

FISH POPULATION RECOVERY FOLLOWING CHEMICAL TREATMENT OF STREAMS

Eric R. Gerstung
California Department of Fish and Game
Grass Valley, California

Abstract. In order to obtain information regarding the length of time required for trout and nongame fish to repopulate decimated stream sections following fish kills or chemical treatment, fish population data were collected during and at periodic intervals following chemical treatment of the North Fork Feather River and of Sutter and Silver King Creeks.

Wild trout populations reached pretreatment levels without restocking in from 1 to 5 years. Trout populations recovered most quickly in the N. F. Feather River below Rock Creek Dam, where within one year heavy recruitment from yearling rainbow trout (Salmo gairdnerii) drifting down some 20 miles of tributaries increased the biomass of rainbow trout to a level three times greater than the pretreatment population.

In Sutter and Silver King Creeks, where only limited trout numbers existed upstream from the treatment area, fish repopulation appeared to be much slower. In Silver King Creek, a high elevation meadow stream, the wild trout biomass of Piute trout (Salmo clarkii seleniris) reached pretreatment levels within 3 years, while numbers of adult trout did not reach pretreatment levels until after 4 years.

In Sutter Creek, a low elevation stream, the wild rainbow trout biomass did not reach pretreatment levels until the fifth year, while numbers of wild adult rainbows reached pretreatment levels within two years.

INTRODUCTION

Although the California Department of Fish and Game has chemically treated several hundred miles of streams for rough fish control purposes during the last two decades, few evaluations have been made and little has been published regarding game fish population changes following treatment, nongame fish reinfestation time, or the relative costs and benefits of treatment programs. Notable examples of treated California streams include the Russian, Merced, Kings, and Kaweah Rivers and Spanish, Putah, and Hat Creeks. From the limited information recorded, several years of improved angling success were reported to have occurred in several of these streams; i.e., Russian River, Kings River (Pintler and Johnson, 1958; von Geldern, 1961). Rough fish eventually returned to former levels of abundance in all treated streams with the exception of Hat Creek, which is still under study.

In order to evaluate the effectiveness of chemical treatment programs and determine year to year fish population trends, three streams were selected for study: Silver King Creek, Alpine County; Sutter Creek, Amador County; and North Fork Feather River, Plumas County. Fish population data were collected during chemical treatment and at periodic intervals following treatment.

METHODS

Fish population data were collected from measured study sections blocked off at each end by one-eighth-inch mesh stop nets. All dead fish in the study section were picked up during chemical treatment. During later surveys of the study sections, fish were generally collected with a direct current electric shocker. Efforts were made to collect all fish over 2 inches long. Those collected were weighed, measured, and returned alive to the study section.

RESULTS

Trout population recovery rates following chemical treatment were measured in Silver King Creek, a high elevation meadow stream; Sutter Creek, a small, low elevation west slope Sierra stream; and in North Fork Feather River below Rock Creek dam, a stream severely altered by power development.

Silver King Creek Trout Repopulation

The upper reach of Silver King Creek, with the exception of two small tributaries, was chemically treated in 1964 to remove accidentally introduced rainbow (Salmo gairdnerii) and cutthroat trout (Salmo clarkii henshawi), which threatened to displace or hybridize the rare and endangered native Piute trout (Salmo clarkii seleniris). No nongame fishes were involved. Angling before 1964 kept the unwary Piute trout at a relatively low level of abundance: 8 lbs/acre in 1964.

The treated area has been closed to fishing since 1965 to protect the Piute trout. A 240-ft-long study section was established within the lower portion of the treated area; it was sampled by shocking in 1968, 1969, 1970, and 1971.

Although Silver King Creek was not surveyed during the first three years following treatment, angling results and visual observation indicate that trout were relatively scarce until 1969. Following the fourth year, trout population growth accelerated as the trout biomass increased from 15 lbs per acre in 1968 to 63 lbs per acre in 1971.

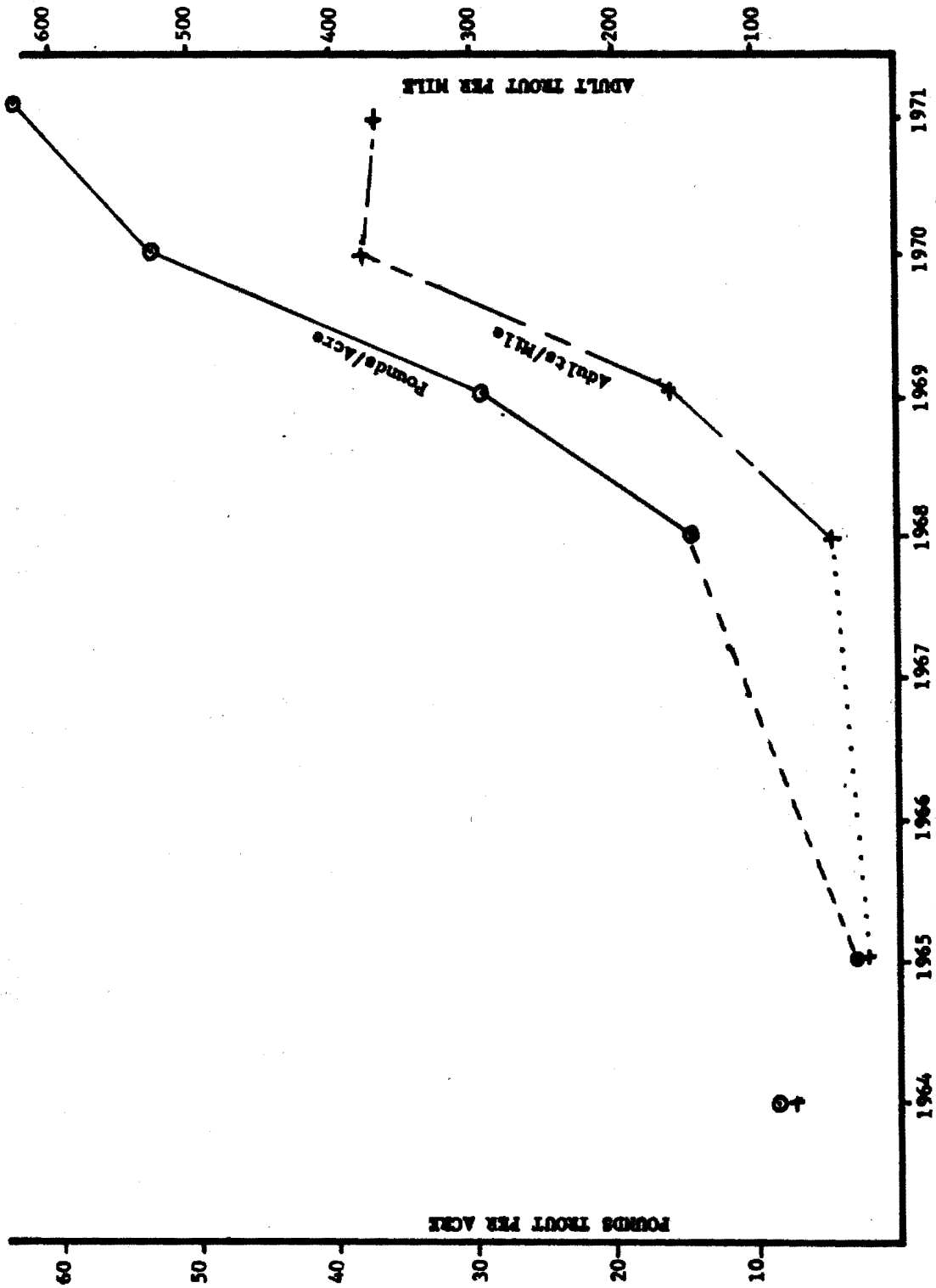
Table 1. Trout population recovery in Silver King Creek

<u>Year</u>	<u>Lb Trout/Acre</u>	<u>Total Trout/Mile</u>	<u>Adults/Miles</u>
1964	8 (before treatment)	182	67
1965	3 (transplants)	30	20
1968	15	440	44
1969	30	560	154
1970	54	794	394
1971	63	550	352

The trout biomass reached pretreatment levels after about three years. Numbers of adult trout were not observed to reach pretreatment levels until about the fifth year following treatment. The rate of population increase peaked during the fifth and sixth years following treatment. Population growth leveled off in 1971 (Figure 1).

Despite the fact that a small transplant of Piute trout was made within the treated section in 1965, most of the recruitment of Piute trout within the treated area could be attributed to the downstream movement of trout from two untreated tributaries with about a mile of occupied habitat. Evidence of reproduction, a few fry, was not observed within the treated area until 1970.

Figure 1 TROUT POPULATION RECOVERY IN SILVER KING CREEK FOLLOWING 1964 TREATMENT



Sutter Creek Trout Population Recovery

In the case of Sutter Creek, the wild rainbow trout population took slightly longer to reach pretreatment levels (about 5 years) than did the Silver King Creek trout population. On the other hand, the recovery of the total trout biomass to a pretreatment level of 40 lb/acre occurred by about the third year following treatment, based on a projected straight line recovery rate from 1967 to 1970 surveys. No measurements were made in 1968 or 1969. The rapid biomass recovery probably resulted from a successful brown trout (Salmo trutta) plant made in 1967, which made up over one-third of the standing crop during the 1967 and 1970 sampling periods (Figure 2).

Sutter Creek, excluding 11 miles of headwater tributaries containing fish, was treated in 1965 at the request of local sportsmen who were concerned over the presence of western roach (Hesperoleucus cymmetricus). Although the number of adult wild rainbows per mile reached pretreatment levels within two years, the rainbow trout biomass did not reach the pretreatment level of 33 lb/acre until 1970.

The total number of rainbow trout per mile had not yet approached pretreatment levels in 1970. A shortage of young rainbows (low recruitment) and competition from planted catchable-sized brown trout may have been responsible for the slow rainbow trout increase. Since no rainbow trout were planted in the study area following chemical treatment, all rainbow recruitment is believed to have originated in the untreated upstream tributaries. Catchable-sized brown trout were planted in lower Sutter Creek during the spring of 1967 and migrated up into the study area, where they were still present three years later.

Table 2. Fish Population Changes in Sutter Creek Following the 1965 Chemical Treatment

Year	Lb Fish/Acre				Adult Rainbow Trout/Mile	Total Rainbow Trout/Mile
	Roach	Brown Trout	Rainbow Trout	Total Trout		
1965	11	6	33	39	160	1,786
1967	4	11	16	27	208	728
1970	6	17	33	50	234	994

The above data indicate that although roach quickly reinfested the study area, they have not reached pretreatment levels of abundance.

In warmer downstream reaches of Sutter Creek, where there are few trout, roach appear by visual observation to be as abundant as they were before the 1965 treatment. The slight improvement in the Sutter Creek trout population might be attributed more to the catchable brown trout plants than to the chemical treatment program which was of questionable benefit.

North Fork Feather River Trout Repopulation

Wild trout population recovery occurred much faster in the treated section of North Fork Feather River than in Sutter or Silver King Creeks. The post-treatment wild rainbow trout population reached and exceeded pretreatment levels in less than one year. Apparently large numbers of young rainbow drifted in from the 20 miles of tributary streams immediately adjacent to the study area and quickly repopulated the unoccupied fish habitat. The rainbow were all about eight inches long during the fall of 1967 and hence likely entered the river as yearlings during the spring runoff.

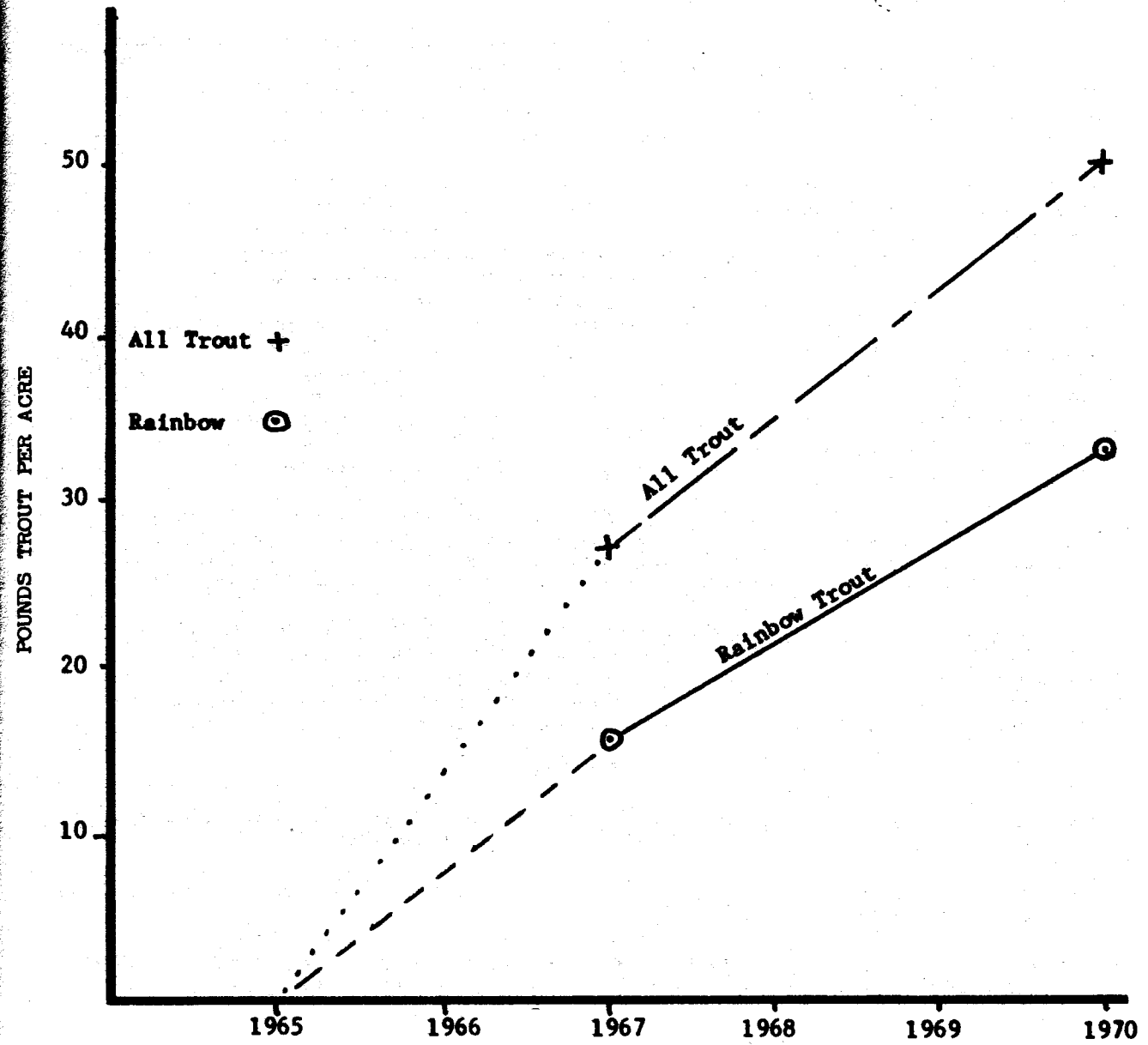
DISCUSSION

The treatment of an 8-mile-section of the North Fork Feather River between Rock Creek Forebay and Cresta Forebay in 1966 produced some very interesting results.

Before 1950, North Fork Feather River downstream from the Rock Creek Dam site was a large, fast-flowing stream containing a trophy rainbow trout fishery. When Rock Creek Powerhouse was completed, minimum flows were reduced from an average of 1,500 to 100 cfs. Rough fish

Figure 2

TROUT POPULATION RECOVER IN
SUTTER CREEK FOLLOWING 1965 TREATMENT



proliferated in the long, quiet pools and newly created forebays. By 1955, angling had become mediocre despite large plants of catchable trout. A creel census that year revealed angling success for the season averaged only 0.23 trout per hour (Rowley, 1955). Less than 10% of the planted catchable trout were returned to the angler.

In 1966, when the section was chemically treated, the trout biomass was only 3 lb/acre, while rough fish totaled 522 lb/acre. Following chemical treatment the stream was replanted with 19,000 brown trout fingerlings, 2,500 brown trout subcatchables (8 inches average), and 7,000 marked rainbow fingerlings. Creel checks in 1967 revealed that angling success improved considerably, averaging 1.0 trout per hour.

The stream was chemically treated again during the fall of 1967. Analysis of data collected from study sections established in 1966 indicated that the trout biomass has increased from 3 lb/acre to 20 lb/acre within a year; a sixfold increase. Even if we exclude the planted brown trout, which accounted for half of the biomass, enough wild rainbow trout drifted into the treated section to produce a biomass of 10 lb of trout per acre.

The carrying capacity of the river for wild rainbow production appears to be considerably greater and perhaps could be reached for a few years prior to rough fish repopulation. For example, in 1970 a trout population of 60 lb/acre was recorded in a section of North Fork Feather River below Almanor Dam containing few rough fish. On the other hand, only 30 lb trout/acre was recorded in river sections at Seneca and Caribou, where rough fish numbers exceeded 200 lb/acre. None of the rainbow trout from the marked fingerling plants were observed during the 1967 treatment. In contrast, an estimated 7% of the brown trout fingerlings survived and reached an average length of 9 inches within a year. Rough fish, though not completely eradicated, totaled 11 lb/acre one year following the 1966 treatment. In 1966 the rough fish biomass consisted of 93% suckers. In 1967, the biomass of suckers declined to 27%, sculpins nearly disappeared, and the percentage of hardheads and squawfish increased substantially (Figure 3). The tremendous sucker population prior to 1966 may have inhibited production of hardheads and squawfish, as well as of trout.

No fish were planted in the river following the 1967 treatment. Despite this, angling was good in 1968 and 1969. For example, 52 anglers checked in August of 1969 (a poor fishing month) fished 80 hours and creeled 55 trout, a catch per hour of 0.7 fish. The fish caught were wild rainbow trout which had drifted down from untreated tributaries.

The North Fork Feather River chemical treatment cost about \$600 for materials, labor, and incidentals. During the 2-year period following the 1967 treatment, an estimated 3,000 anglers caught at least 3,000 trout, largely rainbows. Based on the 10% catchable trout return observed in 1955, a catchable plant of 30,000 rainbows costing \$6,000 would be required to provide the same catch if the stream section had not been treated.

LITERATURE CITED

- Pintler, H.E., and W.C. Johnson. 1958. Chemical treatment of rough fish in the Russian River drainage, California. Calif. Fish and Game, 44(2):91-124.
- Rowley, W. 1955. 1954 creel census, North Fork Feather River. Calif. Dept. Fish and Game, Inland Fish. Admin. Rept. (55-9):16 p.
- von Geldern, C.E., Jr. 1961. An experiment concerning the natural mortality of catchable-sized rainbow trout. Calif. Dept. Fish and Game, Inland Fish Adm. Rept. (61-14):9 p.