstream site is in the reach that, in 1988, was subject to the highest level of harvest.

After the 1995 survey, the primary method of monitoring the fishery should be switched from population surveys to an angler box survey program. A box program has been used successfully in the upstream reach of the Middle Fork and was initiated in the Monument at the start of the 1994 season. Based on the number of forms received, the box program can be successfully used to monitor general trends in the Monument fishery. The 1995 population survey will allow past trout population data to be tied in with the box program. If future returns from the box program indicate a significant decline may have occurred in the fishery, the Department should again survey trout populations within the Monument and take appropriate action.

3. Current fishing regulations remain in place as long as the fishery is able to sustain catch rates and a size structure similar to that present during the 1988 creel survey.

The "unique" characteristic of the Middle Fork is not its capacity to grow trophy-size trout, but its capacity to sustain an unusually high density of small- to medium-size trout. Changing the angling regulations in an effort to substantially increase the number of larger trout would probably fail to achieve the success sought by anglers not content with the fishery's "fast-action" angling opportunities. If, however, the monitoring program shows that a major change has occurred in either catch rates or the size of fish available to the angler, and this change is attributable to an increase in the numbers of trout being kept by anglers, both the National Park Service and the Department have agreed to seek more restrictive regulations.

ACKNOWLEDGMENTS

We are grateful to the members of the Southwest Council, Federation of Fly Fishers, especially the Antelope Valley and Aguabonita clubs, who volunteered to help the Department survey trout populations in the Monument. We wish to express a special thanks to our Department's stream survey crews and their crew leaders--Kyle Murphy and Glenn Sibbald. Dave Lentz headed up the population survey conducted in 1991.

We also wish to thank the National Park Service staff at the Monument for their cooperation and support throughout the study.

Stream habitat data were compiled by Rob Wickwire. Don Rowan provided additional descriptive data. Ralph Carpenter, as he has done so often, ran the computer compilations of the creel survey data. Lee Ann Galbraith rendered the general location map. The report was reviewed by Wymond Eckhardt and Dave Lentz and edited by Chuck Knutson. Anne Gerolamy assisted with the final preparation of the manuscript. We appreciate the contributions each of these individuals made to this report.

REFERENCES

- DeinStadt, J.M., D.C. Lentz, and S. Parmenter. 1995.
Assessment of the wild trout fishery in the upper Middle Fork
San Joaquin River. Calif. Dept. Fish and Game Inland Fish.
Admin. Rep. No. 95-1. 38 p.
- DeinStadt, J.M. and S. Parmenter. 1993 (Draft). Lower Owens
River wild trout management plan. Calif. Dept. Fish and
Game.
- DeinStadt, J.M., G.F. Sibbald, J.D. Knarr, and D.M. Wong.
1986. Survey of fish populations in streams of the Owens
River drainage: 1985. Calif. Dept. Fish and Game Inland
Fish. Admin. Rep. No. 86-3. 71 p.
- DeinStadt, J.M., J.E. Swanson, G.F. Sibbald, and D.R. McEwan.
1987. Survey of fish populations in west slope Sierra Nevada
streams: 1984-86. Calif. Dept. Fish and Game Inland Fish.
Admin. Rep. (Draft).
- DeinStadt, J.M., E.J. Pert, F.G. Hoover, and S. Sasaki. 1990.
Survey of fish populations in six southern California
streams: 1987. Calif. Dept. Fish Game Inland Fish. Admin.
Rep. No. 90-1. 56 p.
- Huber, N.K. and W.W. Eckhardt. 1985. Devils Postpile story.
The Sequoia Natural History Association in Cooperation with
the National Park Service, Dept. of Interior. 30 p.
- Platts, W.S., W. Megahan, and G.W. Minshall. 1983. Methods for
evaluating stream, riparian, and biotic conditions. U. S.
Forest Serv., Gen. Tech. Rep. INT-138. 70 p.
- Seber, G.A. and E.D. LeCren. 1967. Estimating population
parameters from catches large relative to the population.
J. Animal Ecology. 36: 631-643.
- Zippin, C. 1958. The removal method of population estimation.
J. Wildl. Mgmt. 22(1): 82-90.

APPENDIX TABLE 1. Density of Rainbow, Brown, and Brook Trout in the Monument Reach of the Middle Fork San Joaquin River During Surveys Conducted between 1986 and 1991.

<u>Location</u>	<u>Year</u>	<u>Species</u>	<u>Trout/Mile</u>	<u>95% C.I.</u>	
Just Below Ranger St. (Site 1)	1988	Brown	7,266	±	182
		Rainbow	2,383	±	187
		Brook	489	±	67
		Total	10,138		
	1991	Brown	8,459	±	514
		Rainbow	2,072	±	171
		Brook	602	±	348
		Total	11,133		
Opposite Devils Postpile (Site 2)	1986	Brown	2,213	±	75
		Rainbow	1,084	±	115
		Brook	138	±	6
		Total	3,435		
	1988	Brown	4,269	±	275
		Rainbow	1,554	±	270
		Brook	112	±	24
		Total	5,935		
John Muir Trail Bridge (Site 3)	1987	Brown	1,676	±	89
		Rainbow	1,152	±	39
		Brook	63	±	0
		Total	2,891		
	1988	Brown	1,529	±	106
		Rainbow	813	±	50
		Brook	166	±	22
		Total	2,508		
	1991	Brown	2,220	±	247
		Rainbow	859	±	77
		Brook	41	±	77
		Total	3,120		
Below Rainbow Falls (Site 4)	1987	Brown	1,714	±	118
		Rainbow	3,794	±	218
		Brook	23	±	0
		Total	5,531		
	1988	Brown	1,628	±	278
		Rainbow	2,772	±	224
		Brook	0	±	---
		Total	4,400		
Average		Brown	3,442		
	Rainbow	1,831			
	Brook	182			
	Total	5,455			

APPENDIX TABLE 2. Biomass of Rainbow, Brown, and Brook Trout in the Monument Reach of the Middle Fork San Joaquin River During Surveys Conducted between 1986 and 1991.

<u>Location</u>	<u>Year</u>	<u>Species</u>	<u>Lb/Acre</u>
Just Below Ranger Station (Site 1)	1988	Brown	136.5
		Rainbow	23.4
		Brook	4.8
		Total	164.7
	1991	Brown	181.5
		Rainbow	26.4
		Brook	6.9
		Total	214.8
Opposite Devils Postpile (Site 2)	1986	Brown	89.8
		Rainbow	17.9
		Brook	2.2
		Total	109.9
	1988	Brown	102.5
		Rainbow	25.9
		Brook	1.9
		Total	130.3
John Muir Trail Bridge (Site 3)	1987	Brown	48.1
		Rainbow	16.8
		Brook	0.4
		Total	65.3
	1988	Brown	49.4
		Rainbow	12.3
		Brook	0.9
		Total	62.6
	1991	Brown	87.0
		Rainbow	15.4
		Brook	0.9
		Total	103.3
Below Rainbow Falls (Site 4)	1987	Brown	32.7
		Rainbow	37.0
		Brook	1.2
		Total	70.9
	1988	Brown	40.8
		Rainbow	31.3
		Brook	0.0
		Total	72.1
Average		Brown	85.4
		Rainbow	22.9
		Brook	2.1
		Total	110.4

APPENDIX TABLE 3. Density of Rainbow, Brown, and Brook Trout ≥ 6 Inches in the Middle Fork San Joaquin River Study Area During Surveys Conducted Between 1986 and 1991.

Location	Yr	Species	Estimated number of trout/mile				
			Length (Inches)				Total
			6-7	8-9	10-11	≥ 12	
Ranger Station (Site 1)	88	Brown	1,250	1,234	108	15	2,607
		Rainbow	548	16	0	0	564
		Brook	142	0	0	0	142
		Total	1,940	1,250	108	15	3,313
	91	Brown	2,557	1,255	32	32	3,876
		Rainbow	670	15	0	0	685
		Brook	175	0	0	0	175
		Total	3,402	1,270	32	32	4,736
Devils Postpile (Site 2)	86	Brown	792	303	186	47	1,328
		Rainbow	410	0	0	0	410
		Brook	46	0	0	0	46
		Total	1,248	303	186	47	1,784
	88	Brown	529	610	122	20	1,281
		Rainbow	345	43	0	22	410
		Brook	56	0	0	0	56
		Total	930	653	122	42	1,747
Muir Trl Bridge (Site 3)	87	Brown	365	387	86	0	838
		Rainbow	293	63	0	0	356
		Brook	0	0	0	0	0
		Total	658	450	86	0	1,194
	88	Brown	595	340	42	0	977
		Rainbow	208	21	0	0	229
		Brook	0	0	0	0	0
		Total	803	361	42	0	1,206
	91	Brown	532	902	0	0	1,434
		Rainbow	215	64	0	0	279
		Brook	20	0	0	0	20
		Total	767	966	0	0	1,733
Below RB Falls (Site 4)	87	Brown	333	452	24	0	809
		Rainbow	580	218	24	0	822
		Brook	0	23	0	0	23
		Total	913	693	48	0	1,654
	88	Brown	426	326	50	0	802
		Rainbow	427	118	0	0	545
		Brook	---	--	-	-	---
		Total	853	444	50	0	1,347
Average		Brown	820	645	72	13	1,550
		Rainbow	411	62	3	2	478
		Brook	49	2	0	0	51
		Total	1,280	709	75	15	2,079

APPENDIX TABLE 4. Angling Effort and Success by Month on the Middle Fork San Joaquin River, Devils Postpile National Monument Area, June through October 1988.

	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Total</u>
<u>Hour fished</u>	2,242	2,508	2,397	1,672	403	9,222
<u>Number of trout caught</u>						
Wild rainbow trout						
Kept	211	177	49	112	54	603
Released	461	908	1,289	333	186	3,177
Landed	672	1,085	1,338	445	240	3,780
Hatchery rainbow trout						
Kept	7	181	507	345	0	1,040
Released	23	157	133	87	0	400
Landed	30	338	640	432	0	1,440
Wild brown trout						
Kept	722	210	270	134	0	1,336
Released	1,310	2,101	718	504	296	4,929
Landed	2,032	2,311	988	638	296	6,265
Wild brook trout						
Kept	41	216	22	0	0	279
Released	553	490	39	38	18	1,138
Total	594	706	61	38	18	1,417
Total trout						
Kept	981	784	848	591	54	3,258
Released	2,347	3,656	2,179	962	500	9,644
Landed	3,328	4,440	3,027	1,553	554	12,902
<u>Catch/hour</u>						
Wild rainbow trout						
Kept	0.09	0.07	0.02	0.07	0.13	0.07
Released	0.21	0.36	0.54	0.20	0.46	0.34
Landed	0.30	0.43	0.56	0.27	0.60	0.41
Hatchery rainbow trout						
Kept	<0.01	0.07	0.21	0.21	0.00	0.11
Released	0.01	0.06	0.06	0.05	0.00	0.04
Landed	0.01	0.13	0.27	0.26	0.00	0.16
Wild brown trout						
Kept	0.32	0.08	0.11	0.08	0.00	0.14
Released	0.58	0.84	0.30	0.30	0.73	0.53
Landed	0.91	0.92	0.41	0.38	0.73	0.68
Wild brook trout						
Kept	0.02	0.09	0.01	0.00	0.00	0.03
Released	0.25	0.20	0.02	0.02	0.04	0.12
Landed	0.26	0.28	0.03	0.02	0.04	0.15
Total trout						
Kept	0.44	0.31	0.35	0.35	0.13	0.35
Released	1.05	1.46	0.91	0.58	1.24	1.05
Landed	1.48	1.77	1.26	0.93	1.37	1.40

APPENDIX TABLE 5. Angling Effort and Success by Section in the Middle Fork San Joaquin River, Devils Postpile National Monument Area, June through October 1988.

	<u>Section 1</u>	<u>Section 2</u>	<u>Section 3</u>	<u>Section 4</u>	<u>Total</u>
<u>Hours fished</u>	5,697	1,391	1,342	792	9,222
<u>Number of trout caught</u>					
Wild rainbow trout					
Kept	208	74	295	26	603
Released	1,847	358	651	321	3,177
Landed	2,055	432	946	347	3,780
Hatchery rainbow trout					
Kept	1,034	6	0	0	1,040
Released	400	0	0	0	400
Landed	1,434	6	0	0	1,440
Wild brown trout					
Kept	546	92	625	73	1,336
Released	3,036	682	1,053	158	4,929
Landed	3,582	774	1,678	231	6,265
Wild brook trout					
Kept	57	0	222	0	279
Released	601	370	151	16	1,138
Landed	658	370	373	16	1,417
Total trout					
Kept	1,845	172	1,142	99	3,258
Released	5,884	1,410	1,855	495	9,644
Landed	7,729	1,582	2,997	594	12,902
<u>Catch/hour</u>					
Wild rainbow trout					
Kept	0.04	0.05	0.22	0.03	0.07
Released	0.32	0.26	0.49	0.41	0.34
Landed	0.36	0.31	0.70	0.44	0.41
Hatchery rainbow trout					
Kept	0.18	<0.01	0.00	0.00	0.11
Released	0.07	0.00	0.00	0.00	0.04
Landed	0.25	<0.01	0.00	0.00	0.16
Wild brown trout					
Kept	0.10	0.07	0.47	0.09	0.14
Released	0.53	0.49	0.78	0.20	0.53
Landed	0.63	0.56	1.25	0.29	0.68
Wild brook trout					
Kept	0.01	0.00	0.17	0.00	0.03
Released	0.11	0.27	0.11	0.02	0.12
Landed	0.12	0.27	0.28	0.02	0.15
Total trout					
Kept	0.32	0.12	0.85	0.12	0.35
Released	1.03	1.01	1.38	0.62	1.05
Landed	1.36	1.14	2.23	0.75	1.40

APPENDIX TABLE 6. Effort and Success by Angling Method Used on the Middle Fork San Joaquin River, Devils Postpile National Monument Area, June through October 1988.

	<u>Bait</u>	<u>Lure</u>	<u>Fly</u>	<u>Total</u>
Hours fished	5,105	1,783	2,334	9,222
Number of trout				
Kept	2,281	623	354	3,258
Released	3,374	2,532	3,738	9,644
Landed	5,655	3,155	4,092	12,902
Catch/hour				
Kept	0.45	0.35	0.15	0.35
Released	0.66	1.42	1.60	1.05
Landed	1.11	1.77	1.75	1.40

APPENDIX TABLE 7. Effort and Success by Angling Method and Section on the Middle Fork San Joaquin River, Devils Postpile National Monument Area, June through October 1988.

	<u>Section 1</u>	<u>Section 2</u>	<u>Section 3</u>	<u>Section 4</u>	<u>Total</u>
<u>Bait angling</u>					
Hours fished	3,530	537	654	384	5,105
Number of wild trout					
Kept	543	104	697	82	1,426
Released	1,975	273	589	228	3,065
Landed	2,518	377	1,286	310	4,491
Number of stocked trout					
Kept	849	6	0	0	855
Released	309	0	0	0	309
Landed	1,158	6	0	0	1,164
Catch/hour					
Kept	0.39	0.20	1.07	0.21	0.45
Released	0.65	0.51	0.90	0.59	0.66
Landed	1.04	0.71	1.97	0.81	1.11
<u>Lure angling</u>					
Hours fished	836	393	326	228	1,783
Number of wild trout					
Kept	111	62	312	17	502
Released	833	618	837	165	2,453
Landed	944	680	1,149	182	2,955
Number of stocked trout					
Kept	121	0	0	0	121
Released	79	0	0	0	79
Landed	200	0	0	0	200
Catch/hour					
Kept	0.28	0.16	0.96	0.07	0.35
Released	1.09	1.57	2.57	0.72	1.42
Landed	1.37	1.73	3.52	0.80	1.77
<u>Fly angling</u>					
Hours fished	1,331	461	362	180	2,334
Number of wild trout					
Kept	157	0	133	0	290
Released	2,676	519	429	102	3,726
Landed	2,833	519	562	102	4,016
Number of stocked trout					
Kept	64	0	0	0	64
Released	12	0	0	0	12
Landed	76	0	0	0	76
Catch/hour					
Kept	0.17	0.00	0.37	0.00	0.15
Released	2.02	1.13	1.19	0.57	1.60
Landed	2.19	1.13	1.55	0.57	1.75