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RESTORATION OF THE CALIFORNIA GOLDEN TROUT IN THE SOUTH FORK KERN RIVER, KERN PLATEAU, TULARE COUNTY, CALIFORNIA, 1966-2004, WITH REFERENCE TO GOLDEN TROUT CREEK

By

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CALIFORNIA GOLDEN TROUT

Central Region

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RESTORATION OF THE CALIFORNIA GOLDEN TROUT IN THE SOUTH FORK KERN RIVER, KERN PLATEAU, TULARE COUNTY, CALIFORNIA, 1966-2004, WITH REFERENCE TO GOLDEN TROUT CREEK[1]

By

E. P. (Phil) Pister

From primal shores down ages dimly past
You fled your salt tide for our rendezvous.
What geologic eons nurtured you
In utter isolation where, at last,
You shed the steelhead, then the rainbow cast
To match the sunset, don its aureate hue?
Across your parr-mark shines the yellow spew
Of clouds embroiled on mountains dim and vast.

An errant soul, enamored of your spell,
Beholds the ancient miracles in store
Where meadowlands bear sun-reflecting dreams.
By devious ways, in ages none can tell,
I, too, migrated from a primal shore
To win perfection in your golden streams.
Ardis M. Walker

ABSTRACT

This paper describes a major recovery effort for California golden trout, *Oncorhynchus mykiss aguabonita*, started in 1966 and still in progress, to remove an invasion of brown trout and hybrid goldenxrainbow that had invaded and spread throughout the South Fork Kern River drainage and nearly caused extinction of the California State Fish and namesake of Inyo National Forest's Golden Trout Wilderness. The paper condenses and presents an historic and joint effort by the California Department of Fish and Game and Inyo National Forest involving construction of major fish barriers, application of piscicides to more that 100 miles of stream to remove invading fishes, restocking of native fishes, habitat restoration, and reduction of grazing levels and resting of grazing allotments to allow physical recovery of trout habitat. Continuing research by geneticists will allow us to better understand the golden trout resource and its future. The recovery effort almost certainly represents the most extensive such project ever undertaken for a fish, either freshwater or marine.

[1] Central Region Administrative Report No. 2008-1. Submitted by E. P. (Phil) Pister, retired, 437 East South Street, Bishop, CA 93514. All photos by author unless otherwise indicated. Map (Figure 1) drawn by J. Erdman, CDFG.

BACKGROUND

The story of evolution and management of California golden trout (*Oncorhynchus mykiss aguabonita*), a native Californian in every respect, fittingly reflects a glorious history of the Golden State that it represents. Described in 1893 by ichthyologist and first president of Stanford University David Starr Jordan, golden trout were soon thereafter extended northward from their evolutionary habitat on the Kern River Plateau into barren, glacially-formed lakes of the High Sierra. Fears for its vulnerability and possibility of extinction prompted President Theodore Roosevelt to direct Dr. Barton Warren Evermann of U.S. Bureau of Fisheries to conduct a major study (Evermann 1906). Portions of this study still guide fisheries managers today, more than 100 years later.

As I left Templeton Meadow in late summer of 1996, California Department of Fish and Game (CDFG) [2] crews under direction of engineer George Heise and Elk Grove Screen Shop supervisor Dave Rose were preparing to pour the last of an 80 cubic yard concrete barrier dam east of Templeton Mountain to prevent future invasions of brown trout (*Salmo trutta*) and hybridized rainbow *(Oncorhynchus mykiss*)xgolden trout into native habitat of California golden trout, the California state fish. I laid my backpack aside as I watched this tireless crew go about their business with efficiency that brought a deep satisfaction. My mind went back nearly 40 years to my first visit into that marvelous area of California, a visit that began a career-long involvement in an effort to keep that unique resource intact. I reflected on my own experience with this spectacular fish that began in the 1930s, when my father took my brother and me to the Middle Fork San Joaquin River at Devils Postpile. More than 60 years later, in my mind's eye I can still see a catch of golden trout displayed by a proud angler who had taken them on a fly not far from the road. These same sentiments were repeated when in late 2004 I viewed the replacement for the failed Schaeffer Barrier, completed earlier that year and located about 5 miles (8 km.) downstream from Templeton Barrier. I marveled that under budget duress suffered by all California governmental agencies, including Department of Fish and Game, my Region 4 counterparts could somehow acquire well over two million dollars for construction of a fish barrier, vital importance of which could be fully comprehended only by a handful of individuals.

The Beginning

Early records reveal that Mulkey Creek, tributary to SFKR and isolated from the main SFKR, was initially stocked with California golden trout taken from Golden Trout Creek. In 1876 settlers transported 13 of these fish over Mulkey Pass and into the Owens River drainage, planting them in Cottonwood Creek, a tributary to the Owens Valley drainage and Great Basin (Figure 1). These fish thrived in their new habitat, and in 1891 were carried several miles upstream over barriers and introduced into Cottonwood Lakes. In

[2] The terms CDFG (California Department of Fish and Game), FS (USDA Forest Service), INF (Inyo National Forest), and SFKR (South Fork of the Kern River) appear frequently in the text. These acronyms will be used throughout the paper. The entire project occurred within the boundaries of the Inyo National Forest.

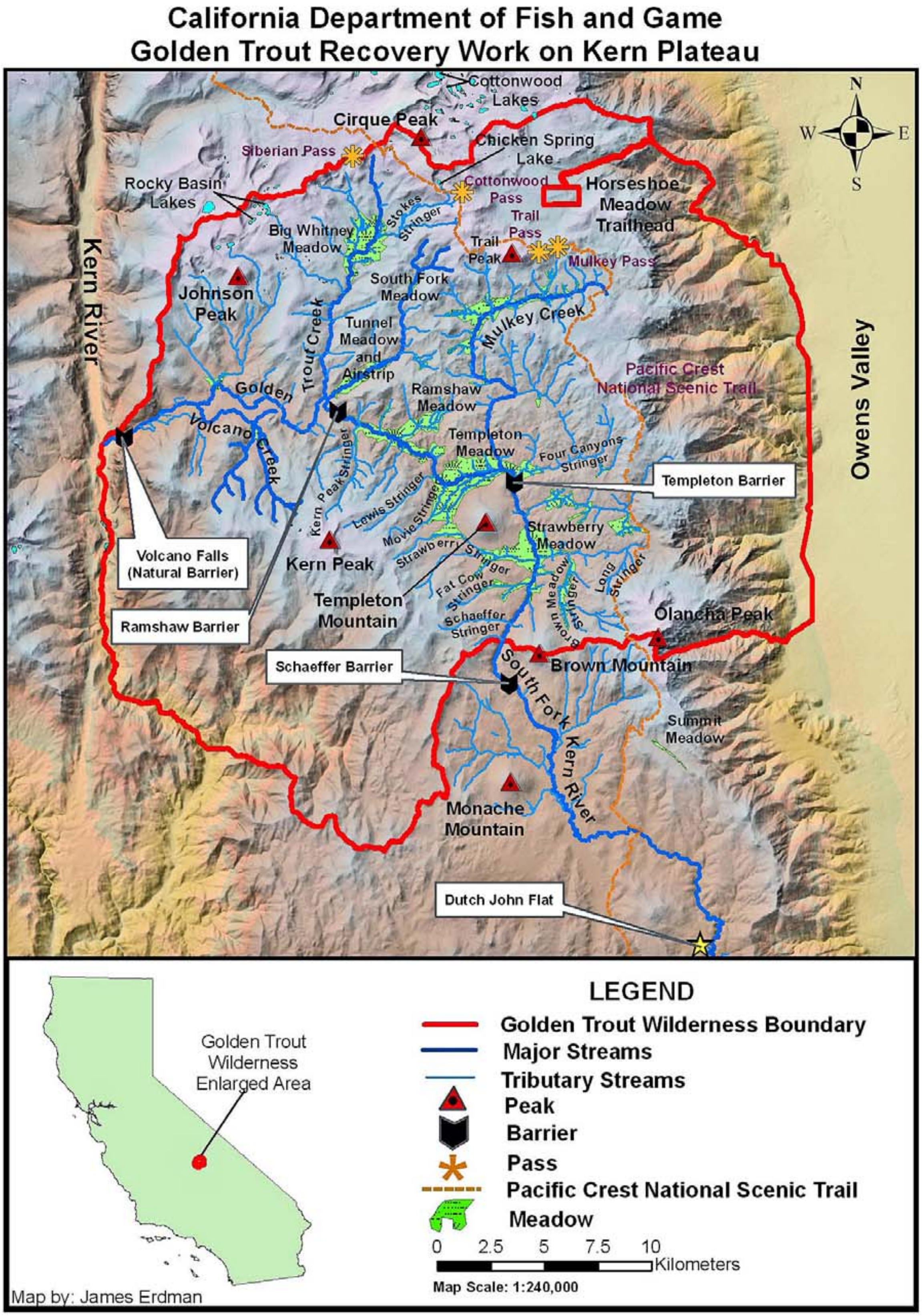

Figure 1 – Map of the project area.

1917-18 the (then) California Division of Fish and Game established a spawning station at Cottonwood Lakes to provide golden trout eggs for hatching and rearing at Mt. Whitney State Fish Hatchery near the small Owens Valley town of Independence. Resulting fingerling trout were planted mainly throughout the Sierra Nevada, but also in other mountainous areas of California and other western states. Some shipments were made to the United Kingdom and Brazil.

During the early to mid portions of the twentieth century things began to happen that caused a gradual decline of golden trout, both in distribution and species integrity. Throughout World War II (1942-45) virtually all field employees of the old Division of Fish and Game were called into military service, and it was no longer possible to operate the Cottonwood Lakes spawning station. Yet public demand for trout stocking continued, and the only salmonid species available was brook trout (*Salvelinus fontinalis*), eggs of which could be acquired from out-of-state sources. Planting records reveal substantial introductions of this species during the war years, into waters in which golden trout had previously been planted. Brook trout, being both prolific and highly competitive, soon displaced goldens in many areas. As a consequence, certain drainages of the Sierra were soon set aside for exclusive maintenance of golden trout (Dill 1950),

Our knowledge of interspecific competition between various trouts and chars was minimal at mid-century, and managers did things that passing of time showed to be wrong in terms of what we know today. An observation attributed to the late Stephen Jay Gould puts this so well: “We are trapped in the ignorance of our own generation.” Non-native but intensively planted brook trout from that era are now widespread throughout the Sierra Nevada, and managers are virtually powerless to do anything about it. This situation underscores an axiom that long ago became apparent to me: “It is much easier to plant a fish than to unplant it.”

We are currently finding that early (pre-1950s) and indiscriminate introductions of trout into a historically fishless High Sierra have not only been to long-term detriment of golden trout, but to much of the entire biota (Reimers 1958, 1979, Pister 2001). Trout in recent years have been identified as a possible contributing factor (along with several others) in largely unexplained declines and extirpation of the mountain yellow-legged frog, *Rana sierrae* in northern and central Sierra Nevada and *Rana muscosa* in southern Sierra Nevada and southern California (Vredenburg et al. 2007, Knapp and Matthews 2000, Knapp et al. 2001, Armstrong and Knapp 2004, Bradford 1989, Bradford et al. 1993, Corn 1994, Drost and Fellers 1996). It is perhaps significant that California golden trout evolved alongside mountain yellow-legged frogs on the Kern Plateau. The worldwide decline of amphibian populations is of great concern to herpetologists, and is not restricted solely to the Sierra Nevada.

Extension of golden trout range northward in the Sierra Nevada from the Kern Plateau into waters in which they are not native only exacerbated problems described in planting of brook trout and reflected anthropocentrism that drove fisheries management programs in mid-twentieth century. It wasn’t until Aldo Leopold brought his “Land Ethic” to our attention in “A Sand County Almanac” (Leopold 1949), in which he emphasized that humans bear an ethical obligation to *all* species and not only to themselves, that managers began slowly to edge into the concept of ecosystem management. If there is a mitigating factor here, it is that golden trout are native to California, whereas brook trout are not. To an invertebrate organism or a frog, however, there is little difference.

Perhaps sometime in the 1930s the broodstock of Cottonwood Lakes golden trout was somehow hybridized with rainbow trout, possibly through inadvertent mixing during rearing at Mt. Whitney Hatchery, then planted as fingerlings back into the Cottonwood Lakes as a normal management procedure. The circumstances surrounding this contamination are speculative but have little to do with the “bottom line,” which is that CDFG has for an unknown number of years been both planting and exporting to other states (and nations) a golden trout now known to be genetically impure (University of Montana fish geneticist Robb Leary, letter to E.P. Pister, 1995).

Planting and exporting of hybridized golden trout outside of their native range, although perhaps in some ways regrettable, from the fisheries management perspective is very different from contaminating native stocks in their evolutionary waters. Planting of hybridized golden trout into other waters, both in California and elsewhere, and where this can be done without adversely impacting other species, often provides a superior angling experience for those anglers in pursuit of this highly-prized trout, which bear a very close physical resemblance to genetically pure California golden trout. The Forest Service and California Department of Fish and Game do not take lightly their obligation to protect and preserve California’s State Fish in its purest possible form. The foregoing underscores the necessity and value of pure stocks in upper SFKR and Golden Trout Creek, native range and evolutionary habitat of California golden trout. It is to this issue that the remainder of the paper will be directed.

EARLY WARNINGS

During my 38 years with CDFG I received a number of what I would now term "significant" messages and phone calls. In the early 1960s came a handwritten note from Kernville angler and conservationist, the late Ardis Walker, telling of catching brown trout much farther north on SFKR than ever before, and that this seemed to be increasing with each passing year. Then came an office memo dated September 6, 1966 from CDFG Warden Carl McCammon of Ridgecrest to Bob Lewis, Fisheries Management Supervisor in Fresno (upper SFKR lies within Tulare County, and geographically within the boundaries of CDFG’s Region 4 in Fresno). Until the early 1990s, SFKR and Golden Trout Creek drainages were managed by CDFG fisheries personnel headquartered in the Bishop Office of then Region 5, (now Region 6). In this memo McCammon told of checking an angler with a brown trout taken from SFKR below Tunnel Guard Station and Ramshaw Falls, much higher in the drainage than we had theretofore been aware. He also checked one fish "that I feel sure was a rainbow. It was completely different than others and had all rainbow markings.”

California golden trout and Sacramento sucker (*Catostomus occidentalis*) are the only fishes native to the upper Kern Plateau, an area that includes Golden Trout Creek and SFKR. Suckers are not found in Golden Trout Creek but are present in SFKR. Rainbow and brown trout have been introduced into SFKR, but not Golden Trout Creek, the brown originally from Europe. However, hybridized goldenxrainbow from Cottonwood Lakes were unintentionally air-planted into headwater lakes of Golden Trout Creek (Rocky Basin and Chicken Spring lakes), and gradually drifted downstream into Golden Trout Creek. Rainbow trout are native to the Pacific Coast from northern Baja California northward, and below major migration barriers such as Yosemite Falls on Merced River and Volcano Falls separating Golden Trout Creek from the main Kern River below, the latter falls being instrumental in isolation of golden trout in stream reaches above.

Urgency of this burgeoning problem was underscored during summer of 1969 in a phone call from CDFG Warden Vern Burandt of Lone Pine. As he related his message a cold feeling consumed me, and I could instantly envision what lay ahead: "Phil, my neighbor, who knows his trout very well, caught a brown trout from the South Fork Kern River right next to Tunnel Airstrip." This is located well above Ramshaw Gorge, which we had naively assumed would serve as a barrier to invasion by any unwanted trout species existing in streams below. I could envision a huge restoration project involving construction of barriers, eradication of browns (while holding genetically adequate numbers of golden trout in off-stream locations), protecting invertebrate fauna (which were just beginning to be recognized as "important" by resource management agencies), reintroduction of the only other native fish in SFKR, (Sacramento suckers), and other administrative, financial, and bureaucratic manipulations that inevitably must accompany a venture of that magnitude. My suspicion of what lay ahead proved to be remarkably accurate.

THE PLAN

On September 12, 1969 CDFG fishery biologists John Deinstadt, Bob Brown and I jumped into Bob White's Cessna 206 and flew into Tunnel Airstrip with a fish shocker to verify what we had been told, meeting CDFG Kernville biologist Howard Shainberg at Tunnel Guard Station. Things were as bad as feared. Immediately below FS Tunnel Guard Station we pulled a brown trout weighing at least five pounds from a stream which, at that time of year, was no more than ten feet wide in its widest portions (Figure 2). Furthermore, golden trout populations were obviously depressed and virtually non-existent in some areas. The aggressive and highly predaceous browns (and there were many of them) were methodically eating up goldens as they foraged for food farther and farther upstream from undercut

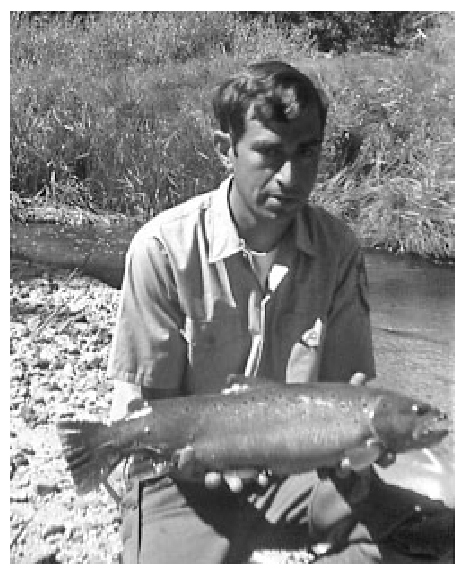

Figure 2 – Howard Shainberg with large brown trout taken from SFKR near Tunnel Guard Station in September 1969.

banks which served as their primary habitat. In most locations we found brown trout to outnumber goldens by more that 100 to 1. Golden trout were edging into extirpation and, ultimately, extinction. A mature golden trout in either SFKR or Golden Trout Creek would measure only six-inches total length and deserves a better fate than to serve as forage for invading brown trout which, from the standpoint of California golden trout, other native fishes, and in the interest of aquatic biodiversity generally, should have remained in Europe and never introduced into North America.

Figure 3 - SFKR in Ramshaw Meadow during cattle grazing, September 1979.

In cooperation with INF personnel we then began to lay out a plan to restore goldens, a plan that went well beyond that per se. Adding to the overall problem was that the entire watershed was suffering terribly from overgrazing (Figures 3 and 4) that had been in progress since the 1860s. This was creating habitat conditions more favorable to browns than to goldens through sedimentation, increased water temperature, and destruction of riparian vegetation. We then began a two-pronged approach: restoration of land as well as golden trout. However, the focus of this paper is on the fish per se (recognizing their close connection), so I shall address those very complex issues involved here, while outlining a brief description of highly important habitat improvement work.

Figure 4 - SFKR in Ramshaw Meadow during cattle grazing, September 1979.

WATERSHED RESTORATION

Starting in the 1930s, INF realized that meadow degradation within the Kern Plateau required attention. Countless gullies were "plugged" in attempts to capture sediment and rebuild meadows. Many of these were successful, but still more needed to be done. In the 1970s INF began to prepare documents addressing livestock management and damage on the Kern watershed (USDA Forest Service 1982, 1982a). These documents laid groundwork for future rehabilitation on the Kern Plateau, designed under directive and constraints of the Endangered American Wilderness Act of 1978, under which Golden Trout Wilderness was created. Eroded areas were identified, and rehabilitative measures prescribed (Figures 3 and 4). This included installation of silt-catching dams in gullies, armoring meadow headcut areas with rock, and reducing and eliminating cattle impacts (Figures 5 and 6). Thus began (long before the term gained common usage) a program designed around basic concepts of ecosystem management. We recognized that, in the long run, full restoration of golden trout depended as much upon integrity of habitat as upon removal of brown and rainbow trout. Since that time progress has been steady, but slow. The cumbersome vehicle of bureaucracy and politics never moves very quickly!

Figure 5 - SFKR in Ramshaw Meadow after removal of cattle, September 2005.

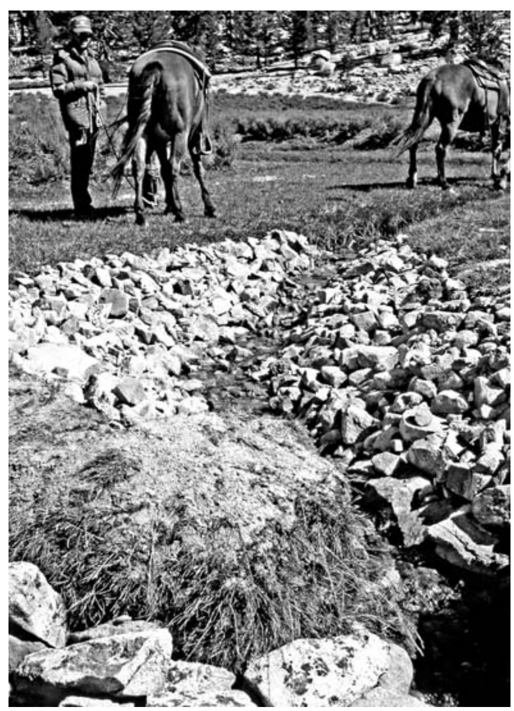

Figure 6 – Forest Service crews armoring meadow erosion headcuts. October 1983.

THE FIRST FISH BARRIER AND EARLY BROWN TROUT CONTROL

Our first effort involved removing as many brown trout as possible from upper reaches of SFKR (rainbow or introgressed goldenxrainbow trout were never found above Ramshaw Falls) in order to temporarily minimize their impact on goldens that remained, while we worked with engineers Ted Vande Sande of CDFG and Steph Johnson of INF on barrier construction. It was their recommendation that a suitable barrier to upstream fish passage be built in the

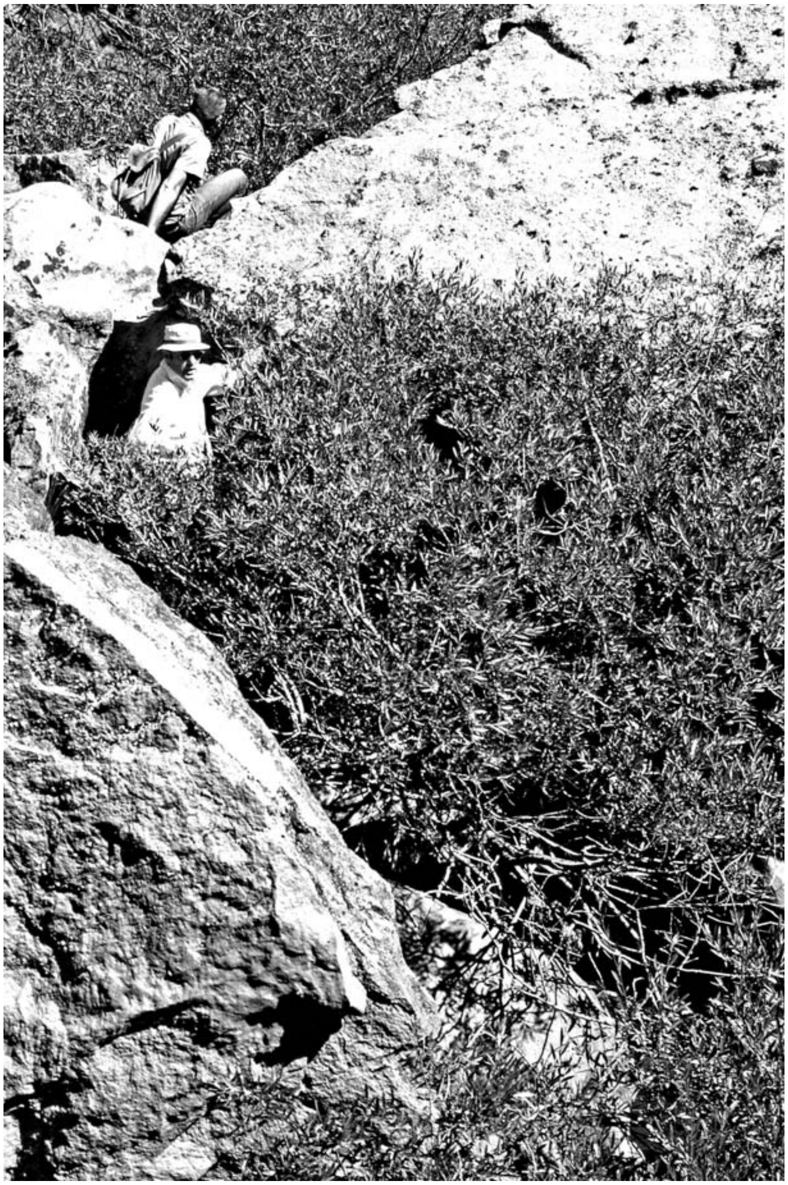

Figure 7 - Ramshaw fish barrier. The willow conceals a ten-foot drop to the SFKR below, as indicated by the person (CDFG engineer Ted Vande Sande) standing in front of the fall. INF wildlife biologist Dave Dunaway sitting at crest of barrier. The barrier had not yet “sealed” to allow water to flow over the barrier to the stream below. September 1970.

gorge about a half mile below Tunnel Guard Station, and this could best be accomplished by blasting rock and building up streambed in one very suitable location (Map, Figure 1). This was done in 1970 and 1973 and headed by late INF wildlife biologist Dave Dunaway, with blasting work being accomplished by INF powder experts. Finally, by the mid-1970s, the barrier had silted in and water was flowing over the top, creating an impassable fall about ten feet (3 m.) high, a condition that persists to this day (Figure 7). We were then prepared to begin major chemical treatment to eradicate brown trout from above this barrier to the very headwaters of SFKR at South Fork Meadows, well above Tunnel Meadow. Early efforts to reduce brown trout populations involved use of swimming pool disinfectant, calcium hypochlorite (trade name HTH), which released free chlorine (toxic to fish) into the stream. This was done in 1969, 1970, 1971 and 1973 in the stream above Ramshaw Barrier (Table 1). Although this process surely helped to reduce brown trout numbers, the chemical was not sufficiently effective to totally remove them. More dependable chemicals would be required later.

Table 1. Chronology of South Fork Kern River Chemical Treatments

Stream Section	Year treated	Chemical utilized
Tunnel Meadows above Ramshaw barrier	1969* 1970* 1971* 1973* 1976	Calcium hypochlorite " " " " " " antimycin
Ramshaw barrier to Templeton barrier	1977 1978 1979	Rotenone " "
Ramshaw barrier to Schaeffer barrier	1981	Rotenone and antimycin
Templeton barrier to Schaeffer barrier	1982 1985 1987 1994	Rotenone " " "

*=below Tunnel Airstrip

1976 - THE MAJOR PROJECT BEGINS

It was our intent that upper reaches of stream from headwaters to Tunnel Guard Station (approximately 10 miles (16 km.) in length) would serve as a "seed" area from which to restock lower stream reaches as we moved the project downstream from Tunnel into the two lower meadows, Ramshaw and Templeton (Figure 8). Plans were then laid to accomplish complete eradication of browns above the upper (Ramshaw) barrier. Crews were recruited from a variety of conservation agencies, including Nevada Department of Wildlife, which had badly-needed experience in administration of the piscicide antimycin. Antimycin was our chemical of choice because it quickly oxidizes, thereby minimizing effects on downstream areas and exerting less detrimental impact on invertebrates and, possibly, amphibians. It should be noted, however, that antimycin is no longer approved for use in California and, because of costs involved in relicensing, will likely never be used again.

Prior to initial use of piscicides, studies were made to assess invertebrate populations, and to determine the impact of piscicides, which affect gill-breathing organisms. The results of this study are summarized in appendix 1. The great majority of resident aquatic insect species have winged adult life stages with a capability of quickly recolonizing following treatment, both from unaffected areas above and below treated sections, and from nearby Golden Trout Creek. Data gathered in this study indicate that use of antimycin exerts a definite impact upon aquatic invertebrate communities in cold mountain streams. Efficiency and effectiveness of antimycin as a fish toxicant, as well as its low toxicity to life forms utilizing free oxygen, make it a valuable and sometimes necessary tool in fish management. Its toxicity to invertebrates and to immature

Figure 8 - Tunnel, Ramshaw, and Templeton meadows, aerial view from northwest to southeast. Orientation: The high point on left skyline is Olancha Peak, elev. 12,123'. At lower elevations to north and west of Olancha Peak lie cinder cones of Templeton Mountain and Brown Mountain (left to right). On extreme right, with a bare spot east of its summit, is Kern Peak, elev. 11,510'. Tunnel Meadow and SFKR lie at the bottom of photo, running to southwest. In extreme lower right corner SFKR makes an abrupt turn to southeast, flowing through Ramshaw Meadow in middle of photo, then into Templeton Meadow surrounding north and western base of Templeton Mountain (elev. 9,932'), then southward through Templeton Gorge along east side of Templeton Mountain. To south of Brown Mountain lies Monache Meadow in extreme right middle background. In far background lie the mountains in northern portion of Sequoia National Forest. Dutch John Flat (not visible in the photo) lies approximately ten miles south (downstream) of Schaeffer Barrier, which is located at the southern boundary of Golden Trout Wilderness. September 26, 1979.

amphibians (dead or dying tadpoles were also collected in drift nets) requires that caution be exercised in selecting where and when it should be used. A careful evaluation of invertebrates that might be affected by the piscicide should help decide if its use is biologically justifiable, and effects of any use on invertebrate communities should be monitored for several years before and after piscicide application. These same precautions must be taken with rotenone formulations.

The chemical was to be administered to the main stream from 55-gallon drums fitted with mechanisms designed to release toxic solutions for a period of 24 hours at a constant concentration. Spring areas and smaller tributaries were treated with 5-gallon and 1-gallon cans fitted with similar constant-flow “drip station” hardware. On the morning of September 14, 1976 this work began and continued through September 15. The 1976 treatment project is detailed in appendix 2.

In anticipation of fish eradication work, from September 10-14, 1976, CDFG electrofishing crews captured approximately 6,000 golden trout and held them in cages in nearby Golden Trout Creek, which, at Tunnel, comes within 200 yards of SFKR. These fish were to be released back into SFKR following treatment, allowing time for recolonization of invertebrates to begin. Restocking was done on September 22 and 23, 1976. However, during an 8 to 13 day period in which the fish were held prior to restocking, more than half disappeared, likely through cannibalism. Fish were restocked as follows: 1,450 between the head of the drainage in South Fork Meadows and Tunnel airstrip, and 1,200 in lower Tunnel Meadows between Tunnel airstrip and Tunnel Guard Station (Figure 1 and Appendix 2).

TEMPLETON AND SCHAEFFER BARRIERS

It was our plan that to provide adequate protection for the upper SFKR drainage from further invasions of non-native and hybridized trout from below, we needed substantial and impassable barriers east of Templeton Mountain and at the head of Monache Meadow near the southern boundary of Golden Trout Wilderness (Figure 1), to be followed ultimately by a lower barrier in vicinity of Dutch John Flat. Construction of Dutch John Flat Barrier would require a series of chemical treatments to eliminate all fish in lower SFKR, after which temporarily fishless waters would be restocked with Sacramento suckers, and California golden trout from presumably pure sources above Ramshaw Barrier. Doing so would return the stream to its native fish fauna and essentially re-establish California golden trout throughout most of its historic distribution in SFKR.

However, recognizing that construction of barriers of that magnitude would require special planning and several years of budget manipulation to have money in hand, INF and CDFG biologists began to construct a barrier near the present Templeton site. This was started in 1973 by blasting large boulders in the area and placing them across the stream, then installing cyclone fence on the upstream side, secured by steel cables and posts driven deep into the streambed (Figure 9). This structure, maintained until the first gabion barrier was constructed in 1980, served more as an impediment than a total barrier to fish invasion. However, it contributed in a way that we had not anticipated. It reduced stream velocity to a point where decomposed granite bedload, that formerly washed downstream, rapidly began to accumulate upstream of the "barrier." When this vast accumulation of granitic sand (Figure 10) was seen by Region 5 Forest Service watershed administrators, they became instant advocates for construction of a sound and permanent barrier. In words of watershed chief Andy Leven: "If that Mickey Mouse device of yours (referring to our cyclone fence structure) ever breaks loose, we'll have half of the Kern Plateau dumped into Lake Isabella!" Our lack of engineering skills bore unexpected results!

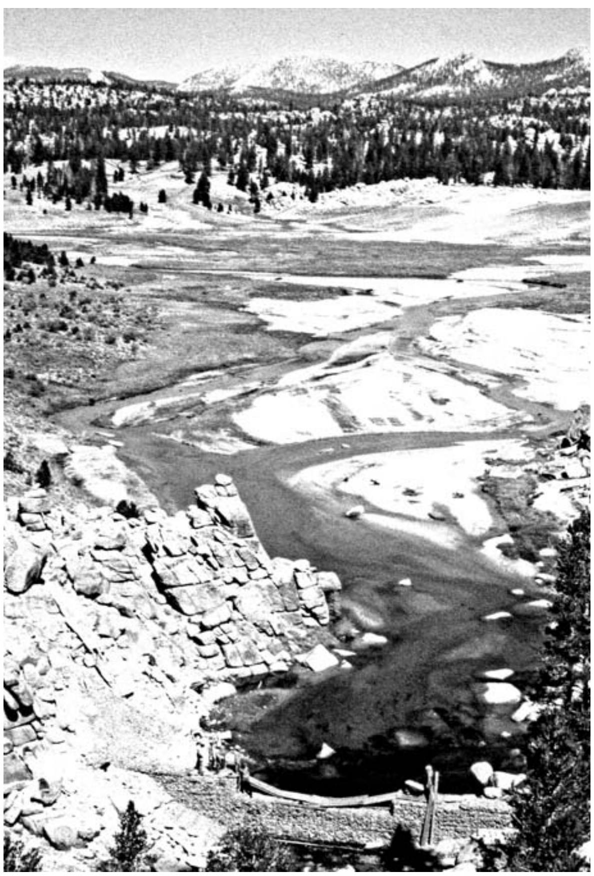

Figure 10 - Decomposed accumulation above Templeton granite Barrier. October 1980.

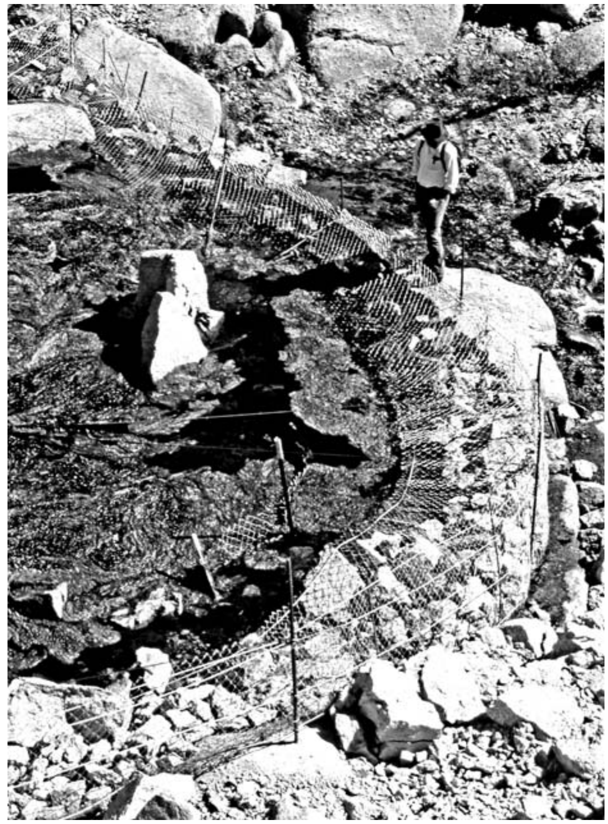

Figure 9 – INF biologist Jerry Stefferud standing atop temporary Templeton fish barrier, constructed in mid-1970s by INF. October 1977.

With strong support for Templeton Barrier now well established in the Forest Service Region 5 Office, and funding supplied by California State Wildlife Conservation Board in Sacramento, INF Engineer Frank Helmick designed and supervised construction of a gabion barrier (Figure 11). Utilizing Youth Conservation Corps labor, construction was largely completed by the end of the 1980 field season. Moving downstream in 1981 to the Wilderness boundary, Helmick's crews built Schaeffer Barrier, also constructed of gabions (Figure 12).

The barriers functioned well for more than 10 years. However, two factors caused gradual disintegration. Newly blasted, baseball-sized

Figure 11 – CDFG biologist Darrell Wong electrofishing below Templeton gabion barrier completed in 1980. August 1985.

12 - Schaeffer Barrier showing gabion basket construction completed 1983. September 1983. Photo courtesy of INF.

granite used to fill gabion baskets performed well in locations within the structure not subjected to direct hydraulic action (such as within the main structure). However, in locations where constant falling water occurred (such as the apron on downstream side of the dam), rocks filling gabion baskets quickly disintegrated into sand, leaving the baskets empty. This problem was exacerbated by erosive nature of bedload sand being carried downstream, gradually removing galvanizing and causing steel wire beneath to rust and disintegrate. Without downstream support of apron gabions, the entire Templeton Barrier began to tip perceptibly downstream. This required major gabion repair and replacement, carried out between October 6-10, 1982.

Figure 13 - Helicopter lowering concrete stabilization blocks onto Templeton Barrier apron. October 1988. Photo courtesy of INF.

In an effort to provide at least a temporary solution to this recurring problem, INF personnel on October 26-27, 1988, placed 100, 2-foot cubes of concrete on the apron of Templeton Barrier (Figure 13). The blocks were pre-cast, flown to the barrier site by helicopter, and lowered into place by winch. This action stabilized the structure for several years until a more substantial concrete barrier could be built in September, 1996 (Figure 14).

The same basic problem was occurring at Schaeffer Barrier downstream. However, since this was located outside Wilderness and near a road, the apron could be strengthened with nearby boulders placed by FS front-end loader. Even so, by the late 1990s, the center section of Schaeffer Barrier had collapsed and stood in need of total replacement (Figure 15). This was accomplished in 2003 (Figure 16).

1977-1979 – HOLDING THE LINE

In anticipation of permanent barrier construction at Templeton and Schaeffer within the next several years, it became our strategy to minimize spawning and recruitment of brown trout in the drainage between Ramshaw Barrier and temporary Templeton Barrier (Figure 9). This was best accomplished by removing as many adult browns as possible from Ramshaw and Templeton meadows between the two barriers, recognizing that the

Figure 14 - Templeton Barrier following 1996 construction. October 1996.

Templeton structure was serving only as an obstruction to upstream migrants, and that each year a significant number of brown trout would enter into upstream areas. Perhaps the greatest impediment to complete eradication would be realized through successful spawning, which by population pressure would tend to force young-of-the-year brown trout into meanders and marshy areas, where they might easily escape chemical treatment. Therefore, in September of the three years 1977-79, "prophylactic" piscicide treatments were conducted between the two upper barriers and in lower portions of all major tributaries. The 1977 treatment is summarized in appendix 3.

Later electrofishing revealed soundness of removing adult browns to minimize reproduction. No young-of-the-year brown trout were found in SFKR following 1977 treatment. We could now move toward completion of the project. Note: As I write this, and in retrospect, I detect a bit of ironic humor in optimism implied in the prior sentence. More than 30 years later we have indeed made additional progress toward completion, but the end is not yet in sight. Regular monitoring and evaluation must become a

Figure 15 - Schaeffer Barrier showing collapsed center section. Circa 1999. Photo by Christy McGuire.

Figure 16 - Schaeffer concrete fish barrier when completed in 2003. Photo courtesy of California Department of Water Resources.

permanent part of any meaningful restoration plan. There are no easy fixes in conservation biology of fishes. A problem yet to be surmounted, and the key to long-term native California golden trout existence, is to gain approval of FS administrators to construct a lowermost barrier near Dutch John Flat (Figure 1). This lower barrier would prevent further invasion upstream by non-native trout, and would also provide opportunities for anglers to catch golden trout in the highly popular fishing area of Monache Meadows

1980-83 – MAJOR CHEMICAL TREATMENTS AND BEGINNING OF MONITORING

With Templeton gabion barrier under construction, and Schaeffer gabion barrier in planning stages, major effort was placed on inventorying fish populations and documenting stream reaches, marshes, and rills requiring treatment throughout the entire upper SFKR drainage. No brown trout were found above Ramshaw Barrier, but below that point not only browns were found, but also significant numbers of goldenxrainbow hybrids, as suggested by abundant spotting below the lateral line. This latter group resulted, as with brown trout, from gradual upstream migration from Kennedy Meadows many miles lower in the SFKR drainage. CDFG had for many years planted catchable rainbow trout there to satisfy roadside anglers, under a naive assumption that insurmountable natural barriers would prevent them from reaching golden trout country. Completely insurmountable barriers are very rare within natural stream systems.

Hybrid rainbowxgolden trout, of course, were (from the standpoint of genetic purity) far more insidious than brown trout, which could not interbreed with goldens. Whereas brown trout would eventually displace goldens through predation and competition, infusion of rainbow genes into golden trout populations would be perhaps even more devastating by destroying the very thing we were trying so hard to protect: pure strain California golden trout in their native, evolutionary habitat. It was necessary to eliminate both brown trout and rainbowxgolden trout hybrids.

Rotenone (liquid derris root extract sold as Pro-Noxfish and Nusyn-Noxfish) is a more effective piscicide than antimycin, and is normally the chemical of choice among fishery managers. Antimycin, however, cannot be detected by target species and brings with it added benefits of quick oxidation, minimizing downstream trout mortality and with less adverse impact on invertebrate organisms.

Figure 17 – CDFG biologist Don Sada charging 55-gallon antimycin 24-hour siphon drip station SFKR at Tunnel Meadows. October 1977.

Figure 18 - Rotenone constant-flow drip station on SFKR in Ramshaw Meadow. September 1981.

On September 14, 1981, working between Ramshaw and Schaeffer barriers, a crew of 22 individuals treated with rotenone all areas within the watershed that were wet, then followed on September 15-16 with four units of antimycin to assure compete mortality (Figures 17 to 19). Detoxification of piscicide at Schaeffer Barrier with potassium permanganate precluded extensive downstream kill. Diversity of the work crew is noteworthy: Office of Endangered Species, U.S. Fish and Wildlife Service; Inyo and Los Padres national forests; California Department of Transportation; Syracuse University (New York); U.C. Davis; and seven functions (including four regions) within CDFG.

Figure 19 - Rotenone constant-flow drip station on Four Canyons Stringer. September 1981

On October 13, 1981, CDFG Bishop biologists, assisted by Inland Fisheries Branch personnel, collected 304 golden trout (mean fork length 4.58 in. or 11.64 cm.) from the SFKR above Tunnel Airstrip. On the following day these fish were taken by pack stock and planted below Ramshaw Falls immediately below the confluence of Kern Peak Stringer.[1] All fish were marked (adipose fin clip) prior to planting to distinguish them from fish that might have escaped 1981 treatment, or migrated downstream over Ramshaw Falls.

In August, 1982, 300 goldens were taken from above Tunnel Airstrip, marked with a left ventral fin clip, and planted throughout upper Ramshaw Meadow. Likewise, 355 goldens were marked with a right ventral fin clip and planted throughout upper Templeton Meadow. Growth and distribution of these fish in later years are detailed in appendix 5 (Figures 20 and 21).

[1] "Stringer" A small tributary to a stream, often unnamed on maps; a term frequently utilized by resource managers and researchers.

Figure 20 - Restocking SFKR and tributaries by helicopter from Tunnel Meadow. September 1983. CDFG biologist Randy Benthin in right foreground.

During the period of September 7-12, 1982, another group of 23 individuals, representing agencies similar to those listed for 1981, treated between Templeton and Schaeffer barriers, including all tributary streams. Treatment began at 0800 on September 9. Three crews applied rotenone (Pro-Noxfish), and one crew applied potassium permanganate at Schaeffer detoxification station. Application, as usual, was by 5-gallon drip station, polyethylene squirt bottle, and garden sprayer. The entire drainage was treated on September 9, and was repeated on September 10. Approximately 15 gallons of Pro-Noxfish were applied on each day. Spot treatments with piscicides of certain areas on Brown Stringer were conducted on the morning of September 11. Detoxification began on the evening of September 9 and was continued on a 24-hour basis until morning of September 11. Some mortality occurred for about one mile below the detoxification station at Schaeffer Barrier when the supply of potassium permanganate was exhausted a short time before the last remnant of toxic water passed through.

We expect that complete mortality of fishes was effected, but an abundance of marshes and seeps within the treatment area made total effectiveness less certain. Monitoring conducted during summer of 1983 revealed no brown trout, and restocking with SFKR golden trout occurred shortly thereafter. Application of potassium permanganate at Schaeffer Barrier was by 55-gallon drip stations and, when plumbing clogged, spread by hand. The relative inaccuracy of the latter method probably

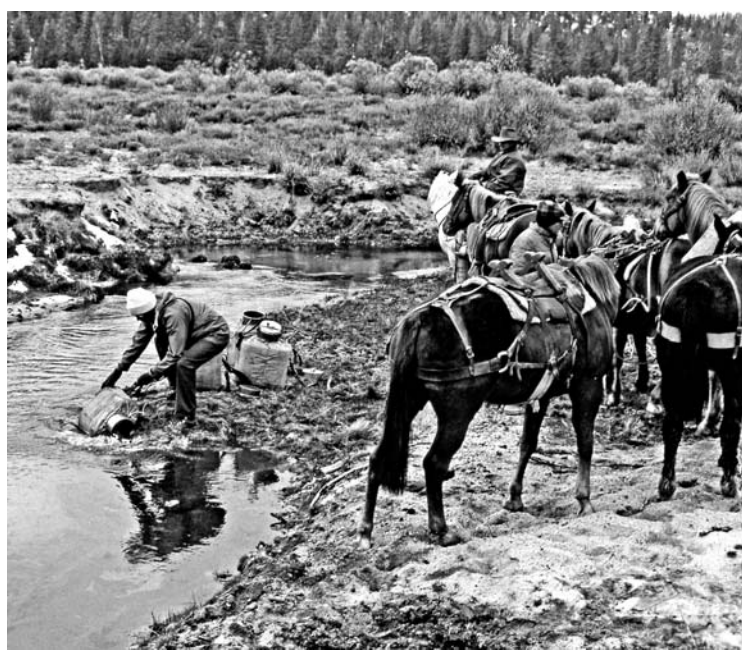

Figure 21 – CDFG biologist Darrel Wong restocking SFKR and tributaries by packstock. October 1981.

explains why we ran a bit short of chemical. The permanganate was applied at one part per million. It was originally intended that a rotenone concentration of 0.025 ppm would be used. However, unusually low water temperatures and high organic load (both of which reduce rotenone effectiveness) caused us to double the concentration to 0.050 ppm. (California Department of Fish and Game 1966, p. 500). Post-treatment inventories revealed that approximately 5,000 brown trout, 1,000 goldens or goldenxrainbows and 1,000 Sacramento suckers were killed during the treatment.

Between August 10-13, 1983, extensive electrofishing throughout the upper SFKR drainage below Ramshaw Falls revealed neither brown trout nor hybridized goldens above Schaeffer Barrier. Widespread restocking was therefore implemented to supplement initial plants made in the Ramshaw-Templeton areas during 1981 and 1982. 1982-stocked fish (fin-clipped) were found to be in excellent condition.

On September 12, 1983, a crew of eight flew into Tunnel Airstrip augmented by 1,699 pounds of shockers, batteries, live cages, and miscellaneous gear. Beginning in the afternoon of September 12 and continuing through September 14, CDFG crews collected approximately 3,600 goldens from the SFKR between its very uppermost headwaters in South Fork Meadows and Tunnel Airstrip (Figure 1).

On September 15, 1983, Mount Whitney Hatchery personnel, supervising loading and planting operations, counted 2,568 fish (many smaller fish escaped through the 0.5 in. (1.27 cm.) mesh hardware cloth holding cages) and readied them for planting. This was accomplished primarily by helicopter, with Kern Peak Stringer and a stringer to the northeast being planted by packstock. In all, 14 tributaries (several unnamed) were stocked between Ramshaw and Schaeffer barriers, with a known loss of only two fish. The 1983 restocking effort is detailed in appendix 4.

1984-1994 – THE PROJECT CONTINUES, BUT OTHER PROBLEMS ARE ENCOUNTERED

During the week of July 11-14, 1984, extensive electrofishing was conducted in Templeton and Ramshaw meadows to check for brown trout and to note sizes and distribution of goldens. Fish were found to be growing well and were most numerous in the upper Ramshaw area, likely reflecting planting distribution in 1981 and 1982. Fish planted during the previous year had increased their length significantly and were sometimes mistaken for larger brown trout until collected and examined. A summary of 1984 activities is presented in appendix 5.

As a result of this inventory, on September 17-19, 1984, 1,000 goldens were collected by electrofishing above Tunnel Airstrip and held in live cages until September 20, when 600 were planted by packstock above and below the confluence of Strawberry Stringer and SFKR, between Templeton and Schaeffer barriers. On September 21, 300 were taken by packstock to the Templeton Barrier area and planted immediately below; 100 were taken about two miles up Four Canyons Creek and planted above Templeton

Barrier above a series of beaver dams. All fish carried very well in pack cans, and loss was minimal.

However, with exception of those fish planted in Four Canyons Creek, above planting efforts were found to be in vain, when a field check on July 31, 1985 again revealed existence of brown trout between Schaeffer and Templeton barriers. It is likely that these fish surmounted Schaeffer Barrier during extremely high runoff in early 1983 and escaped detection during 1984 field checks. It was obviously necessary to eradicate the browns at the earliest possible date, so on August 25, 1985 a crew of seven flew to Tunnel Airstrip and walked to Templeton Spring on the south side of Templeton Mountain. Treatment and camping gear were brought in to Templeton Spring Camp by packstock (appendix 6).

August 26 was spent electrofishing Strawberry Stringer (where a brown trout was discovered) and in preparation for treatment on the following day. Treatment began on Schaeffer Meadow, Fat Cow, Strawberry, and Templeton Spring stringers on August 27, and on August 28 drip stations were started on Strawberry, Brown and Long stringers, while Dry Creek was sprayed upstream to a rock barrier. On August 28 the main drip station was started for the SFKR at Templeton Barrier. On August 29 all operations were repeated, including a drip station on Schaeffer Iron Stringer (Figure 1). Estimated kill was 200 browns, 1,000 goldens, and 500 Sacramento suckers. Flow in SFKR was estimated at 10 cubic feet per second, and 10.34 gallons of Pro-Noxfish were utilized to achieve a concentration of 0.05 ppm. Detoxification was handled at Schaeffer Barrier by a crew under direction of Dan Christenson of Region 4.

Very little work was done on the Kern Plateau in 1986. Most effort during that year was devoted to administrative aspects of making repairs to Templeton Barrier.

Brown trout were again discovered above Schaeffer Barrier in summer of 1987, necessitating treatment between September 14 and 18 of the same areas covered in 1985 (appendix 7), underscoring the vital necessity of a reliable concrete Schaeffer Barrier, as finally completed in 2003.

The main effort in 1988 was helicopter placement of 100, 2-foot concrete cubes on the apron of Templeton Barrier to reduce erosion and possible barrier collapse (Figure 13).

The period from 1989 to 1993 constituted something of a lull on the Kern project, as administrative authority for the upper SFKR and Golden Trout Creek was transferred from CDFG’s Bishop Office (Region 5) to Visalia and Kernville offices of Region 4. In the interim, brown trout again invaded the SFKR above Schaeffer Barrier, probably attributable to a rapidly disintegrating structure. Treatment below Templeton Barrier was therefore repeated by Region 4 CDFG personnel on September 13-14, 1994. Activity resumed with completion of a concrete barrier at the Templeton site in 1996, followed by completion of a concrete Schaeffer Barrier in 2003 (Figures 14 to 16).[4]

THE STRAWBERRY CONNECTION

In 1995 Kernville CDFG fisheries personnel discovered introgressed (hybridized with rainbow) golden trout in Strawberry Stringer, underscoring a problem that required correction at the earliest possible date. Several years before, biologists from CDFG Bishop Office discovered a situation that has come to be known as "The Strawberry Connection."

Historically, Strawberry Stringer flowed southeasterly down a natural channel to its confluence with SFKR well below Templeton Barrier. However, at some time in the distant past grazing permittees at Templeton Cow Camp, in order to have a source of fresh water more readily available, diverted a portion of Strawberry Stringer from its natural channel to flow past their cabin. The downstream extension of the man-made channel flows northerly and, at high water, overflows onto the west side of Templeton Mountain. Thus, if brown trout or introgressed golden trout were to gain access to the upper reaches of Strawberry Stringer, there exists a strong possibility that in a high water year, they could enter SFKR above Templeton Barrier by means of Movie or Templeton Mountain stringers (Figure 1). This is a risk we could not afford to take. Strawberry Connection problems were addressed by INF personnel during 1999 field season by diverting Strawberry Stringer back into its natural channel. This potential problem will need to be investigated periodically. It is encouraging to note that elimination of grazing for the past seven years has promoted recovery of the stream’s natural hydrology, and has allowed for vigorous revegetation to a point where the two channels would most likely not connect except possibly in an extreme runoff event. The removal of cattle from this area has been of great value in the overall plan to restore the California golden trout.

1995-2004 – RIPARIAN FENCING AND HABITAT ENHANCEMENT

Primary activity during this period involved habitat improvement (willow planting), barrier construction, monitoring, and genetic research. In addition, Movie Stringer, a tributary to SFKR lying a short distance south of Lewis Stringer, was chemically treated in 2000 to remove a population of goldenxrainbow trout. Much work was done within the Golden Trout Creek drainage by removing hybridized fish from headwater lakes, and from portions of Golden Trout Creek known to contain high percentages of hybridized fish. Hybridization within the Golden Trout Creek drainage almost certainly resulted from downstream migration of hybridized golden trout planted in headwater lakes (Chicken Springs and Rocky Basin) prior to our knowledge of hybridization in Cottonwood Lakes broodstock. The level of rainbow trout introgression in Golden Trout Creek is relatively low, and good numbers of genetically pure California golden trout are present in the population. All trout have been removed from headwater lakes, and the Golden Trout

[4] The concrete Schaeffer Barrier was designed and constructed by California Department of Water Resources under contract with Department of Fish and Game (figure 16).

Creek population is being genetically monitored over time to determine how low levels of introgression change (increase, decrease, unchanged) in absence of additional non-native trout or hybrid goldenxrainbow trout entering the population

A major accomplishment during this time has been implementation of more restrictive range management procedures by INF on SFKR and Golden Trout Creek. This has involved fencing of key golden trout habitat areas and reduction and removal of livestock from badly damaged locations. A 2001 INF decision to remove cattle from two of the four Kern Plateau allotments for a minimum of ten years has constituted a major step toward recovery of California golden trout habitat. Regrowth and recovery of riparian areas has been dramatic (Figures 3 to 5 and appendix 8), and monitoring of vegetative and geomorphic stream features to compare riparian recovery between rested and grazed allotments continues to be a priority with INF managers.

GOLDEN TROUT SYSTEMATICS

Systematics of golden trout have been revised multiple times over the years to reflect our growing understanding of this complex group and acquisition of new (often genetic) data, since their original description as *Salmo mykiss agua-bonita* by David Starr Jordan (Jordan 1892). A century later Behnke (1992) lists them as *Oncorhynchus mykiss aguabonita*, a designation concurred in by The American Fisheries Society (2004, p. 210) and by Stearley and Smith (1993). This entire matter requires clarification by competent systematists. Scientists at University of California (Davis) are currently studying this problem (Bagley and Gall 1998, Cordes et al. 2006, Stephens et al. 2005, Stephens 2007, Cordes, Stephens, and May 2003). More recent genetic assessment *of O. mykiss* phylogeny rather conclusively shows that the level of genetic structure observed warrants subspecies status for *O. m. aguabonita*.

Recent research (Stephens 2007) suggests that there are three groups of trout native to the Kern River Basin: *O. m. aguabonita* (California golden trout), *O. m. whitei* (Little Kern golden trout), and *O. m. gilberti* (Kern River rainbow trout), with the latter being the least distinct subspecies based on genetic and morphometric data. In addition, within *O. m. aguabonita*, there may also be two groups, one in the South Fork Kern and the other in Golden Trout Creek. Differences between SFKR and Golden Trout Creek golden trout, and based solely on morphometric data, were noted by Evermann (1906, p. 14) who observed:

> That Volcano Creek [Golden Trout Creek] was originally [and naturally] stocked with trout from Kern River may be accepted without much question. The lava flows already referred to doubtless killed off all the trout of the lower portions of the creek, leaving perhaps only those of the headwaters to reinvade the depleted portion after the conditions became suitable. At that time it is probable that the trout of the South Fork Kern (which was presumably also stocked from the main Kern River) did not materially differ from those of Volcano Creek; but the period that has

> elapsed since their segregation, due to the formation of the alluvial barrier [at Tunnel] and the numerous impassable falls, has proved quite sufficient to permit a differentiation which renders them readily distinguishable and, I believe, specifically distinct.

It is for this reason, of course, that Evermann described South Fork Golden as *Salmo aguabonita* and Golden Trout Creek golden as *Salmo roosevelti*. The superb illustrations by Charles Bradford Hudson [a worthy predecessor to Joe Tomelleri] that accompany Evermann's classic paper imply differences, and these same external differences are discernible today. Current differences may well relate to a higher degree of hybridization with rainbow trout in SFKR than is found in Golden Trout Creek.

It seems reasonable that we should adhere to advice of R. J. Behnke (1992, p. 227). In his epilogue to *Native Trout of Western North America*, in which he discusses preservation of trout diversity, he states:

> It can be assumed that no system of classification of western trout will ever receive universal agreement. My advice to fishery biologists, managers, and administrators is to avoid taxonomic anxiety and concentrate on recognizing that particular forms of trout are native to particular areas, and that these forms are differentiated from each other. The sum total of this differentiation represents the biodiversity of western trout--a genetic resource still to be integrated into fisheries management programs. The biodiversity of western trout should be recognized as a natural resource, but one that has been historically neglected, squandered, and depleted.

So what to do until someone finally clarifies systematics of the golden trout series? Such a utopia seems unlikely, inasmuch as controversy is inherent within a group like *O. mykiss*, which has both natural and historic connectivity and introgression between groups in its history, and “unnatural” or anthropogenically induced introgression in its more recent history. We now have enough information at our disposal to suggest that SFKR and Golden Trout Creek golden trout may be separate evolutionarily significant units (Bagley and Gall 1998, Cordes et al. 2006, and Stephens 2007), so it seems reasonable for management purposes to differentiate them as *O. mykiss aguabonita* (SFKR) and *O. mykiss aguabonita* (GTC). In that way we can hold the line until systematists may provide us with a more clearly understood nomenclature. We must recognize that for all the sophistication of modern systematics, we do not yet have (and may never have) a procedure that gives us a last word - only a *latest* word. Again, as in the observation attributed to the late Stephen Jay Gould: “We are trapped in the ignorance of our own generation.” This statement, true as it may be, should never keep us from doing what we feel is right at the time, and best for the trout resource in the long run.

It should be noted here that in his recent *Trout and Salmon of North America*, Behnke (2002) suggests the two groups as being distinct, but lists them both as *Oncorhynchus mykiss aguabonita.* The Conservation Assessment and Strategy, a recent (2004) document prepared jointly by CDFG, FS, and U.S. Fish and Wildlife Service (California Department of Fish and Game et al. 2004) calls for management of the California golden trout in the two drainages as separate entities. This was done in keeping with the precautionary principle, assuming that the groups may someday be determined to be genetically distinct due to natural separation over 6,000-10,000 years (and not due to having different hybridization levels.). As things stand, it may be difficult to ever make a solid case that Golden Trout Creek and SFKR trout are genetically distinct due to natural evolutionary forces, although it is reasonable to assume that this may be true. California golden trout were proposed for listing as endangered under the Endangered Species Act by Trout Unlimited in 1999, but to date no decision has been rendered by the U.S. Fish and Wildlife Service.

GOLDEN TROUT AND SACRAMENTO SUCKERS

The matter of restocking suckers was difficult for anglers to understand. Anglers usually consider suckers to be competitors with trout, and therefore undesirable. Evolutionary biologists would consider suckers to be an essential component in the evolutionary progression of golden trout. I like the observation of nature-writer Annie Dillard: "A habitat shapes species like a bowl shapes water." Sacramento suckers were restocked regularly into SFKR along with California golden trout.

CONCLUSIONS AND RECOMMENDATIONS

Great progress has been made in restoring California golden trout within its evolutionary habitat in SFKR and Golden Trout Creek, and non-native fishes are no longer known to exist in the SFKR above Schaeffer Barrier. However, the job is not yet complete, and monitoring will remain a necessity indefinitely. Adoption and implementation of "The Conservation Assessment and Strategy for the California Golden Trout" cited above will provide guidance for future restoration programs.

The following items need to be accomplished before the California golden trout may be considered secure: Note that this document constitutes a history of work done since 1966 to 2004 to restore the golden trout resource and is intended to provide a segue into the vastly more detailed (and previously referred to) Conservation Assessment and Strategy for the California Golden Trout. The items listed below constitute agreement and reiteration of strong feelings expressed by others as highly important considerations in the matter of golden trout restoration on the Kern Plateau.

1. The highest level of security must be obtained by construction of a barrier near Dutch John Flat, and this must be done at the earliest possible date. One could reasonably assume that it was the intent of Congress, in establishing the Golden Trout Wilderness, to restore its namesake trout throughout its historic range, and not simply in a limited area within northern portions of the Wilderness. Enabling legislation and the Golden Trout Wilderness Management Plan (USDA-Forest Service 1982a) provide mechanisms for accomplishing this.

2. Continue to monitor “The Strawberry Connection” to assure that Strawberry Stringer continues to flow down its natural channel to the SFKR below Templeton Barrier. Should it again cut a channel to the northeast, there exists an unacceptable possibility that it would allow non-native and/or hybridized fishes to bypass Templeton Barrier and ascend as far upstream as the Ramshaw Barrier immediately below Tunnel Meadows and less than a mile from Golden Trout Creek.

3. FS and CDFG engineers must periodically inspect Ramshaw, Templeton, and Schaeffer barriers to determine their soundness and effectiveness. Maintenance of these barriers must occur as needed. Ramshaw Barrier provides a last defense, should non-native fishes somehow surmount the lower barriers. Winter conditions in this area are extremely hard on concrete, and freezing and thawing can quickly erode the structures.

4. Assuming that Dutch John Barrier will be constructed, thorough monitoring by electrofishing should be implemented as follows:

a. Annually above Dutch John Barrier through Monache Meadows to Schaeffer Barrier.

b. Annually between Schaeffer and Templeton barriers.

c. Biennially between Templeton and Ramshaw barriers.

d. Occasionally above Ramshaw Barrier and into Tunnel Meadows.

The appearance of unacceptable fishes in any above areas could alter and intensify the above monitoring schedule, at direction of biologists involved.

5. Based on the most recent analysis of trout tissue samples from Golden Trout Creek and the SFKR, a genetics management plan should be developed to assist managers in making wise management decisions on recovery of California golden trout.

6. A golden trout recovery group should be established to guide future management decisions. This group should consist of geneticists, trout conservationists, and biologists from various management agencies that have expertise in trout recovery.

7. Golden trout continue to evolve as they have in streams of the Kern Plateau since the Ice Age. Proper evolution demands a stable habitat to emulate the habitat conditions that created this magnificent species. Livestock grazing must continue to be controlled or eliminated to provide stable riparian habitat and acceptable water quality (figs. 3-5). To repeat the observation of nature writer Annie Dillard, habitat shapes species as a bowl shapes water.

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The California golden trout restoration project continues to be a team effort in every respect, involving everything from airplanes to mules and a great diversity of governmental interests. Special thanks are due the late Bob White, and John Langenheim of Eastern Sierra Flying Service out of Lone Pine. Without their interest and cooperation, the project would not have been possible. Tunnel Air Camp packers Duane Rossi and Steve Stewart performed miracles by loading 55-gallon drums onto packstock and transporting necessary equipment throughout the project area. Although it is difficult to select outstanding individuals from within an already outstanding group, Darrell Wong, Stan Stephens, Randy Benthin, Dan Christenson, and Bill Loudermilk played major roles, as did INF hydrologist (the late) Tom Felando. Pete Stanistreet flew at his own expense from New York to assist in treatments, and others were similarly dedicated. In more recent years, and since the project came under direction of Region 4 in 1990, Christy McGuire of Kernville, Stan Stephens of Visalia, and Bill Loudermilk of Fresno have assumed research and management with a high degree of competence. INF biologists Jerry Stefferud, Sara Chubb, Robin Hamlin, Chris Riley, Dave May, and Lisa Sims have contributed in like manner. INF wildlife biologist Cathy Noland supervised helicopter placement of concrete blocks below Templeton Barrier in 1988. INF Supervisors Joe Radel, Everett Towle, Bob Rice, Gene Murphy, Dennis Martin, and Jeff Bailey have given full cooperation through the years. The INF’s (late) Luci McKee provided guidance in preservation of environmental integrity. Engineers Frank Helmick of INF, and George Heise and Ted Vande Sande of CDFG designed and supervised construction of vitally important fish barriers above Ramshaw and below Templeton meadows. Jerry Stefferud of INF supervised construction of the initial Templeton Barrier during the mid-1970s. The concrete Schaeffer Barrier was designed and constructed under contract with California Department of Water Resources, with field supervision provided by Stan Stephens of CDFG. Preparation of environmental and administrative documents for the Schaeffer Barrier and arranging for the necessary financing, were somewhat magically brought about by Stan Stephens and Bill Loudermilk, with the entire project being delayed a year and greatly complicated by the McNally forest fire in 2002 that closed that portion of the INF after construction had started. Just the financial and budget manipulations alone, conducted by Loudermilk as Manager of CDFG Region 4, border on the unbelievable. CDFG’s Elk Grove screen shop, under direction of Dave Rose, did heroic things in construction of the 1996 concrete Templeton Barrier. Marilyn Myers and Mignon Shumway authored field work summaries for 1976, 1977, and 1984, as did Curtis Milliron for 1987 and Christy McGuire for the period of 1999 to 2004. Assistance throughout much of the project was provided by Jerry and Sally Stefferud, Don Sada, Eric Gerstung, Walt Reid, Kent Connaughton, Dave Travis, Ellen Gleason, Rai Clary, Pete Stanistreet, Julie West, Glenn Yoshioka, Nadine Kanim, Joanne Kerbavaz, Howard Shainberg, Tom Taylor, Jeannine Koshear, Wayne Iseri, Bridget Maloney, Gary Combes, Jan Goldberg, Kate Symonds, Chuck Marshall, Bob Brown, Fred Partridge, Melanie Wilson McFarland, Terry Mills, Dennis McEwan, Rob Hitchcock, Linda Ulmer, Ken Aasen, Steve Juarez, Shawn Hayes, Gary Ponder, Steve Lee, Pat Hurt, Barb King, Dale Lockard, Gail Kobetich, Doug Reid, Bob Toth, Larry White, Jim Sommer, Doug Selby, Andy Pauli, Tom Blankinship, Pam Clark, Jack Hansen, Laura Bordenave, Toni Keefe, Jackie Hyatt, Ralph Giffen, Ann Wong, Dorothy

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APPENDIX 1 - AQUATIC INVERTEBRATE MONITORING, BROWN TROUT CONTROL PROGRAM, SOUTH FORK KERN RIVER, SEPT. 1976

AQUATIC INVERTEBRATE MONITORING

BROWN TROUT CONTROL PROGRAM, SOUTH FORK KERN RIVER, SEPT. 1976

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June 9, 1977

INTRODUCTION

The purpose of this study was to briefly monitor some of the effects of antimycin A on the aquatic invertebrates of the South Fork of the Kern River in the Sierra Nevada, Inyo County, California. This was done as part of the project conducted in September 1976 by California Fish and Game Region 5, Bishop Office, and the Inyo National Forest, to eradicate brown trout from that section of the South Fork of the Kern from its headwaters downstream to the Ramshaw barrier at the end of Tunnel Meadow (see project report for further information).

There is some disagreement as to the effects of antimycin on aquatic invertebrates. The instructions which are attached to each unit of antimycin state "In the usual, recommended concentrations, it causes no apparent harm to aquatic plants, insects, or bottom fauna". Much of the work that has been done with antimycin has been accompanied by little or no invertebrate observations. Indeed, it has seldom been considered standard practice to monitor effects on the invertebrate community during any poisoning program.

Many of the projects with antimycin that have looked at affected invertebrates were done in ponds and lakes with some reporting detrimental effects on plankton (Callaham and Huish 1969; Gilderhaus, et al 1969) and others reporting no effects on plankton or benthos (Houf and Hughey 1973; Walker et al. 1964). These studies are valuable, but deal with an entirely different group of invertebrates than those that occur in a stream, particularly a small, cold, mountain stream.

Little has been done to study the effects of antimycin on stream insects. The Salmon Falls River system project of the Nevada Fish and Game (1972) reported "no bad effects from the exposure" to antimycin in their bioassay insects. Degan (1973), on the other hand, in an extensive study of the effects of antimycin on invertebrates in a Wisconsin trout stream, showed quite rapid rises in drift rates and dramatic reductions of benthic numbers of certain invertebrates, most notably Baetis sp., Gammarus sp., Antocha sp., Hydropsyche sp., and Brachycentrus americanus, all of which, except Gammarus sp., were found in the South Fork Kern.

It was therefore considered an important part of our chemical treatment to monitor the effects on the aquatic invertebrate populations, especially in view of the lack of knowledge of the insects present in this stream, whose aquatic systems were sufficiently isolated in the geologic past to allow evolution of the golden trout to occur.

Changes and effects were shown by changes in drift composition and pattern, and by changes in the benthic fauna.

METHODS

Equipment and sampling were limited by several factors. Since the upper South Fork Kern River is in a roadless backcountry area, all equipment was flown in to a landing strip in Tunnel Meadow. Equipment was then packed up and down the meadow by backpack. Only one person (myself) was available to work on the insect monitoring due to the heavy manpower requirements of the treatment work. Because of these factors the number of samples taken was small, and it was decided to limit the insect monitoring to Tunnel Meadow itself, although treatment occurred both further up and downstream from the meadow.

Tunnel Meadow lies at an elevation of 9,000 feet on the Kern Plateau and is about two miles long with approximately six miles of meandering stream. The stream, as it flows through the meadow, had a flow during the study period of about one cubic foot per second. A storm of 36 hours duration occurred from the morning of September 9 to the night of September 10. The resulting runoff raised the South Fork of the Kern to at least ten times its previous flow, but by midday September 11 it had receded to the level of flow present prior to the storm.

Sampling sites were located on similar gravel substrates in riffle areas. The lowest site (A) had a substrate containing larger gravel than the other sites, and also some rubble. Sampling sites are shown on Figure 1. Five sites (A-E) for benthic sampling were distributed the length of the meadow, while four sites (1-4) for drift sampling were located immediately opposite the air camp at the north end of the meadow.

The South Fork Kern River was treated with antimycin concentrate on September 14 from the headwaters to the middle of Tunnel Meadow, where a temporary barrier had been erected, and on September 15 from there to Ramshaw barrier. Antimycin coated on sand (Fintrol-5) was used on backwater areas and oxbows. A concentration of approximately 30-50 ppb in the stream was used (see project report for concentrations applied), with an exposure of about 3-4 hours plus residual time. Site A was approximately 150 yards below a drip site, Site B about 300 yards, Site C about 600 yards, Site D about 400 yards and Site E about 50 yards.

Benthic samples were taken using a Surber sampler on September 9 and 12 at sites A-E prior to treatment. Benthic samples were taken at sites C-E on September 14 about 45 minutes after the drip tank immediately above the site had been activated. At sites A and B benthic sampling was done on September 15 approximately one hour after the drip tanks above them had been activated. Benthic samples were also taken at sites C-E on September 15 and again at sites A-E on September 22. Samples were preserved in 70% isopropyl alcohol and sorted by eye from detritus in the lab.

Drift samples were taken using drift nets with a rectangular frame of 12 x 8 inches with standard mosquito netting (21.5 mesh per inch) and an end netting of polyester lining fabric. Four nets were used on similar gravel riffles with the second net (Site 2) about 85 yards upstream from the first (Site 1), the third (Site 3) about 95 yards upstream from the second, and the fourth (Site 4) about 105 yards upstream from the third. The nets were placed in the stream moving from Site 1 to Site 4, so that net 4 was placed 15 minutes after net 1. The nets were left in the stream for thirty minutes. The resulting samples were preserved in 70%

isopropyl alcohol and later sorted by microscope. Drift nets were set six times prior to treatment and six times following treatment (Table 1) with some of the samples being taken at peak drift times of dawn and dusk. Samples following treatment were taken one and one half hours after the drip tank immediately above had been activated and again at two and one half hours and eight hours. Drift samples were also taken at the benthic sites A-E for 15 minutes while each Surber sample was being taken.

Amount of flow of the stream through the drift nets was measured using a Gurley pygmy current meter.

TABLE 1
SAMPLING DATES AND TIMES

BENTHIC		
Date	Site	Time
September 9	A – E	1100 – 1700
September 12	A – E	1200 – 1600
September 14	C – E	1730 – 1900
September 15	A – E	1200 – 1600
September 22	A – E	1300 – 1630
DRIFT — 15 MINUTE		
Date	Site	Time
September 9	A – E	1100 – 1700
September 12	A – E	1200 – 1600
September 14	C – E	1730 – 1900
September 15	A – E	1200 – 1600
September 22	A – E	1300 – 1630
DRIFT - 30 MINUTE		
Date	Site	Time
September 11	1 – 4	1550 – 1620
September 12	1 – 4	1435 – 1505
September 12	1 – 4	1940 – 2010
September 13	1 – 4	0600 – 0630
September 13	1 – 4	1925 – 1955
September 14	1 – 4	0550 – 0620
September 14	1 – 4	1930 – 2000
September 14	1 – 4	2200 - 2230
September 15	1 – 4	0600 – 0630
September 15	1 – 4	1345 – 1415
September 15	1 – 4	1920 – 1950
September 22	1 – 4	1535 – 1605

RESULTS

Drift — 30 Minute

The results of the thirty minute drift sampling are shown in Figures 2-8. Thirty six different taxa of aquatic invertebrates were found in the drift samples (Table 2). Most abundant were Baetis sp. (mayfly), Simuliidae (blackflies) and Chironomidae (midges).

It was assumed in this study that all factors in the stream remained constant for the two weeks of the study, except for changes due to the antimycin treatment.

As can be seen in Figure 2, total numbers of drift increased drastically following treatment. A lag time occurred just following treatment, with the drift not peaking until the afternoon of the day following treatment. This was not unexpected since antimycin seems to take some time to affect its victims, especially the smaller ones. Fish were still alive in the stream at 0700 on the morning following treatment the afternoon before. The amount of drift went down quite rapidly as the dead and dying insects passed through, but had not returned to the pre-treatment level by September 22. This was probably partly due to the lack of fish predation on the drifting insects, but may also have been a result of continuing adverse effects of the treatment on the behavior patterns of the invertebrates.

Diel fluctuations were seen, with the dusk samples showing larger amounts of drift.

A large amount of drift was present on the afternoon of September 11. This was composed mainly of Chironomidae (midges) and seemed to be the tail end of the drift caused by the runoff flooding of September 10. Drifting numbers of Chironomidae have been found to be greatly increased by flooding (Anderson and Lehmkuhl 1968).

Differences occurred between sites (Figure 3) with Site 4 showing a much larger increase in drift after treatment. Prior to treatment the sites did not differ much. This may be because normal drift is of a fairly short range (Waters 1965), being composed mainly of temporarily displaced live insects, which also stand a high chance of being consumed by fish. The amount of drift is approximately the same between sites. The catastrophic drift caused by treatment was of a longer range because it was composed of large numbers of dead or distressed insects which therefore would not or could not resume a benthic position. The lack of predation (since all fish were dead or dying) allowed the drift to attain a longer range. Thus the highest site (4) took out most of the drift leaving only that which bypassed that net and that which was generated between sites. The highest site also had the largest flow through the drift net of the four sites (Table 3) which would cause it to collect a larger amount of drift.

The increased amount of drift was of a large enough proportion to effectively rule out attributing the rise to any usual phenomena such as periodic fluctuations. The drastic decrease in the amount of drift following the peak rules out lack of fish predation as the cause of the post-treatment increase. Dead insects were noted in the drift at Site 4 at dawn on September 15 (Baetis sp., Simuliidae, Alloperla sp., and Chironomidae) and on the afternoon of September 15 (Baetis sp., Simuliidae, and Hydropsyche sp.) supporting the assumption that the increased drift consisted of dead and dying insects.

It was feared that the amount of physical disturbance in the stream by the crews of electrofishers, who were gathering fish for restocking, would greatly affect the drift with the result that any increase in drift could not be attributed to the antimycin. However most activity in the stream ceased after the treatment. Thus the low drift recorded prior to treatment occurred during the period of high physical disturbance and the high drift after treatment occurred when little physical disturbance was taking place.

The most drastically affected mayfly was Baetis sp. (Figure 4). Pretreatment levels of Baetis sp. were quite low, but post-treatment levels were twelve times greater. The drift of Baetis sp. peaked on September 15 in the afternoon. This effect on Baetis sp. is in accordance with Degan (1973) who found that the use of antimycin had a drastic effect on both drift and benthic biomass of Baetis sp.

All other mayflies occurring in the drift samples showed a definite effect of the treatment. Paraleptophlebia sp. was quite heavily affected, going from a pre-treatment average of one per sample to a peak of 29 in post-treatment samples. Centroptilum sp., Rhithrogena sp. and Cinygmula sp. all showed a rise in drift. Ephemerella (Seratella)sp. did not show a change in drift pattern, but Ephemerella grandis grandis, Ephemerella hystrix, and Ephemerella prob. inermis, all absent from pre-treatment drift, occurred in small numbers in post-treatment drift.

TABLE 2

TAXA PRESENT IN SOUTH FORK KERN 30 MINUTE DRIFT SAMPLES

Phylum – Coelenterata
- Class – Hydrozoa
  - Order – Hydroida
    - Family – Hydridae
      - Hydra sp.

Phylum – Nematoda – roundworms

Phylum – Annelida
- Class – Oligochaeta – aquatic earthworms

Phylum – Arthropoda
- Class – Arachnida
  - Order – Acarina – mites

- Class – Insecta
  - Order – Collembola – springtails
    - Family – Entomobryidae
      - prob. Archisotoma sp.

  - Order – Ephemeroptera – mayflies
    - Family – Heptageniidae
      - Cinygmula sp.
      - Rhithrogena sp.

    - Family – Leptophlebiidae
      - Paraleptophlebia sp.

    - Family – Ephemerelidae
      - Ephemerella (Seratella) sp.
      - Ephemerella grandis grandis
      - Ephemerella hystrix
      - Ephemerella prob. inermis

    - Family – Baetidae
      - Baetis sp.
      - Centroptilum sp.

    - Family – Siphlonuridae
      - Ameletus sp.

Order – Plecoptera – stoneflies
Family – Nemouridae
Nemoura sp.
Eucapnopsis sp.

Family – Peltoperlidae
Peltoperla (Yoraperla) sp.

Suborder – Setipalpia

Family – Chloroperlidae
Alloperla sp.

Family – Perlodidae
Isoperla sp.
Isogenus sp.

Order – Trichoptera – caddisflies
Family – Hydropsychidae
Hydropsyche sp.

Family – Hydroptilidae
Hydroptila sp.

Family – Brachycentridae
Brachycentrus sp.

Family – Limnephilidae
poss. Dicosmoecus sp.
poss. Psychoglypha sp.

Order – Coleoptera – beetles
Family – Hydrophilidae – water scavenger beetles
Anacaena limbata

Family – Elmidae – riffle beetles
Cleptelmis ornata

Order – Diptera – flies
Family – Psychodidae – mothflies
Pericoma sp.

Family – Dixidae
Dixa (Meringodixa) sp.

Family – Simuliidae – blackflies

Family – Chironomidae – midges

Family – Heleidae – biting midges

Family – Stratiomyiidae – soldier flies

Phylum – Mollusca
Class – Gastropoda – snails
Order – Pulmonata
Family – Planorbidae
Gyraulus sp.

TABLE 3
FLOW THROUGH DRIFT NETS, SEPTEMBER 22, 1976

Net 1 .... 0.17 cfs	Net A .... 0.35 cfs
Net 2 .... 0.07 cfs	Net B .... 0.21 cfs
Net 3 .... 0.14 cfs	Net C .... 0.22 cfs
Net 4 .... 0.31 cfs	Net D .... 031 cfs
	Net E .... 0.09 cfs

It was expected that the mayflies would be among the more susceptible to the antimycin, since they are generally an intolerant group, particularly those which inhabit mountain streams. They also lend themselves well to monitoring by drift collection, Baetis sp. and Paraleptophlebia sp. often being major drift components (Anderson and Lehmkuhl 1968).

There was a fairly heavy effect on the stoneflies (Figure 5). No stoneflies occurred in pre-treatment drift. Following treatment six genera of stoneflies drifted. Alloperla sp. showed the most increase in drift, but Peltoperla (Yoraperla) sp., Nemoura sp., Isogenus sp., Isoperla sp., Eucapnopsis sp. and some unidentified, small Setipalpia also entered the drift after treatment.

The caddisflies showed a varied effect to the treatment (Figure 6). Hydroptila sp. drifted in much larger quantities following treatment. It was also observed that many more of the Hydroptila sp. drifting after treatment were not in their cases than before treatment. Hydropsyche sp. also showed increased drift after treatment and dead Hydropsyche sp. were observed in post-treatment drift. The third caddis to appear in any large numbers in the drift was a very small unidentified Limnephilidae. It showed no major change in drift following treatment.

Two families composed the major portion of the drifting Diptera (Figure 7). The Simuliidae (blackflies) showed a catastrophic increase in numbers drifting after treatment. It was also observed, although no measurements were taken, that the average size of Simuliidae drifting after treatment was larger than that before. Anderson and Lehmkuhl (1968) noted a tendency for larger individuals to be collected in catastrophic drift. The Chironomidae (midges) showed no increase after treatment. The large numbers of September 11 were probably due to the flooding of September 10. The increased numbers of September 22 could perhaps be due to a new hatch, however, the algal bloom, caused by the nutrients added by the decaying fish and occurring several days after treatment, was probably mostly responsible for dragging the Chironomidae with it as it broke loose and drifted downstream.

The September 22 samples had large amounts of algae and many of the Chironomidae were entangled in it.

The other Diptera showed a slight increase in drift after treatment, however the Heleidae (midges) exhibited a pattern quite similar to the Chironomidae, although with much fewer numbers.

The Acarina (mites) and the Oligochaeta (worms) seemed to be affected by the antimycin (Figure 8). However, the Oligochaeta also showed an increase in drift on September 22. This may again be due to the drifting algae, since many Oligochaeta were present in the algae.

Drift - 15 Minutes

The fifteen minute drift samples taken at the same time as the benthic samples, showed the same pattern of drastically increased drift as the thirty minute drift samples (Figure. 9). Thirty two different taxa were obtained in these samples (Table 4). These samples were taken along the entire length of the stream in Tunnel Meadow. They showed a variation between sites which was partly due to the varying flows through the nets (Table 3). However, all sites showed some increase, confirming that the rapid rise in drift caused by the antimycin occurred along the entire length of the meadow.

Benthos

Benthic sampling results are shown in Figures l0 and 11. These samples yielded 55 different taxa (Table 5). While the total number of organisms found in the benthic samples decreased after the treatment, it must also be noted that the total numbers decreased steadily following the first sample, and at some of the sites the total for September 22 was higher than for previous samples. It is possible that the flooding which occurred on September 10 was the cause of the sharp decrease in benthos between sampling dates 9 and 12.

These results are not too surprising. The very small number of benthic samples taken make the possibility of the variability in the samples being much greater than any change occurring because of the treatment, quite probable. Such a small number of samples precludes the determination of all but very dramatic changes. However, both Baetis sp. and the Simuliidae, both of which showed high drift rates following treatment, appeared in the benthic samples in such low numbers on September 22 as to suggest an actual depletion of their numbers in the benthos.

The benthic samples did give a fairly good survey of the invertebrates living in the South Fork Kern riffles at that time of the year. The major value of the benthic samples, however, was to show that the benthic populations were not completely depleted by the antimycin treatment. The benthic samples taken on September 22, 8 days following treatment, contained almost all the major taxa that were found prior to treatment. Only two taxa were missing that could really have been expected to be there, Ephemerella spinifera (mayfly) which was found in 61% of the other samples, and the Simuliidae (blackflies) which were found in 78% of the other samples. The presence of the majority of the taxa in the samples of September 22 seems to indicate that the antimycin treatment did not completely destroy the invertebrate community.

TABLE 4

TAXA PRESENT IN SOUTH FORK KERN 15 MINUTE DRIFT SAMPLES

Phylum – Annelida
- Class – Oligochaeta – aquatic earthworms — Sites B, C, D, E

Phylum – Arthropoda
- Class – Arachnida
  - Order – Acarina – mites — Sites A, B, D, E
- Class – Insecta
  - Order – Ephemeroptera – mayflies
    - Family – Heptageniidae
      - _Cinygmula_ sp. — Sites C, D, E
      - _Rhithrogena_ sp. — Site D
    - Family – Leptophlebiidae
      - _Paraleptophlebia_ sp. — Sites A, B, C, D
    - Family – Ephemerellidae
      - _Ephemerella_ _spinifera_ — Site A
      - _Ephemerella_ _grandis_ _grandis_ — Sites C, D
      - _Ephemerella_ prob. _levis_ — Sites B, C, E
    - Family – Baetidae
      - _Baetis_ sp. — Sites A, B, C, D, E
      - _Centroptilum_ sp. — Site B
    - Family – Siphlonuridae
      - _Ameletus_ sp. — Site A
  - Order – Plecoptera – stoneflies
    - Family — Nemouridae — Site E
      - _Nemoura_ sp. — Site A
    - Family – Peltoperlidae
      - _Peltoperla_ sp. — Site A
    - Family – Chloroperlidae
      - _Alloperla_ sp. — Sites B, C, D
    - Family – Perlodidae
      - _Isoperla_ sp. — Site D

Order – Trichoptera – caddisflies
Family – Hydropsychidae
Hydropsyche sp. — Sites A, C

Family – Hydroptilidae
Hydroptila sp. — Sites C, D

Family – Limnephilidae — Site C
poss. *Dicosmoecus* sp. — Site A
Pedomoecus sierra — Site A

Order – Coleoptera – beetles
Family – Dytiscidae – predaceous diving beetles
Oreodytes sp. — Site A
Deronectes striatellus — Site C

Family – Elmidae – riffle beetles
Optioservus sp. — Site A
Cleptelmis sp. — Sites A, B

Order – Diptera – flies
Family – Psychodidae – mothflies
Pericoma sp. — Sites B, E

Family – Dixidae
Dixa (*Dixa*) sp. — Site A

Family – Simuliidae – blackflies — Sites A, B, C, D, E

Family – Chironomidae – midges — Sites A, B, C, D, E

Family – Heleidae – biting midges — Sites A, C

Family – Liriopeidae – phantom crane flies
Liriope sp. — Site A

Family – Ephydridae – shore flies — Site A

Phylum – Mollusca
Class – Gastropoda – snails
Order – Ctenobranchiata
Family – Bulimidae — Site E

Class -- Pelecypoda – clams
Order – Heterodonta
Family – Sphaeridae
Pisidium sp. — Sites A, B, D, E

TABLE 5

TAXA PRESENT IN SOUTH FORK KERN BENTHIC SAMPLES

Phylum – Platyhelminthes
- Class – Turbellaria – flatworms
  - Order – Tricladida — Site A

Phylum – Annelida
- Class – Oligochaeta – aquatic earthworms — Sites B, C, D, E

Phylum – Arthropoda
- Class – Crustacea
  - Subclass – Ostracoda – seed shrimp
    - Order – Podocopa — Site B
- Class – Arachnida
  - Order – Acarina – mites — Sites A, B, C, D, E
- Class – Insecta
  - Order – Ephemeroptera – mayflies
    - Family – Heptageniidae
      - Cinygmula sp. — Sites A, B, C, D, E
      - Rhithrogena sp. — Site D
    - Family – Leptophlebiidae
      - Paraleptophlebia sp. – Sites B, C, D, E
    - Family – Ephemerellidae
      - Ephemerella spinifera — Sites A, B, C, D, E
      - Ephemerella prob. inermis — Site A
      - Ephemerella sp. — Sites A, C, D, E
      - Ephemerella doddsi — Site A
      - Ephemerella grandis grandis — Sites A, B, C, D, E
      - Ephemerella prob. levis — Sites B, C, D, E
      - Ephemerella prob. hystrix — Site D
    - Family – Baetidae
      - Baetis sp. — Sites A, B, C, D, E
      - Centroptilum sp. — Site E
    - Family – Siphlonuridae
      - Ameletus sp. — Sites C, E
  - Order – Plecoptera – stoneflies
    - Family – Nemouridae — Sites B, C, D, E
      - Nemoura sp. — Sites A, C, E
      - Eucapnopsis sp. — Site C

Family – Pternarcidae
Pteronarcys prob. princeps — Site B

Family – Peltoperlidae
Peltoperla sp. — Sites A, C

Suborder – Setipalpia — Sites D, E

Family – Chloroperlidae
Alloperla sp. — Sites A, B, C, D, E

Family – Perlodidae
Isogenus sp. — Sites A, C, E
Isoperla sp. — Site E

Family – Perlidae
Acroneuria californica — Site C
Acroneuria sp. — Site E

Order – Trichoptera – caddisflies
Family – Hydropsychidae
Hydropsyche sp. — Sites A, B, C, D, E

Family – Rhyacophilidae
Rhyacophila acropedes subgroup — Sites A, B
Rhyacophila valuma — Site A
Rhyacophila sp. — Sites A, B
Rhyacophila vedra group — Site C

Family – Philopotamidae — Site A
Wormaldia gabriella — Site A

Family – Hydroptilidae
Hydroptila sp. — Sites C, D, E

Family – Glossosomatidae
Glossosoma sp. — Sites A, B

Family – Brachycentridae
Micrasema sp. — Site E
Amiocentrus aspilus — Site C

Family – Limnephilidae — Sites A, C, E
Pedomoecus sierra — Site A
Neophylax occidentis — Site A

Order – Coleoptera – beetles
Family – Elmidae – riffle beetles — Sites A, B, C, D
Optioservus sp. — Sites A, B, C, D, E
Optioservus quadrimaculatus — Sites A, B, C, D, E
Optioservus divergens — Sites A, B, C
Cleptelmis sp. — Sites A, B, C
Cleptelmis addenda — Sites A, C
Cleptelmis ornata — Sites A, B

Order – Diptera – flies
Family – Tipulidae – craneflies
Antocha monticola — Site A
Dicranota sp. — Sites A, D, E
Hexatoma sp. — Sites B, C, D, E
Limnophila sp. — Sites B, C, D

Family – Psychodidae – mothflies
Pericoma sp. — Sites A, B, C, D, E

Family – Simuliidae – blackflies — Sites A, B, C, D, E

Family – Chironomidae – midges — Sites A, B, C, D, E

Family – Heleidae – biting midges — Sites A, B, C, D, E

Family – Dolichopodidae – long legged flies — Sites A, B, C, D, E

Family – Muscidae — Sites B, E

OTHER INVERTEBRATES FROM SOUTH FORK KERN RIVER[5]

Phylum – Arthropoda
Class – Insecta
Order – Ephemeroptera – mayflies
Family – Leptophlebiidae
Paraleptophlebia debilis — Adult, 9-15-76, site 2.

Family – Baetidae
Baetis bicaudatus — Adult, 9-11-76, site 4.

Order – Odonata – dragonflies and damselflies
Family – Gomphidae
Ophiogomphus severus — Nymph, 9-13-76, about 300

[5] This table was Appendix 4 in the original report and has been moved to here for convenience. Appendices 1-3 in the original report were data tables, which have been omitted in this version.

yards above site 4.

Order – Trichoptera – caddisflies
Family – Brachycentridae
Brachcentrus americanus — Dead pupa, 9-22-76. Site B

Family – Limnephilidae
Dicosmoecus atripes — Adults, 9-14-76, site 1

Order – Diptera – flies
Family – Simuliidae – blackflies
Simulium prob. tuberosum — Adult, 9-12-76, site 4

DISCUSSION

While the benthic sampling does not show any significant change in the populations of invertebrates that is clearly attributable to the antimycin treatment, the drift does show a dramatic change which can definitely be said to be a result of the treatment.

It is not surprising that the benthic sampling gave such unreadable results. The accuracy of benthic sampling in estimating total populations is dependent on a large number of samples (Needham and Usinger 1956). The small number of samples taken here simply show the sampling variability.

Drift sampling, on the other hand, gives a much more reliable indication of changes in the drift numbers and composition with a fairly small number of samples. The time duration involved in drift sampling helps to reduce the variability. The ability to resample the exact site over a period of time without destroying the conditions which are responsible for the given fauna that is being sampled, is of a great deal of value especially in a stream as small as the South Fork of the Kern. The repeated disturbance of the substrate of a small riffle has a definite effect on the numbers and composition of organisms found there. The repeated sampling of drift at a given spot, providing there is no disturbance of enough magnitude to alter the current patterns, does not affect the number or composition of invertebrates which drift by there.

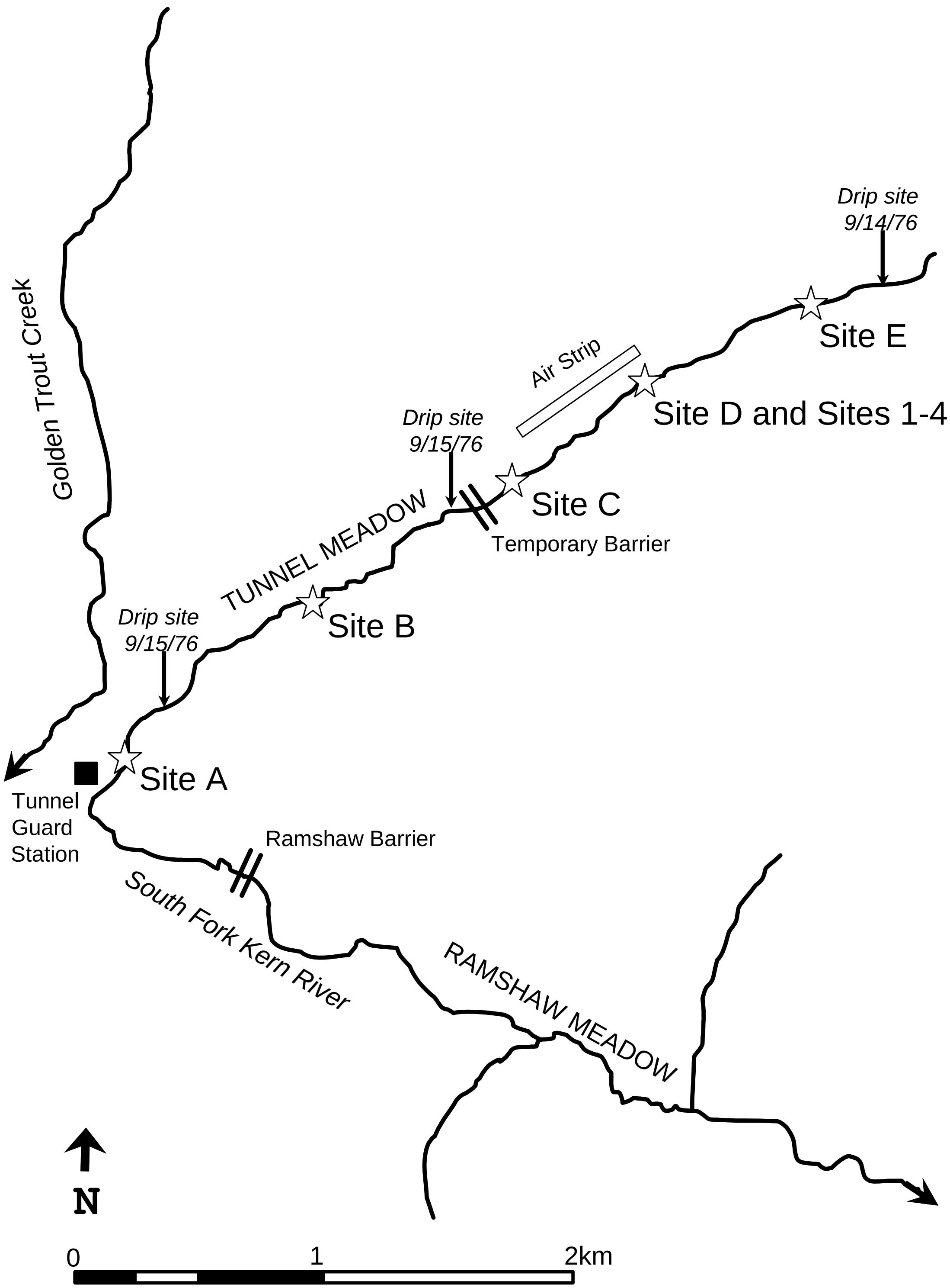
The idea behind the use of drift as an indicator of invertebrate kills is that dead or dying invertebrates lose their hold on the substrate and drift downstream. Any abnormal increase in drift may also indicate that normal behavior patterns have been disturbed. Drift has been used to monitor effects of Sevin (Coutant 1964), DDT (Hoffman and Surber 1948) and antimycin (Degan 1973) on aquatic invertebrates with much the same rapid rise in drift as was observed in this study.

The data gathered in this study indicate that use of antimycin as a piscicide has a definite effect upon the aquatic invertebrate community in cold mountain streams. The efficiency and effectiveness of antimycin as a fish toxicant, as well as its low toxicity to animal forms utilizing free oxygen make it a valuable and sometimes necessary tool in fish management. Its toxicity to invertebrates and to immature amphibians (dead or dying tadpoles were also collected in the drift nets) require that care be used in selecting where and when it should be used. A careful evaluation of the invertebrates to be affected should help decide if use is biologically justifiable and the effects of any use on the invertebrate community should be monitored.

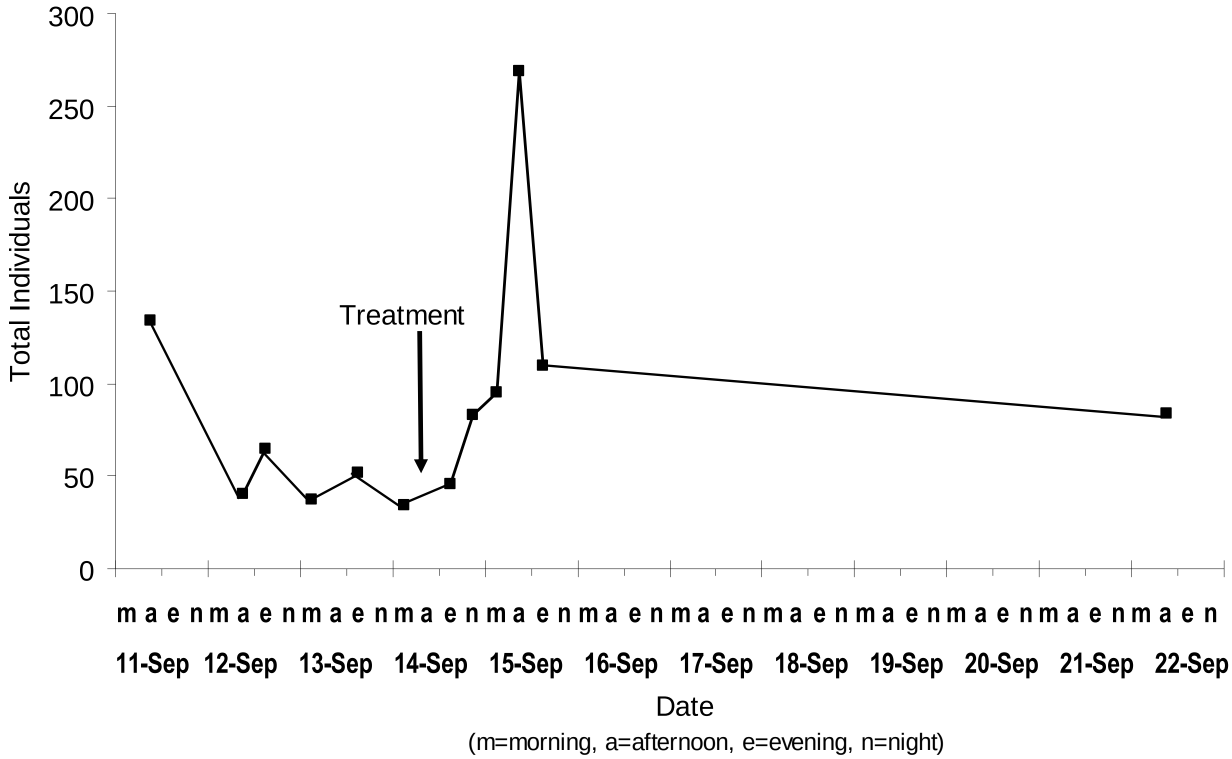
FOLLOW-UP

Sampling is being conducted during the summer 1977 to check for long-term effects of the antimycin treatment and to provide baseline data for future treatment of lower sections of the South Fork Kern River.

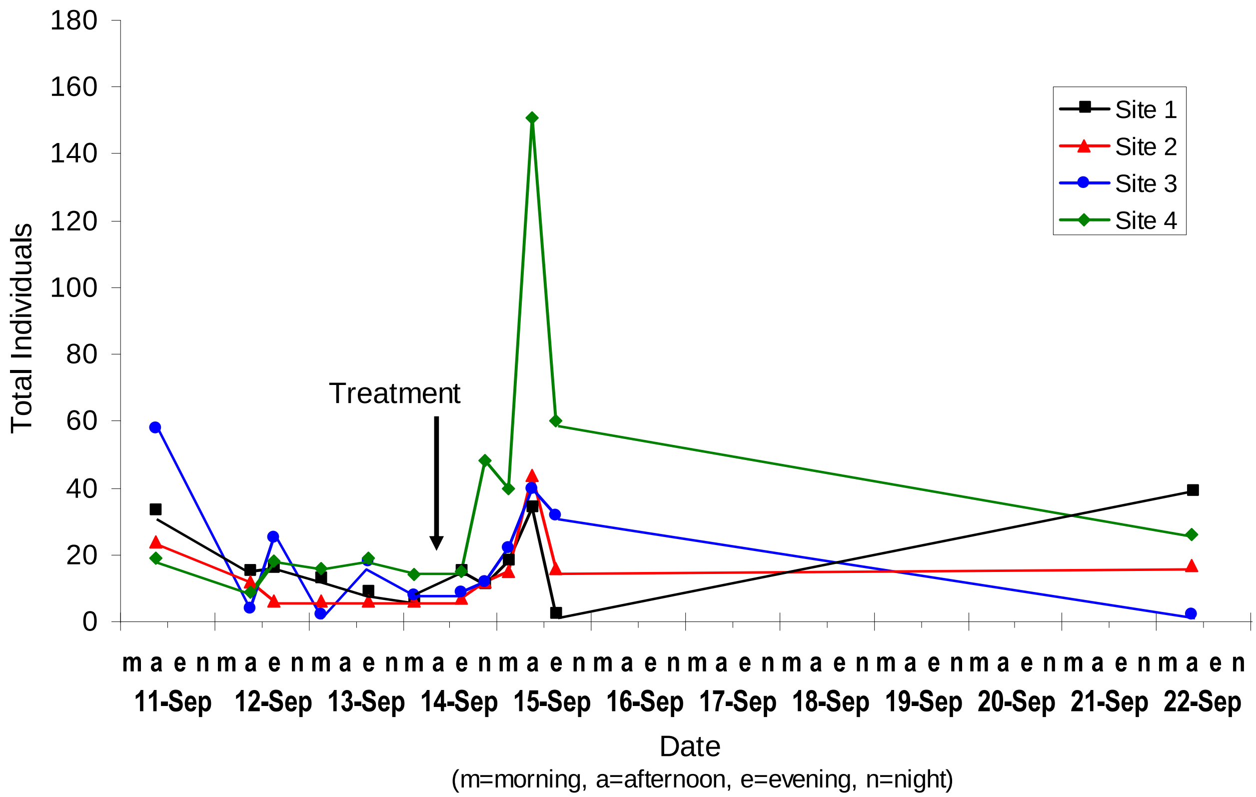
APPENDIX I



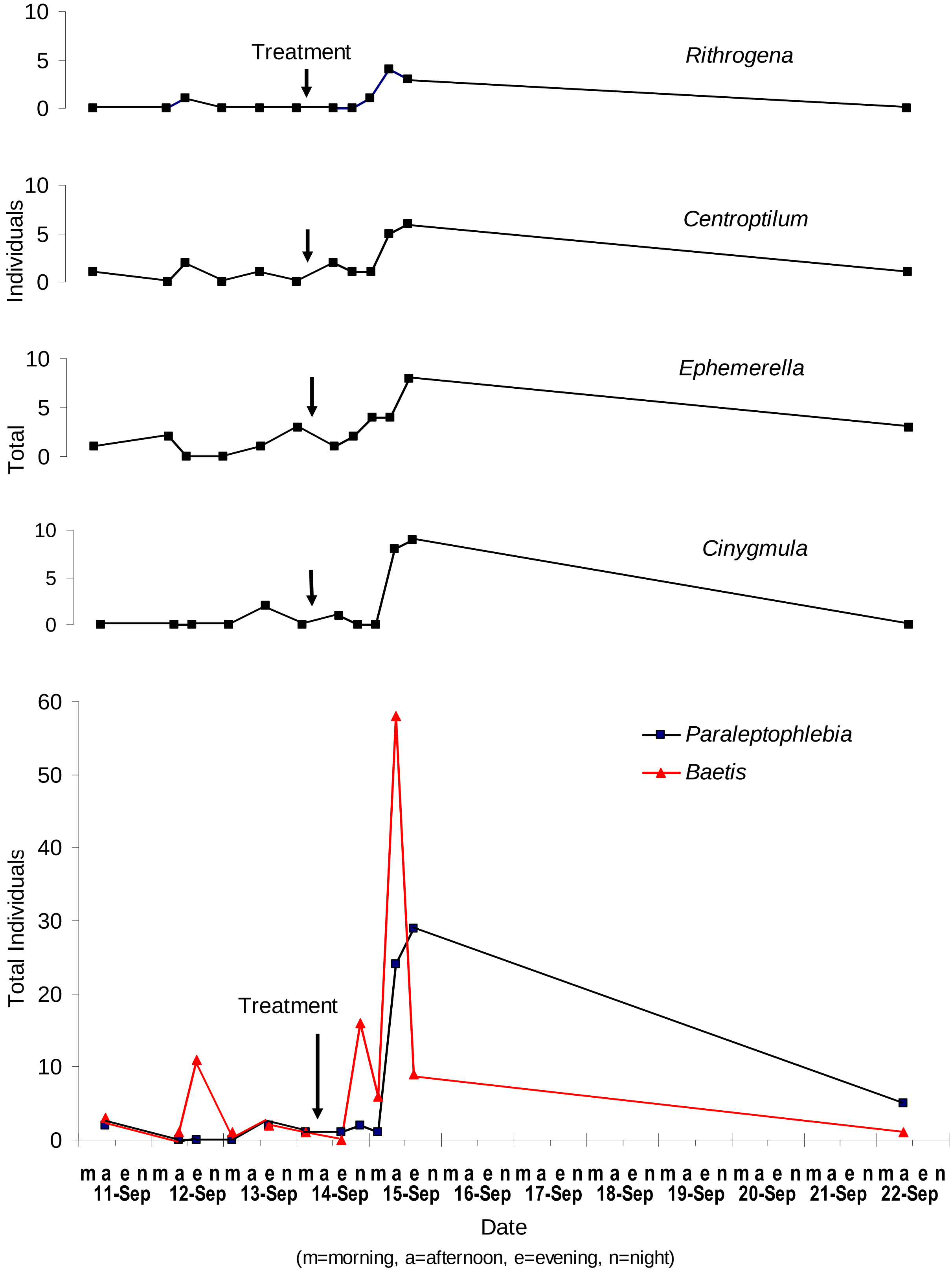
Appendix 1, Figure 1. South Fork Kern River (Tunnel Meadow) Invertebrate Sampling Sites, 1976.



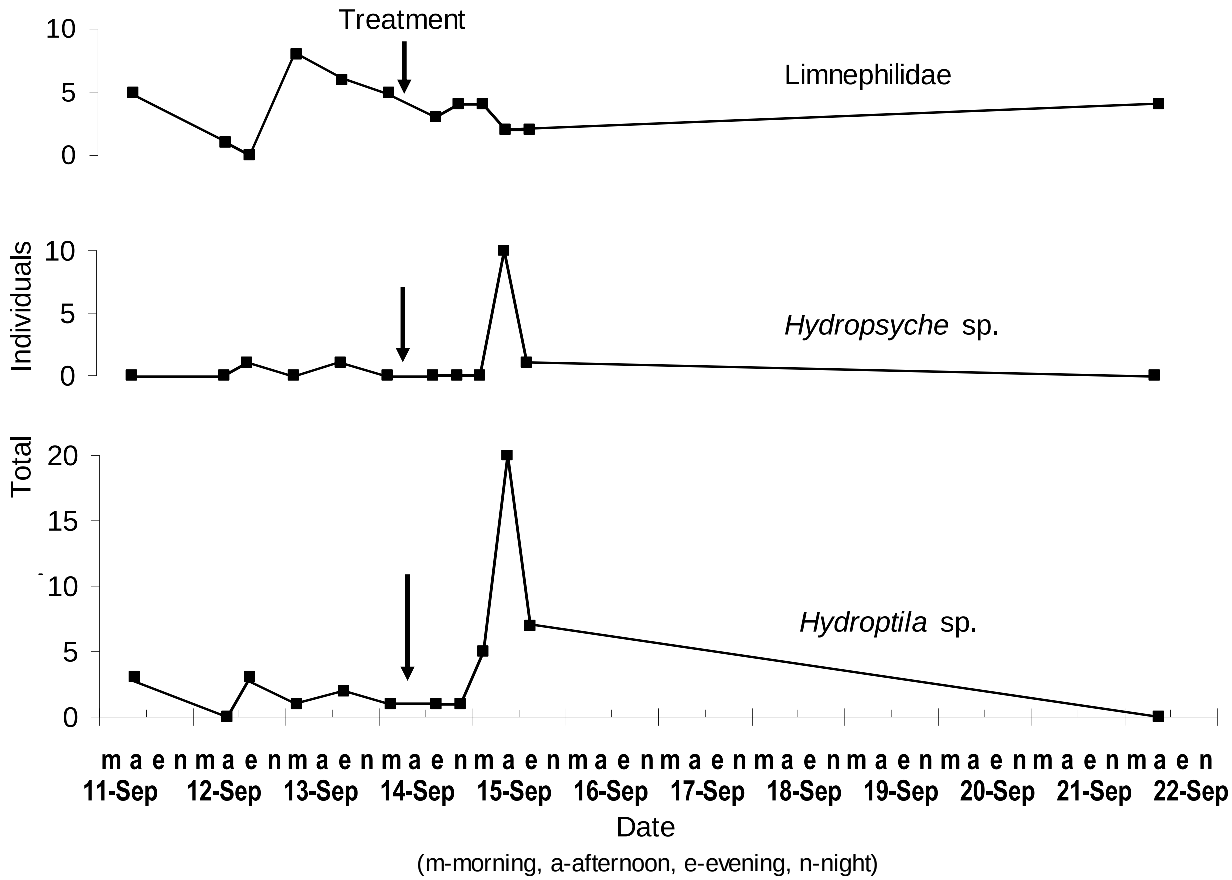
Appendix 1, Figure 2. Total 30 minute drift at sites 1-4, South Fork Kern River



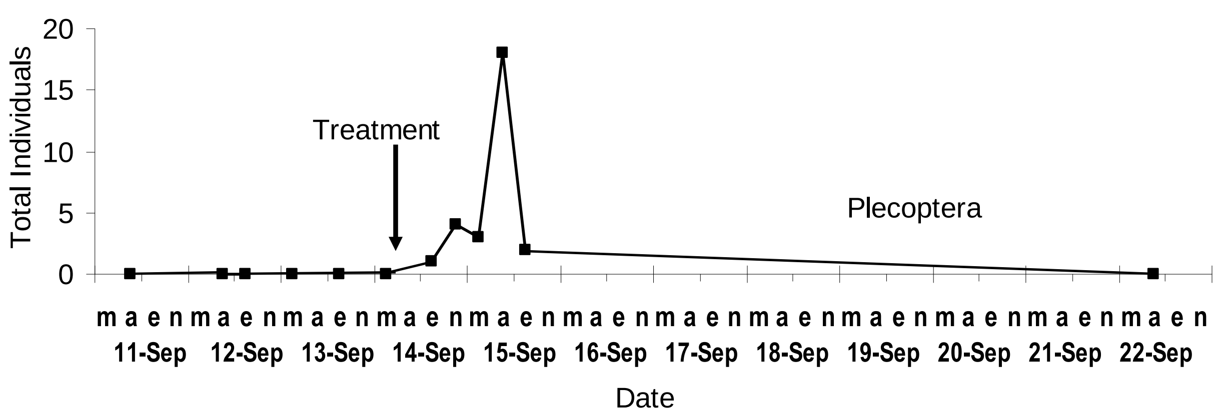
Appendix 1, Figure 3. 30 minute drift at sites 1-4, South Fork Kern River



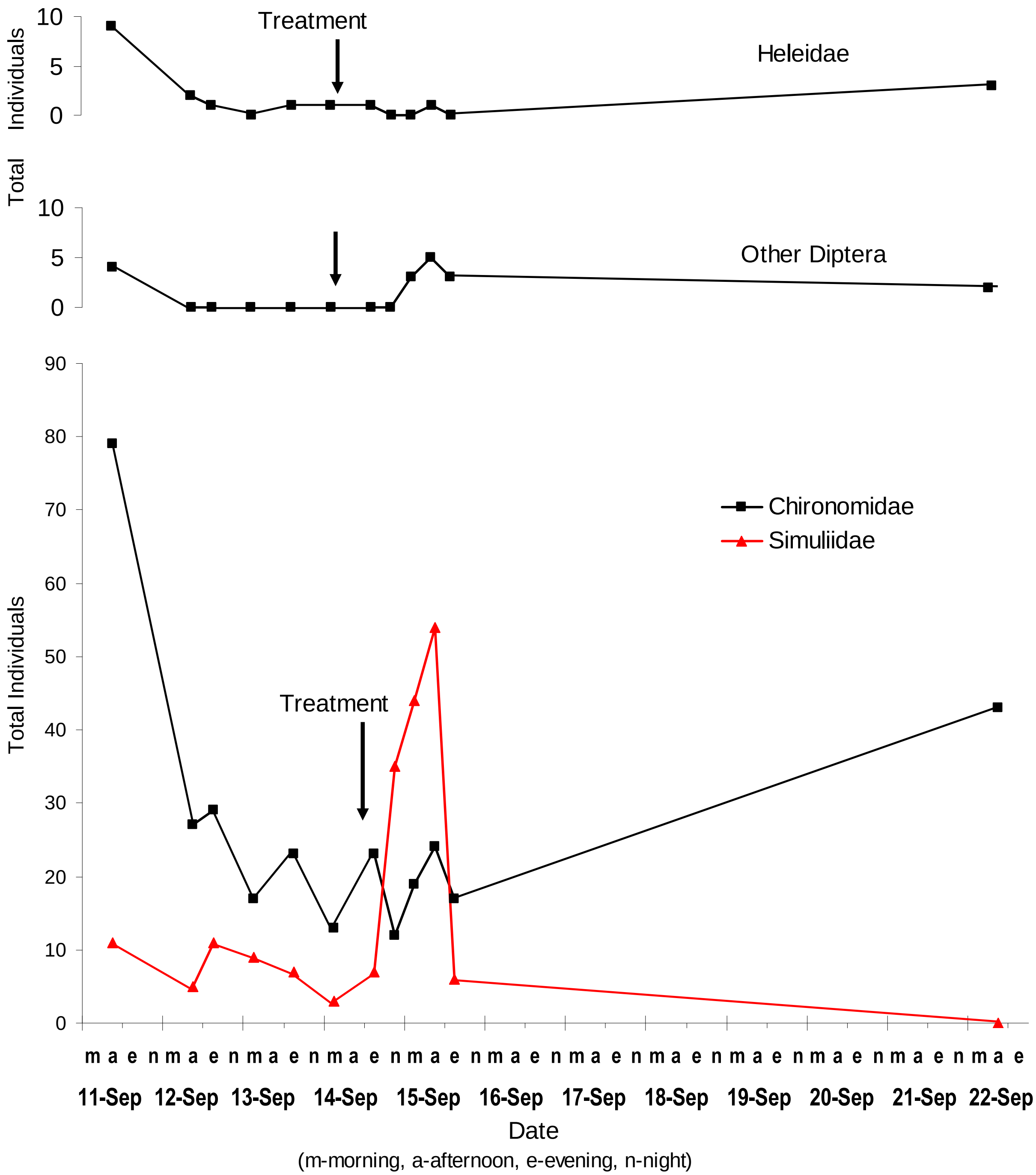
Appendix 1, Figure 4. Ephemeroptera 30-minute drift, total sites 1-4, South Fork Kern River



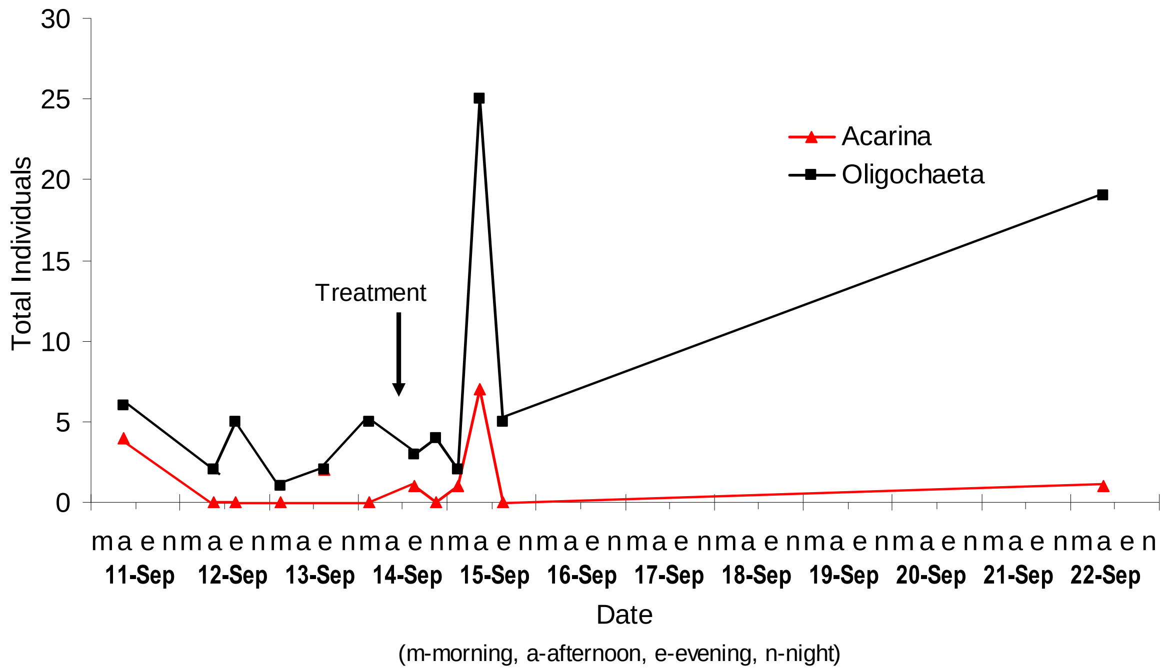
Appendix 1, Figure 5. Trichoptera 30-minute drift, total sites 1-4, South Fork Kern River.



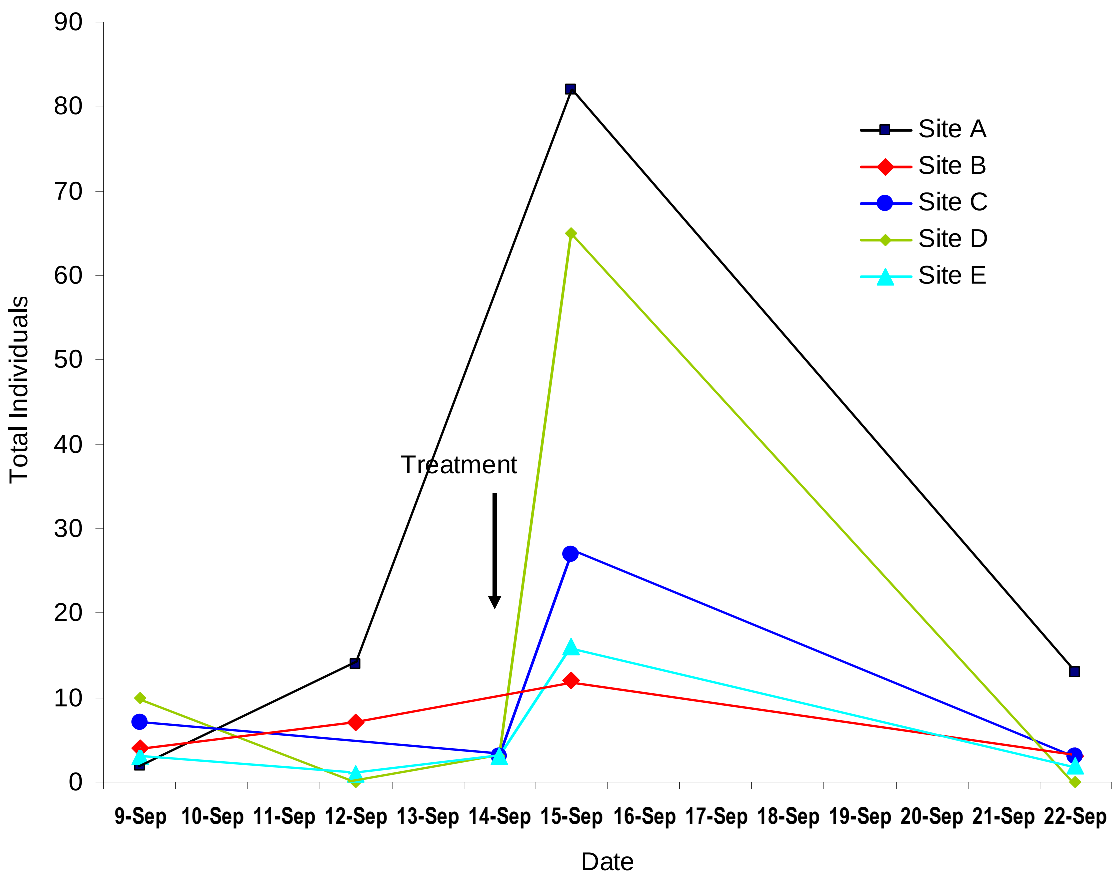
Appendix 1, Figure 6. Total Plecoptera 30-minute drift, total sites 1-4, South Fork Kern River.



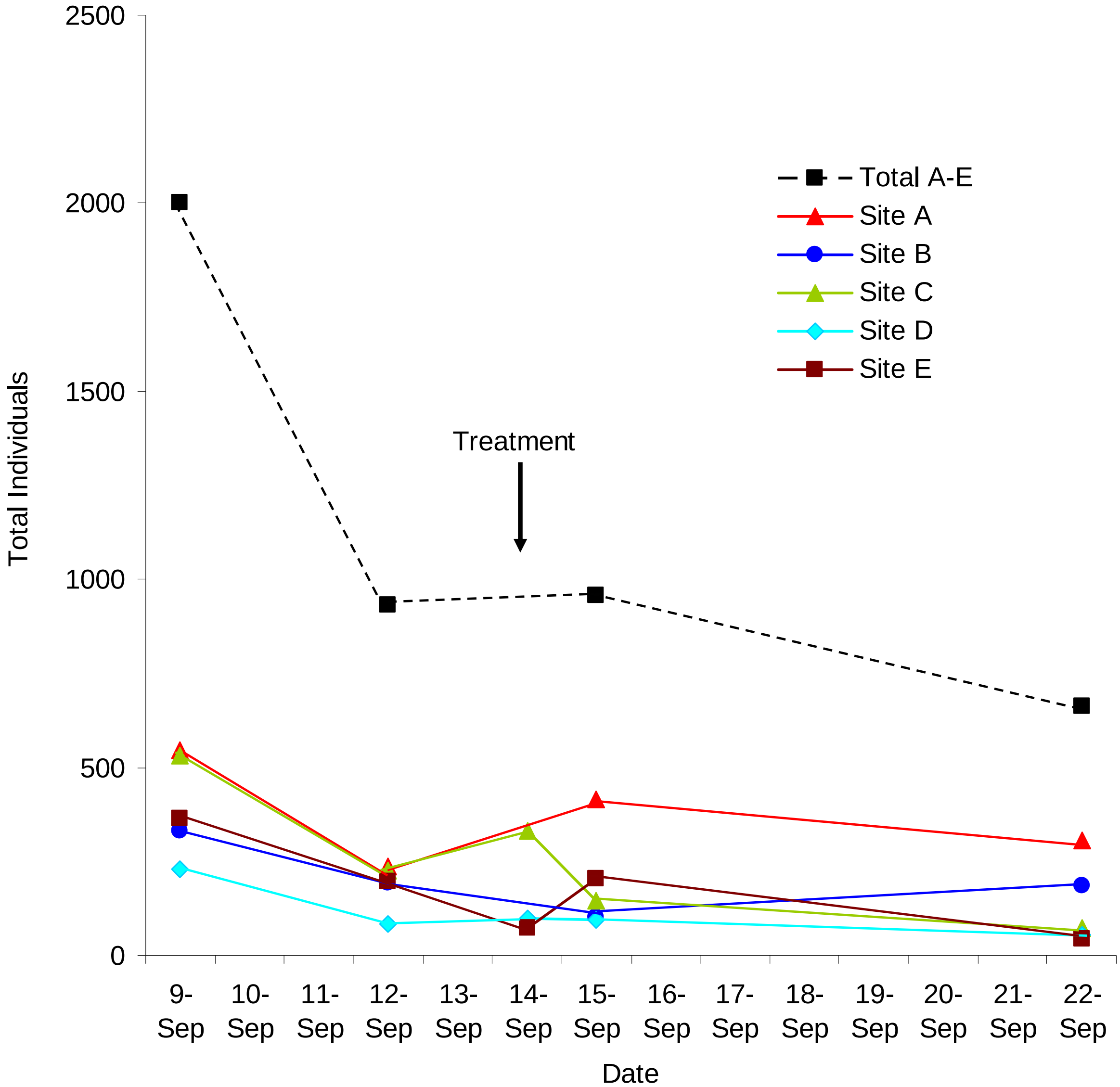
Appendix 1, Figure 7. Diptera 30-minute drift samples, total sites 1-4, South Fork Kern River.



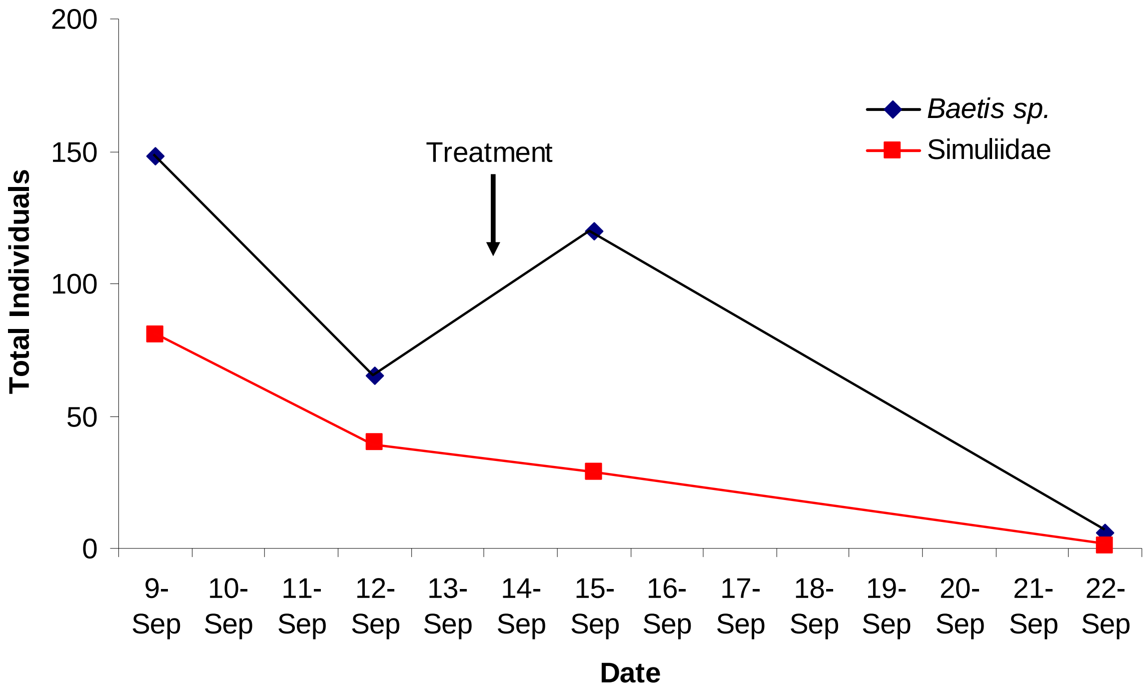
Appendix 1. Figure 8. Other invertebrates 30-minute drift, total sites 1-4, South Fork Kern River.



Appendix 1, Figure 9. 15-minute drift at sites A-E, South Fork Kern River.



Appendix 1, Figure 10. Total benthos collected, South Fork Kern River.



Appendix 1, Figure 11. Baetis sp. and Simuliidae in benthic samples, total sites A-E, South Fork Kern River

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APPENDIX 2 - BROWN TROUT CONTROL PROGRAM, SOUTH FORK KERN RIVER, 1976.

State of California **The Resources Agency**

Memorandum

To W. M. Richardson Date: April 28, 1977

From :**Department of Fish and Game -** Marilyn Myers

Subject: Brown Trout Control Program, South Fork Kern River, 1976.

Introduction

Through the summer of 1976 joint plans were laid by the Bishop office of the Dept. of Fish & Game and the Inyo National Forest Service for the eradication of the brown trout (Salmo trutta) from the upper reaches of the South Fork of the Kern River on the Kern Plateau. The two agencies were faced with the continuing problem of brown trout invasion into golden trout territory. Less drastic measures attempted in previous years had failed to eliminate the brown trout. It was decided that a carefully planned treatment of the stream with antimycin would be necessary to finally remove all the brown trout.

The Kern Plateau is distinguished from the more northerly Sierra Nevada by its rolling hills, generally flat topography, meandering streams and large meadows. The South Fork of the Kern erupts from springs about 0.5 mile above South Fork Meadows, runs down through Tunnel Meadow (where a landing strip is located), and meanders on through Ramshaw Meadow into Templeton Meadow. At the southern end of Templeton Meadow east of Templeton Mountain, two fish barriers were constructed by the Dept. of Fish and Game and the Inyo National Forest in 1973. The most optimistic and ideal project envisioned during the summer of 1976 was treatment of the entire drainage from the headwaters to the Templeton barriers.

In fall of 1969 Warden Vernon Burandt reported a brown trout being caught out of the South Fork Kern in Tunnel Meadow. In mid-September of 1969 electroshocking through Tunnel Meadow confirmed the report. Many browns were caught at that time. Year classes of 0, I, and IV were found. It was hypothesized that browns may have jumped the series of small falls that separated Ramshaw and Templeton Meadows during high water levels in spring runoffs of 1967, 1968 or 1969.

Two possible explanations for the presence of the brown trout in the upper reaches of the South Fork Kern were suggested. One was that the brown trout had slowly migrated northward from the Kennedy Meadows area. Brown trout have been planted in that area since 1940. A plant of 21,000 fingerling browns was made as late as 1962 to bolster their population after the drought years of the early 1960s. The first report of brown trout in Ramshaw Meadow occurred in 1966. A second explanation for the unexpected appearance of the browns in the upper South Fork Kern is that there may have been an illegal plant by an angler.

The appearance of the brown trout caused immediate concern in the Dept. of Fish and Game. The brown's aggressive nature and cannibalistic habits would soon decimate the golden trout population. If the browns were left unchecked they would soon eliminate the State Fish from its 20,000 year homeland.

A second cause of concern was the close proximity of the South Fork Kern to Golden Trout Creek. It would be very easy for an uninformed fisherman to make a "coffee can transplant" of browns from the South Fork Kern to Golden Trout Creek.

On September 23, 1969 the lower end of Tunnel Meadow was electroshocked and all browns caught were removed. The lower end of the stream was then treated with 96 pounds of calcium hypochlorite (HTH). It was thought at the time that there was a complete kill of the brown trout. Plans were discussed with the Forest Service to improve the barrier between Ramshaw and Tunnel Meadows.

In September, 1970 the Dept. of Fish & Game and the Inyo National Forest Service worked together to construct an impassable fish barrier between Ramshaw and Tunnel Meadows. The Forest Service men were in charge of the dynamiting and rock drilling and the Fish and Game personnel piled rocks. Electroshocking in Tunnel Meadow again produced browns. So the lower end of the stream was treated with 75 lbs. of HTH.

Each year from 1971 through 1975 brown trout were shocked out of South Fork Kern at Tunnel Meadow and HTH was used in an attempt to check their population. It was finally decided that the brown trout could not be controlled by electroshocking and HTH and that a complete treatment of the upper South Fork Kern was necessary.

Materials

Antimycin A was the chemical selected for several reasons. Antimycin will kill eggs in the gravel as well as the free swimming fish; the fish cannot detect its presence in the water; and its effect is irreversible — once the fish are exposed to a lethal dose they will die even though they may swim to water with a less concentrated dose. Another valuable characteristic of this chemical is that it is so concentrated only a small amount is needed in comparison to rotenone. When working the backcountry it is important to use the smallest, lightest materials possible.

A continuing problem plagued the Department as soon as it was decided to use antimycin; there was/is no steady reliable source of the toxicant. Antimycin is no longer being manufactured, so the Bishop office had to look to other offices in and out of the state to try to locate enough antimycin for the project. The scarcity of antimycin is a problem which remains unsolved.

Containers were needed to distribute the chemical at a steady rate over a relatively long period of time. The containers were patterned after a prototype described in "Aids for Stream Reclamation" in the January 1963 issue of "The Progressive Fish Culturist". The next step was to locate 55 gallon drums that had both a top bung and side bung. The Bishop dump was the best source; 6 barrels in good condition were found there. All other leads produced drums with a top bung only. A second side bung had to be welded on the barrels to give a total of ten usable barrels. All the barrels were then steam cleaned to remove the residual chemicals they held. Pipe fittings, bushings, and valves were ordered using the specifications listed in the article. When the parts arrived one barrel was outfitted with the internal plumbing to make sure everything fit properly.

Over 300 feet of 1/4" and 1/8" hardware cloth were bought for live cages and fencing material. Five gallon plastic bottles were collected for distribution of antimycin on small springs and stringers. A small hole was drilled in the bottom of each 5 gallon bottle so it would drain in about 1.4 hours. The 55 gallon drums, the hardware cloth and the 5 gallon plastic bottles were all flown up to the Kern Plateau by a Forest Service helicopter.

August 24, 1976 a crew of five flew into Tunnel Meadow to survey the treatment area. This crew consisted of Jerry Stefferud, Fisheries Biologist for the Forest Service; Gary Ponder, DFG Fishery Biologist; Don Sada, Steve Lee, and Marilyn Myers, seasonal aids for the DFG. Stringers flowing into the South Fork Kern in Ramshaw and Templeton Meadows were electroshocked to compare relative numbers of brown trout and golden trout. Each stringer was walked out to check for fish barriers. All stringers, springs, and marshy areas that would need to be treated were noted and marked on maps. A thorough reconnaissance was completed in 3 days, and the extent of the project was defined.

Procedures

On Sept. 7, 1976 the following people flew into Tunnel Meadow: Jerry Stefferud and his wife Sally; Gary Ponder; Darrell Wong, DFG Fisheries Biologist and his wife Ann; Don Sada, Steve Lee, Pat Hurt and Marilyn Myers, seasonal aids. A volunteer worker, Barb King, walked in. The afternoon of the 7th, camp was organized and several live cars were constructed from 1/4" hardware cloth.

Throughout the project the DFG made extensive use of Bob White's Flying Service in Lone Pine. His planes were relied on extensively to fly people, equipment, and food into Tunnel Meadow. The camp in Tunnel Meadow became headquarters for the project. Without his services the project would have been much more complicated and costly.

On September 8 Phil Pister, Terry Mills and Dan Christensen, DFG Fisheries biologists, flew in. Three electroshocking crews began collecting golden trout from the South Fork in Tunnel Meadow. The fish were collected in buckets and then carried to large live cars. Another crew began construction of a large holding area for the golden trout on Golden Trout Creek.

An unusual geologic feature made it feasible and practical to keep Golden Trout from the South Fork Kern in Golden Trout Creek. The South Fork Kern was originally a tributary of Golden Trout Creek. Volcanoes erupted, filling the canyon of lower Golden Trout Creek. The stream was dammed up behind the lava barrier, and silt was deposited behind the dam. The stream divided, part of it draining into the newly formed South Fork Kern and part of it flowing in the Golden Trout Creek direction. Eventually the lava was eroded away so that Golden Trout Creek flowed in its original channel. Slowly the silt deposited behind the lava barrier has been eroded away, leaving the two streams separated by a ridge of deposits only about 175 yards wide.

There has been much conjecture over the strains of Golden Trout on the Kern Plateau. It is believed by many that the golden trout of the South Fork Kern are distinct from the golden trout in Golden Trout Creek. For this reason every precaution was taken to make the holding area for transferred golden trout very secure.

Water from Golden Trout Creek was diverted into a previously dry channel which would normally fill only in times of high water. With 1/4” hardware cloth, two barriers about 10 feet apart were constructed at the head of the channel. The hardware cloth was buried about a foot deep and was secured well with rocks, gravel, and fence posts. A third hardware cloth fence was set up along a side portion of the channel, and a fourth one was built to seal off the lower end of the channel. The length of the holding area was about 40 yds. long, and it had about a 1/2 cfs flow. Several good pools and sheltered hiding areas were formed providing a habitat where the fish could be safely held several days.

Also on Sept. 8, Steve Lee, Barb King and Marilyn Myers flew from Tunnel Meadow down to Templeton Meadow to set up a second camp. Don Sada hiked down. Steve and Don scouted the southern end of the meadow for additional stringers which needed to be treated. Barb and Marilyn set up camp and built live-cars.

On Sept. 9 this group of four hiked to Lewis Stringer at the north end of Templeton Meadow. A barrier was built using 1/8” hardware cloth where the stringer entered the South Fork Kern. Seven fish were caught by hand to be used in bioassay cages as the antimycin was applied. Terry Mills from the Tunnel Camp hiked over to help administer the chemical.

The first treatment station was set up about 50 yds above a natural fish barrier. Bioassay cages were placed at 15 ft. (2 fish), 30 yds (2 fish), and 80 yds (3 fish), away from the station. The stringer was small enough (about 1/2 cfs) that a 5 gallon bottle could be used effectively. The first dose tried was 3cc of the Fintrol—5 (5.5ppb.). After about 1 1/2 hours the bottle had drained, and the fish 15 feet away were not showing signs of distress. The jug was refilled using 10 cc of the liquid concentrate. After 2 hours all the fish were still alive. The bioassay cages and fish were left in place to be checked the next day.

The first doubts about being able to treat all of the upper South Fork Kern from the headwaters through Templeton Meadows were expressed at this time. It became apparent that more chemical and time would be required than had been anticipated.

At Tunnel Meadow electroshocking crews continued to collect fish and move them to holding cages in the South Fork Kern. The large holding area on Golden Trout Creek was completed in the afternoon.

It began raining in the early morning of the 10th and continued through the day. The group of four camped in Templeton Meadow packed up and hiked back to Tunnel Meadow. A check of the bioassay fish on Lewis Stringer showed six to be dead with one in the last cage still alive but in distress.

At Tunnel Meadow fish were shocked and collected until rising water prevented further shocking. Fish were moved by a Forest Service packer with mules over to the Golden Trout Creek enclosure. Rising water allowed an estimated 2,000 fish to escape from live cages in the South Fork Kern before they could be transported to the Golden Trout Creek holding area.

A careful eye was kept on the Golden Trout Creek enclosure to prevent rising water from running unchecked into the channel. The amount of water entering the channel could be controlled and had to be watched constantly throughout the duration of the storm so that the hardware cloth fences were not damaged, thereby allowing Golden Trout Creek trout to enter and South Fork Kern trout to escape.

It was jointly decided on the 10th that it would not be feasible to treat all of the drainage at this time. It was agreed that it would be best to thoroughly treat the stream from its headwaters through Tunnel Meadows to the barrier between Ramshaw and Tunnel Meadows. The rest of the area would have to wait until the following summer.

On the 11th pleasant weather returned. Phil Pister, Terry Mills and Dan Christensen flew out. Electroshocking crews collected more fish until all the batteries died. Don Sada spent the day with Joe Bellas, a Forest Service packer, placing the 55 gallon drums at varying intervals along the stream starting at the head of the South Fork Meadow. Mules were used to move the barrels. Placement of the drums depended on the amount of stream flow and the stream condition (rapids, falls, meandering). Since antimycin is oxidized fairly rapidly, the drums had to be closer together through sections of rapids and falls. The tenth barrel was located in about the middle of Tunnel Meadow.

On Sept. 12, Gary Ponder flew out with the electroshocking batteries to recharge them. Don Sada, Pat Hurt and Marilyn Myers returned to Templeton Meadow to pick up all equipment and trash left behind by the first group. More golden trout were transported over to the Golden Trout Creek holding area using a tractor available at the camp. Steve Lee outfitted all but the top two 55 gallon drums with the internal hardware.

On Sept. 13, fresh batteries arrived and two crews began collecting more golden trout. Fish were transported down to the Golden Trout Creek holding area on the tractor in mule cans. The following people flew in: Phil Pister; Dale Lockard, Nevada F&G; Gale Kobetich, USFWS; and Doug Reid, DFG seasonal aid. Gary Ponder and his wife Dorothy hiked in.

On Sept. 14 the treatment began. Jerry Stefferud, Gary and Dorothy Ponder, Dale Lockard, Gail Kobetich, Don Sada and Doug Reid hiked up to the top barrel carrying 5-gallon plastic bottles, the internal hardware for the top 2 barrels, bioassay cages, an electroshocker to catch bioassay fish, antimycin liquid concentrate, graduated cylinders, and antimycin sand. The 5-gallon jugs were placed on all springs and stringers entering the South Fork, every 400 yards between barrels through South Fork Meadow, and every 200 yards between barrels through the rapids between South Fork Meadow and Tunnel Meadow. Thirty c.c. of liquid concentrate (equaling 55 ppb) were used in each 5 gallon container.

Sixty c.c. of concentrate were used in the first 55 gallon drum drip station (10 ppb), and 120 c.c. (20 ppb) were used in the next 6 drums. The 8th, 9th and 10^{th} drums had 60 cc. In them. The increased concentrations were used through the rapids section where oxidation of the chemical would occur more rapidly. The flow from each drum was calibrated to equal 1 quart /min. It took each 55 gal. Drum about 3.5 hours to drain. The approximate locations of the barrel, the amount of antimycin used, and resulting ppb are listed below:

Barrel Number	Location	Dose	Ppb
1	Head of South Fork Meadows	60cc/55gal. water	10
2	End of South Fork Meadows about 1300 yds. downstream from #1.	120cc/55 gal. water	20
3	Just above trail split	“	“
4	Approx. 300 yards downstream from #3	“	“
5	Approx. 550 yards downstream from #4	“	“
6	Approx. 400 yards downstream from McConnell sign	“	“
7	At east meadow fence	“	“
8	Across from Tunnel Air Camp	60cc/55 gal. Water	10
9	Approx. 200-300 yards above airstrip outcropping	“	“
10	Approx. 400 yards below airstrip outcropping	“	“

Meanwhile, more golden trout were collected in the lower end of Tunnel Meadow and transferred to Golden Trout Creek. A fence of 1/8” hardware cloth was constructed about 150 yds below the last barrel to prevent any fish from moving into or out of the treated area. The camp water supply was replenished in the morning before the treatment began so that there would be plenty of fresh water for two days.

The first drip station was started at 1200. The crew finished loading the 10th station at about 1730. While walking back down through the South Fork Meadow and the head of Tunnel Meadow, Dale Lockard broadcast a can of antimycin sand on all boggy, marshy areas which would not have been affected by antimycin in the flowing water. Bioassay cages were placed at varying distances below the drip stations.

The following day, Sept. 15, fish were still seen swimming sluggishly in the early morning. They were very pale in color and swam listlessly. By about 1000 no living fish were observed. Pat Hurt and Marilyn Myers began sanding all marshy areas within 25 yards of the stream starting at the head of Tunnel Meadow. Undercut banks and slow moving water in the streambed were also sanded. Two cans of sand were used from the starting point down to the hardware cloth fence.

Six of the barrels used the previous day were picked up with the tractor and moved to locations below the hardware cloth fence. Barrels were placed about 1/2 mile apart, and 120 cc of concentrate were used in each. The treatment of the second section of stream began at about noon. Sanding of the area began immediately. Three more cans of sand were spread from the hardware cloth fence down to the barrier between Tunnel and Ramshaw Meadows. The placement of the barrels in the second section was as follows:

Barrel Number	Location	Dose	ppb
11	Immediately above temp. barrier	120 cc/55 gal. Water	20
12	One-half mile downstream from #11	“	“
13	One-fourth mile downstream from #12	“	“
14	Approx. 50 yards above FS pasture	“	“
15	Immediately below Tunnel Guard Sta.	“	“
16	At campground below Tunnel Guard Sta.	“	“

Altogether, 6 cans of antimycin sand and 4 units of antimycin concentrate were used over an estimated 10 stream miles in a stream flowing at about 1 cfs. The manufacturers of Fintrol—5 suggest neutralizing the chemical with potassium permanganate ($KMnO_4$); this was not done for two reasons. First, it was very difficult to locate any $KMnO_4$. Second, the stream entered a steep area of rapids and falls before entering Ramshaw Meadow. It was assumed that most of the chemical would be oxidized in this area. Even if the chemical were not oxidized, the Ramshaw Meadow would have to be treated the following year so any fish killed there would not matter. Darrel and Ann Wong, Dale Lockard, and Don Sada flew out in the afternoon, and Dorothy Ponder walked out.

On the following day, Sept. 16, the stream was walked out, and several large brown trout (dead) were observed. All fish in bioassay cages were dead. The kill extended down into Ramshaw Meadow through the first couple of beaver dams. Beyond that no more dead fish were seen. Dead brown trout were occasionally seen all the way up to the upper barrel, showing how extensive their population had been and emphasizing the necessity of thorough treatment.

Sally Stefferud, an aquatic entomologist, took aquatic insect samples from several sites before, during, and after the treatment to see what effect the antimycin had on the aquatic insect fauna. The Salmon Falls River System Project using antimycin had reported “no bad effects from the exposure” to their bioassay insects. Sally found the antimycin did affect the aquatic insects.

Post—Treatment

Sept. 16 In the afternoon the following people flew out: Phil Pister, Gail Kobetich, Gary Ponder, Jerry and Sally Stefferud, Pat Hurt, and Marilyn Myers. Steve Lee and Doug Reid, seasonal aids, remained to keep an eye on the Golden Trout Creek holding area and to pick up equipment.

Sept. 17. The hardware cloth fence in the South Fork Kern was removed and all the 55 gallon drums were stood up on end and in plain view. Doug and Steve took the fork lengths of 212 dead golden trout from the South Fork Kern in Tunnel Meadow. The average length was 3.4 inches. Two brown trout were found and measured. One was 7.0 inches and the other was 4.0 inches. They also measured 16 brown trout killed in Ramshaw Meadow. Their average length was 9.4 inches, the largest fish being 19.0 inches in length.

Sept. 18 Steve Lee and Doug Reid flew out, and Don Sada and Marilyn Myers flew in. Don and Marilyn picked up the 55 gallon drums and live cars with the tractor. All materials were taken to Tunnel Guard Station.

Sept. 19 Don and Marilyn electroshocked from Tunnel Guard Station down to the Ramshaw barrier. No living fish were seen or shocked. A species composition check in this section revealed 140 golden trout and 181 brown trout. However, 100 golden trout had been shocked out of this section before the treatment. From the Ramshaw barrier to the first beaver dam 56 suckers (Catostomus occidentalis), 75 browns, and 1 golden were found. Three live cars with 2 fish each were set up through Tunnel Meadow to determine if the chemical had detoxified.

Sept. 21 The Live cars were checked — all fish were still alive. The holding area on Golden Trout Creek was watched. Jerry Stefferud rode in on a Forest Service horse.

Sept. 22 Bill Richardson, Fisheries Management Supervisor for Region 5; Bob Toth, fish pathologist for DFG; Phil Pister, and Sally Stefferud flew in. Seven hundred and fifty fish were removed from the enclosure on Golden Trout Creek. Ten mule cans of fish were packed by Duane Rossi’s (Tunnel Meadows Pack Station) horses up to South Fork Meadow. Two cans at a time were planted throughout the meadow.

All hip boots and buckets which had been used during the treatment had been thoroughly washed and rinsed before being used in the restocking.

Sept. 23 Full scale recapture of the golden trout from the holding area began. The water supply to the holding area was cut off:, leaving several pools full of fish. Recapture of the fish turned out to be much more difficult than anticipated. Some of the pools extended far beneath logs and roots, making effective use of an electroshocker difficult. Roots had to be chopped out and rocks removed before many fish could be recovered. Very cold water temperatures in the morning hours made working in the water difficult. Many fish were removed by hand one—by—one. Care was taken to avoid overshocking the fish.

Once the fish were caught they were taken with buckets to mule cans. The mule cans were then placed on the tractor and distributed throughout Tunnel Meadow. The meadow was restocked as follows:

Number of fish	Location
1,000	Between lower rock outcropping and FS pasture fence
200	Below Tunnel Guard Station
730	Below trail division at McConnell Mdw., down to East Meadow fence
750	South Fork Meadow
Total: 2,680	

Concern was expressed over the fact that over 2,000 fish fewer were removed from the holding area than were placed in it. Several ideas were suggested to explain the disappearance of the fish. Some fish could have escaped, however, when the barriers were removed they looked sound. The ability of a fish to squirm through a small opening cannot be ignored, however. There may have been a miscount of the numbers of fish placed in the holding area, although the counters of the fish did feel confident in their count. Incomplete recapture probably accounted for many of the lost fish. Many fish were probably hidden in the mud, under rocks, behind roots and other inaccessible places. The fish may have been preyed upon. With so many fish in a relatively small area they would be easy prey for raccoons and birds. However, the people staying by the holding area did not notice anything out of the ordinary. A major probability is that smaller fish were heavily preyed upon by the larger fish. Competition for space and food may have induced the larger fish to eliminate many of the smaller ones. Most likely the complete explanation consists of a combination of some or all of these factors.

In the afternoon of the 23rd Bill Richardson and Bob Toth flew out. The remaining crew removed all the barriers from the holding area and carried all equipment to Tunnel Guard Station. A section of Golden Trout Creek was shocked to compare the fish of Golden Trout Creek with those of the South Fork Kern. Differences in the number and distribution of spots and body shape were noted between the fish. However, many fish were not distinctive and could have belonged to either stream.

Sept. 24 Fifteen more live golden trout were recovered from the holding area and moved to the South Fork Kern. Jerry and Sally Stefferud left with Ajax, the Forest Service horse. Phil, Don and Marilyn walked along the South Fork Kern through Tunnel Meadow to check the distribution of the restocked fish. About 25 new dead golden trout were spotted. A stagnant pond was found that had not been sanded and would need to be treated. Phil, Don and Marilyn, the last of the work crew, flew out in the afternoon.

A few days later, Don Sada flew in to treat the stagnant pond found on Sept. 24th. He flew in and out on the same day.

In October, Gary Ponder, Don Sada, Steve Lee and Larry White from the DFG flew into Templeton Meadow to improve the barriers in preparation for treatment of Ramshaw and Templeton Meadows in the summer of 1977.

Conclusions:

Antimycin was found to be especially suited for use in the backcountry. Its extremely high concentration made it very convenient to use. Although the liquid concentrate and sand were very effective, it is hoped that bars of antimycin can be used in future projects. Bars would eliminate the use of unwieldy 55 gallon drums and 5 gallon jugs and would be even easier to carry and apply.

The project appears to be very successful with a 1OO% kill being effected to the best of our knowledge. Only fishing and shocking in future years will tell for sure. The project was greatly aided by a very dry year which reduced stream flow and volume. It would be optimal to complete the project in the summer of 1977 when the area is suffering its second year of drought. The amount of antimycin needed would be reduced and the area of marshy, difficult to treat, terrain would be minimized.

Restoration of the upper South Fork Kern to a pure golden trout stream is well underway. Hopefully, there will be no illegal plants of brown trout by well meaning, ignorant fishermen nullifying the work done and making more treatments necessary. Barring such unforeseen circumstances, the future of the golden trout on the Kern Plateau seems bright, indeed.

PROJECT EXPENSES ($) KERN PLATEAU WORK, 1976

6-55 gallon drums	29.68
steam cleaning drums	24.50
welding labor on drums	66.78
plumbing for drums	133.74
2 motorcycle batteries	87.98
115 feet º” hardware cloth	151.33
213 feet 1/8” hardware cloth	332.30
miscellaneous items:	
maps, rubber gloves, spray cans,	
misc. plumbing, alcohol, etc.	30.00
Sub-total	856.31
6 days Tractor rental	60.00
rental of horses @12.00	108.00
packers wages - 1 day	40.00
1,110 pounds of gear flown in	55.50
Sub-total	263.50
air fares	1,861.00
Grand total	**2,980.81**

1976
South Fork Kern Treatment Project Personnel

		Pre-treatment	Treatment	Post-treatment	Total
Name	**Agency**	**Man days**	**Man days**	**Man days**	**Man days**
Phil Pister	Ca.DFG,R-5	10	8	3	21
G. Ponder	"	5	10	0	15
M. Myers	"	6	10	7	23
Don Sada	"	7	9	8	24
J. Stefferud	Inyo N. F.	3	10	3	16
S. Stefferud	Ca. DFG,R5	0	1	3	13
Steve Lee	Ca. DFG, R-5	7	10	2	19
D. Wong	"	0	9	0	9
Dale Lockard	Nev. DFG	0	3	0	3
Gail Kobetich	USFWS	0	4	0	4
Walt Reid	Ca.DFG,R-5	0	4	2	6
Pat Hurt	"	0	10	0	10
Dan Christenson	Ca.DFG,R-4	0	4	0	4
Terry Mills	"	0	4	0	4
Bill Richardson	Ca.DFG,R-5	0	0	2	2
Bob Toth	"	0	0	2	2
A. Wong	Volunteer	0	9	0	9
D. Ponder	"	0	3	0	3
King	"	0	4	0	4
Bellas	Inyo N. F.	0	2	0	2
Total		38	123	32	193

APPENDIX 3 - BROWN TROUT CONTROL PROGRAM, SOUTH FORK KERN RIVER, 1977.

State of California
The Resources Agency

M e m o r a n d u m

To : E. P. Pister **Date:** October 31, 1977

From : Department of Fish and Game - Mignon Shumway

Subject: Brown Trout Control Program, South Fork Kern River, 1977.

Introduction

In September, 1976, the Bishop office of the Department of Fish and Game and Inyo National Forest jointly began a project to eradicate brown trout (Salmo trutta) from the South Fork Kern River, Tulare County. The area of concern encompassed from the headwaters of the South Fork Kern River in South Fork Meadows, to a point where the South Fork leaves Templeton Meadow to the south. Within these boundaries the South Fork flows through three large meadows; Tunnel, Ramshaw, and Templeton. Brown trout had slowly invaded this area for the past few decades, causing a decline in the golden trout (Salmo aguabonita) population. The goal of the two agencies was to chemically treat the South Fork within these boundaries so that it contained only golden trout and suckers (Catostomus occidentalis). This project was originally planned to last two weeks, but the extent of the project was not fully realized until after the work had begun in September 1976. In 1976 the South Fork was treated from its headwaters to a natural barrier just north of Ramshaw Meadow. This barrier was improved in past years to insure that no brown trout from downstream could re-invade the treated area upstream of this barrier. Antimycin was used as the toxicant for the project. Four units of antimycin concentrate and six cans of antimycin sand were used to treat this stretch of stream. Sally Stefferud, an aquatic entomologist employed by the DFG in the Bishop office, conducted extensive benthic and drift sampling in Tunnel Meadow before and after the chemical treatment. These data will be analyzed to determine what effect, if any, antimycin has on stream invertebrates.

In Sept. 1976 an estimated 10 stream miles were treated, including a tributary stringer and marshy areas near the stream. The project lasted two weeks and used a total of 193 man days.

In September 1977, the DFG (Bishop office) and Inyo National Forest resumed treatment of the South Fork. The same procedures were followed except that rotenone was used in addition to antimycin. Rotenone was used in deep pools in Ramshaw Meadow and Templeton Meadow. Rotenone was chosen for use in these pools because it is more effective at greater depths than is antimycin. A total of 21 units of antimycin and 7 gallons of rotenone were used for the whole project. Approximately 34 stream miles were treated, including all tributary stringers. The South Fork was treated all the way to a man-made barrier at the southeast edge of Templeton Meadow. The project took two weeks and 121 man days.

Pre—Treatment

Sally Stefferud took benthic and drift samples in the South Fork Kern River during June, July, and August 1977. Samples were taken in Tunnel, Ramshaw, and Templeton Meadows. These data are to be used as part of her study on the effect of antimycin on aquatic insects. In August, Sally Stefferud and Jim Sommer, a seasonal aid, saw unusually large trout fry in Tunnel Meadow. A positive identification was not made, but fearing that they might be brown trout, they informed the Bishop office. On August 19, Phil Pister, Gary Ponder, and Jim Sommer flew into Tunnel Airstrip and electroshocked the South Fork to sample the fish population. They found no brown trout. The golden trout young of the year were much larger than in previous years. This is hypothesized to be because of lowered competition for food. It was confirmed that last year's treatment was a success, pending studies in future years.

In early September Jerry Stefferud, a Forest Service fisheries biologist, and other Forest Service employees, flew into Templeton Meadow to improve the man made rock barrier at the downstream end of Templeton Meadow. This barrier is the final barrier that is supposed to keep all brown trout out of the upper stretches of the South Fork in future years. Rock was blasted and piled along the existing barrier. Much was accomplished; however, it was decided that further improvements should be made at a later date so that the barrier would be effective during years of high runoff.

On Sept. 13, Phil Pister and two seasonal aids, Don Sada and Peter Stanistreet, flew into Tunnel Air Strip to hike the entire length of the stream and all tributary canyons. This was done to determine locations and amount of water, so that more specific plans could be made for the treatment. It was decided at this time that the beaver dams at the upper end of Ramshaw Meadow should be blasted so that a drip station could work effectively upstream of this area.

The Treatment

Materials

The same basic materials were used as those used in the previous year's treatment. Fifty—five gallon steel drums were used as drip stations along the mainstream. Five gallon plastic jugs were used as drip stations along smaller tributaries. A hole was punched in the bottom of the plastic containers to allow chemical to drain for about 1 1/2 hours. Antimycin sand was not available this year so instead antimycin concentrate was used in Forest Service bladder bags, to be sprayed in marshy areas where a drip station could not work. Two electroshockers, four batteries and a gasoline generator were brought in. Metal stakes and hardware cloth were used for temporary barriers. Most of the hardware cloth, stakes, and steel drums were left on the Kern Plateau from the previous year's treatment. All other equipment, including food and camping gear, was flown in by Forest Service helicopter.

General Procedures

The first project was to blast the beaver dams. While this was being done, Kern Peak Stringer and Lewis Stringer were chemically treated. Those were treated first so that they could be used to hold the golden trout and suckers that were saved. Temporary barriers were placed at the mouth of each stringer to eliminate movement of fish in or out of the stringer.

Before the mainstream was treated it was electroshocked in various sections to determine the ratio between golden trout and brown trout and also to collect golden trout and suckers so they could be transported to Lewis Stringer until the chemical detoxified in the South Fork. Kern Peak Stringer was not used to hold fish, due to a series of seemingly unsuccessful treatments. Fish were held in a live cage and pack cans until Duane Rossi from Tunnel Air Camp packed them to Lewis Stringer.

Also, before the mainstream could be treated, all tributary channels had to be treated with barriers placed at their mouths so that browns could not escape into untreated waters. Then the South Fork was treated. Other isolated pools, channels, and marshy areas were also treated. When all waters had been treated the temporary barrier was removed from Lewis Stringer, releasing the captured goldens and suckers back into the main stream.

Daily Log

Sept. 21 — Gary Ponder and Peter Stanistreet flew into Tunnel Meadow in the early morning to meet two Forest Service blasters. The four of them worked on blasting the beaver dams in upper Ramshaw Meadow, immediately below the Ramshaw barrier.

Later in the day Don Sada, Sally Stefferud, Doug Selby, and Mignon Shumway; seasonal aids from the Bishop office; and Ellen Gleason and Andy Pauli from the Blythe office, flew into Templeton Meadow and set up a base camp in the shallow Canyon between Ramshaw and Templeton Meadows.

Sept. 22 - Duane Rossi and Don Sada packed 10, 55 gallon drums to Ramshaw Meadow and placed them at 800 yd-intervals along the South Fork. Kern Peak Stringer was treated. First, a temporary barrier was erected approximately 500 yds upstream of the stringers' confluence with the South Fork. Three, five gallon drip stations were placed on each fork of Kern Peak Stringer. They were placed about 600 yds apart. The uppermost drip stations on both forks were placed just below natural barriers. Each jug contained 30 ml antimycin per *5* gal. water (55 ppb).

The rest of the beaver dams were blasted that day. Approximately 1 1/2 miles of stream were covered, and twelve beaver dams were destroyed. Lewis Stringer was electroshocked to determine the ratio between browns and goldens. This was done to find out if it was worth the effort to collect golden trout and suckers there before treating it. It was decided that it would not be worth the effort inasmuch as only 2 golden trout were found in the entire 500 yds covered.

Sally Stefferud took benthic samples during the day throughout Templeton Meadow. Drift samples were taken at dusk in Templeton Meadow.

Sept. 23 - Lewis Stringer was treated with five, 5 gal. drip stations along its north fork. The concentration of antimycin was 34 ml/5 gal water (64 ppb). The south branch of the Stringer was sprayed with a bladder bag. The concentration was 10 ml antimycin per 1 1/2 gal. water.

The 55 gallon drums were set upright and filled with water in preparation for the treatment of the mainstream. A temporary barrier was set up below the last barrel to keep fish from moving in or out of the treated section of stream.

Sections of stream throughout Ramshaw Meadow were electroshocked to determine the ratio of browns to goldens. Spot checks were made from base camp to the beaver dams in upper Ramshaw Meadow. We counted 26 golden trout, 72 brown trout, and 12 suckers, which indicates a ratio of 3 browns: 1 golden.

Kern Peak Stringer was checked to determine the success of the previous days' treatment. Dead fish were abundant but several live browns were seen in stressed condition. Live fish were seen 500 feet above the confluence of the two forks of the stringer. It was assumed that these fish would die within the next *24* hours.

Ellen Gleason and Mignon Shumway electroshocked 470 feet of the South Fork in the lower end of Ramshaw Meadow. Lengths and weights were measured from the netted fish. The data are shown below in cm. and gm.

Golden Trout		Brown Trout		Brown Trout		Suckers	
l. (cm)	wt. (g)	l.	wt.	l.	wt.	l.	wt.
21.8	133	21.3	125	20.4	91	18.0	92
15.5	50	19.0	81	23.0	122	29.1	290
13.5	34	22.3	150	17.4	62	19.4	104
17.6	64	20.1	112	21.2	102	29.4	320
19.5	91	25.3	210	15.0	39	29.6	340
21.6	128	21.2	142	22.4	130	≥4.8	202
20.2	122	19.0	90	23.3	153	24.8	200
12.8	40	9.2	5	16.0	47	29.0	325
19.6	100	23.0	132	16.4	51	31.0	380
16.2	66	14.2	28	21.5	114	28.4	265
		22.5	133	21.2	106	24.8	196
		9.8	4	18.6	72	29.0	330
		21.8	128	17.8	66	29.2	340
		14.2	36	18.0	64	26.0	220
						22.8	162

These numbers, again, indicate a 3:1 ratio between browns and goldens.

Sept. 24 - Although the ratio of goldens to browns was found to be low, the main-stream was electrochocked in Ramshaw and Templeton Meadows to remove as many golden trout and suckers possible. 140 golden trout and 8 suckers were removed from lower Ramshaw Meadow and held in a live cage in the middle of the meadow. A total of 38 goldens and 72 suckers were removed from a section of stream in between Ramshaw and Templeton Meadow. These were held in pack cans placed in the stream. A total of 49 goldens and 62 suckers were netted in the upper end of Templeton Meadow, and these too were held in fish cans.

Sally Stefferud took drift and benthic samples in Ramshaw Meadow, during the day, and dusk drift samples in Templeton Meadow. Jerry Stefferud flew into Tunnel Air Strip that day.

<u>Sept. 25</u> - Sally had seen live browns in Kern Peak Stringer while working the day before so the stringer was walked to determine if any fish were still alive and if it should be retreated. Several live, but stressed, fish were seen in both forks of the stringer, but 2 fairly active fish were seen in the north fork. So the north fork was treated a second time. Four drip stations were spaced along the channel approximately 400 yds apart. The concentration of antimycin was 35 ml per 5 gal water.

Electroshocking and collection of goldens and suckers continued in Templeton Meadow. A 1500 yd section was shocked, and 129 goldens and 145 suckers were netted. Lengths and weights of 50 goldens and 50 suckers were measured. The data are shown below.

Golden Trout				Suckers			
l. (cm)	wt(g)	l.	wt	l.	wt.	l.	wt.
15.0	36	18.o	61	28.0	221	25.4	160
16.4	46	14.6	18	22.0	120	29.5	260
13.9	30	15.0	39	16.0	50	24.3	148
13.4	23	19.0	76	28.2	218	25.4	174
22.1	102	9.6	5	23.4	132	25.5	168
16.1	39	10.0	7	22.8	122	15.6	44
13.4	30	12.7	21	26.9	200	23.1	131
15.0	32	15.6	37	30.4	242	20.2	92
20.7	102	20.5	87	19.7	94	16.9	43
25.0	116	24.5	131	26.2	192	19.8	78
14.7	33	13.6	28	29.0	240	19.7	79
13.3	25	13.4	23	29.5	250	19.8	80
18.2	64	18.4	61	25.8	170	23.2	129
13.6	24	14.8	33	28.4	228	23.6	143
11.7	16	13.6	26	21.8	113	26.5	185
18.3	56	14.7	34	26.6	180	28.1	208
12.7	17	13.1	26	30.4	240	28.0	238
13.0	18	11.4	17	29.2	252	26.0	197
12.0	13	15.2	34	29.5	250	22.0	130
16.9	49	19.0	64	25.9	169	25.8	182
13.8	24	14.0	26	26.0	174	21.5	118
13.0	20	13.9	22	26.6	l~6	24.1	148
13.4	29	13.4	20	26.4	158	26.0	190
11.0	16	15.5	41	25.0	163	22.6	116
19.2	91	16.1	41	19.8	82	29.2	287

Peter Stanistreet hiked to the beaver dam area in upper Ramshaw Meadow and tore out the dams that the beavers had already started to rebuild.

Sally took benthic samples throughout Templeton during the day and drift samples in Templeton.

Sept. 26 — Two marshy channels north of Kern Peak were treated as well as isolated puddles and channels along the beaver dam area of the South Fork. Seven bladder bags were used. The concentration in each bladder bag was 35 ml. antimycin per 5 gal. water. Care was taken not to get any toxicant in the main stream, inasmuch as golden trout and suckers were still being held in the main stream downstream from this area.

Mulkey Creek flows into the South Fork in Templeton Meadow. It was treated from a barrier 2 miles upstream to its confluence with the South Fork. Eight drip stations were placed 400 yds apart. The usual concentration was used.

Ellen Gleason waited by the live car in Ramshaw Meadow for Duane Rossi so that she could show him where to pick up the captured goldens and suckers and help him transport them to Lewis Stringer. Duane did not show up that day.

Phil Pister, Terry Mills, and Ken Aasen flew into Tunnel Meadow and hiked to camp. Phil posted warning signs about the poison being used in the drainage and a brief explanation of the purpose of the project near Tunnel Guard Station, the Ramshaw barrier, and the Templeton barrier.

Sept. 27 — The chemical treatment of the South Fork began this day. One hundred and seventy-five ml antimycin were administered to each 55 gallon drum. One drum was skipped by mistake. So nine drums were drained that day. All connected side pools and backwashed areas were treated in addition, to insure a complete kill.

Ellen and Duane packed goldens and suckers to Lewis Stringer and released them there. A total of 356 golden trout and 287 suckers were saved.

The 500 yds below the temporary barrier on Kern Peak Stringer was treated with 2, 5-gal. drip stations.

A series of springs were treated at the mouth of the northwest canyon entering Ramshaw Meadow. This canyon is labeled #1 on the map. Three drip stations were set up, one at each spring head. A bladder bag was used to spray the lower reaches of the channels where the flow stagnated. The usual 33 ml antimycin per 5 gal water was used.

Side waters along Mulkey Creek were treated that had not been treated the previous day. Two full bladder bags were used (5 gallons) with 40 cc antimycin in each. A 5 gallon drip station was also placed below the beaver dams found near the mouth of Mulkey Creek. Sixty milliliters of antimycin were used in this drip station.

Eric Gerstung and John Modin, DFG biologists from Sacramento, flew into Templeton Meadow and hiked up to the upper Ramshaw Meadow barrier to collect kidney smears from golden trout.

Sept. 28 — On the second day of the treatment the 10 barrels were moved downstream to their new positions. A temporary barrier was constructed below the tenth barrel which was in the upper end of Templeton Meadow. Each barrel was filled with water and 175 ml antimycin.

The upper reaches of Canyon #1 were treated. Two main spring channels were found here. A total of 90 ml antimycin was used on these channels. Two drip stations and a bladder bag were used.

A series of deep pools in the east end of Ramshaw Meadow were treated with 2 gallons of rotenone. The Rotenone was diluted to 2 quarts per 5 gal-water and sprayed from a bladder bag. One bladder bag was filled with water and 30 ml antimycin to be used in peripheral marshy areas.

Connected side pools and backwashes along the South Fork were sprayed with bladder bags. Twenty-five bag fulls (750 ml antimycin) were used along this section. A 5-gallon drip station was placed below the temporary barrier on Lewis Stringer.

Sept. 29 — Two canyons on the south side of Ramshaw Meadow were treated. On the map they are labeled canyon #2 and #3. Twenty ml of antimycin per two gallons of water were used in a small spring in canyon #2. Three bladder bags with 34 ml antimycin each were used in the channels found in canyon #1. At the mouth of this canyon, in Ramshaw Meadow, two springs are found. These were treated with a total of 50 ml antimycin.

Treatment of the South Fork continued. Seven barrels were placed downstream from the temporary barrier to the rock barrier at the lower end of Templeton Meadow. This completed the treatment of the main stream. One gallon of rotenone was poured into the stream to assure a kill in the algae choked, still water immediately above the barrier. Twenty bladder bags with 30 ml antimycin in each, were used to spray along the sides of the main stream. A marshy area containing several springs in the south end of Ramshaw Meadow was treated with bladder bags. A total of 215 ml antimycin was used in the bladder bags, at the usual concentration of 35 ml antimycin per 5 gal water.

Additional attention was given to the beaver dams at the confluence of Mulkey Creek and the South Fork. One drip station was placed above the beaver dams and one below. Side pools and a nearby spring were also treated with a bladder bag.

Sept. 30 — Now that the South Fork and its tributaries were treated, attention was given to springs and watercourses that did not at that time connect to the main stream, but possibly could during exceptionally wet years.

A third canyon on the south side of Ramshaw Meadow was treated. The canyon divides into two forks. A drip station was placed on each fork just above their confluence. The rest was treated with a bladder bag. A total of 140 ml antimycin, was used in this canyon.

Three canyons at the northeast end of Ramshaw Meadow were checked, are labeled canyons #5, #6, and #7 on the map. A drip station was placed at the top of canyon #5. Canyon #6 did not have enough water to warrant treatment. Canyon #7 contained two spring heads. A drip station was placed at each spring head. Another canyon to the west was checked for water, but none was found.

Six bladder bags were used to treat the south fork of Four Canyons in addition to two 5 gallon drip stations. It was treated up as far as its confluence with an intermittent stream.

Nine drip stations were placed 200-300 yds apart on the north fork of Four Canyons. Two bladder bags were also used.

Oct. 1 — The day before, Sally saw several fingerling fish upstream of the temporary barrier on Kern Peak Stringer. These were identified as sucker fingerlings. Kern Peak Stringer was treated for a third time. Four drip stations were set up on each fork of the stringer, and two drip stations were set up below the confluence of the two forks.

Four Canyons was checked and it was found that the previous day's treatment was a success. In the north fork of Four Canyons a pure population of golden trout was found with a natural barrier below, isolating this population from the rest of the drainage. This section was not treated.

Movie stringer was treated will eight drip stations placed approximately 400 yds apart. Ramshaw Meadow was walked to make sure all stringers and bogs had been treated.

October 2 — The upper part of Four Canyons, above the confluence of the forks, was treated. Eight bladder bags were used. The lowest section of Four Canyons was also treated. Four 2 1/2 gallon drip stations were used as well as 2 bladder bags and 1 gallon of rotenone.

A total of four gallons of rotenone was used in a series of pools forming a channel around the base of Templeton Mountain.

Sally completed her sampling taking benthic samples in Ramshaw and Templeton Meadow. Afternoon and evening drift samples were also taken.

Temporary barriers in Kern Peak Stringer, Lewis Stringer and the two barriers in the South Fork were removed and placed near the trail for Duane to pack out.

Oct.3 - The remaining crew packed up all camping gear and flew out by helicopter.

Post Treatment

On Oct. 5 -Sally and Jerry Stefferud and Don Sada flew into Templeton Meadow and hiked to the rock barrier. They worked on improving the barrier and flew out the same day.

On Oct. 12 — Phil Pister and Don Sada flew into Templeton Airstrip to make a reconnaissance of the area. No browns were seen in the South Fork. They walked around the base of Templeton Mountain to determine whether or not Strawberry Creek could possibly flow into the South Fork above the barrier. A channel of Strawberry Creek which was dry at this time could possibly run over into channels in the southwest end of Templeton Meadow. This portion of Strawberry Creek will be deepened to prevent such runoff.

On Oct. 13 — Don and Phil flew out from Tunnel Airstrip.

On Oct 18 — Phil Pister flew into Tunnel Meadow to again check the South Fork for browns. None were seen.

Summary of toxicant used:

antimycin

South Fork Kern River 1st day		1575 ml
	2nd day	1750 ml
3rd day	1225 ml	
Kern Peak Stringer	1st treatment	180 ml
	2nd "	140 ml
	3rd "	420 ml
Canyon #1		230 ml
Canyon #2		20 ml
Canyon ~		145 ml
Beaver pond area		245 ml
Mulkey Creek		385 ml
Lewis Stringer		210 ml
Side waters along the South Fork 1st day		750 ml
	2nd day	750 ml
	3rd day	600 ml
Side waters along Mulkey Creek		140 ml
Four Canyons		665 ml
Movie Stringer		280 ml
Pools in last end of Ramshaw Meadow		30 ml
Marshy area in southwest Ramshaw Meadow		215 ml
Canyon #4		140 ml
Canyon #5		35 ml
Canyon #7		70 ml

10,200 ml total or

2l 1/4 units antimycin

Rotenone

At Templeton barrier		1 gallon
Isolated pools in Templeton		4 "
Pools in east end of Ramshaw		2 "
Lower section of Four Canyons		1 "
	8 gallons total	

APPENDIX 4 - REINTRODUCTION OF GOLDEN TROUT INTO SOUTH FORK KERN BELOW TUNNEL MEADOWS, 1983

State of California   The Resources Agency

Memorandum

To : Keith R. Anderson, F.M.S.   Date: September 20,1983

From : **Department of Fish and Game** — E. P. Pister

Subject: Reintroduction of Golden Trout into South Fork Kern below Tunnel Meadows

The following summarizes subject reintroduction:

Monday, September 12

Beginning at 0900, the following persons flew into Tunnel Airstrip via Cessna 206 piloted by John Langenheim of Eastern Sierra Flying Service.

Phil Pister	Cal. Fish & Game, Bishop
Darrell Wong	“
Randy Benthin	“
Julie West	“
Rob Hitchcock	“
Mignon Shumway	“
Peter Stanistreet (volunteer)	Alaska Dept. Fish and Game
Robert E. Brown	Calif. Dept. Water Resources

In addition, 1,699 pounds of gear (shockers, batteries, live cages, etc. were flown in.

We were joined later in the day by Tom Felando, Inyo National Forest hydrologist, who walked in from Horseshoe Meadows. Between the hours of 1500 and 1700, two electrofishing crews, working above Tunnel Airstrip, collected 600 GT, which were placed in the holding area adjacent to the airstrip.

Tuesday, September 13

We were joined at 0800 by Robin Hamlin, Mt. Whitney Ranger District wildlife biologist, and her assistant, at which time we hiked upstream approximately three miles to South Fork Meadows. Steve Stewart of Tunnel Pack Trains packed live cages, batteries, and pack cans to the area by mule. Approximately 1,100 GT were collected prior to 1500 and were then taken by mule to the Tunnel Meadow holding area. The crew returned to headquarters at Tunnel Air Camp.

Wednesday, Sept. 14.

Bob Brown (DWR) flew out to Lone Pine at 0800 on the same flight that brought in Bob Smith of Mt. Whitney Hatchery. Smith brought in 100 pounds of ice for use in transporting the fish on Sept. 15.

Two crews, working all day from below the airstrip to the mouth of the gorge below South Fork Meadows, collected about 1,900 GT. Again, these fish were taken by mule to the holding area at the east end of Tunnel Airstrip.

Felando left for Horseshoe Meadow at 1300. Hamlin and assistant were available only on Tuesday, Sept. 13. Two Forest Service radios were left with us to maintain contact with the helicopter, which was scheduled to arrive at Tunnel Airstrip at 1000.

Thursday, Sept. 15

Bob Smith was placed in charge of counting and readying the fish for planting. A total of 2,568 fish were counted (many smaller fish escaped through the 1/2" hardware cloth), and these were divided up and planted as summarized below. Exact planting locations are marked on the accompanying map. The fish ranged in size from about 3" t. l. (76mm) to 7" (l78mm), with the median measuring about 4.5" (114mm).

At 1000 the Forest Service contract helicopter landed at Tunnel, and four flights were made. All planting was accomplished within a 3—hour period, including a refueling stop at Lone Pine Airport. The helicopter used was a Bell Long Ranger, with a cruising speed of 140 knots. This allowed us to cover what would normally be a 2—day hike in a period of about five minutes. I estimate that the same procedure, using packstock, would have taken two weeks to accomplish.

Nine cans were utilized during the planting procedure, three pack cans placed in the cabin of the chopper, and six airplane cans placed in the luggage compartment. Two sets of cans were available, with one set being prepared by Bob Smith and his crew while the other was in the air. Although the stream temperature was cool (10C, 50F), ice was used to assure adequate oxygen during the short helicopter flight. Some of the fish in the first plant were in shock when they first hit the water, but seemed to recover quickly. No mortality was noted.

In order to reestablish a population in a small tributary entering Ramshaw Mdws. (where it was impossible to land the chopper), and to eliminate the need for another helicopter flight, Kern Peak Stringer and the small tributary to the northeast were planted by packstock. Only two fish failed to survive this plant.

	Location	No. trout planted
Load I (Pister, Wong)	Gomez Cr. near Kern	112
	Brown Mdw. Stringer	224
	Schaeffer Mdw. "	168
	Fat Cow Mdw. "	168
Load II (Benthin, Wong)	Strawberry Stringer	336
	Movie "	168
	Lewis "	168
Load III (Pister, Wong)	Mulkey Cr., lower	448
	Four Cyns. Cr., lower(bel. beaver dams)	224
Load IV (Pister, Wong)	Big Dry Mdw. at Death Cyn. Cr.	60
	Lower Dry Creek	60
	Long Stringer	168
Packstock (West, Stanistreet)	Kern Peak. Stringer	164
	Ramshaw "	100
	Total plant	2,568

The weather cooperated throughout the operation, with nothing more than a few afternoon clouds. There were no injuries or problems of any consequence.

Following the transplant, camp was cleaned up, and we flew out in three separate flights beginning at 1500. Much of the heavier, more cumbersome gear (live cages, etc.) was taken out by helicopter sling to Lone Pine Airport when the chopper returned for refueling.

We shall monitor the transplants closely, and I shall begin this procedure in early October, when I go in to check progress on the Templeton Barrier repairs. It may prove advisable to bolster the populations during the next couple of years.

E. P. Pister
Associate Fishery Biologist

cc:
Region 4
Eric Gerstung
FWS ,Sacramento

APPENDIX 5 - GOLDEN TROUT MONITORING IN TEMPLETON AND RAMSHAW MEADOWS

To: Fisheries Files Date: 7—24—84

From: Dept. of Fish and Game, M. Shumway (seasonal aide)

Subject: Golden Trout Monitoring in Templeton and Ramshaw Meadows

During the week of July 11—14, 1984 two 3-man crews electroshocked the South Fork of the Kern River in Templeton and Ramshaw Meadows to look for possible Salmo trutta (BN) invasion in the area and to note the sizes and distribution of Salmo aguabonita (GT). The relative abundance of the different age cohorts was determined by keeping a tally of two inch size groups. Marked fish were measured and their locations were noted to determine their growth and movement since plantings (Note: In Aug. 1982, 300 GT-LV were planted throughout upper Ramshaw Meadow and 355 GT—RV were planted throughout upper Templeton Meadow. In Oct. 1981, 305 GT—Ad were planted at the confluence of Kern Peak Stringer and the S. Fork of the Kern R.). Young of the year were not counted but their relative abundance was noted.

M. Shumway, P. Clark, and L. Bordenave worked as one crew (crew #1) and E. Gerstung, T. Keefe, and J. Hyatt worked as another crew (Crew #2). Crew #1 used a type 5 electroshocker and Crew #2 used a type 5 the first day and a type 7 the remaining two days. Both Templeton and Ramshaw Meadows were split between the two crews.

July 11

Both crews worked in upper Templeton Meadow. Crew #1 started a quarter mile below the lower fence line of the USFS cattle exclosure and ended at the upper fence line. The habitat in this section is relatively poor. Severe bank damage exists and the stream course consists of mostly of wide, shallow runs. Aquatic Ranunculus sp. provided most of the cover for fish. Few young of the year were observed but their numbers increased in the upper half of the section. One hundred and sixty GT were counted in this section; 14 of these had previous marks. GT were more numerous in the upper half of the section. Brown trout were not seen.

Crew #2 worked from the upper fence line of the exclosure to the mouth of the gorge which separates Templeton and Ramshaw Meadows. The habitat in this section was similar to the habitat that crew #1 worked in. The stream course improved significantly in the upper half of this section; more undercut banks and holes, and less bank damage. Fewer fish were found just below the gorge. This was probably due to the steeper gradient and faster flow even though the habitat looked good. Young of the year were abundant in this section. Two hundred GT were counted in this section; 26 of these had previous marks. No BN were seen.

July 12

Both crews worked in Ramshaw Meadow. An outcropping of rocks on the south side of the meadow (3—M mountain) was used as a halfway mark. Crew #2 worked in the lower half of the meadow and crew #1 worked in the upper half. Crew #2 started shocking at the campsite located just above the gorge separating Ramshaw and Templeton Meadows. They worked approximately half way to 3—M mountain. The habitat improved in this area and larger fish were found. One hundred and eighty two GT were observed in this section; 51 of these had previous marks. Young of the year were abundant in this area.

Crew #1 started at 3—M mountain and shocked upstream to the upper fence line of the cattle exclosure in Ramshaw Meadow. Bank erosion was prevalent in this section also, but the habitat improved at the upper end of the exclosure. Three hundred and sixty GT were observed; 36 of these had previous marks. Very few young of the year were seen. The 2—4" class was most abundant, indicating successful spawning last year.

July 13

Both crews completed their sections in Ramshaw Meadow . Crew #2 had difficulty observing fish due to extreme turbidity caused by thundershowers. The habitat degraded as they moved upstream into the middle of the meadow. Few fry were seen but the turbidity prevented seeing many fish, regardless of their size. Two hundred and one GT were counted; 19 of these had previous marks.

Crew #1 worked from the upper fence line of the exclosure to the gorge above Ramshaw Meadow. We stopped counting fish at the uppermost edge of the meadow due to difficulties with the electroshocker. The shocker worked intermittently so we continued up into the gorge looking for brown trout. We stopped shocking when the channel narrowed and velocity increased. Below the gorge the channel meandered through thick willow groves. We saw recently built beaver dams and an active lodge. Young of the year were numerous in this section. A total of 1071 GT were counted; 27 of these had previous marks. No brown trout were seen.

Summary

A total of 2182 GT were observed in both meadows in the course of 3 days. Of this number,, 1822 were found in Ramshaw Meadow and only 360 were seen in upper Templeton. The GT population increases significantly as one moves upstream. This increase is especially evident in Ramshaw Meadow where Crew #2 observed a total of 391 GT in the lower half of Ramshaw Meadow and Crew #1 observed 1431 GT in the upper half of the meadow. This discrepancy is partly due to the fact that Crew #2 did not get to see all the fish in the stream on July 13th when their section was extremely turbid. However the difference in habitat quality may also account for the higher density of fish upstream.

A comparison can be made between LV and RV marked fish which were measured in 1983 and this years measurements on GT—LV and GT—RV. In 1983 a total of 58 LV and RV marked fish were measured. The range in fork length was 182—262 mm and the mean fork length was 207 mm. This year a total of 153 LV and RV marked GT's were measured with a range in fork length of 182—380 mm and a mean fork length of 256 mm. Unfortunately the LV and RV marked fish were not measured in 1982 when they were originally planted.

In 1981 305 GT—Ad were transplanted from Tunnel Meadows to upper Ramshaw. Sixty of these were measured with a range in fork length of 83—175 mm and a mean fork length of 102 mm. This year 21 GT—Ad were recaptured and measured with a range in fork length of 198—286 mm. The mean fork length was 237 mm.

There has been an apparent migration of GT—RV in the last 2 years from upper Templeton to Ramshaw Meadow. Many GT—RV were found in lower Ramshaw with fewer observed in upper Ramshaw. Few GT moved downstream; only one GT—LV was found in Templeton Meadow. There was no apparent migration of GT—Ad; they were found near their original transplant site in upper Ramshaw.

Due to upstream migration and previous transplants, the density of GT is much higher in the upper end of Ramshaw Meadow. This is also due to habitat differences. Generally, bank stability and stream habitat improves as one moves upstream. In Templeton Meadow the S. Fork of the Kern R. consists of wide, flat runs bordered by 3—10” high eroded banks. The substrate is much finer which inhibits spawning and insect production. If this situation does not improve, densities of GT may never increase beyond the present density in Templeton Meadow.
Collection data follow:

Sampling data, July 11, Crew #1, mid-Templeton Meadow

GT tallied		**Marked GT recaptures (fork length, mm)**	**Sampling stations (start)**
2-4”	12		200 yards below lower fence line
4-6”	89	LV 270	
6-8”	30	RV 260	150 yards below lower fence line
8-10”	12	RV 282	
10-12”	3	RV 254	At lower fence line
		RV 296	
Total	146	RV 260	Middle of exclosure
		RV 250	
		RV 250	300 yards below upper fence line
		RV 260	250 “
		RV 250	150 “
		RV 300	125 “
		RV 264	240 “
		RV 256	260 “
		RV 256	Upstream of upper fence line
		Total: n=14	
		Range= 250-300 mm	
		Mean=265 mm	

Sampling data, July 11, Crew #2, upper Templeton Meadow

GT tallied	Marked GT recaptures, all RV clips (fork length, mm)		Sampling stations
2-4” 31			Upper Templeton Meadow, exact location not noted.
4-6” 98			
6-8” 24			
8-10” 16			
10-12” 5	251	220	
	241	260	
Total 174	261	220	
	262	200	
	220	250	
	274	270	
	236	220	
	289	225	
	268	230	
	230	250	
	12		
		250	
	260	250	
	269	250	
	Total: n=26		
	Range=250-300		
	Mean=246 mm.		

Sampling data, July 12, Crew #1, Upper Ramshaw Meadow

GT tallied	Marked GT recaptures, (fork length, mm)	Marked GT recaptures, (fork length, mm)	Sampling Area
2-4” 179	LV 284	LV 232	35 electrofishing stations, extending from 50 yards above 3-M Mtn. to 50 yards below upper exclosure fence. 14 stations inside exclosure/
4-6” 64	Ad 266	LV 254	
6-8” 53	LV 302	RV 257	
8-10” 17	LV 216	LV 268	
10-12” 1	RV 236	LV 278	
Total: 324	RV 304	LV 272	
	LV 278	LV 211	
Total RV: 6	LV 232	LV 235	
Total LV: 25	LV 320	Ad 262	
Total Ad: 5	LV 232	LV 233	
	Ad 286	LV 234	
	RV 200	Ad 255	
	LV 212	LV 231	
	LV 276	Ad 259	
	LV 250	LV 222	
	LV 214	LV 258	
	LC 222	RV 233	
	RV 264	LV 232	

Sampling data, July 12, Crew #2, Lower Ramshaw Meadow

GT tallied	Marked GT recap. LV Fk. L, mm.	**Marked GT recap LV Fk. L. mm.**	**Sampling Area**
2-4” 53 4-6” 41 6-8” 17 8-10” 7 10-12” 15 12-14” 2	290 220 270 280 310 260 230 292 270 325 260 300 225 210 255 264 270 268 286 290 260 250 274 312 270 310	260 300 255 230 192 270 240 270 310 280 270 270 270 270 255 296 340 238 262 250 290 235 320 275 281 Total: n=51 Range:292-340 mm Mean Fk. L= 270mm	**Lower Ramshaw Mdw., areas unspecified**

Sampling Data, July 13, Crew #1, Upper Ramshaw Meadow.

GT tallied	**Marked GT recaptures Fk. L. mm**	**Marked GT recaptures, Fk. L, mm.**	**Sampling area**
2-4” 812 4-6” 141 6-8” 68 8-10” 21 10-12” 2 Total: 1,044	LV 255 LV 222 Ad 233 LV 229 LV 221 Ad 231 Ad 209 Ad 234 Ad 234 LV 210 Ad 212 LV 214 LV 195 Ad 220	Ad 198 LV 182 Ad 250 **Ad 230** Ad 225 Ad 230 Ad 225 Ad 265 Ad 240 Ad 209 LV 207 Ad 256 RV 307 Total: n=27 Range: 195-307 Mean Fk. L: 227 mm	27 electrofishing stations in upper Ramshaw Meadow, extending from above exclosure past Kern Peak Stringer to 100 yards below mouth of Ramshaw Gorge.

Sampling Data, July 13, Crew #2, Lower Ramshaw Meadow

GT tallied	**Marked GT recaptures, Fk. L inches, all LV**	**Marked GT recaptures, Fk. L ,inches, all LV**	**Sampling area**
2-4” 55 4-6” 67 6-8” 20 8-10” 11 10-12” 17 12-14” 10 Total: 180	12 11 10 12 10 11 11 9 11 10	10 10 12 10 15.2 13 10 11 11 Total: n=19 Range 9-15.2” Mean Fk. L=11.0	Lower Ramshaw Meadow, exact location not specified. Note: Unmarked GT measured: 12 10 11 10 13 14 12 13 12 12

APPENDIX 6 - BROWN TROUT ERADICATION PROJECT, SOUTH FORK KERN RIVER AND LOWER PORTIONS OF TRIBUTARIES BETWEEN TEMPLETON AND SCHAEFFER FISH BARRIERS, TULARE COUNTY, AUGUST 25-30, 1985.

State of California **The Resources Agency**

Memorandum

To: Keith R. Anderson, FMS Date: September 30, 1985

From : **Department of Fish and Game** — E. P. Pister

Subject: Brown trout eradication project, South Fork Kern River and lower portions of tributaries between Templeton and Schaeffer fish barriers, Tulare County, August 25-30, 1985.

<u>Sunday, August 25</u>

Wong, Benthin, Pister and Wilson flew from Lone Pine to Tunnel Meadows and walked to Templeton Spring on the southeast of Templeton Mountain. McEwan and Hitchcock accompanied packer and packstock from Cottonwood Pack Station. All parties in camp by 1800. Utilized 10 mules, 2 horses, 2 packers. Dropped off gear and chemicals near Templeton Barrier on way in.

<u>Monday, August 26</u>

Benthin, McEwan and Hitchcock electrofished South Fork Kern above Templeton Barrier and below U.S.F.S. exclosure; and lower section (one mile) of Mulkey Creek. No BN found. Felando (U.S.F.S.) estimated flows for treatment.

Wong, Wilson, and Pister electrofished Strawberry Creek and found one 6” BN, necessitating later treatment.

<u>Tuesday, August 27</u>

Benthin and Felando treated Schaeffer Meadow Stringer, setting two, four hour drip stations with 16 oz. Rotenone in each drip. Station was set at a natural barrier above the meadow where GT were planted in 1983. Felando and Benthin then hand-sprayed all wet areas from the drip station to the confluence of the South Fork Kern River, utilizing 4 oz. rotenone.

Wong sprayed wet areas in Fat Cow Stringer with 4 oz. rotenone, then treated Templeton Spring Stringer outflow with 4 oz. rotenone.

Wilson, Hitchcock and McEwan prepared Templeton Spring Stringer to hold fish, erecting a hardware cloth barrier and small rock dam holding pools. Approximately 100 GT were then shocked up from Strawberry Stringer and placed in Templeton Spring Stringer. High mortality was noted, probably resulting from high temperature and handling shock, possibly combined with residual rotenone.

Pister treated pools in Strawberry Airstrip Stringer with 8 oz. rotenone, then packed up gear and backpacked counter—clockwise around Templeton Mountain to a camp on the South Fork Kern just below Templeton Barrier. Hauled gear down from cache and prepared drip stations for following morning. Attempted unsuccessfully to contact Dan Christenson at Schaeffer Barrier. Received word from Bald Mountain (Sequoia) Lookout that Christenson was expected to arrive at Black Rock Station at about 2000 on August 27.

Wednesday, August 28

Finally established radio contact with Christenson at Schaeffer Barrier detox station at 0900. Pister started drip station at Templeton Barrier, using 1.5 gallons rotenone, to run for 4 hours. Treated area from about 100 yards upstream from barrier with about 32 oz. rotenone to catch underflow beneath barrier. Recharged station with 1.5 gallons rotenone at 1300 and walked to mouth of Dry Creek, checking fish and treating side channels and backwaters with 32 oz. rotenone. Radio contact with Christenson at 1800 hours revealed some distress, although main “slug” was not expected until about midnight.

One drip station with 12 oz. rotenone set in upper Strawberry Stringer by Wong. Wilson sprayed riparian pools with 16 oz. rotenone, and Felando and McEwan set booster drip station below trail crossing with 8 oz. rotenone.

In afternoon the upper Strawberry drip station was reset with 20 oz. rotenone, and the lower was reset with 8 oz. Wong, Wilson, and Hitchcock sprayed down to the confluence of the South Fork Kern with 24 oz. rotenone.

Benthin and Hitchcock set drip station at first beaver dam of Long Stringer (about a mile from its confluence with the South Fork Kern), using a rate of 32 oz. of rotenone for 8 hours. Hitchcock then sprayed from the confluence down to Schaeffer Iron, using 8 oz. rotenone. Benthin sprayed the South Fork upstream from Long to Dry, using 8 oz. rotenone, and then sprayed Dry from its confluence with the South Fork Kern to a rock barrier, using another 8 oz. rotenone.

McEwan set station on Schaeffer Iron at the barrier with two drips of 10 oz. each, then sprayed from Schaeffer Iron to Schaeffer Barrier with 8 oz. rotenone.

Thursday, August 29

Pister started Templeton Barrier station at 0600 with 1.0 gallon rotenone, set for 3 hour drip. Check at 0800 with Christenson at Schaeffer Barrier revealed that concentrations used on previous day were inadequate to achieve kill through entire stream reach. Suggested heavier concentration on Thursday. Consequently, Pister treated area above barrier with 32 oz. rotenone and set second drip station at 0930, using 1.75 gallons rotenone to be drained in 3 hours. Counted 70 GT, 28 Sacramento SKR, and 0 BN in half—mile section below barrier. Apparently the EN population was largely restricted to the area between Schaeffer Barrier and Strawberry Stringer. Second station was completely drained by 1300. Pister photographed entire operation area, then hauled all gear to drop point above barrier to be picked up on August 30 and returned to Cottonwood Pack Station. Backpacked back to main camp at Templeton Spring, arriving at 1600 hours. Met packer, already in camp, with 10 mules and 2 horses.

In morning Wong set lower Strawberry drip station (at upper fork) with 24 oz. rotenone, then went to upper station and set another 24 oz. station. Wilson sprayed other fork of Strawberry Stringer with 32 oz.

In afternoon Wong treated upper fork area with 16 oz. Rotenone. Wilson sprayed 4 oz. Rotenone to Templeton Spring. Wong set 8 oz. drip station at Templeton Spring confluence, then sprayed another 3 oz. downstream to the South Fork Kern confluence.

Two drip stations were set on Long Stringer with one at the first beaver dam and one at the confluence with the South Fork Kern. Both drips were set at a rate of 5 gallons for 3 hours, with 32 ounces of rotenone in each. The lower station was reset at 1200 hours with 16 oz. rotenone and at l400 with 32 oz. rotenone.

Benthin repeated spraying of the South Fork and Dry Creek, using 4 oz. rotenone. Hitchcock and McEwan sprayed from the mouth of Long Stringer to a mile above the Schaeffer Barrier, using 8 oz. rotenone. They also set a drip station at the Schaeffer Iron barrier, using 32 oz. rotenone dispensed over a 6 hour period.

<u>September 3</u>

Randy Kelly, DFG field supervisor for the southern area of Region 4, phoned to relay a message from Dan Christenson that both live and dead fish had been observed up to three miles downstream from the Schaeffer Barrier. We had been cautioned by certain Inyo National Forest personnel to hold our radio communication to an absolute minimum, so it was impossible to carry on the desired degree of communication with Dan Christenson at the Schaeffer Barrier detox station. When a few dead fish began to appear from the treatment of Schaeffer Iron Stringer, he assumed this was the main concentration of chemical. Unable to discuss this with us because of restriction on radio use, he began to administer potassium permanganate several hours earlier than otherwise would have been necessary. This exhausted his chemical supply at 1600 hours on Friday, August 30, resulting in toxic water flowing past the barrier for an unknown length of time, and a fish kill of unknown duration and extent. During the treatment period 150 kg (330 pounds) of potassium permanganate were placed in the South Fork Kern at the Schaeffer Barrier to detoxify the rotenone.

It is unfortunate that our radio communication was restricted. In past years, although we used our radios only when necessary, we remained “on the air” in order to maintain optimum efficiency. Following our admonition from Inyo Forest personnel early on August 28, I restricted our radio use essentially to three times per day, for 10 minutes at 0800, 1200, and 1800. Should further treatment work be necessary on the Kern, we shall work out an advance arrangement concerning radio use, to assure that all Inyo personnel are informed of the urgency and legitimacy of our needs. Unfortunately, the topography of the area is such that State radio frequencies cannot be used there.

We wish to acknowledge the close cooperation and assistance of personnel from the Inyo Forest, especially Tom Felando and Ralph Giffen. We also wish to express our deep appreciation to the Bald Mountain (Sequoia) fire lookout, who was of invaluable assistance in relaying messages concerning the detox station. It is really heartening to work under such a cooperative atmosphere, especially in a project specifically authorized by Congress and given the blessings of virtually everyone from the Forest Service's Washington Office, the Regional Office, and both the Sequoia and Inyo. This is the way government should work, and it was a pleasure to be part of the overall operation. I still have nightmares over how close we came to having a Golden Trout Wilderness without golden trout.

Although it is difficult to evaluate the success of such projects immediately thereafter, we have no reason to believe that we were unsuccessful. Only time will tell. The increased height of the Schaeffer Barrier should preclude further invasion of the upper areas, and we are grateful to Mt. Whitney Ranger District personnel for handling this project so competently. We shall continue to monitor the entire drainage above the Schaeffer Barrier for at least five years to check for the presence of exotic and introduced species. Restocking of the project area will begin naturally as golden trout drop downstream over the Templeton Barrier. We plan to transplant goldens from the upper South Fork Kern above Tunnel Meadows as soon as it is expedient to do so, probably in conjunction with the 1986 monitoring work.

E. P. Pister
Associate Fishery Biologist

cc: DFG — Sacramento
DFG — Fresno
USFWS, OES — Sacramento
Supervisor, Inyo National Forest
Supervisor, Sequoia National Forest

Miscellaneous notes

Stream flows

On Monday, August 26, Forest hydrologist Tom Felando estimated the following stream flows in the project area:

South Fork Kern at Templeton Barrier	10.0	cfs.
Long Stringer	0.29	cfs.
Schaeffer Iron Stringer	0.23	cfs.
Strawberry Stringer	0.63	cfs.

Measurements of target species

Measurements and scales were taken from the majority of brown trout observed, the largest of which was a gravid female measuring 488 mm. (19.2 in.), fork length. Other brown trout were collected in the following numbers and locations.

12 in Schaeffer Iron Stringer
31 in South Fork Kern from Dry Creek to Schaeffer Barrier
1 in Strawberry Stringer

The above fish appear to be of the same year class, with the following length data.

n = 22 (488 mm female not included)
mean length 159.5 mm (6.3 in.), fork length.

SD 7.0

Summary of rotenone application

Tuesday, August 27	52 oz.	
Wednesday, August 28	620 oz.	
Thursday, August 29	651 oz.	
	1323 oz.	Or 10.34 gallons

State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME
STREAM AND LAKE REJUVENATION

Post-rejuvenation Evaluation

Name of Water: South Fork Kern River & tribs. County: Tulare

Date treated: Aug.27—29,1985 Surface area: ____ Volume: _____

Stream miles: 6 Stream flow: 10 c.f.s. Period of toxicity: 8/27-30,1985

Toxicant: Rotenone Conc.: 0.05 ppm Amount: 10.34 gal Cost: None-material in storage

Manhours: survey and planning 400 treatment 240 Misc. costs: $3,000.00

Water conditions during rejuvenation:

Depth in meters	Temperature	pH	Dissolved oxygen
	50—60^{0}F.	~7	Presume saturation

Fish eradicated:

Species	Number	Pounds	Percent eradicated
BN	200	25	100
GT	1,000	50	100
SKR	200	50	100

FG 741 (Revised 10/77)

APPENDIX 7 - BROWN TROUT ERADICATION PROJECT, SOUTH FORK KERN RIVER AND LOWER PORTIONS OF TRIBUTARIES BETWEEN TEMPLETON AND SCHAEFFER FISH BARRIERS, TULARE COUNTY, SEPT.14-18 1987.

State of California **The Resources Agency**
Memorandum

Date: January 19, 1988

To: Keith Anderson, Fisheries Management Supervisor
Long Beach, Region 5

From: Department of Fish and Game – C. W. Milliron, Bishop

Subject: Brown trout eradication project, South Fork Kern River and lower portions of tributaries between Templeton and Schaeffer fish barriers, Tulare County, Sept.14-18 1987.

This chemical treatment was necessary due to the capture of 3 brown trout within the Golden Trout Wilderness on August 26, 1987 during the annual Kern Plateau monitoring activities. A day-by day account of the treatment process follows. Note: Chemical used for this treatment was Nusyn—Noxfish (rotenone plus synergist)

Monday, September 14, 1987.

Wong, Iseri, Hayes, Goldberg, and Symonds flew from Lone Pine to Tunnel Meadows and walked to Templeton Spring on the southeast side of Templeton Mountain. Milliron and McEwan accompanied packer and packstock from Cottonwood Pack Station and arrived in camp at 2000. Utilized 12 mules, 2 horses and 2 packers.

Tuesday, September 15, 1987.

Wong, McEwan and Goldberg walked to Bell Camp Meadow fish barrier and observed no brown trout. Estimated flow in lower Brown Meadow Stringer as .2 CFS or less.

Electrofished from first fence line up Brown Meadow Stringer to half way to Brown Cow Camp. Observed many golden trout and no brown trout. Hiked cross country to Schaeffer Meadow Stringer and treated the intermittent flow with 3 ounces of rotenone. Hiked to Schaeffer Iron Stringer and observed consistent flow but no fish while shocking from fish barrier to South Fork Kern River. Treated Schaeffer Iron Stringer with 3 ounces rotenone.

Hiked to Fat Cow Stringer. Observed no fish in intermittent middle section. Milliron and one packer utilizing one mule dropped off two, five gallon constant flow drip cans, two gallons rotenone and two hundred pounds of salt (4, 50 pound blocks) at South Fork Kern booster station located between Strawberry and Schaeffer Stringer confluences.

Milliron, Iseri, Hayes and Symonds electrofished 110 Sacramento suckers (*Catostomus occidentalis*) from below Templeton barrier and transplanted to approximately one quarter to one half mile above barrier. Measured stream flow just above Templeton barrier at 4.9 cfs. Test ran two, five gallon constant flow drip cans at Templeton barrier.

Wednesday, September 16, 1987

Established radio contact with Christenson and Brown at Schaeffer barrier detox station at 0900. Milliron started drip station at Templeton barrier at 1005 using 100 ounces rotenone and adjusted flow to deliver a stream concentration of 0.07 ppm rotenone over a four hour period. An additional six ounces of rotenone were sprayed above barrier to effectively treat underflow beneath barrier.

McEwan and Symonds treated Brown Meadow Stringer from approximately 20 meters upstream from Bell Camp Stringer confluence with 16 ounces rotenone (4 hour drip). A one quart drip bottle with 4 ounces rotenone was then set at the Bell Camp barrier. They then sprayed lower Brown Meadow Stringer to confluence of South Fork Kern River with 10 ounces rotenone.

Wong and Goldberg treated upper Strawberry Creek setting two drip stations, each with 10 ounces rotenone and spraying intermittent pools up Strawberry Creek to Cow Camp. McEwan and Symonds sprayed lower Strawberry Creek with 10 ounces rotenone and then set a quart drip bottle charged with 4 ounces rotenone approximately 1 mile above South Fork Kern confluence.

Milliron placed 200 pounds of salt in mid-stream South Fork Kern at booster station at 1330 to warn personnel at the detox station to begin introducing KmnO4. Started 2 five gallon drip cans charged with 100 ounces rotenone at 1350 and adjusted flow rate to achieve .07 ppm rotenone stream concentration for a four hour duration.

Hayes sprayed Dry Creek from its confluence with South Fork Kern to a rock barrier using 10 ounces rotenone. Iseri sprayed South Fork Kern from the confluence of Dry Creek to Templeton barrier using 10 ounces rotenone. Iseri and Hayes then sprayed South Fork Kern from confluence with Dry Creek downstream to Strawberry Creek using 4 ounces rotenone.

Thursday, September 17, 1987

Milliron started Templeton barrier drip station at 1135 using 120 ounces rotenone set for a 3 hour drip. Then hiked to Dry Creek spraying wet areas along the way using 9 ounces rotenone. Collected 5 brown trout near Dry Creek confluence. Slugged small spring fed tributary located about 300 meters upstream from Dry Creek (west side) with 3 ounces rotenone. Then hiked back to Templeton barrier and packed out equipment. Back in camp at 1630.

McEwan set South Fork Kern booster station with 100 ounces rotenone for 3 hour drip at 1000.

Wong treated Bell Camp and Brown Meadow stringers using a quart drip bottle charged with 10 ounces rotenone, observed many live golden trout in lower Brown Stringer necessitating later treatment. Wong and McEwan sprayed South Fork Kern from Strawberry Creek confluence to booster drip station using 20 ounces rotenone. Recharged booster station with 100 ounces rotenone at 1300. Then continued downstream to Schaeffer Iron Stringer spraying wet areas along the way (30 ounces rotenone). Observed 12 brown trout ranging from 9 to 13 inches. Met with detox crew (Christenson and Brown) at Schaeffer Iron Stringer where they set an additional 5 gallon drip booster station charged with 40 ounces rotenone. Treated Schaeffer Iron Stringer with 3 ounces rotenone. Arrived back at camp at 2000.

Goldberg and Symonds treated upper Strawberry Creek, setting two drip stations (50 ounces rotenone) and spraying intermittent pools (8 ounces rotenone).
Iseri and Hayes sprayed Dry Creek and the South Fork Kern between the confluence of Dry and Strawberry creeks. Used 32 ounces rotenone.

Friday, September 18, 1987.

Wong and Milliron sprayed Brown Stringer with 40 ounces rotenone. This extra treatment effort was felt necessary due to the slow flow and large intermittent pools in Brown Stringer.

Loaded equipment and broke camp at 1100. Utilized 12 mules, 7 horses and 2 packers. Arrived at Cottonwood Pack Station at 1800.

Final observations by all personnel involved with this treatment indicate that a complete fish kill was achieved in the target area.

Curtis Milliron
Fishery Biologist

APPENDIX 8 – SUMMARY OF FIELD WORK AND STUDIES, 1999-2004

APPENDIX 8-1
CALIFORNIA GOLDEN TROUT MANAGEMENT ACTIVITIES
California Department of Fish and Game
Southern Sierra Fishery District

1999 Summary of Field Activities

June 7 - 16: Gill netting Johnson Lake (3 sci. aids)
Fifteen gill nets were set in Johnson Lake for seven days, and fish were removed, counted, measured and buried daily. A total of 334 GtxRT were removed ranging in size from 10 to 34 cm. The outlet stream, Johnson Creek, was visually surveyed for the presence of frogs and fish to approximately 1.5 mi. downstream of the lake. The outlet was dry for the first 1/4 mi. No fish or frogs were observed in the 1.5 miles of stream surveyed. Tree frogs were observed around the lake, but there was no evidence of mountain yellow-legged frogs.

June 24 - 27: Monache Meadows Wildlife Area (2 sci. aids)
Put up fence, discuss management plan, and stream habitat improvement. Richard Flint consulted with us on habitat improvement projects.

June 30 - July 2: Monache Meadows Wildlife Area (2 sci. aids)
Finish putting up fence.

July 9 - 16: Golden Trout Creek (4 sci. aids)
Collect genetic samples and survey for MYLF.

August 9-10: Monache Meadows Wildlife Area
Continue stream habitat improvement on Monache Cr.

September 9 - 16: Templeton Meadows
Electrofish Movie Stringer to remove hybrid fish. Population inventory and genetic sampling.

October 9 - 10: Monache Meadows Wildlife Area
Take down fence at Monache WA. Electrofish below Schaeffer Barrier and mark all fish caught with Ad & LV fin clips. 143 BN and 131 GtxRT, 323 total.

October 18 - 19: Schaeffer Barrier
Reinforced repairs on barrier with extra wire mesh.

October 21 - 24: Rocky Basin and Johnson Lakes
Set gill nets over winter in lakes to remove fish.

October 25 - 29: Strawberry Connection & Movie Stringer
Remove Strawberry Connection and electrofish Movie Stringer to remove hybrid fish.

APPENDIX 8-2

CALIFORNIA GOLDEN TROUT MANAGEMENT ACTIVITIES
June - October 2000
California Department of Fish and Game
Southern Sierra Fishery District

Johnson Lake

June 7 - July 17

- Retrieved 6 gill nets set over winter, removed 206 fish and reset nets.
- Set 5 additional nets, removed an additional 93 fish over 38 days of netting.
- Collected sample for DNA analysis.
- Sunk dead fish in deep parts of lakes using weighted burlap bags to return nutrients to lake.
- Surveyed outlet & inlet streams for spawning activity.
- No spawning occurred because of low water and lack of fish.
- Surveyed for amphibians.

October 7

- Set 9 gill nets over winter.

Rocky Basin Lake No. 1

June 7 - July 19

- Retrieved 2 gill nets set over winter, removed 9 fish and reset nets.
- Set 16 additional nets, caught no fish over 40 days of netting.
- Sunk dead fish in deep parts of lakes using weighted burlap bags to return nutrients to lake.
- Electrofished outlet and surveyed outlet & inlet streams for spawning activity.
- No spawning occurred because of low water.
- Surveyed for amphibians.

October 6

- Set 3 gill nets over winter.

Rocky Basin Lake No. 2

June 10

- Retrieved 7 gill nets set over winter, no fish caught.

Chicken Spring Lake

Sept. 7 - 29

- Set 8 gill nets for 20 days, caught only one fish on 12th day

_ Electrofished outlet stream daily and removed 4 adults and 28 yoy.
_ Collected DNA sample.
_ Sunk dead fish in deep parts of lake using weighted burlap bags.

Golden Trout Creek

June 13
_ Collected genetic sample in Golden Trout Creek in Big Whitney Meadow.

Upper South Fork Kern

July 10 - 16
_ Evaluated rediversion of Strawberry Creek and planted willow cuttings.
_ Surveyed “connection” creek for presence of fish, creek dry.
_ Surveyed Movie Stringer for fish and frogs and measured flow; observed 30 adult trout and 100's of yoy; found no MYLF.
_ Evaluated Ramshaw Barrier for effectiveness, made improvements.
_ Electrofished below Templeton Barrier to remove brown trout and mark hybrids.
_ Electrofished above Templeton Barrier to survey for brown trout and look for marked fish.
_ Collected samples for DNA analysis in upper Mulkey Creek, and South Fork Kern at South Fork Meadows, the mouth of Mulkey Creek, the mouth of Movie Stringer and Tunnel Meadow.
_ Conducted two 100m population inventories in Ramshaw Meadow.
_ Found MYLF in South Fork Meadows.

Movie Stringer

September 24 - 29
_ Collected aquatic macroinvertebrates to place in temporary holding tubs during chemical treatment.
_ Chemically treated Movie Stringer to remove hybrid trout.
_ Removed 1000 yoy and 200 yearlings and adults during chemical treatment.

Monache Wildlife Area
June 22 - 25
_ Put up and improved fence around Wildlife Area.
_ Enclosed 7 acres of USFS land inside fence to protect lower Monache Creek from cattle grazing.
_ Botanical survey of Wildlife Area.

July 17 - 21

_ Repaired headcuts in Monache Creek and Olivas Meadow under direction of Inyo NF hydrologist.

October 14

_ Took down fence at Monache Wildlife Area.

Fish Creek

October 7

_ Collected genetic sample in Manter Fire area below Rodeo Flat.

October 15

_ Collected genetic sample upstream of Manter Fire in Smith Meadow.

November 7

_ Took 100m population inventory at Rodeo Flat.

APPENDIX 8-3

California Golden Trout
2001 Field Work Summary

Habitat Restoration

May 19 – 20   Willow Collecting in Brown Meadow (Figure 1)
A crew of 4 collected willow cuttings in Brown Meadow in the south fork Kern watershed, and backpacked them out for propagation at Kern River Planting Base (2 biologists, 2 sci. aids). On May 21 – 22, the willow cuttings were placed with potting soil into propagation cones and trays. These were placed in several inches of water in one of the empty hatchery raceways (4 sci. aids).

June 2   Monache Meadows Willow Planting
Willows were planted on gravel bars along the south fork Kern in Monache Meadows (1 biologist, 1 sci. aid). These willows were cut in January and propagated by volunteers at Lemoore Naval Air Station.

June 23 – 24   Monache Wildlife Area
Volunteers provided the labor for the annual raising of the fence at the Wildlife Area to keep cattle away from the south fork of the Kern. Additional willows were planted along Monache Creek (1 biologist, 2 sci. aids, 9 volunteers).

July 20 – 23   Templeton Meadow Willow Planting (Figure 2)
Willows were cut and planted in gravel bars along the south fork of the Kern in Templeton Meadows. The Inyo National Forest supplied the packer and pack stock. (I biologist, 3 sci. aids, 8 volunteers)

October 6 - 7   Monache Wildlife Area
The Wildlife Area fence was taken down for the winter. The rooted willow cuttings that had been propagated at KRPB were planted in the Wildlife Area along Monache Creek (1 biologist, 9 volunteers).

Gill Netting

An intensive gill netting effort has been underway since 1999 in the headwater lakes of Golden Trout Creek to remove hybrid golden x rainbow trout

June 5 - 28   Rocky Basin #1, Johnson, and Chicken Spring Lakes
Gill nets set over the winter were pulled in Rocky Basin Lake #1 and Johnson Lakes. Three nets had been set over the winter in Rocky Basin Lake #1 (12 - 27 surface acres), and one fish was caught. The Inyo National Forest supplied some of the nets and pack stock for the June trips.

In Johnson Lake (8 - 15 surface acres), four fish were caught in the nine nets set over the winter. Johnson Lake was intensively gill netted with 9 nets for 19 days, but only one fish was caught.

Chicken Spring Lake (8 – 12 surface acres) was gill netted for 19 days using 10 nets. No fish were caught in the gill nets. The outlet, which consisted of two small pools, not connected by flowing water to the lake, was electrofished during this period. Three adults and 15 YOY were caught electrofishing.

<u>October 13 – 15</u> (Figure 3) Another over winter set of 8 nets in Johnson Lake and 6 in Rocky Basin Lake was put in place (3 sci aids).

<u>November 20 – 21</u> Five gill nets were placed in Chicken Spring Lake for the winter (1 biologist, 1 sci. aid, 1 volunteer).

<u>Electrofishing and Genetic Sampling</u>
Of the populations in the Golden Trout Creek watershed that were analyzed for DNA, the population in the area of the mouth of Barrigan Stringer was shown to be the most heavily hybridized. It was decided to try to remove as many of these fish as possible by electrofishing in hopes of reducing their numbers.

<u>August 6 – 12</u>

<u>September 9 – 14</u> (Figure 4) A 1.4 mile reach of Golden Trout Creek above and below Barrigan Stringer was intensively electrofished to remove hybrid golden-rainbows. Over 3000 fish were removed on the first pass. Three percent were YOY. Barrigan Stringer from the mouth to the barrier ½ mi. upstream was also electrofished to remove trout, with 638 trout removed, 75% of which were YOY (3 biologists, 6 sci. aids).

<u>September 23 – 28</u> Genetic samples were collected by two crews, one in the upper south fork Kern watershed (five sci. aids) and one in the Volcano Creek watershed (1 biologist , 1 sci. aid).

<u>October 9 – 14</u> The second electrofishing pass was made on1.8 miles of Golden Trout Creek to remove all fish, beginning 1 mi. below Barrigan Stringer. Over 2300 fish were removed, 4% of which were YOY. Genetic samples were collected at the beginning and end of the reach. Barrigan Stringer was again electrofished from the mouth to the barrier ½ mi. upstream with 219 trout removed, 87% of which were YOY (2 biologists, 4 sci. aids, 1 volunteer).

Figure 1 Willow cuttings at Brown Meadow

Figure 2 Willow planting at Templeton Meadow

Figure 3 Setting gill nets at Rocky Basin Lake #1

Figure 4 Golden Trout Creek near Barrigan Stringer

APPENDIX 8-4
Southern Sierra Fishery District
2002 Annual Report
Christine L. McGuire
Associate Biologist

The Southern Sierra Fishery District covers the southern third of Region 4, the San Joaquin and Southern Sierra Region of the California Department of Fish and Game. It encompasses all of Kern and Tulare Counties with the exception of the lands managed by Sequoia-Kings Canyon National Park. The Kern River is the dominant watershed of this district, and because it contains native trout, it has been the focus of most of the activities of the District Biologist. The District Biologist is based in Kernville.

Native Trout Management in the Kern Basin
There are three native trout endemic to the upper Kern River basin, the California golden trout (GT-CA), *Oncorhynchus mykiss aguabonita,* Little Kern golden trout (GT-LK), *O. m. whitei,* and the Kern River rainbow trout (RT-KR), *O. m. gilberti.* All three have been highly impacted by human activities since European settlers arrived in the area in the mid- 1800's. The introduction of non-native rainbow, brown and brook trout has been the most serious threat to the native trout, while habitat degradation, primarily due to domestic cattle and sheep grazing has caused changes in population structure. Because all three are subspecies of coastal rainbow trout, they readily hybridize with rainbows, and hybridization is difficult to detect without laboratory analysis of their genetics. Restoration efforts begun in the 1970's have focused mainly on the two types of golden trout. Management activities for RT-KR have been limited due to lack of funding. The GT-LK has been federally listed as threatened since 1978, and the GT-CA was petitioned for listing as endangered in 2000.

California Golden Trout

California golden trout are native to the Golden Trout Creek and South Fork Kern watersheds, eastern tributaries to the Kern River in a geographic region known as the Kern Plateau. This subspecies is at risk due to threats of hybridization, predation, interspecific competition, and habitat degradation. The Department has been involved cooperatively with other agencies in a long-term effort to restore golden trout to its native range. A Conservation Agreement and Strategy is being developed to guide the restoration process. In 2002, the majority of the summer and fall field work by Southern Sierra fishery District staff was directed toward GT-CA (Figure 5). This included collection of samples for DNA analysis, some limited eradication of hybrid golden x rainbow trout in the Golden Trout Creek watershed, population surveys, and habitat restoration activities. Planned fish migration barrier work was postponed due to the McNally Fire.

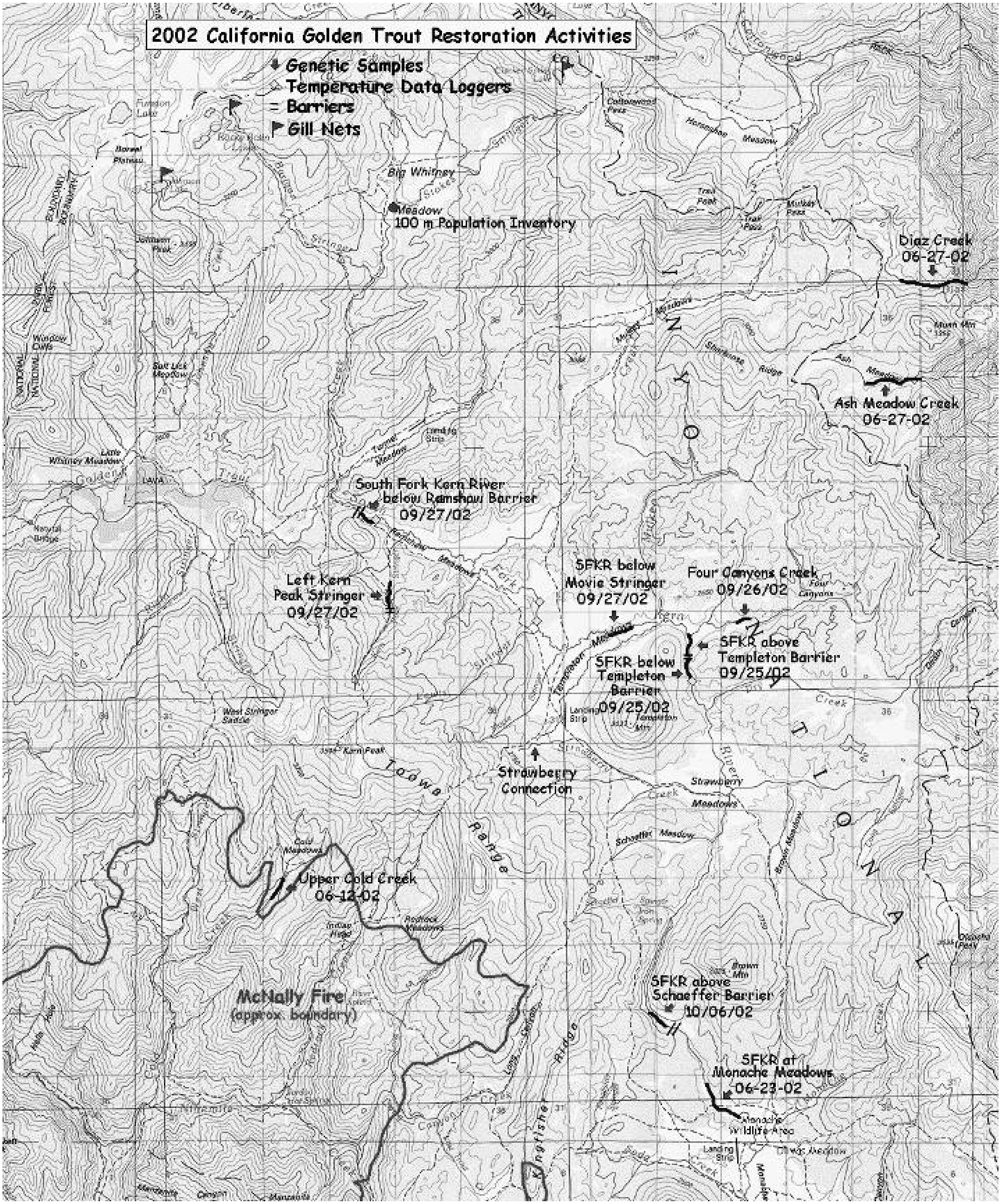

Figure 5 - 2002 California golden trout restoration activities

Status

DNA studies were begun in 2000 by researchers at the University of California at Davis to investigate the genetic status of California golden trout populations. This technique is much more sophisticated than the starch gel electrophoresis method previously used which utilized protein gene products and was hampered by low variability at the sub-species and population level. Based on this new technology, geneticists concluded that all but one of the populations from the Golden Trout Creek watershed were slightly introgressed with non-native rainbow trout (Cordes et al. 2001) A single sample analyzed from the upper South Fork Kern River was also shown to be slightly introgressed. Further DNA studies of the south fork Kern and from waters outside the basin were needed to get a better picture of the extent of hybridization and clarify the status of the subspecies. Additional fin samples were collected in 2002, and analysis was begun on these and others already archived at UC Davis. A report is due in May, 2003.

In October 2000, California golden trout was petitioned for federal listing as Endangered by Trout Unlimited. After completing the initial 90-day finding of the listing package in 2002, the US Fish and Wildlife Service (USFWS) determined that substantial evidence exists to support the petitioned action. The USFWS began a 12 month review to decide whether or not to propose the California golden trout for listing as Endangered. At the end of this review period, the USFWS will determine whether listing is “not warranted,” “warranted” or “warranted but precluded” due to the precedence of higher priority species.

State representatives from Trout Unlimited, Cal Trout and the Federation of Flyfishers met with Department personnel in Sacramento May 16th to gain information on the status of golden trout. The district biologist prepared and presented a PowerPoint slide show for the meeting attendees detailing progress toward California golden trout recovery. Little Kern golden trout and Kern River rainbow were also discussed. Concerns of the representatives were heard and given consideration in the revision of the Conservation Strategy.

Conservation Strategy.

The initial Volcano Creek Golden Trout Conservation Strategy was developed and signed by the California Department of Fish and Game (CDFG), Inyo National Forest (INF), and the USFWS in April 1999. Since that time, the name “California golden trout” has been adopted for these fish by the agencies. An Implementation Plan for the Strategy was drafted in May 2002, but not signed. Because the recent DNA analysis has changed our understanding of the geographic range of the remaining pure populations of California golden trout, some of the proposed actions and timelines in the Implementation Plan needed revision. A new Conservation Assessment and Strategy (Strategy) is being developed jointly as a cooperative effort between the CDFG, INF, Sequoia National Forest (SQF) and USFWS. Numerous meetings were held between the cooperating agencies to draft the new document beginning in November 2002. The revised document will aid USFWS during their 12 month review in considering whether to list the CGT as Endangered.

Barriers

On the south fork Kern River, there is a series of three man-made fish migration barriers that were put in place to aid in the restoration efforts and protect pure strain GT-CA from non-native trout downstream of the barriers (Figure 5). Schaeffer Barrier is the furthest downstream at the head of Monache Meadows, and Templeton Barrier is 6.4 miles upstream at the lower end of Templeton Meadows. Ramshaw Barrier is the uppermost, located in the gorge between Ramshaw Meadow and Tunnel Meadow.

Schaeffer Barrier

The Schaeffer Barrier is a rock and wire gabion structure built in 1981 to separate golden trout upstream from non-native brown and rainbow trout downstream of the barrier. Failure of the barrier occurred when a large jump pool formed beneath it allowing passage of trout upstream. Additionally, by the early 1990's the galvanized wire had deteriorated, and sections of the barrier collapsed during subsequent high flows. Reconstruction using cement was proposed, and the Department contracted with the California Department of Water Resources (DWR) to engineer a new barrier. The reconstruction of the Schaeffer Barrier was subcontracted by DWR to a private contractor who began mobilization in July. DWR was to be overseeing the project. Numerous meetings were held between the agencies involved and the contractor in preparation for the job. The district biologist coordinated with the involved agencies and the contractor, and attended the meetings to discuss the details and logistics of the reconstruction project. As the contractor was mobilizing, but before the construction began, the McNally Fire started on July 21st, 2002. The construction crew was evacuated due to the high risk of the fire burning into the construction area. By the time the fire was declared controlled in September, it was too late in the season for the construction to be completed before winter snows closed the area. The project had to be postponed until 2003.

In the meantime, the integrity of the gabion structure has continued to deteriorate. Beavers have established a dam on top of the barrier, causing water to back up behind the dam and flow through the gabions near the eastern edge of the structure. This flow has the potential to undermine the integrity of the barrier along the eastern wing wall and is already causing erosion of the stream bank below the barrier.

Templeton Barrier

The Templeton Barrier, another rock and wire gabion dam, was rebuilt with cement in 1996 to protect golden trout from mixing with downstream non-native trout. George Hiese, the designer of the barrier, visited the site on a September trip to the south fork Kern to evaluate the integrity of the structure. He documented a small area on one side where minor piping under the barrier has occurred during spring flows. It appeared to be a minor problem and the only action recommended was to continue to monitor it annually.

Strawberry Creek, a western tributary to the South Fork Kern River, enters the river just downstream of Templeton Barrier. Strawberry Creek and Templeton Meadows are separated by a low lying ridge west of Templeton Mountain. A possible bypass of the Templeton Barrier by non-native trout is the “Strawberry Connection”, a network of small tributary streams in the extensive meadow system surrounding Templeton Mountain (Figure 5). Some years ago the cattle permittee at the Templeton Cow Camp constructed a small wood and metal dam that diverted part of the stream flow from upper Strawberry Creek north and easterly into an unnamed channel flowing into the South Fork Kern River in Templeton Meadow upstream of Templeton Barrier. This diversion created a possible hydrologic route for trout to travel around Templeton Barrier and is referred to as the “Strawberry Connection.” The existence of the “Strawberry Connection” exposes 83 miles (134 km) of native habitat for California golden trout in the heart of their range between Templeton and Ramshaw barriers to invasion by non-native and hybrid trout.

Work was done two years ago to try to rectify the problem by re-diverting a small tributary to Strawberry Creek into its original channel at the Templeton Cow Camp. The site was visited by the District Biologist and the Inyo Forest fishery biologist in September 2002 where it was discovered that the “connection” still exists due to a new channel being dug downstream of the original diversion. The Inyo Forest plans to evaluate hydrology of the site during high flows in 2003 to help determine what actions would need to be taken to rectify the problem.

Genetic sampling

Collection of California golden trout fin samples for DNA analysis was resumed for the season in June, with scientific aids, Sean Belcher, Jason Morgan and Breck McAlexander, collecting fins from several locations in the Golden Trout Wilderness where it is believed that transplanted pure populations exist. The Inyo National Forest collaborated on one of the trips, to Cold Meadow, contributing pack stock and a scientific aid. Ash and Diaz Creeks were sampled during a separate backpacking trip. In the south fork of the Kern, fin samples for DNA analysis were collected in six locations the week of Sept. 23rd. With the help of volunteers, the south fork of the Kern was electrofished above Schaeffer Barrier October 6th to collect fin samples from 40 fish for DNA analysis. These collections are summarized in Table 1.

	WATER	DATE	DRAINAGE	n
1.	Ash Meadow Creek	6/28/02	ORD	40
2.	Cold Creek, upper	6/12/02	KR	40
3.	Diaz Creek	6/27/02	ORD	32
4.	Four Canyons Creek	9/26/02	SFK	40
5.	Left Kern Peak Stringer	9/27/02	SFK	40
6.	South Fork Kern above Schaeffer Barrier	10/6/02	SFK	40
7.	South Fork Kern above Templeton Barrier	9/25/02	SFK	39
8.	South Fork Kern at Monache Mdws	6/23/02	SFK	40
9.	South Fork Kern at Movie Stringer	9/27/02	SFK	40
10.	South Fork Kern below Ramshaw Barrier	9/27/02	SFK	40
11.	South Fork Kern below Templeton Barrier	9/25/02	SFK	40

DRAINAGE CODES: KR – Kern River, ORD – Owens River Drainage
SFK – South Fork Kern River

Table 1 - California golden trout genetic samples collected in 2002

Population Monitoring

Members of both the regional and state wild trout crews joined fishery district personnel to assist with a population inventory in Golden Trout Creek in Big Whitney Meadow during the week of Sept. 9th. A report is pending.

Non-native trout removal

Headwater gill netting

When in 1995, hybrid golden x rainbow trout were discovered in the headwater lakes of Golden Trout Creek, an intensive gill netting effort was undertaken to try to remove these fish because of the threat they posed to pure golden trout populations downstream in the watershed. It was found that, once the numbers of trout in the lakes were reduced by daily gill netting over a period of several weeks during the summer, gill nets set over the winter are effective in removing the few trout that remain. The gill netting to remove trout in the lakes was initiated in 1999. After three years of intensive gill netting in both summer and winter, the winter gill nets of 2001-2002 produced no fish in any of the lakes. The nets were set again over the winter of 2002-2003 in Johnson and Rocky Basin Lake No. 1 to verify that all the fish have been removed. One of the things that have facilitated the removal of the trout in Johnson and Rocky Basin Lakes has been the drought of the past 5 years. The inlet and outlet streams of these lakes have dried up early in the season leaving no available spawning habitat. Additionally, the lakes have been greatly reduced in volume. When the gill nets are set over two winter periods and no fish are caught, the lakes will be declared fishless. It is hoped that this will allow for pure California golden trout to be eventually reestablished in some of these lakes.

Chicken Spring Lake outlet

Chicken Spring Lake has proved to be problematic. Several years of gill netting effort in Chicken Spring Lake appears to have been effective at removing all of the trout in the lake. Below the lake, however, an isolated section of creek still contained a few fish, and Department staff was not able to remove all of them by repeated electrofishing. In an effort to remove the last remaining fish from the outlet, the district biologist and crew backpacked some high-volume portable hand pumps into the Golden Trout Wilderness to attempt to temporarily dewater the pools in the creek. The method worked well in the smaller pools, and three adult fish were removed. No young-of-the-year or yearling fish were found. A larger pool could not be drained with the hand pumps. No fish were observed in this pool, but it is heavily overgrown with aquatic vegetation. The Inyo National Forest granted approval for gasoline-powered pumps to be used in the wilderness area to accomplish the job. However, this approval came in November after winter snows had closed the area. Plans are for the pumps to be used in the fall of 2003, with two more years of over-winter gill netting in Chicken Spring Lake.

APPENDIX 8-5
2003 ACCOMPLISHMENTS
Conservation Assessment and Strategy
California golden trout

Task 1.1a - Develop a genetic monitoring protocol – Completed in 2003

Task 1.1b - Collect trout for genetic analysis. Samples collected in 2003 included:

WATER	DATE COLLECTED	COLLECTOR	n	BASIN	STATUS	PRESERVATIVE
Kings River, Middle Fork at Upper Le Conte Canyon	July – Sept. 2003	SEKI	40	Kings	To UC Davis 3/3/04	Dry
Dorst Creek	2003	CDFG & Volunteers	14	N Fork Kaweah	At Kernville	DMSO
Kern River above Hell's Hole	July 2002	CDFG & Volunteers	61	KR	To UC Davis 3/3/04	DMSO
Johnson Spring Creek, Little Whitney Cow Camp-dry duplicate sample archived at Kernville	9/23/03	CDFG	61	GTC	Sent to Matt Campbell, Idaho DFG	Alcohol
Big Five Lake #3 (Culver Lake)	8/22/03	CDFG	41	KR	To UC Davis 3/3/04	Dry
Volcano Creek Left Stringer	9/24/03	CDFG	83	GTC	Sent to Matt Campbell	Alcohol
South Fork Kern above Kennedy Mdws	2/14/03	CDFG	4	SFK	Analyzed 2003	DMSO
South Fork Kern at Kennedy Mdws Campground (UC Davis called it below Kennedy Mdws)	3/3/03	CDFG	4	SFK	Analyzed 2003	DMSO

Task 1.1c - Conduct baseline DNA analysis of trout within the SFKR and GTC basins – Completed, December, 2003 by UC Davis.

Task 1.2c - Monitor the integrity and effectiveness of the Templeton and Ramshaw Barriers. Templeton Barrier was surveyed October 11, 2003. The piping noted under the east wing wall appeared to be reduced from previous years, and seems to be gradually going away. The south fork Kern River was electrofished on October 11 by CDFG and volunteers, from the rocky gorge approx ¼ mile below the barrier to the barrier. All golden trout hybrids caught were marked with an adipose fin clip. Forty one GT hybrids marked in previous years were caught, and 185 additional GT hybrids were marked. The river was electrofished above the barrier for approx. ¼ mile, and no brown trout or marked GT hybrids were found. Ramshaw Barrier was surveyed Sept. 26, 2003 by CDFG. The barrier remains functional with no repairs needed. The INF supplied packers and pack stock for both trips.

Task 1.2d - Monitor the "Strawberry Connection" during runoff and map hydrologic flow patterns. The Strawberry Connection was reviewed by INF staff in 2003. The preliminary assessment is that the two stringers (Strawberry and Un-named creek) occur within an area that does not have sufficient topographical relief to avoid sheet flow connectivity during high flows. Channels within this area will be mapped in 2004 to give an accurate assessment of the situation.

Task 1.2e - Remove brown trout from Strawberry Creek and monitor movement of GTxRT hybrids in the area of the 'Strawberry Connection". Strawberry Creek was electrofished October 12 by CDFG and volunteers from its confluence with Fat Cow Creek upstream to the Templeton Cow Camp. Brown trout have ascended the creek as far as the confluence of the north and south forks of Strawberry Creek. Six brown trout from 4" to 8" in length were caught and removed. Golden trout hybrids were marked with adipose clips (557 total were marked) and replaced in the stream. Above the confluence of the two forks of Strawberry Creek, the creek becomes intermittent due to the low water in 2003.

Task 1.2g - Reconstruct the Schaeffer Barrier. Completed in October, 2003.

Task 1.2j – Reduce the brown trout population in the SFK downstream of Templeton and Schaeffer Barriers. The south fork Kern River was electrofished on October 11 by CDFG and volunteers, from the rocky gorge approx ¼ mile below the barrier to the barrier. Fifty brown trout were removed, including several very large ones.

Task 1.2k - Monitor other native aquatic biota in conjunction with California golden trout restoration efforts. CDFG staff located a previously unknown population of mountain yellow-legged frogs in Bullfrog Meadow, a westward stringer of Mulkey Meadow.

Task 1.2n - Address the Kennedy Meadows catchable non-native trout stocking program. CDFG began rearing sterile triploid rainbow trout in 2003 which will reach catchable sizes in 2004. The allotment for the south fork Kern River at Kennedy Meadows is being reduced in 2004, and only sterile triploids will be stocked at that location.

Task 1.2o - Determine the current status and distribution of non-native brown trout. See tasks 1.2c, 1.2e, and 1.2j above.

Task 1.2p - Establish locations for fish population inventories. Coordinate with stream habitat monitoring. Two additional fish population inventory sites were established by CDFG in the south fork Kern watershed in 2003. The first was in the lower end of Tunnel Meadow within the SCI site established there by the Inyo NF. The second was in upper Fish Creek at the lower end of Smith Meadow on the Sequoia NF. Streambank stability monitoring was begun in 2003 by SQF at the Fish Creek location, and an SCI plot will be established in 2004.

Task 1.2q - Conduct 1-3 fish population estimates per year. A population estimate was conducted at the lower Tunnel Meadow site on September 25, 2003 by CDFG staff, with INF packing in all of the supplies and equipment. The Fish Creek site was done by CDFG and SQF staff on October 1, 2003. Reports for both surveys are being compiled.

Task 1.2s - Remove trout from headwater lakes. Nine gill nets were set over the winter of 2002-03 in each lake, Rocky Basin Lake #1 and Johnson Lake. They were retrieved on June 10 and 11, 2003. No fish were caught in the nets for the second consecutive winter, and it is believed that the lakes are now fishless. Both lakes are still at low levels due to drought with no spawning habitat available. There are no plans for future gill netting in these lakes. Chicken Spring Lake was not gill-netted over the winter of 2002–03 due to scheduling problems. The outlet creek below the lake was flowing for a short distance in October, 2003, and an attempt was made to use a gasoline-powered pump to dewater the large pool just below the outlet. Flows were higher this year than in October, 2002, when this plan was conceived, and it couldn't be done. No fish were observed in the outlet creek. Gill nets were set for the winter in Chicken Spring Lake on October 24 by CDFG and a volunteer. The INF packed both the pumping equipment and the netting equipment to the lake.

Task 1.2t -Establish locations for fish population inventories in the GTC watershed. Coordinate fish population with stream habitat monitoring. One new fish population inventory site was established by CDFG in Little Whitney Meadow in Johnson Spring Creek, a short tributary to Johnson Creek adjacent to the Little Whitney Cow Camp.

Temperature monitoring units were installed in 2 locations in Little Whitney Meadow and one in Volcano Meadow. Data from already established temperature monitoring sites was downloaded. Temperatures are recorded hourly, 12 months out of the year, and the data is downloaded annually. Previously established temperature monitoring sites are located in Big Whitney, Mulkey, Templeton, Ramshaw and Monache Meadows, and in Johnson and Rocky Basin Lakes.

Task 1.2u - Conduct 1-2 fish population estimates per year. A population estimate was conducted at the site in Johnson Spring Creek by CDFG on September 23, 2003. The equipment was packed in and out by the INF packer.

The following task was done by US Forest Service crews:
Task 2.1c - Develop monitoring plan for Templeton and Whitney grazing allotment restoration activities. This year USFS watershed crews established baseline data for headcut monitoring, placed monuments at each site and took data as to soil type, size of headcut, vegetation cover, etc. Photo points were established at each site. Watershed crews were packed in with Forest Service pack trains.

Watershed:

Monache Allotment: Approx. 6 days,
    Red Rock Meadow
    Cold Water Meadows

Templeton Allotment: Approx 9 days,
    Brown Meadow
    Death Canyon
    Strawberry Meadows, upper and lower
    Schaeffer Meadow
    Fat Cow Meadow

Mulkey Allotment: Approx. 6 days,
    Mulkey Meadow, upper and lower
    Bear Meadow
    Overholster Meadow
    Bullfrog Meadow

Whitney Allotment: Approx. 8 days
    Stokes Stringer
    Big Whitney Meadow (five sections within the larger complex)

Information is still being compiled.

Fisheries:

The modified SCI method was completed with a crew of two or three at the following locations. Crews back-packed into remote areas to conduct surveys. Equipment costs are included in dollar figures.

    South Fork Meadow: Approx. 3 days
    Overholster Meadow: Approx. 2 days
    Browns Meadow: Approx. 2.5 days
    Strawberry Creek: Approx 5 days
    Red Rock Creek: Approx. 3 days
    Fat Cow Meadow, a fork of Strawberry Creek,
    and Long Stringer were both dry, otherwise they would have been surveyed.

Data for these surveys still needs to be compiled, which will take about two days per survey area.

Task 2.2a - Implement watershed restoration opportunities where identified by the assessment. The weekend of June 21 - 22, the old horse pasture fence at the Olivas Cow Camp was repaired by INF, CDFG, and volunteers to exclude cattle. This area is a wet meadow no longer used as a cow camp. Rooted willows, propagated over the winter from cuttings by volunteers, were planted to stabilize headcuts within the fenced area. Portions of the fence were burned in the Summit Fire and will need additional work in 2004.

Task 2.2d - Prevent water transfers from non-native water bodies into golden trout waters. CDFG and INF biologists monitored the progress of the Summit Fire, a fire use fire in the Monache Meadows area, and provided recommendations to the fire management staff on water drops. The West Kern Fire, another fire use fire in the Kern Canyon, was also monitored, but it stopped short of the native golden trout habitat in lower Golden Trout Creek.

Task 2.2e - Continue habitat improvement on CDFG Property in Monache Meadows. Fencing was put up in June to keep cows out of the CDFG Monache Wildlife Area. The fence was taken down for the winter in October.

APPENDIX 8-6
2004 ACCOMPLISHMENTS
Conservation Assessment and Strategy
California Golden Trout

GOAL 1: PROTECT AND RESTORE CALIFORNIA GOLDEN TROUT GENETIC INTEGRITY AND DISTRIBUTION IN ITS NATIVE RANGE.

OBJECTIVE 1.1: IDENTIFY AND MONITOR EXTANT CALIFORNIA GOLDEN TROUT POPULATIONS

Task 1.1a - Capture and summarize trout stocking records from CDFG Region 6 (Bishop) Offices – Begun in 2004.

Task 1.1b - Collect trout for genetic analysis. Samples collected in 2004 are summarized in the table below.

	WATER	DATE COLLECTED	BASIN	n
1	Adula Lake	7/27/04	Kern	27
2	Cirque Lake Outlet	8/21/04	Owens	9
3	Cliff Creek	9/5/2004	Kaweah	5
4	Dogbone Lake (Upper Kern)	7/29/04	Kern	48
5	Dorst Creek	6/30/04	Kaweah	40
6	Golden Trout Creek above Barrigan Stringer	7/19/04	Kern	40
7	Grizzly Creek, East Fork	8/17/04	Kings	18
8	Humphrey's Basin A	8/20/04	So. Fork San Joaquin	4
9	Humphrey's Basin B	8/21/04	So. Fork San Joaquin	5
10	Humphrey's Basin C	8/23/04	So. Fork San Joaquin	5
11	Kennedy Creek	Aug, 2004	Kings	40
12	Kern River, Upper Kern Headwaters	7/29-30/04	Kern	38
13	Lake South America	7/29/04	Kern	49
14	Lost Creek	7/25/04	Kern	40
15	Mc Dermand Lake 3 (Upper Kern)	7/30/04	Kern	10
16	Milestone Creek	7/30/04	Kern	54
17	Milestone Creek, South Fork	7/31/2004	Kern	5
18	Ned's Lake	7/27/2004	Kern	1
19	Nine Mile Creek at Casa Vieja Meadow	7/17/04	Kern	45
20	Osa Creek	7/16/04	Kern	39
21	Salmon Creek	7/10/04	Kern	36
22	Shepherd Pass Lake	7/31/2004	Kern	5
23	Sky Blue Lake	8/17/04	Kern	30
24	Soldier Lake 1	8/16/04	Kern	38
25	South Fork Kern River @ Rockhouse Basin	6/28/04	So. Fork Kern	13
26	South Fork Kern River above Schaeffer Barrier	6/20/04	So. Fork Kern	40
27	South Fork Kern River below Schaeffer Barrier	6/20/04	So. Fork Kern	40
28	Strawberry Creek	9/27/04	So. Fork Kern	40
29	Tawny Point Lake	8/2/04	Kern	37
30	Tyndall Creek (A) Group 1	7/25/04	Kern	9
31	Tyndall Creek (B) Group 2	7/26/04	Kern	13
32	Tyndall Creek (C) Group 3	7/26/04	Kern	18

Task 1.1c - Conduct baseline DNA analysis of trout within the SFKR and GTC basins – Completed, December, 2003 by UC Davis. Additional sample collected in 2004 from lower reaches in the South Fork Kern River at Rockhouse Basin for reference.

Task 1.1d - Monitor hybridization and introgression levels in California golden trout populations within the South Fork Kern River and Golden Trout Creek basins. Four samples were collected from previously sampled sites to monitor introgression levels over time in Golden Trout Creek above Barrigan Stringer, Strawberry Creek and South Fork Kern River above and below Schaeffer Barrier.

Task 1.1e - Conduct DNA analysis of suspected California golden trout populations outside their native range. In 2004, CDFG biologists and volunteers collected fin samples from twenty-seven potentially non-introgressed California golden trout populations occurring outside of their native range. These populations reportedly were established using trout from GTC (CDFG, unpublished records, Ellis et al. 1920). While non-native trout may have been planted on top of some of these populations, water bodies have been selected where there are no records of this occurring. Additional samples will be collected in 2005 and analyzed with the 2004 samples in a study expected to be completed by U.C. Davis in 2006.

Task 1.1f – Collect information on the location of archived California golden trout museum specimens. No action in 2004.

OBJECTIVE 1.2: MAINTAIN AND IMPROVE THE GENETIC INTEGRITY, POPULATION STRUCTURE AND ECOSYSTEM ELEMENTS OF CALIFORNIA GOLDEN TROUT.

MANAGEMENT ACTIONS BASED ON THE CURRENT UNDERSTANDING OF GOLDEN TROUT GENETICS

Task 1.2a - Develop and implement a genetics management plan. No action in 2004.

Task 1.2b - Remove trout from GTC headwater lakes. Six gill nets were set over the winter of 2003-04 in Chicken Spring Lake. The nets were retrieved with the aid of volunteers on June 5, and no fish were observed or caught in the nets. The outlet creek was visually surveyed on three occasions, and no fish were observed. On October 16, twelve gill nets were backpacked to and set over the winter in Chicken Spring Lake by CDFG and INF personnel and one volunteer. Rocky Basin Lakes and Johnson Lake were not monitored in 2004, and it is believed that the lakes remain fishless.

Task 1.2c - Reduce trout numbers in selected streams within GTC watershed with high levels of non-native trout genetic material. No action in 2004.

Task 1.2d - Prepare written plans for integration of California golden trout population and habitat protection into INF and SQF fire pre-suppression planning. Completed by both the Sequoia and Inyo National Forests in 2004.

Task 1.2e - Eliminate fish from targeted waters if warranted per the genetics management plan. No action in 2004.

FISH POPULATION MONITORING

Task 1.2f -Establish additional locations for fish population monitoring and coordinate with INF and SQF stream habitat monitoring. No action in 2004.

Task 1.2g – Conduct 1-3 fish population estimates per year at the established monitoring sites. Population estimates were conducted at Strawberry Stringer and the South Fork Kern River in Templeton Meadow by CDFG with the assistance of INF personnel and volunteers. The INF provided packers and pack stock for the field work.

REFUGES FOR CALIFORNIA GOLDEN TROUT POPULATIONS

Task 1.2h – Establish criteria for identifying refuges for California golden trout. No action in 2004.

Task 1.2i - Investigate locations for refuges within the California golden trout native range. No action in 2004.

Task 1.2j - Investigate locations for refuges outside of the species' native range. No action in 2004.

Task 1.2k – Establish refuges for California golden trout. No action in 2004.

MANAGEMENT ACTIONS FOR CONTROLLING UPSTREAM MOVEMENT OF NON-NATIVE TROUT

Task 1.2l - Monitor the integrity of the South Fork Kern River Barriers. The Ramshaw, Templeton and Schaeffer Barriers were inspected by the CDFG and INF biologists in 2004 to determine whether maintenance is required. Ramshaw Barrier did not require any maintenance. The piping observed at Templeton Barrier in previous years appeared to be almost non-existent in 2004. Schaeffer Barrier will require field inspection in 2005 by the DFG engineer to assess the piping under the west wing wall of the barrier.

Task 1.2m – Assess the hydrological effectiveness of Templeton and Schaeffer Barriers. No action in 2004.

Task 1.2n – Monitor the effectiveness of Templeton and Schaeffer Barrier. The south fork Kern River was electrofished on September 26 by CDFG, INF and volunteers, from the rocky gorge approx ¼ mile below the barrier up to the barrier. All golden trout hybrids caught were marked with an adipose fin clip. Twenty six GT hybrids marked in previous years were caught, and additional 156 GT hybrids were marked. All brown 106 trout caught were removed. The river was electrofished above the barrier for approx. ¼ mile, and no brown trout or marked GT hybrids were found. The INF supplied packers and pack stock.

Task 1.2o - Determine the current status and distribution of brown trout and reduce their numbers at the upstream extent of their distribution. The electrofishing survey in the SFKR below and above Templeton Barrier was conducted on

September 26 to assess whether brown trout have ascended the barrier. No brown trout were found above the barrier. Strawberry Creek was electrofished September 27 – 28 from the mouth upstream to the Templeton Cow Camp and brown trout were removed. Volunteers assisted CDFG and INF with the electrofishing. The INF supplied packers and pack stock.

Task 1.2p – Revegetate the access road and Schaeffer Barrier construction site. No action in 2004.

Task 1.2q - Evaluate the Strawberry Connection during runoff and map hydrologic flow patterns. In the summer of 2004, Forest Service hydrologist and fisheries biologist reviewed the situation at the headwater area of Strawberry Creek and the un-named stringer in the Movie Stringer area. This area is still confounding, and will require more intensive investigation, such as recording with GPS all the ditches that were dug around the Templeton Cow Camp. The solution could be as simple as some shovel work up in that area, to some type of engineered design for the area. Ditches that had been dug to re-direct water could have some influence on fish moving over into the Movie Stringer side of this very un-defined boundary between the two watersheds. Any major work proposed within the area would need to be analyzed through the NEPA process and analyzed for consistency for Wilderness values.

Task 1.2r- Modify the hydrologic connection between Templeton Meadow basin and Strawberry Creek. No action in 2004.

Task 1.2s - Remove all trout from Strawberry Creek and monitor movement of GTxRT hybrids in the area of the Strawberry Connection. Electrofishing of Strawberry Creek by CDFG, INF and volunteers in September 2004 was conducted to remove the golden x rainbow hybrids beginning at the mouth and continuing upstream. Because 2003 was a dry year, the creek became intermittent in the area of the Templeton Cow Camp, and no trout were present in the area of the Strawberry Connection.

Task 1.2t - Revise the CDFG Kennedy Meadows catchable non-native trout stocking program. Only sterile triploid catchable-size rainbow trout were stocked in Kennedy Meadows in 2004.

Task 1.2u – Assess the need for an additional barrier downstream of the Schaeffer Barrier. No action in 2004.

OBJECTIVE 1.3: STRATEGIC PROGRAM MANAGEMENT

Task 1.3a - Conduct annual coordination meetings among the involved agencies; modify management tasks based on new genetic and habitat information; produce annual reports of expenditures, major findings, and accomplishments; and develop and secure the budget for the coming year. The annual inter-agency coordination meeting was held on March 2, 2004. The final editing was completed on the Conservation Assessment and Strategy for the California Golden Trout prior to the signing of the inter-agency MOU.

Task 1.3b - Review and update the Implementation Plan. The Plan was reviewed and updated at the coordination meetings. The Conservation Assessment and Strategy for the California Golden Trout was formally adopted by the cooperating agencies on September 17, 2004.

Task 1.3c – Review of management direction. No action in 2004.

GOAL 2: IMPROVE RIPARIAN AND INSTREAM HABITAT FOR THE RESTORATION OF CALIFORNIA GOLDEN TROUT POPULATIONS

OBJECTIVE 2.1: EVALUATE HABITAT RESTORATION EFFORTS AND NEEDS

Task 2.1a - Evaluate and document the success of past habitat restoration efforts. This process has been initiated by the Hydrologic Technician on the Inyo National Forest.

Task 2.1b - Evaluate opportunities for future watershed restoration efforts within SFKR and GTC watersheds. Several areas were identified for headcut restoration within the Golden Trout habitat, including headcuts in the west Mulkey Stringer and maintenance in the Olivas Spring area, willow planting in the Ramshaw Meadow area and fencing opportunities in the Bullfrog Meadow area.

Task 2.1c - Monitor habitat changes in Templeton and Whitney allotments during 10 year grazing hiatus. This monitoring strategy incorporates several protocols for assessing the rate of recovery of the trout habitat in grazed and grazing-suspended allotments. Monitoring was continued in the below listed activities.

Stream Monitoring using modified-SCI Protocol. Monitoring continued this year on several steam reach segments as directed under the Appeal Decision notice from the Whitney and Templeton Allotment Decision. The following streams were surveyed in 2004 using the modified Stream Condition Inventory protocol:

Bullfrog (tributary to Mulkey Creek) (1.10 miles)
South Fork Kern River at Tunnel Meadow (1.82 miles)
South Fork Kern River through Monache Meadows (3.82 miles)

These surveys will be used with previous and future year's surveys to compare the recovery of important fish habitat components within the stream. This data will show the trend and rate of recovery between streams with continued cattle grazing, and those where cattle have been removed. Data was input into Excel spreadsheets for statistical analysis using the Kalidagraph program. At this point it is too soon to see a trend towards recovery. These surveys will be continued in 2005.

Stream Condition Inventory (SCI). This monitoring protocol looks at the hydrological functionality of the streams within the watersheds. It is also a component of the Monitoring Plan for the Whitney and Templeton Allotments grazing decision. The activities conducted in 2004 included locating and recording the plots where SCI is conducted. The data for these plots will be collected in 2005.

One problem with this type of data collection is that the exact location for replication of the data is critical to the quality and accuracy of the results. When new people are hired to collect the data, it takes extra time to re-locate those areas. Casey Shannon located and marked many of the plots in 2004 so that they can be easily found and efficiently organized to collect the data in 2005.

Vegetative Rooted Frequency and Riparian Habitat: This monitoring is being conducted out of the Regional Office and will be continued in 2005.

Macro-invertebrate monitoring: This monitoring was sponsored out of the Regional Office in 2004.

Task 2.1d - Monitor the effectiveness of best management practices that could affect California golden trout habitat. A number of "best management practices" are typically implemented in association with any activity occurring on the forest. There were no activities in 2004 to apply these management practices.

Task 2.1e – Monitor stream water temperatures to document possible changes over time. CDFG has been continuously monitoring temperatures at points in the SFK and GTC watersheds in 2004.

Task 2.1f – Complete roads analysis in SFKR watershed including CDFG property. No action in 2004.

Task 2.1g - Monitor Fish Creek habitat. The streambank disturbance survey was completed at Smith Meadow in the fall of 2004, using the trample-chisel protocol used the previous year. Disturbance was at 10%. The Stream Condition Inventory reach was established for Fish Creek in Smith Meadow in 2004. This involves establishing cross sections, a longitudinal profile, evaluating bank stability, particle size, stream shading, abundance and size distribution of woody debris, fines in pools, amount of slow and fast water habitats, etc.

Task 2.1h - Monitor and evaluate the effects of beaver to the California golden trout within the SFKR and GTC. Field observations were taken at the beaver dams in Ramshaw Meadow and Golden Trout Creek in September, 2004. Their impacts to trout habitat and appropriate measures for the management of the beavers for the benefit of the trout were discussed.

Task 2.1i - Assist CDFG's Wildlife Management Division with the completion of a Monache Wildlife Area Management Plan. No action in 2004.

OBJECTIVE 2.2: RESTORE DEGRADED HABITATS

Task 2.2a - Implement watershed restoration opportunities as appropriate. No action in 2004.

Task 2.2b - Consider habitat monitoring results in grazing allotment re-issuance. Data is being collected at this time under 2.1c for this effort.

Task 2.2c - Prevent water transfers from non-native water bodies into golden trout waters. The fire-plan was completed in 2004 for both the Inyo and Sequoia National Forests, and is currently in effect to control the use of water transfer in golden trout habitat. CDFG and Sequoia NF biologists monitored the progress of a fire use fire in the Monache Meadows area, and provided recommendations to the fire management staff on water drops.

Task 2.2d - Continue habitat improvement on CDFG Property in Monache Meadows. CDFG is continuing to implement activities to improve riparian habitat on their property in Monache Meadows. Cattle exclosure fencing was put back in place and metal locking gates were installed by CDFG, INF and volunteers June 19-20. On the weekend of October 9-10, the agencies and volunteers returned to take the fences down for the winter.

Task 2.2e - Investigate the acquisition of private property from willing sellers with the purpose of habitat improvement. No action in 2004.

Task 2.2f - Re-route access roads through INF into CDFG property outside the riparian zones. No action in 2004.

GOAL 3: EXPAND EDUCATIONAL EFFORTS REGARDING CALIFORNIA GOLDEN TROUT RESTORATION AND PROTECTION.

OBJECTIVE 3.1: EXPAND PUBLIC EDUCATION ABOUT THE CALIFORNIA GOLDEN TROUT STATUS AND CONSERVATION NEEDS.

Task 3.1a - Inform the public about proposed and planned management actions. This process is ongoing.

Task 3.1b - Conduct an annual coordination meeting with stakeholders. The annual meeting was held March 3, 2004.

Task 3.1c - Produce an annual forest user's brochure. A simple annual forest user's brochure will be produced annually informing the public of current California golden trout management activities. This was started in 2004, and should be completed with 2005 activities by the end of April 2005.

Task 3.1d - Develop a golden trout web page and update it annually. No action in 2004.

Task 3.1e – Produce and distribute full-color California golden trout brochure. INF and CDFG collaborated with Cal Trout and Trout Unlimited to utilize Orvis grant funding to complete and distribute a full-color brochure in July 2004.

Task 3.1f - Build additional educational kiosks on the California golden trout. No action in 2004.

Task 3.1g - Produce additional Kern Basin native trout distribution maps. A design was drafted by SQF in 2004, but the design has not been finalized.

OBJECTIVE 3.2: ENFORCE STATE FISH AND GAME LAWS TO PROTECT CALIFORNIA GOLDEN TROUT.

Task 3.2a - Work with Wildlife protection and USFS law enforcement personnel to enforce resource laws. This task has been ongoing.

Task 3.2b - Ensure angling regulations are posted at key public access locations. Angling regulations are posted in areas where fishing is allowed and appropriate.