

CALIFORNIA WILD TROUT MANAGEMENT PROGRAM
COTTONWOOD CREEK WILD TROUT MANAGEMENT PLAN
INYO COUNTY

Prepared by

California Department of Fish and Game

with assistance from

and

in cooperation with

U.S. Forest Service
Inyo National Forest

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TABLE OF CONTENTS

	Page
PREFACE	
INTRODUCTION	
RESOURCE STATUS	
General Setting	
Access	
Land Ownership	
Fishery Description	
FISHERIES MANAGEMENT PROGRAM	
Early History	
Golden Trout Egg Source	
Lake and Stream Management	
Angling Regulations, Limited Harvest, and Population Dynamics	
Angler Reaction to More Restrictive Regulations	
Monitoring Program	
Land Use Management	
Water Development	
Philosophical Aspects	
MANAGEMENT PROGRAM	
Program Goals and Management Objectives	
Management Direction	
LITERATURE CITED	
APPENDIX	
A list of references pertaining to the California golden trout	
Table 1. Cottonwood Creek Flow Records	

Table 2.	Cottonwood Lakes Egg Production
Table 3.	Summary of Angling Regulations
Table 4.	Golden Trout Monitoring, 1980
Figure 1.	General Location Map
Figure 2.	Sampling Stations
Figure 3.	Longitudinal Stream Profile
Figure 4.	Mean Monthly Flow
Figure 5.	Land Classification
Figure 6.	Probable Supply and Demand Trends

PREFACE

In 1966, the Department of Fish and Game in the California Fish and Wildlife Plan recommended expansion of trout management activities to "protect and enhance wild trout fisheries." In response to this recommendation and to concerns expressed by the public, the California Wild Trout Management Program was established by the California Fish and Game Commission in 1971. The primary purpose of the program is to preserve attractive stream trout fisheries which are not naturally sustained by wild strains of trout rather than artificially sustained by domesticated, catchable-sized trout stocked on a put-and-take basis. Emphasis is placed on protecting the aquatic environment to perpetuate natural production and on preserving the natural character of the streamside environment to provide a quality angling experience.

Since 1971, the Fish and Game commission has designated twelve trailside and seven roadside streams as wild trout streams. In addition, Martis Lake (Nevada and Placer counties) was added in 1974. Each wild trout water is to have its own management plan and regulations which will emphasize individuality and diversity.

The Cottonwood Creek management plan is an in-house document written to identify the Department of Fish and Game's activities within the Cottonwood basin, including the management direction to be taken in coordinating with agencies responsible for

environmental protection. all land use planning is the ultimate responsibility of the u. s. forest service. as stated in the memorandum of understanding between the department and the forest service, the department will identify management direction intended to preserve and protect wildlife resources in national forests, and the forest service will recognize the department's responsibilities and concerns along with those of the other users of the forest in their multiple use planning.

INTRODUCTION

The management of a threatened species per se is a relatively new concept in fisheries science.* Whereas highly restrictive regulations must be imposed to assure the perpetuation of certain fishes, in others circumstances it is possible to allow innovative uses of the fishery resource without adding to the threat of endangerment. Such is the case with the californian golden trout (Salmo aguabonita Jordan) in both its area of origin (the upper Kern River system of Tulare County) and the adjacent Cottonwood Creek drainage of Inyo County. The details of the evolutionary origin of this magnificent fish are a matter of conjecture (Schreck and Behnke 1971) and are left for the reader to investigate at his discretion. It should be sufficient to indicate that the golden trout is generally believed to have evolved in post-Pleistocene times in the waters of the upper Kern River system, has been proclaimed as California's state fish, and is worthy of special management consideration both in the Kern Plateau and in Cottonwood Creek, where it was introduced in 1876.

*Although the golden trout as a species is not generally considered threatened, it is most certainly threatened in its area of evolutionary origin in the upper Kern Plateau and, to a lesser extent, within the upper Cottonwood Creek Basin of Inyo County, the lakes of which supply eggs for the Department's hatchery and management programs.

Increased use of the Cottonwood Basin was coincidental with the development of the Department's wild trout management program. The implementation of wild trout management concepts for Cottonwood Creek, and its ultimate designation as a wild trout stream by the Fish and Game Commission, were logical measures to be adopted as a means for providing a valuable use of the golden trout while serving to assure its perpetuation and conservation. This plan presents the background, development, and results of wild trout management to date and suggests future management as the inherent values of wild trout management philosophy become apparent to California's angling public.

RESOURCE STATUS

General Setting

The Cottonwood Creek Basin is located within the Inyo National Forest in the extreme southern Sierra Nevada about 15 miles southwest of Lone Pine, Inyo County (Figure 1). The basin is surrounded by the southernmost major peaks of the Sierra crest, dominated by Mt. Langley (elev. 14,042 feet) and Cirque and Trail peaks (Figure 2). The drainage system begins in the snowfields gracing the uppercrest, includes a series of 13 lakes in the extreme upper basin, and comprises two main forks which join together not far above Golden Trout Camp. The Fish and Game Commission designation, enacted in 1972, establishes the wild trout area as Cottonwood Creek and its tributaries above the confluence of Little Cottonwood Creek, a distance of about 10

stream miles. As such, the wild trout section includes the more level portions of the stream in the upper basin.

Leaving the lowermost lake at an elevation of about 11,000 feet, Cottonwood Creek flows through alternating meadow and lodgepole and foxtail pine forest before plunging precipitously to the floor of the Owens Valley over a mile below (Figure 3).

The stream is relatively small (5 to 20 feet in width) and exhibits a flow pattern typical of east-slope streams. Mean monthly stream flows from August through March have ranged between 5.7 and 8.5 cfs. Runoff starts in April and peaks in May with a mean flow of approximately 36 cfs (Table 1, Figure 4).

Winter conditions are severe, with ice and snow generally appearing in November. Summer climate is mild, with daytime temperatures in the sixties and dropping to near freezing at night. Occasional thundershowers occur, generally during July and August. Water temperatures range annually from the low sixties on a summer afternoon to a fraction above freezing during the winter. Diurnal water temperatures fluctuate several degrees in the summer and show practically no change during periods of ice and snow cover.

The streambed comprises glacial till ranging from sand in eddies and pools through various sizes of gravel up to larger boulders. An average riffle section comprises gravels and rubble from

one-half inch to three inches in diameter. Spawning normally occurs in deposits of smaller gravel.

Riparian vegetation, other than conifers, consists primarily of alpine grasses and willow.

Water quality is relatively sterile, reflecting typical high basin runoff characteristics from a predominantly granitic alluvial substrate. Virtually no change in quality would be expected between the upper and lower boundaries of the wild trout section.

Access

Southern Inyo interests were successful during the early 1960's in convincing the County Board of Supervisors that a road into the upper Cottonwood Basin would significantly improve a depressed local economy. Surveys were conducted, bids were issued, and (over the strong objections of local fisheries personnel and milder objections at the more political levels) the road was completed in 1967 and opened to unrestricted public use in the following year. In anticipation of this (and out of fear of increased use from additional development within the basin), the Fish and Game Commission in 1966 closed Lakes 1-4 to all angling. To establish a baseline of angling pressure effects, trout population sampling stations were established along Cottonwood Creek between the lakes and the roadhead (Figure 2).

Fears of increased visitor (and angler) pressure within the basin were real, and use jumped from an estimated 500 visitor days in 1967 to over 50,000 in the following year.

Studies of the feasibility of a ski development were conducted during this general period which, unfortunately for proposed developers, issued in the era of the environmentalist, the National Environmental Policy Act, and similar laws at the state level. For a variety of reasons, the ski development never materialized, but the road remains today, exemplifying Aldo Leopold's observation that "Recreational development is a job not of building roads into lovely country, but of building receptivity into the still unlovely human mind" (Leopold 1949).

Depending upon the extent of winter snowfall, the road generally opens to the roadhead in June and remains open until the first significant winter storm, normally in late October or early November. The road provides major access to the Pacific Crest Trail and the upper Kern River over Mulkey, Trail and Cottonwood passes and is advertised as such by the U. S. Forest Service. Trails also lead from the roadhead to the upper Cottonwood Basin, and over Army Pass to Sequoia National Park (Figure 2).

Under the newly adopted Golden Trout Wilderness Management Plan, the minimal campgrounds currently in existence in the area of the pack station will be abandoned. They will be replaced by sanitation facilities and traffic controls as necessary to

prevent deterioration at trailheads. Parking facilities and separate campground areas for backpackers and equestrians, and a new pack station, will be constructed in the area near the roadhead.

Land Ownership

The vast majority of the Basin is administered by the Inyo National Forest. Certain lands along the road and within Horseshoe Meadows are owned by the City of Los Angeles, presumably for potential hydroelectric development. Other than privately owned building sat Thacher Camp, there is no private property within the upper Cottonwood Basin (Figure 5).

Fishery Description

Native Fishes

There are no native fishes in the upper basin of Cottonwood Creek and no native salmonids anywhere in either the Owens River or Pluvial Death Valley drainage area of which the Owens is a part. Native fishes in the Owens River system below the barriers presented by the eastern escarpment include the Owens chub (Gila bicolor snyderi), Owens sucker (Catostomus fumeiventris), Owens dace (Rhinichthys osculus ssp.) and Owens pupfish (Cyprinodon radiosus). Any fishes which might have invaded the upper reaches

of the stream in pre-Pleistocene times would have been eradicated by ice during the various Pleistocene glacial periods.

The only fish species present in the wild trout section is the golden trout (Salmo aguabonita Jordan), which was introduced into Cottonwood Creek in 1876 (see Early History). Abundance ranges from relatively low in the lower stream accessible by road to near maximum carrying capacity in the less accessible headwater areas.

FISHERIES MANAGEMENT PROGRAM

Early History

The Civil War was still fresh in his memory when Colonel Sherman Stevens moved west and, in 1873, built a sawmill in the upper reaches of Cottonwood Creek, Inyo County (Pister 1964). It perplexed him, at the end of a hard day of hauling and milling the foxtail and lodgepole pine logs which supplied the life blood of Cerro Gordo's mines, that the beautiful stream powering his mill could not also provide him and his crews with an occasional platter of trout. Their usual austere fare had to be transported by pack train for over 20 miles, and up 5,000 feet, from Lone Pine in the southern Owens Valley.

His quest for saw logs had taken him southwest over the low divide separating Cottonwood Creek from the small tributaries

feeding the South Fork Kern River, where he marvelled at the small, canary-colored trout which abounded there. It then became only a matter of time until, in the company of A. C. Stevens and Thomas George, Colonel Stevens journeyed to Mulkey Creek, where the Hockett Trial enters Mulkey Meadow, and caught 13 trout with hook and line. This was in July, 1876.

After a short journey (about 4 miles) over the Hockett Trial in a coffee pot, 12 fish (1 died in transit) were planted about a mile above the sawmill. They found an abundance of food and an ideal habitat in barren Cottonwood Creek, and they thrived there. In 1879 Colonel Stevens and Judge A. C. Harvey of Lone Pine caught a string of eight-inch fish from Cottonwood Creek, one of the first of countless catches which have been taken since the initial introduction.

In 1891, a small branch of Cottonwood Creek was diverted from its channel, and about 1900 fish were collected and taken upstream past barrier falls about 2 1/2 miles to the Cottonwood Lakes. Although perhaps only 50 survived the journey, the golden trout population flourished in the lake habitat, and Evermann (1905) and McCloud (1943) reported trout up to six pounds being taken from the basin's lakes. Evermann (1905) reports the above events in detail.

Golden Trout Egg Source

In 1918, the California Fish and Game Commission began to utilize Lakes 1-4 to provide eggs for rearing at its Mt. Whitney Hatchery. An average of over a million were taken annually in the decade from 1929-1938, at which time a disease outbreak seriously decimated the populations (McCloud 1943). Spawning operations at the Cottonwood Lakes ceased during World War II and were not resumed until 1953. A summary of Cottonwood Lakes egg production is presented in Table 2.

Golden trout reared from eggs taken at the Cottonwood Lakes are planted by air in over 200 lakes ranging from the southern Sierra to the Trinity Alps. In past years some were planted back into the Cottonwood lakes. This practice has been discontinued, inasmuch as natural reproduction is normally adequate to sustain the population, especially in the lakes closed to angling.

Lake and Stream Management

No precise data are available concerning the populations in the lakes open to angling, but our observations, based upon interviews with anglers, indicate a high degree of angler satisfaction. The concept of limited harvest is very important in the management of Cottonwood Creek's trout population. There is little question that the best thing we can do to preserve a species is to acquaint the public with it, get them to appreciate

it, and then let them know how easily it could be lost without proper management restrictions. What we have to do at Cottonwood Creek, then, is carefully equate angling pressure with the ability of the resource to absorb it, allowing anglers to catch a few fish and appreciate them without going past the harvestable surplus.

With the implementation of the DFG wild trout program, the Cottonwood Basin seemed an ideal area to try this concept as a means of protecting a unique resource in a unique area and under unique conditions. Already the Cottonwood Lakes closure was paying dividends in terms of golden trout eggs, which climbed from a 1956-65 average of less than 600,000 eggs to its current level, utilizing only a fraction of available spawners (Table 2)*.

However, the Cottonwood Creek sampling program implemented in 1969 revealed rapidly declining numbers of trout throughout the length of the stream, with the roadhead populations being virtually eradicated. Tightened angling regulations began to change this trend and, as they were made even more restrictive, the overall picture began to improve

*Surplus fish are sometimes moved to nearby lakes open to angling. A gill net survey during the fall of 1976 revealed the mean condition of the various populations to be approximately that measured by Curtis (1935) over 40 years earlier.

Angling Regulations, Limited Harvest, and Population Dynamics

The golden trout population in upper Cottonwood Creek, Inyo County, comprises one of California's most valuable resources. Increased angler use, resulting primarily from the completion of the Horseshoe Meadow Road in 1968, caused the Fish and Game Commission to close to angling four major lakes to protect the State's historic golden trout egg source. As angling pressure within the basin increased, it became necessary in 1970 to restrict the catch throughout the basin by imposing a reduced creel limit. Additional restrictions, implemented later, include a six-inch minimum size limit in 1972, artificial flies with barbless hooks in 1974 and, more recently, lures with single hooks. Wild trout designation was adopted in 1972 for the drainage above the confluence of Little Cottonwood Creek. Following removal of the minimum size limit in 1974, both lake and stream populations responded well to the various regulations and are currently thriving. Public response to the status quo has been enthusiastic. Objectives of the plan include creating a public awareness of the aesthetic values of the golden trout and promoting the desirability of a quality angling experience in preference to a full creel. Acceptance of both concepts by the public is necessary if we are to successfully meet the demands on the resource which the future will almost inevitably impose.

Current regulations for the basin are: Season open from July 1 through October 31, artificial lures with single, barbless hooks only, limit five fish. Cottonwood Lakes 1-4 and their tributaries are closed to all fishing. A chronology of regulations since 1966 is presented in Table 3.

Limited harvest is also desirable from the standpoint of reducing the strong tendency of an unharvested golden trout population to stunt. In 1972, in order to "standardize" regulations in the upper Kern Plateau-Cottonwood Basin areas, a six-inch size limit was enacted. Unfortunately, there was no biological basis for this recommendation, which was no doubt a well intended attempt to allow the "little ones to grow up" before being caught. However, with the abundance populations which had built up through the years in upper Cottonwood Creek, it was virtually impossible for a trout to attain a length of even six inches.

To provide this point, in 1973 a Region 5 electrofishing crew sampled upper Cottonwood Creek in eight different test sections ranging from the stream crossing about one mile below Golden Trout Camp downstream for about 20 miles to the campground across from the pack station.

Of 321 trout collected, only 16 (5 percent) were 7 inches in length or greater. A random sample of 138 revealed a mean total length of 4.5 inches. Only 6 of 138 (4.3 percent) were 6 inches in length or greater. A sample of 21 fish between 5.0 and 5.9

inches was examined for sexual maturity. Of 14 males examined, 8 were sexually mature; of 7 females, 6 were sexually mature.

We noted the usual decrease in population density as we worked downstream. Whereas 68 trout were taken in the uppermost (150 foot) stream section, this number decreased to 24 in a 200 foot section adjacent to the campground.

A similar electrofishing survey was conducted in 1969, at which time a total of 358 trout was collected. The 1973 population was found to be very similar to that encountered in 1969, with numbers very low and fry virtually nonexistent in the roadhead areas. Recruitment was believed to be almost entirely from upstream locations. Again in 1980, population monitoring revealed a tendency for both trout density and mean length to increase proportional to the distance from the roadhead (Table 4). It seems reasonable to assume that this situation will persist under existing regulations.

The increase in size which often accompanies reduced competition for food and space was dramatically illustrated during a brown trout eradication project in the South Fork Kern River at Tunnel Meadows above Ramshaw Falls. During September 1976 all trout were eradicated for a distance of about 10 miles and the stream was restocked with 3,000 goldens averaging between 3-4 inches, fork length. We estimated that we had reduced the population by at least 10,000 fish, and probably far more.

In August 1977 we returned to Tunnel Meadows and found that, in less than a year, the mean length of the restocked golden trout had nearly doubled, and 7-8 inch fish were common instead of the very rare exception. Size limits, like any other regulation, must have (or should have) a sound biological basis as a condition of adopting and implementation. The ineffective size limit regulation was removed in 1974.

The value of the closure of Cottonwood Lakes 1-4 has already been discussed, and it is our observation that the five trout limit is successfully equating angling pressure with the productivity of the nine lakes remaining open to angling. More recently, the implementation of the "barbless lures only" provision has strengthened this situation, and we feel that, under existing use, both lake and stream population are stabilizing.

Angler Reaction to More Restrictive Regulations

During the course of a joint fishery evaluation and angler opinion study conducted in the Cottonwood Basin in 1969 (Pister 1969), 332 anglers were asked to state their reaction to a possible limit reduction. The specific question posed to them was: "Would you return to fish in this basin if the limit were reduced to five (5) golden trout?" Of this number, 206 (62 percent) were definitely in favor of a reduction and would return, 65 (20 percent) were opposed to a reduction and would not

return, and 61 (18 percent) either did not care or expressed no opinion.

What this said to us was that 62 percent of those interviewed were already sold on wild trout concepts, and that 18 percent certainly were not opposed to them. Our challenge lies in convincing the remaining 20 percent who opposed the reduction of the limit to 5 that it is worth catching a golden trout for reasons more profound and sophisticated than simply to fry it for breakfast. The five trout limit was implemented in 1970. It is our feeling that the implementation of a "Zero Limit" regulation should be seriously considered for those areas of the basin where stunting is least likely to occur.

It is time that we took a hard look at the future and realized that non-consumptive management is not just an innovative and nice thing to do. It is absolutely essential if we are to pass on a meaningful fish and wildlife resource to future generations (Pister 1976). In other words, there is only so much harvestable fish and wildlife, and when that is gone the demand for fish and wildlife oriented recreation must be met in some other way. Figure 6 points this out very graphically.

Monitoring Program

In order to monitor the status of the various golden trout populations within the Cottonwood Basin, a series of sampling

stations (Figure 2) was established in 1969. These stations were electrofished sporadically until 1978, at which time a new series of stations was established. Data from the most recent (1980) monitoring effort are included in Table 4 and in the appendix. Current plans call for the Cottonwood Creek stations to be monitored every two years. This is conducted in conjunction with similar monitoring in various locations of the upper Kern River under an agreement with the Inyo National Forest. This plan and agreement were implemented, among other reasons, to monitor the impact of increased visitor use resulting from the newly-constructed Horseshoe Meadow Road upon the wildlife resources of the impacted area.

A standardized methodology has been established to allow more accurate comparison of data from year to year and area to area and to better define golden trout population dynamics within the Cottonwood Creek Basin.

Fish are collected with electrofishing gear within the five established Cottonwood Creek stations (Figure 2). A depletion methodology is used to determine population size, and additional data are collected to allow calculation of length/weight and age-growth relationships, and size and age class distributions. This work is scheduled to be repeated every two years in even years.

The same basic data are taken periodically from the lake populations by means of gill net sampling. This allows us to evaluate the possibility of stunting in the broodstock lakes and to assess the adequacy of catch regulations in those lakes remaining open to angling.

Land Use Management

Prior to the enactment of the Endangered American Wilderness Bill in 1978, wilderness management regulations were in effect in the John Muir Wilderness immediately to the north of Thacher Camp. A de facto wilderness situation existed in the entirety of the upper Cottonwood-Horseshoe Basin (because of its remoteness from vehicular access) until the opening of the Horseshoe Meadow Road in 1968. In 1978 the entire upper basin became designated wilderness with the exception of a narrow access corridor paralleling the road (Figure 5).

Other than fishing and hunting and a small grazing allotment in Horseshoe Meadow, there are not significant exploritive uses of the Basin's resources. Logging and milling occurred there in the late 1800's but ceased before the turn of the century. The logs were flumed to the Owens Valley and used for smelter charcoal or taken across Owens Lake to provide timbers for the mines of Cerro Gordo in the Inyo Mountains above Lone Pine. Since 1918 the four main Cottonwood lakes have provided golden trout broodstock and

the egg supply for the statewide planting programs of the Department of Fish and Game (see Fisheries Management Program).

Water Development

A hydroelectric generating plant is operated by the Los Angeles Department of Water and Power on lower Cottonwood Creek. In recent years considerable interest has been expressed by both private individuals and the Los Angeles Department of Water and Power in developing additional hydroelectric power higher on the stream. State policy strongly discourages such development on designated wild trout streams. Cottonwood Creek flow ultimately ends up in its entirety in the Los Angeles Aqueduct west of U.S. 395.

Philosophical Aspects

It should be the total of any conservation agency worthy of the name, while acknowledging its responsibility and subservience to the public, to lead that public toward the form of management which its professionals known by training and experience will, in the long run, be most beneficial to the resource (and therefore, ultimately, to the public). This leadership must be exerted prudently, lest it be defeated through the democratic process. Yet it must be experted constantly if the desired programs are to gain the political support which, of neccessity, must precede adequate funding and staffing. In no other way will such

programs be able to prove themselves sufficiently to gain widespread acceptance.

It was this basic rationale that we followed implementing the programs in the Cottonwood Basin (less so in the Kern Plateau). We know the value of the golden trout and were acutely aware of its fragility. We knew it could not survive under heavy angling pressure, and we felt that (knowing though our questionnaire that over two thirds of the anglers would not object) we could kill two birds with one stone. We could protect the resource while teaching the public that maybe there is more to angling, and to catching a golden trout, than taking a bunch of trout by conventional means and for conventional reasons. And we could also teach a few people to use a barbless fly in the process.

MANAGEMENT PROGRAM

- A. Program Goal: Maintain wild trout populations at levels necessary to provide optimum recreational angling opportunities for wild trout.

Management Objective

1. By continuing the ongoing fishery investigation plan:
 - 1) define the optimum potential of the Cottonwood Basin fishery; 2) identify management changes needed to provide quality wild trout angling; and 3) identify and monitor

fishery objectives in the following terms for both Cottonwood Creek and the Basin's 13 lakes:

- a) Population size
- b) Trout size distribution
- c) Broodstock and egg production for hatchery rearing program in Cottonwood Lakes 1-4.

B. Program Goal: Increase public awareness of esthetic and historical values of golden trout.

- 2. Utilize to the greatest extent possible the inherent opportunities within the Cottonwood Basin to conduct visitor information activities.

C. Program Goal: Maintain and enhance where possible the habitat required for optimum trout production.

Management Objective:

- 3. Assure maintenance of optimum trout habitat through implementation of the Golden Trout Wilderness Management Plan and similar principles within the John Muir Wilderness.

4. Identify adverse impacts resulting from inadequate angling regulations or increased visitor use by continuing the ongoing monitoring program.

D. Program Goal: Preserve the natural character of the streamside environment.

Management Objective: Maintain existing characteristics of the area by:

5. Adhering to the provisions of the Golden Trout Wilderness Management Plan and the Wilderness Act of 1964.

Management Direction

1. National Forest land management direction will be determined in the Forest Land and Resource Management Plan, by the Golden Trout Wilderness Management Plan which addresses specific management direction in the southern portion of the Cottonwood Basin, and by the Wilderness Act of 1964, which addresses management direction in the remainder of the Basin.
2. The Department will cooperate with the Forest Service in implementing and conducting appropriate portions of the plans.

3. The Department will oppose any water development proposed for Cottonwood Creek that would result in drastic flow regime changes or otherwise adversely impact the aquatic or riparian habitat.

LITERATURE CITED

California Department of Fish and Game. 1976. The golden trout of the Cottonwood Lakes and Kern Plateau. California Department of Fish and Game, Long Beach. 4 pages, map.

Curtis, Brian. 1935. The golden trout of Cottonwood Lakes. California Fish and Game, Vol. 21, No. 2, April 1935, pp. 101-109.

Evermann, Barton Warren. 1905. The golden trout of the southern high Sierras. Bulletin of the Bureau of Fisheries, Vol. XXV, 1905, pp. 1-51.

Leopold, Aldo. 1949. A Sand County Almanac. Oxford University Press, New York. 226 p.

McCloud, George. 1943. Golden trout propagation in California. California Fish and Game, Vol. 28, No. 4, pp. 191-195.

Pister, Edwin P. 1964. Cottonwood Lakes, California's "gold" mine. Outdoor California, Vol. 25, No. 5, May 1964. pp. 7-9.

_____. 1969. Visitor use and fishery evaluation studies, upper Cottonwood Creek Basin, Inyo County. California Dept. Fish and Game, Sacramento. Typewritten report, 8 pages, October 31, 1969.

_____. 1976. A rationale for the management of nongame fish and wildlife. Fisheries (Bull. Amer. Fish. Soc.), 1(1): 11-14.

Schneegas, Edward R. and Edwin P. Pister. 1965. Fishery habitat management plan for native golden trout waters. U. S. Forest Service, Inyo National Forest. Mimeographed report, 46 p.

Schreck, Carl B. and Robert J. Behnke. 1971. Trouts of the Upper Kern River Basin, California, with reference to systematics and evolution of western North American Salmo. J. Fish. Res. Bd. Canada 28: 987-998.

U. S. Department of Agriculture, Forest Service. 1982. Environmental assessment and management plan for interim management of the Golden Trout Wilderness, Inyo and Sequoia National Forests, Pacific Southwest Region.

A List of References Pertaining to the California
Golden Trout, Salmo aguabonita

- Allen, A. H. 1904. With the Sierra Club to Mount Whitney. Mt. Whitney Club Journal. Vol. I, No. 3, pp. 114-121.
- Brown, Henry M. 1984. The tunnel. Los Tulares, Bulletin of the Tulare County Historical Society, No. 144, August, 1984.
- Capaprice, John R. and John E. Cushing. 1964. Erythrocyte antigens of California trouts. California Fish and Game, Vol. 50, No. 3, July, 1964. pp. 152-157.
- Clyde, Norman. 1949. Kern River region trout. Outdoor Life, Feb. 1949, p. 130.
- Curtis, Brian. 1934. The golden trout of Cottonwood Lakes (Salmo aguabonita Jordan). Transactions of the American Fisheries Society, Vol. 64, 1934, pp. 259-265.
- _____. 1935. The golden trout of Cottonwood Lakes. California Fish and Game, Vol. 21, No. 2, April 1935, pp. 101-109.
- _____. 1938. The life story of the fish. D. Appleton-Century Co., Inc. New York. XIV 260 pp.

Dill, William A. 1941. The Little Kern River drainage, Tulare County. Progress Report No. 1, Report to Bureau of Fish Conservation, California Division of Fish and Game, Dec. 8, 1941, 11 pp. 1 map (typewritten).

_____. 1945. The Little Kern River drainage, Tulare County. Progress Report No. 2, Report to Bureau of Fish Conservation, California Division of Fish and Game, Sacramento. Mimeographed Report. 27 pages plus appendices.

Ellis. S. L. N. 1915. A record of fish plants made in the waters of the Fresno Division, Fish and Game Commission, comprising the counties of Kern, Tulare, Kings, Fresno, Madera, Merced, Mariposa, Tuolumne, and Stanislaus, 1870-1915. (Handwritten manuscript. Typewritten copies in files of Inland Fisheries Branch).

Ellis. S. L. N. and H. C. Bryant. 1920. Distribution of the golden trout in California. California Fish and Game, Vol. 6, No. 4, October, 1920. pp. 141-149.

Evermann, Barton Warren. 1905. The golden trout of the southern High Sierras. Bulletin of the Bureau of Fisheries, Vol. XXV, 1905, pp. 1-51.

Fisk, Leonard O. 1983. Golden trout of the High Sierra. California Department of Fish and Game, Sacramento. 16 pp.

Gold, Jr. R., and G.A.E. Gall. 1975. Chromosome cytology and polymorphism in the California High Sierra golden trout (Salmo aguabonita) C. Gent., Cytol. 17:41-53.

_____. 1975. The taxonomic structure of six golden trout (Salmo aguabonita) populations from the Sierra Nevada, California (Pisces: Salmonidae). Proceedings of the Calif. Acad. Sci., Vol. XL, No. 10, pp. 243-263.

Jordan, David Starr. 1893. A description of the golden trout of Kern River, California (Salmo mykiss aguabonita). Proc. U. S. Nat. Mus., XV, pp. 481-483.

McAfee, William R. 1966. Golden trout. In Inland Fisheries Management (ed.) by Alex Calhoun. California Department of Fish and Game, Sacramento. pp. 216-221.

McCloud, George. 1943. Golden trout propagation in California. California Fish and Game, Vol. 28, No. 4, pp. 191-195.

McDermid, Charles. 1946. Waters of the golden trout country. G. P. Putnam's Sons, New York, XII, 162 pp.

Moyle, Peter B. 1976. Inland fishes of California. University of California Press, Berkeley, Los Angeles, London. 405 pp.

Needham, P. R., and E. H. Vestal. 1938. Notes on growth of golden trout (Salmo aguabonita) in two High Sierra lakes. California Fish and Game, Vol. 24, No. 3, July, 1938. pp. 273-279.

Pister, Edwin P. 1959. Hatchery program expanded for popular golden trout. Outdoor California, Vol. 20, No. 9, September, 1959, pp. 8-9.

_____. 1962. Golden trout (Salmo aguabonita Jordan). In Deepest Valley - guide to Owens Valley and its mountain lakes, roadsides and trails. Edited by Genny Schumacher. Sierra Club, San Francisco. pp. 163-164.

_____. 1964. Cottonwood lakes, California's "gold" mine. Outdoor California, Vol. 25, No. 5, May 1964. pp. 7-9.

_____. 1976. The management of High Sierra lakes. In A symposium on the Management of High Mountain Lakes in California's National Parks. California Trout, Inc., San Francisco, pp. 27-34.

_____. 1977. Wild trout concepts and the management of threatened fishes. In A Symposium on Wild Trout Management. California Trout, Inc., San Francisco, pp. 49-59.

_____. 1985. Cottonwood Creek management plan.

Mimeographed wild trout management plan, Calif. Dept. Fish and Game, Sacramento. In press.

Schneegas, Edward R. and Edwin P. Pister. 1965. Fishery habitat management plan for native golden trout waters. U. S. Forest Service, Inyo National Forest. Mimeographed report, 46 pp.

Schreck, Carl B. 1969. Trout of the Upper Kern River Basin, California. M.S. Thesis, Colorado State University, Fort Collins. unpublished, 120 pp.

Schreck, Carl B. and R. J. Behnke. 1971. Trout of the Upper Kern River Basin, California, with reference to systematics and evolution of western North American Salmo J. Fish. Res. Bd. Canada 28: 987-998.

Snyder, John O. 1933. California trout. California Fish and Game, Vol. 19, No. 2, April, 1933, pp. 81-112.

Soule, Scott M. 1950. Initial planting of golden trout in Hooper Creek drainage, Fresno County, California. Central California Sportsman, Vol. 9, No. 7, pp. 132-133, 136-137.

Stefferd, Jerome. 1985. Spawning season and habitat preferences of South Fork Kern golden trout (Salmo aguabonita aguabonita) in the southern Sierra Nevada. California Fish and Game In press.

U. S. Forest Service. 1982. Golden Trout Wilderness management plan, Inyo and Sequoia National Forests. U. S. Forest Service, San Francisco. 54 pp., appendices, maps.

_____. 1982. Golden trout habitat and watershed restoration on the Kern Plateau. Inyo National Forest, Bishop, Ca. 48 pp., appendices, photos.

Vestal, Elden H. 1964. Golden trout: Salmo aguabonita. In The Mammoth Lakes Sierra - a handbook for roadside and trail. Second edition. Edited by Genny Schumacher. Sierra Club, San Francisco. pp. 117-118.

Vore, F. H. 1928. Planting golden trout in barren waters of California. California Department of Fish and Game, 14 pp.

Wales, Joseph H. 1957. Trout of California. Department of Fish and Game, Sacramento. 56 pp.

White, Stewart Edward. 1904. The golden trout. In The Mountains. McClure, Phillips and Co., New York, pp. 255-260.

TABLE 1. Cottonwood Creek Flow Records*

<u>Month</u>	<u>Year of Record</u>	<u>Adjusted Mean cfs</u>	<u>Adjusted Mean Acre-Feet</u>
Jan	34	6.37	392
Feb	34	6.71	387
Mar	34	8.38	515
Apr	34	17.09	1,016
May	34	35.59	2,188
Jun	34	26.09	1,553
Jul	34	11.43	740
Aug	33	8.50	522
Sep	33	5.68	338
Oct	33	6.83	420
Nov	33	6.48	385
Dec	33	6.05	372

*Measured near Cottonwood Power Station by Los Angeles Department of Water and Power between 1921 and 1961. Records during 1922, 1937, 1938, 1941, 1952, and 1958 disregarded because of unusually high runoff. Flows of Little Cottonwood Creek are included in the above data.

Table 2. Cottonwood Lakes egg production, 1927-1981. Compiled from McCloud, 1943 and Mt. Whitney Hatchery records.

<u>Year</u>	<u>Egg Take</u>	<u>Year</u>	<u>Egg Take</u>
1927	500,000	1961**	None
1928	690,000	1962	251,800
1929	1,060,000	1963	588,200
1930	1,250,000	1964	574,100
1931	975,000	1965	608,600
1932	910,000	1966	704,100
1933	1,218,000	1967	692,500
1934	2,115,000	1968	825,100
1935	1,380,900	1969	770,400
1936	1,204,000	1970***	718,600
1937	1,047,625	1971	692,800
1938	1,171,650	1972	853,800
1939	320,000	1973	841,400
1940	108,000	1974	903,800
1941*	271,000	1975	797,900
1953	476,300	1976	824,900
1954	762,300	1977****	523,900
1955	448,900	1978	660,500
1956	558,900	1979	724,000
1957	536,200	1980	604,000
1958	523,400	1981	529,300
1959	544,300	1982	414,500
1960	547,900	1983*****	None
		1984	535,000

*The Cottonwood Lakes golden trout program was abandoned during World War II and was not resumed until 1953.

**The drought experienced in 1961 resulted in a decision to abandon the program in that year because of an anticipated decrease in the Mt. Whitney Hatchery water supply.

***Beginning in 1970, the spawning run had increased to a point where not all fish were required for spawning purposes. Mt. Whitney Hatchery personnel estimate that an additional 25% could be added to the figures listed.

****The numbers of eggs taken in 1977 was intentionally reduced because of an anticipated decrease in the Mt. Whitney Hatchery water supply.

*****An unusually heavy snowpack in the Cottonwood Basin during the winter of 1982-83 made access impossible until after the fish had spawned.

TABLE 3. A summary of angling regulations, Cottonwood Basin and Kern Plateau, 1966 to 1982.

Year	Cottonwood Basin	Kern Plateau
1966	Lakes 1-4 closed to all fishing;	Season corresponds
1967	"	
1968	"	
1969	Lakes 1-4 closed to all fishing; Lakes 5-6 returned to regular season.	
1970	Same as above, but limit reduced to 5 trout, including lakes.	
1971	"	
1972	Season within entire Basin July 1- November 15; 5 trout 6 inches or greater. Lakes 1-4 and tributaries closed to all fishing.	
1973	Season within Basin July 1 to October 31, 5 trout 6 inches or greater. Lakes 1-4 and tributaries closed to all fishing.	
1974	Artificial flies with single barbless hooks, 5 trout, no size limit, July 1- October 31. Lakes 1-4 and tributaries closed to all fishing.	
1982 to present	Artificial lures with single, barbless hooks, 5 trout, no size limit, July 1- October 31. Lakes 1-4 and tributaries closed to all fishing.	

Table 4. Golden trout monitoring - Cottonwood Creek, 1980.

Station		Distance from Roadhead	Number of Trout per meter	Mean Fork Length (cm)
I.	Near Roadhead	-	0.28	11.6
II.	Beaver Dams	0.5 miles	0.29	9.8
III.	Sand Banks	1.0 miles	0.25	11.1
IV.	Golden Trout Camp	2.5 miles	0.59	13.8
V.	Below Lake #1	4.5 miles	0.93	16.2