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URBAN TROUT ANGLING

INLAND FISHERIES
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No. 63-3

IRVINE LAKE, ORANGE COUNTY

THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF FISH AND GAME

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Department of Fish and Game

URBAN TROUT ANGLING[1/]

SUMMARY

Trout stocking in urban areas could provide 1,000,000 or more days of fishing in California annually, perhaps as many as 3,000,000. This opportunity to increase outdoor recreation near the cities merits serious attention.

A state-wide program would cost $500,000 at the very least - a million dollars is a more likely figure - and it could ultimately approach $3,000,000 a year.

Urban trout fishing occurs now in California, on a small scale. The Department stocks 10 percent of its catchable-sized trout in 18 lakes and streams in or near major cities. Private stocking also occurs, particularly in the south.

The appetite for this sport is strong. However, funds are lacking, so expansion is blocked. Critical public relations problems for the Department of Fish and Game result.

A new way to finance urban trout fishing has evolved recently. Anglers pay daily fees which offset all costs. This approach increased angler use from 7,000 to 50,000 days annually at Murray Lake, in San Diego. It also increased fishing success substantially. The Helix Irrigation District stocked 50,000 pounds of large trout, purchased privately, during a 100-day winter fishing season, in 1961. Anglers averaged about a pound of trout per day, far more than usual in southern California. The operation was not only self-supporting - it cleared a profit of several thousand dollars, although the daily fee was only $1.00 - since increased to $1.25, to offset rising costs.

This "pay-as-you-fish" method of financing trout angling has also succeeded at Wohlford and Irvine Lakes in Southern California and at four public fishing parks in Missouri. It makes a large urban trout fishing program financially feasible in California for the first time.

1/ Submitted February 15, 1963.

Inland Fisheries Administrative Report No. 63-3, by Alex Calhoun.

(Complete report available upon request.)

URBAN TROUT ANGLING

Trout fishing could be developed on a fairly large scale near most California cities. Many anglers would welcome it, judging from demands upon the Department for more fish.

The potential scope of such recreation is difficult to gauge. Given adequate funds, a substantial program is feasible, ranging from perhaps 1,000,000 upward to as many as 3,000,000 man days of fishing annually. See Table 1 in this connection.

The estimate of 1,200,000 angler days in the right-hand column of Table 1 is based on one day of fishing for each licensed angler living in 4 metropolitan areas - probably conservative.

Based on these estimates, a state-wide program would cost $500,000 at the very least, more probably $1,000,000, and it could ultimately approach $3,000,000 a year. Stocking rates and program scope will determine these costs. They can be estimated only roughly now, hence the uncertainty about total costs. However, we can assume they would be large.

This report summarizes recent experiences with urban fishing in California and elsewhere, and their implications for planning future programs.

First, let us look at the Department's urban trout program. It has tended to develop wherever lakes or streams near cities were cool enough for trout during the open season. Some 18 urban waters now receive over 700,000 8-inch trout annually, as shown in Table 2. This is about 10 percent of all such trout stocked by the Department. Given a chance, metropolitan areas could absorb much of the remaining 90 percent judging from recent requests. The all-year trout season in southern California has urgent implications here, because it made trout stocking feasible for the first time in many warmwater reservoirs.

This situation presents a dilemma. Metropolitan areas demand more trout. The Department has to refuse, for lack of funds. Meanwhile, the State is losing a major opportunity to increase outdoor recreation near the cities.

Fortunately, a new method has evolved to finance urban angling. Participants pay daily fees which offset all costs. Such "pay-as-you-fish" financing succeeded notably at Murray Lake, in San Diego. This 150-acre reservoir used to provide about 7,000 man days of fair angling for black bass and sunfish each year - all that the natural crop of fish would support. Then, in 1959, Mr. Grosse of the Helix Irrigation District, which owned the lake, purchased trout and stocked them in Murray under permit from the Department.

Results were astonishing. By 1961, attendance increased to 50,000 angler days, although the open season had been cut two-thirds. The catch jumped from 7,000 to 50,000 pounds of fish. Anglers averaged nearly a pound of trout per trip. (See Appendix Table A-1 for further details)

TABLE 1

Estimated Recreational Potential of Urban Trout Angling[1/]

Urban area	1960 population[2/]	Possible waters	Estimated angler-days and pounds of trout annually[3/]
Los Angeles[4/]	7,550,000	Many reservoirs in or near the metropolitan area	755,000
San Diego	1,030,000	Numerous reservoirs in San Diego County	103,000
San Francisco-Oakland	2,780,000	EBMUD reservoirs, Lake Merritt, Lake Merced, Marin lakes	278,000
San Jose	640,000	Anderson, Coyote, Uvas, Llagas reservoirs	64,000
	12,000,000		1,200,000

1/ These are rough, preliminary estimates to define the probable scope of such a program and to illustrate the places where it might be developed.

2/ From: Statistical Abstract of the U.S. 82nd edition, 1961; U.S. Chamber of Commerce. Pages 14-20.

3/ Based on one pound of trout a year per resident angling licensee (10% licensees in the general population). It takes about a pound of trout per angler day to support this type of fishing on a daily fee basis. It seems reasonable to expect urban anglers to average one trip a year to nearby trout-fishing waters if a substantial program develops, particularly since youngsters under 16 are not included among the 10% of angling licensees.

4/ Including San Bernardino-Riverside.

TABLE 2

Existing Urban[1/] Trout Stocking Program (1962)

Urban area	Water	Trout stocked (5 per pound)
Fresno	San Joaquin River below Friant	56,000
	Kings River below Pine Flat	70,000
Los Angeles[2/]	Puddingstone Lake	50,000
	Legg Lake	30,000
	Arroyo Seco Creek	2,500
	Bouquet Canyon Creek	5,000
	Tujunga Creek	4,000
	San Antonio Creek	2,000
	San Dimas Reservoir	5,000
	San Gabriel River	82,000
Sacramento	Nimbus Lake	30,000
	Putah Creek	20,000
San Diego	Morena Lake	25,000
San Francisco-Oakland-San Jose	Merced Lake, San Francisco	150,000
	Phoenix Lake, Marin	30,000
	Lagunitas Lake, Marin	30,000
	San Mateo County	67,000
	Santa Clara County	75,000
Total		733,500

1/ Within about a half-hour's drive of a metropolitan area.

2/ San Bernardino mountain lakes not included - primarily a resort area rather than an urban area.

This operation was not just financially self-supporting, it made a profit of several thousand dollars a year which could be spent to improve facilities. Initial fees of $1.00 per day, the usual access charge for fishing in water supply reservoirs in San Diego County, were increased to $1.25 in 1962, to meet rising costs.

Heavy sustained attendance, averaging about 500 anglers per day through a winter fishing season of about 100 days, confirms this program's popularity with San Diego fishermen.

Several factors contributed to this achievement. Unusually successful fishing, sustained by heavy stocking, was certainly important, along with the convenient location and the low fee. The large trout, up to a pound, undoubtedly attracted anglers.

This Murray Lake experience is not an isolated case. The same thing was done at Irvine Lake, in Orange County; at Wohlford Lake, in San Diego County; and at four state-operated fishing parks in Missouri. See the appendix for further details.

The responsibility of the Commission for setting angling regulations, and of the Department for enforcing them and aiding with fishery management, continues in daily-fee waters like Murray, Wohlford, and Irvine. The warmwater fish that augment the hatchery trout are a state responsibility. All the fish are planted under permit from the State, and, in public waters, become State property after release. The usual angling licenses and stamps are therefore required on daily-fee waters. Active partnership between the Department and local agencies in managing such waters is essential.

It is timely to review urban trout stocking in the light of these, highly successful experiences with "pay-as-you-fish" financing. The program is already here on a small scale, pressures for more are mounting, and further expansion of some sort appears inevitable. However, its eventual fate will depend largely on the form it takes.

We face an important crossroad. One way appears to lead toward welcome new recreational opportunities, without unusual financial problems or controversy. This is the path of "pay-as-you-fish" financing, illustrated by Murray Lake. The other way promises more of the controversy and unrealized opportunities so characteristic of the existing catchable-sized trout program. This is the road of traditional financing, with angling license revenues.

Urban trout fishing is pure recreation. It has more in common with golf and swimming than with traditional angling for wild trout. Hence, angling license revenues do not seem an appropriate source of funds. They were established originally as use fees, to control fishermen harvesting wild fish, and to provide revenues for protecting and improving natural fisheries. The catchable trout program stretched this concept mightily. An urban trout fishing program shatters it.

Murray Lake, near San Diego, on April 18, 1962, a Wednesday during Easter vacation. Over 800 fishing permits had been sold by noon, when this picture was taken.

Fortunately, daily-fee financing offers a promising alternative. It's early acceptance as the way to finance urban trout fishing will facilitate the growth of this promising new recreation.

However, new legislation, specifically authorizing fee-fishing for trout in public waters, is also needed. Water districts have traditionally charged daily fees to offset costs of fishing programs, particularly on drinking water lakes where the public health requires close angler surveillance at considerable expense. Complex legal questions about the water district's right to charge for fishing have been avoided by relating the fees to access and use of facilities. However, when water districts purchase trout with the fees collected from anglers for access privileges, they stretch this theory considerably. It could not reasonably be further extended to cover public waters now freely open to fishing, nor do any existing laws specifically authorize the Department or any one else to finance trout angling through daily fees, although domestic fish breeders may charge for fishing on artificial ponds.

These involved legal matters will not be discussed here except to suggest some law changes as possibilities. For example, a State policy set forth in the law recognizing the desirability of financing urban trout fishing with daily fees, on a non-profit basis, would clarify the situation. Legislation authorizing appropriate State, local and quasi-public agencies to operate such programs would increase the number of places where it could be tried. However, nothing should be done in new laws to weaken State control over all fish in the waters of the State, including control over all private stocking of fish and other aquatic animals and plants, the setting and enforcement of angling regulations, the management of the fisheries, and the requirement for State angling licenses. All of these existing controls are strongly in the public interest.

Either State or local agencies could logically operate urban fee-fishing programs, depending on local circumstances and desires. Hence, both should probably be authorized to do so, to speed program development.

One of the aims of this report is to summarize the experience gained so far with urban trout programs, for the guidance of those planning new ones. Above all, they should take great care from the outset to avoid financial difficulties.

Experience with the four "pay-as-you-fish" programs described in the Appendix suggests that such operations had better be financially self-supporting from the start. All four had the goal of a balanced ledger. To achieve it, they had to maintain good fishing throughout the season, so continuous, heavy attendance could spread operating costs to many anglers, keeping the pro-rata charge per angler day small. Thus, most of the revenues were left for buying trout. This aspect of managing urban trout fisheries seems to be critical for success.

Another important point - because the program on the daily fee waters described were self-supporting, they could expand to meet growing demands

without financial strain. Elsewhere, the growth of trout stocking programs is generally blocked by lack of funds.

The managers of all four successful "pay-as-you-fish" operations described in the appendix consider it essential for youngsters to pay a fee. This is not surprising. I observed two young boys at Murray Lake with combined trout limits worth nearly $5.00 in the fish market.

A small bag limit, about five fish, also seems important for the financial success of these operations.

The stocking rate at Murray during four years of operations, at Wohlford in 1960, when only trout were involved, and in Missouri, was consistently about one pound per angler day. This seems to satisfy anglers while permitting reasonable fees. Large catches may compensate somewhat at urban lakes for some of the other outdoor qualities commonly associated with mountain trout angling. Significantly, the stocking rate was less at Irvine Lake, where naturally produced warmwater fish contributed relatively more to the catch.

State waters in the catchable-sized trout program are stocked much less heavily, and with smaller fish, to keep costs in line with limited revenue.

The size of trout stocked is another important factor. Large size attracts anglers, for obvious reasons. Also, variation in size is desirable, to heighten interest, and the value of a few large, trophy fish is great out of all proportion to their cost, in terms of increased interest and satisfaction. The desirability of relatively large fish was so obvious to those in charge at Murray, Irvine, and Wohlford, and also in the Missouri fee-fishing program, that they all used them early in the program. (Financial limitations prevent this type of stocking in the regular catchable-sized trout program in California.)

Reservoir size is another important consideration. A lake must accommodate enough anglers so fees are reasonable. Conversely, it must be small enough to provide good angling with reasonable stocking, and to ensure that most of the trout are caught. The 100-acre size of Murray and Wohlford is obviously satisfactory, and smaller lakes will probably do. The Missouri experience (see appendix) suggests waters can be quite small. Lake Irvine is almost 400 acres, indicating they can also be quite large, particularly if there is also a good crop of warmwater fish.

Whatever the size, heavy, sustained fishing is essential, for otherwise the trout will not be fully harvested, the service cost per angler will rise, and the operation will slump into financial collapse.

The Department might appropriately operate "pay-as-you-fish" programs, under some circumstances, as, for example in suitable state parks, or elsewhere as a service to local jurisdictions. Some anglers might even welcome scattered waters in resort areas stocked with more and larger trout paid for by small daily fees. Permit vending machines recently developed by the U. S. Forest Service to collect daily fees at camp grounds offer interesting possibilities in this connection. Test waters could provide valuable experience for future planning. However, as mentioned earlier, enabling legislation would have to be passed before the Department could operate any fee-fishing areas.

Bennett Trout Fishing Park, a daily-fee fishing stream in Missouri.

APPENDIX

DESCRIPTIONS OF FOUR DAILY-FEE TROUT-FISHING OPERATIONS

Murray Lake

Location: Outskirts of San Diego - bordered on two sides by growing subdivisions.

Size: Area open to fishing about 100 acres - there is a 1500 foot setback from the dam, for public health reasons. Total area, full, about 200 surface acres.

Type of lake: Originally a mediocre to poor warm water fishery, producing a natural crop to the creel of about 40 pounds per acre per year. All year trout season made winter trout fishery possible. Now predominately a trout fishery. Mr. Grosse estimates 80% trout - 20% warmwater fish in spring of 1962.

Open season: December 3, 1960 - July 5, 1961.1/ — why not open to reduce warm water pop.?

Open days: Saturdays, Sundays, Wednesdays, and holidays.2/

Operating agency: Helix Irrigation District, 8111 University Avenue, La Mesa, through 1962 only. Responsibility will then revert to the Utilities Department of the City of San Diego, which has purchased the dam.

Angling licenses: State license and stamps required.

Responsibilities of Department and Commission: Set and enforce angling regulations. Assist with fishery management, excluding trout stocking - warmwater fish present are State property.

Use pattern: Use was consistently heavy throughout the 1961 and 1962 seasons, averaging about 500 anglers per day.

1/ Closing date considered too late by Grosse. Trout stopped biting earlier because of warming water. Before December, water is too warm for trout.

2/ Mr. Grosse said this schedule maximizes recreational benefits and minimizes operating costs, giving the individual angler the best fishing for the lowest daily fee. The fish bite best after the lake has been closed: Wednesdays have the highest catches, Saturdays next, and Sundays poorest. Moreover, a three day schedule can be run with a single shift of personnel, and it concentrates use, permitting low daily fees.

Amount of Fishing:	1960-61	1961-62 (Dec. 2 - June 12)
Adult permits	45,682	43,123
Junior permits (Ages 8 through 11)	7,380	7,255
Total permits	53,062	50,378
Permits per acre (100 acres open to fishing)	530	503
Permits per day	542	515
Permits per acre per day	5	5

Daily fees:

Adult (16 or over) - $1.00 in 1960-61
$1.25 in 1961-62

Junior (8 to 16) - $0.50

Under 8 - Free

(Only daily permits issued)

Access: Through a single entry gate, where permits are sold. The lake is patrolled once or twice a day. Trespass problems are not serious, although they are increasing as subdivisions spread around the lake. A fence will probably be needed soon, for public health reasons also.

Types of fishing: Fishing is mainly from shore. A fishing float is popular. Rental skiffs are available, and private boats may be launched.

Bag limit: 5 trout.

Catch in pounds (1960-61 season):	Trout	Warmwater	Total
Total, annual	45,400	7,600[3/]	53,000
Total, daily	541	-	-
Per acre (at 200 acres)[4/]	265	-	-
Per angler day	0.85	-	-

3/ No record for 1960-61 - This is 1951-52 estimate, which gives the order of magnitude.

4/ Total, maximum surface area. The area open to fishing is only about 100 acres.

Stocking program (1960-61 season): 2,000 pounds stocked initially. Each Thursday, the recorded catch for the preceding week, plus 10 percent, was restocked. 75 percent of the trout were about one-half pound; 25 percent were one pound. Season total - 52,300 pounds, value of trout stocked (using April, 1962, cost of 80 cents per pound) - $41,840.

Percentage recapture of trout:

Year	Pounds planted	Pounds caught	Percent caught 5/
1959	23,050	19,717	90
1960	36,200	30,687	84
1961	52,000	45,377	87
1962	57,000	50,073	88

The 50,073 pounds caught in 1962 represented 93,271 trout.

Operating costs vs. revenues: The program is fully self-supporting.

5/ Minimal figures, since there was inevitably some poaching.

TABLE A-1

Comparison of Lake Murray Fishery Before and After the Trout Program

	Warmwater fish only	Trout stocked
Open season	July 1951-June 1952	Dec. 3, 1960-July 5, 1961
Days open to fishing	365	98
Angler use		
total annual	7,450	53,062
average daily	20	542
Catch		
total annual	7,600 lbs.1/	53,000 lbs.2/
total daily	21 lbs.	541 lbs.
per acre (200 acres)	38 lbs.	265 lbs.
per angler day	1 lb.	1 lb.
Daily fee	$0.50	$1.00
Public satisfaction	low - considered a problem water - complaints from sportsmen.	high - heavy use, no complaints.

1/ Based on 1955 estimate of 38 pounds per acre, 200 acres.

2/ No record kept of warmwater harvest - this figure is the trout catch of 45,377 pounds plus the warmwater estimate.

Lake Wohlford

Location: 5 miles east of Escondido, about 40 miles northeast of San Diego.

Size: Area open to fishing fluctuates between about 110 surface acres in April to about 150 in August. Water comes from Lake Henshaw, and level is independent of rainfall.

Type of lake: Historically an outstanding producer of warmwater fish. Chemically treated in fall of 1958, and restocked. Trout were first stocked privately in 1955, with the advent of the all-year season in southern California.

Open season: 5 months - last Friday in March through Labor Day weekend. Water level is too low at other times, creating public health problems, because the closed area near the dam includes too much of the lake at low level. Open 7 days a week.

Daily fees: 12 years and older - $1.00
Under 12 years - .50
No one free, if he fishes. Only daily permits issued.

Operating agency: Escondido Mutual Water Company, 620 No. Ash Street, Escondido.

Angling license: State license and stamps required.

Department and Commission responsibilities: Set and enforce angling regulations. Assist with fishery management, excluding the stocking of trout. State personnel helped with the 1958 chemical treatment, and the State provided some of the warmwater fish for restocking. Others were purchased by the water company.

Access: Multiple access points, with periodic patrol to check for permits. Operators do not consider trespass a serious problem. Permits are sold at the two resorts, for a service fee.

Type of fishing: Shore and boat - private boats permitted for a fee.

1960 trout fishery[1]:	Daily bag limit - 10 trout
permits sold	22,577
trout planted[2]	53,383 fish (21,900 lbs.)
percentage caught	90.5%[3]

Operating costs compared with income: In a letter of May 3, 1962, Mr. J. M. Burns, Assistant Secretary-Superintendent of the Escondido Mutual Water Company, stated as follows: "We feel that stocking a lake of this size with trout and taking trout only, as we did in our 1960 season, is not very profitable, although we didn't lose any money, but with our token plants of trout along with the other warm water fish we now have in the lake, it is very profitable, especially after we cut the trout limit to five fish. Incidentally, this year (1962) is our first season for the five trout limit. Previously the trout limit was ten."

1/ In 1960, following chemical treatment, the fishery was exclusively for stocked trout.

2/ Fish were stocked on 14 occasions at weekly or bi-weekly intervals from Jan. 8 to June 17.

3/ Estimated by the water company; based on complete catch records.

Lake Irvine

Location: In Orange County, near the town of Orange.

Size: Roughly 360 surface acres open to angling.

Type of lake: A productive warmwater reservoir suitable for trout in the winter.

Open season: In 1961, from March 1 to July 6.

Daily fee: $1.50 per person, 10 years or older.

Operating agency: Stevenson Lake Corporation, Irvine Lake, Orange.

Angling license: State license and stamps required.

Access: A single, heavily controlled, drive-in access point. No entry to fish without a permit.

1961 use: 56,124 permits during 127 day season.

Trout stocking: 34,600 pounds total planted in 1961. Large fish, one to three pounds stocked.

Catch: No records kept of either trout or warmwater fish. However, the lake is recognized as an outstanding producer of warmwater fish, and it is larger than Murray. Hence, a satisfactory operation requires relatively fewer trout, in relation to angling pressure.

Bag limit: 10 trout.

Missouri Program

The Missouri State Conservation Commission has a daily fee trout program in four "trout parks". Total use was 180,023 angler days in 1961, on four stream sections, each about one mile long. A daily fee of $1.00 per angler, including children, keeps the program financially self-supporting.

The regulations are as follows:

Season: March 1 - October 31.

Limit: 5 daily, 10 in possession.

Daily fee: $1.00 plus regular fishing permit.

Types of fishing: Single pole or rod; no gigging or snaring.

Daily hours: Roughly sunrise to sunset, although specific hours are posted rather than time of sunrise and sunset.

At Montauk State Park this type of fishing occurs on a stream that is fed by a spring that runs some 60 million gallons of water per day. It starts in the park. The upper mile and one-half is stocked with trout. Most of the stream can be waded with body waders, and this is permitted. Some pools are 100 feet wide - but most are 25 to 50 feet.

At Roaring River State Park the fishing occurs on a stretch of stream one-half mile long, spring fed running some 12 million gallons per day. This took care of 45,000 fishermen in 1961.

At Bennett Springs State Park there is 1½ miles of stream, fed by a spring that starts in the park, flowing some 50 million gallons per day. The use was 73,675 in 1961.

There is a hatchery at each of these three streams to supply its fish.

The fourth stream is the Maramec Trout Management Area, about one-half mile long. It was "made" with a drag line, diverters, dams, etc. The spring flows some 20 million gallons of water. The pools are from 100 feet wide to 50 feet, with narrower riffles.

Anyone, who fishes has to buy a $1.00 tag. Under 17 they do not have to have a State Fishing License. It has been found necessary for children to have tags, because they catch as many fish as adults.

As soon as a stream closes they stock it for the next day, with 2½ fish per tag they think they will sell. This number of fish keeps the streams well stocked. All trout stocked are at least 10 inches long.

Tags are about 4 inches by 4 inches with strings for tying them on. They are numbered and the angling license number is written on the tag, which is worn while fishing, then kept with the fish.

On one area next year, Missouri will install a tag vending machine to reduce labor and traffic jams.

#

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– golden trout – complex

* Larson, R.L., H.W Menard, and S.M. Smith. 1968. Gulf of California: A result of ocean-floor spreading and transform faulting. Science, 161(3843): 781-784.

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An Unusual Trout in the Upper Sacramento River System

A Preliminary Report

Leo F. Marnell
May, 1968

Submitted

to

Dr. Robert J. Behnke

An Unusual Trout in the Upper Sacramento River System

Leo F. Marnell
May, 1968

Introduction

Fish collections made from tributaries of the upper Pit and McCloud Rivers in northern California during recent summers have revealed an unusual trout. The peculiar upper Sacramento trout manifests basic characteristics of rainbow, golden, and cutthroat trout. Occurrence of such a fish in the upper Sacramento system provokes some penetrating zoogeographical speculation. Knowledge of its affinities to other western trouts would contribute to a more sound understanding of the systematics of the Salmo complex of western America.

Taxonomy of Western North American Salmo

The high degree of variability in the native trouts of western North America misled early investigators. The literature is confused by more than 30-names given these trout by various workers (Behnke - personal communication).

The current taxonomic arrangement of western trouts is based on a more realistic appraisal of intra-specific variability. The trend is toward consolidation of what were formerly regarded as different species.

A view which seems plausible, though not substantiated by facts, is that all native American species of Salmo belong to but two major phylogenies; the rainbow lineage or the cutthroat trout lineage. Several forms may be intermediate (Fig. 1).

Nomenclature of North American Salmo presented in this paper is from Behnke,(1966, 1967a, 1967b) and Shapovalov, Dill, and Cordone (1959)

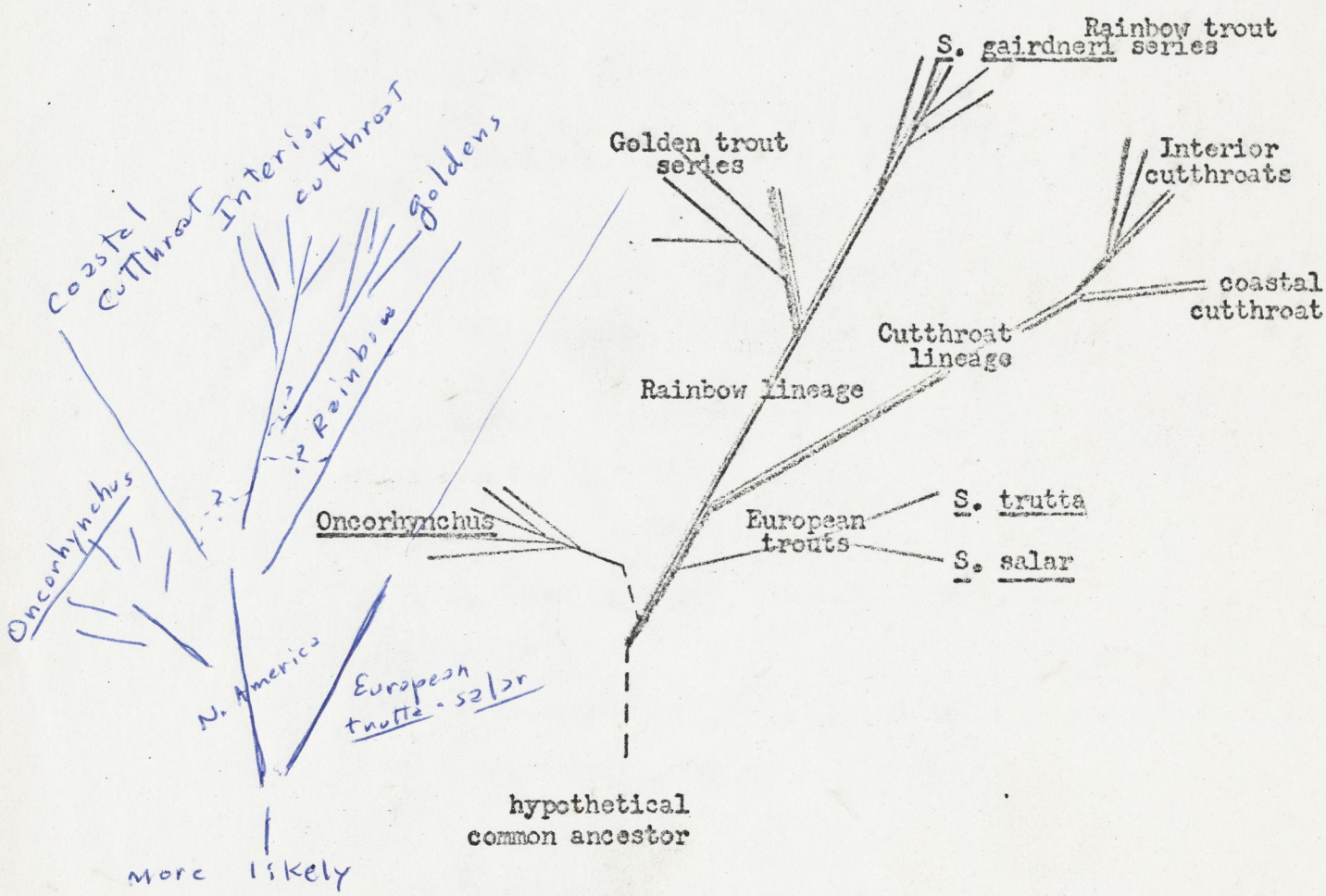


Fig. 1 - Hypothesized phylogenetic tree of Salmonidae showing affinities of Salmo species in western North America.

and are arranged according to the proposed phylogenetic scheme.

Rainbow trout lineage

Rainbow series

Salmo gairdneri Richardson

S. gairdneri gairdneri Richardson - steelhead rainbow
S. gairdneri kamloops (Jordan) - kamloops rainbow
S. gairdneri stonei Jordan - Shasta rainbow
S. gairdneri gilberti Jordan - Kern River rainbow
S. gairdneri aquilarum Snyder - Eagle Lake rainbow
S. gairdneri regalis Snyder - royal silver rainbow
introduced

Golden Series

Salmo aguabonita Jordan

S. aguabonita aguabonita Jordan - South Fork of Kern golden
S. aguabonita whitei Evermann - Little Kern golden

Salmo gilae - gila trout

Salmo apache m s name apache trout

Salmo chrysogaster Needham and Gard - Mexican golden

Cutthroat trout lineage

Salmo clarki Richardson

Coastal series

S. clarki clarki Richardson - coastal cutthroat

Interior series[1/]

S. clarki henshawi Gill and Jordan - Lahontan cutthroat

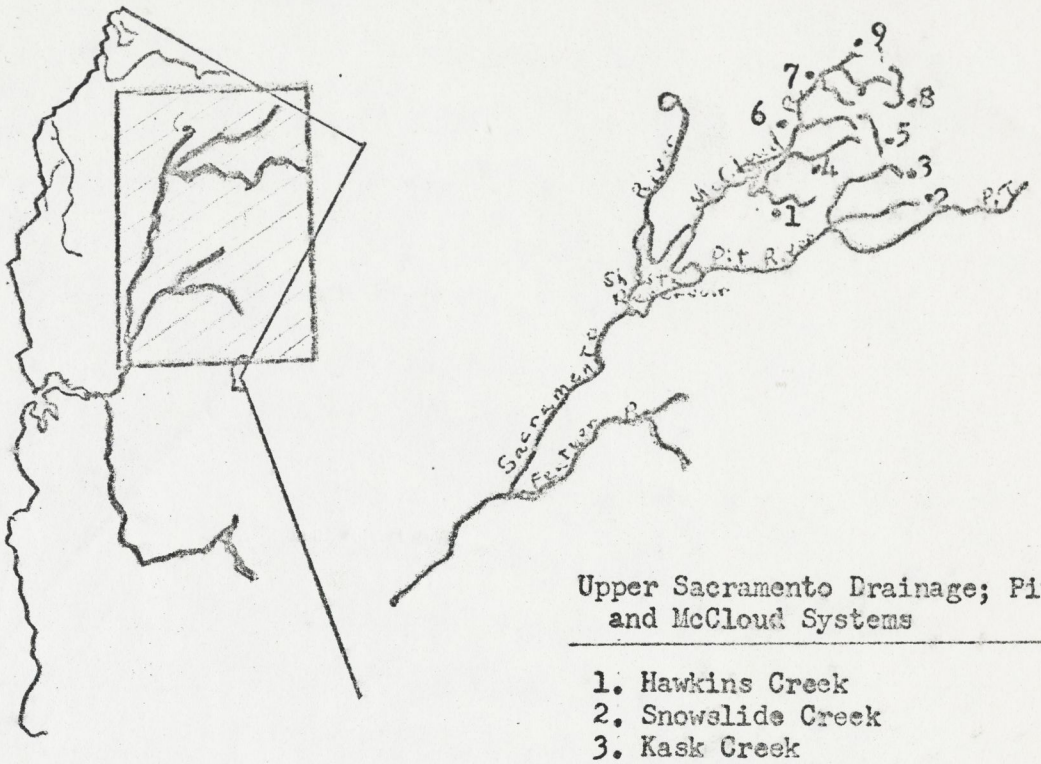
S. clarki seleniris Snyder - Piute cutthroat

+ several more

The Upper Sacramento Trout

Available specimens of the upper Sacramento trout were collected from areas shown in Fig. 2.

1/ - Recognized subspecies of S. clarki occurring only in the upper Sacramento and adjacent drainages are listed. Systemattic investigations of the plastic cutthroat group are currently in progress by members of the Colorado Co-op Fishery Unit at Ft. Collins.



Northern California - showing Sacramento-San Jaoquin Drainage

Shaded area enlarged at right

Upper Sacramento Drainage; Pit and McCloud Systems

1. Hawkins Creek
2. Snowslide Creek
3. Kask Creek
4. Star City Creek
5. Sheephaven Meadow Creek
6. Racoon Creek
7. Edson Creek
8. Moosehead Creek
9. Trout Creek

Fig. 2 - Map of collecting areas for specimens of upper Sacramento trout.

Gross external appearance of the upper Sacramento trout reveals a pattern of coloration not seen in other described trouts. Specimens are fine-scaled, rather thickly spotted and exhibit a reddish-brown lateral band. Lower sides are pale gold fading to white on the belly. A white band is prominent in the anal and paired ventral fins. Some specimens bear basibranchial (hyoid) teeth and show faint cutthroat-like pale slashes under the jaw.

Significance of the Upper Sacramento Trout

If it is demonstrated that the trout is a valid species distinct from described forms, certain basic questions follow. What are its phylogenetic relationships to other species of Salmo? Through what lineage did it evolve? Could it be a relict of a common ancestor of both the supposed rainbow and cutthroat lineages?

Alteration of the upper Sacramento drainage by construction of dams and diversions and fish introductions throughout the basin raises the possibility that the trout could be a hybrid. Occurrence of such a distinctive fish in the relatively isolated tributaries from which specimens were collected is not indicative of recent hybridization. Review of the early literature suggests that the trout was present in the upper Sacramento prior to changes brought by Man. Rutter (1908) described a fine-scaled trout from the upper McCloud, calling it Salmo irideus Gibbons -

> .... the trout from upper McCloud River are dusky above, pale below, a reddish-brown stripe along sides, opercles washed with same; back and sides, dorsal and caudal fins thickly covered with oval or round black sopts about half size of pupil; belly and lower fins yellowish; tips of dorsals anal and ventrals often white. Very abundant. About six inches long; scales small, 146 to 165.

Snyder (1908) mentions a small-scaled trout having cutthroat-rainbow characteristics from certain Pit River tributaries. Several specimens of a small fine-scaled trout were collected by Wales (1939) from isolated tributaries of the McCloud, including Edson and Moosehead Creeks (Fig. 2). Wales thought them to be "golden" trout. Needham and Behnke (1962) comment on the possibility that a "fine-scaled rainbow" in the upper Pit may have been crossed with anadromous steelheads during early hatchery operations

resulting in the now widespread McCloud River hatchery stock. Livingston stone (1883) likewise expressed awareness of the possibility that he was dealing with two distinct froms of trout on the McCloud at the time he was developing the hatchery strain.

Lack of complete descriptions and inability of early investigators to cope with the plasticity of the Salmo complex has created a difficult task for the modern systematist. To assess the significance of the trout in question, several approaches should be considered. Useful information may be obtained through consideration of the geological history of the area, associated fish fauna, chromosome numbers, and certain meristic features of the various trouts.

Knowledge of geological events affecting the distribution of fishes in western North America is incomplete. The natural distribution of Salmo can be accounted for only by imagining that existing drainages are much different than they were in the past. Detailed consideration of changes which have occurred throughout each of the major basins of the west has little relevance to the present investigation. On the basis of available evidence it seems certain that water connections existed between all adjacent basins at one time or another in the past. It is not implied that the links were necessarily continuous. The connections were, however, sufficiently developed to permit faunal exchanges. The most encompassing account of inter-basin connections is that by Taylor (1960) on the distribution of the freshwater clam Pisidium ultramontanum. Taylor cites evidence of a former link extending from Walker Lake in western Nevada (Fig.3) across Eagle Lake and the upper Pit River, California, to Klamath Lake, Oregon; thence across Fossil Lake and the Malheur basin, Oregon, to the Snake River;

and through Gentile Valley and Bear Lake, Idaho, to Utah Lake, Utah. This scheme is based on recent and fossil distributions of Pisidium and related froms of clams Carnifex, Ceriphasia, and Pyrgulopsis. Faunal ties along this suggested route date from Pliocene and seemingly hinge on more recent Pleistocene changes in the Snake drainage. Taylor's contention is supported by geologic and zoogeographic findings of other investigators (Cope, 1883; Hubbs and Miller, 1958; Blackwelder, 1931, 1934, 1948; Charlesworth, 1957; Miller, 1946).

Pertinent to the problem of accounting for the upper Sacramento trout are the faunal affinities between the Sacramento and adjacent basins. As expected, a major part of the fauna in the Sacramento-San Jaoquin complex is represented by marine or semi-marine fishes. Certain elements of the upper Sacramento (Entosphenus, Cottus, Siphateles) indicate a former connection with the Klamath system (Miller, 1946; Robins and Miller, 1957). The link was probably through Goose Lake (Anderson, 1941). Ichthyological studies have shown a marked faunal distinctiveness between the upper and lower Klamath. It is suggested by Miller (1956) that the part above the falls has only recently established a connection with the Pacific. Affinities between the Sacramento and Great Basin are seen in Gila and Siphateles as well as Salmo clarki. Distribution of the peculiar sucker group Chasmistes lends support to Taylor's contention of connection between the Klamath and the Great Basin. A few zoogeographical puzzels, however, are not readily explained. The cyprinid Ptychocheilus, native to the Columbia, Sacramento, Colorado and Great basins, but does not occur in the Klamath system. The discontinuous distribution of the Dolly Varden trout (Salvelinus malma) is equally inexplainable. Although Cope (1879b) reported the Dolly Varden in

the upper Klamath, it has not been recorded by other investigators. It might be conjectured that in some instances movement of fishes between basins was one way and/or rapidly quelled by localized extinction of certain species. Robins and Miller (1957) envision a severence of a presumed Pleistocene connection between the upper Pit and the Klamath prior to the invasion of certain endemic headwater forms of the Sacramento system.

From the investigations thus described, it is apparent that there have been several opportunities for fishes to disperee from one drainage to another during late Pliocene and Pleistocene times. Representatives of Salmo have apparently exploited several of the available dispersal routes. - meristic counts

The fairly recent innovation of counting chromosome numbers has aided significantly in the establishment of phylogenetic relationships among salmonid fishes.1/ At present, chromosome data are available for only a limited number of Salmonid species. Figures given in Table 1 indicate chromosome numbers in relation to various lineages and series of salmonids.

Table 1. Diploid (2N) chromosome numbers of salmonid groups

Pacific Salmons	Rainbow Series	Golden Series	Interior Cutthroat	Coastal Cut.
52 - 74	60	58	64	70

Due to the high degree of variability in species of Salmo, selection of meristic features for analysis must be based on a knowledge of the fish

1/- Chromosome studies in Salmonids have been conducted by Drs. Robert Behnke and Ray Simons of the Colorado and OregonsCo-operative Fishery Units respectively

group being studied. At the suggestion of Dr, Robert Behnke, analysis of the following meristic features will be undertaken: (1) vertebrae numbers, (2) scale counts, (3) presence of basibranchial teeth, (4) gill raker counts, and (5) pyloric caeca numbers.

Chromosome counts for the upper Sacramento trout will be made after summer - 1968 field collections. The writer feels that chromosome data will give the most positive indication for appropriate placement of the trout within the Salmo complex. Hopefully, analysis of meristic features will guide field workers to the most promising area in so far as obtaining an uncontaminated (e.g.- non-hybridized) stock. A preliminary report on meristic features will be available by June.

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June 24, 1968

Dr. Donald W. Seegrist
U.S. Department of Agriculture
Forest Service
Post Office Box 245
Berkeley, California 94701

Dear Dr. Seegrist:

I have to apologize for not being more prompt in my reply to you. With the summer fishery program and two counties to manage, my correspondance sometimes gets ahead of me. Your description about the salmonids found in the McCloud and lower Pit River drainage is most interesting. Characteristics and general coloration of fishes collected by you is note worthy. A cursory check of native rainbow found in tributaries of the upper Pit system bear similar color and large spots.

There are a number of streams that I would suggest for your collection trip. They are East Creek, Mill Creek above Clear Lake, Parker Creek, Lassen and Cold Creeks. The first three streams are located in the South Warner Mountains and drain to the Pit system. Lassen and Cold Creeks drain to Goose Lake. I am enclosing maps of the area to aid you in the location of these streams.

If I can be of any further assistance to you, please feel free to contact me when you come through Alturas. My home address is 306 Court Street, ph. 233-2643.

Sincerely yours,

Vernon King

Vernon King
Fishery Biologist
California Dept. of Fish and Game

Berkeley Calif

Dear Bob,

Enclosed is copy of letter from Harold Hewitt about the cutthroats in Hope Valley. Also the location of the piute like trout. Also enclosed are copy of articles from the Forest and Stream. It is interesting that "Apache" says the Rio Grande trout have yellow bellies. What fish are these?

Please give the reference from Jordan ? about bright-colored trout in the Mokelumne River.

I asked one of our boys in Bend to find out about native trout in the area. He wrote back that:

"The following areas near Bend are known to contain pure-strains cut-throat trout.

1) Hackleman Creek and Fish Lake which parallel Hwy #20 just west of Cascade summit in the Blue River - MacKenzie Ranger district. (in upr Willamette drainage)

North Creek

2) The headwaters streams of Blue River & Lookout Creek in the H. J. Andrews Experimental Forest.

3) upper Tumalo Creek near Bend (possible)

4) Dolly Varden trout in the Metolius River. East of the Cascades & in the Silver Lakes area, in particular all streams and lakes have been stocked. No one I've talked to knows of any areas where you might still find pure strains."

Signed Dave Koehler

I talked to Hewitt and he said the Rush Creek egg station is the Bush Creek in Mono County.

The reference on Geological history is

Geology of Northern California Bulletin 190
Calif. Division of Mines and Geology
Ferry Building, San Francisco, 1966
Edgar H. Bailey, Editor

This paper gave

a reference:

Lawson. A.C 1904 — the Geomorphology of the Upper Kern basin
Calif. Univ. Dept. Geology Bull. V 3 No 15
pp. 291-376 —
has maps of the glaciation

On page 141 - Geol. of Sierra Calif.

" at Trout Meadows at the mouth of the Little Kern River, a basalt flow fills the river gorge of the Little Kern to within a few hundred feet of the present stream level. The basalt extends across the trace of the Kern Canyon fault without displacement. The date of the basalt is 3.5 ± 0.1 m.y. shows the limits of the cutting of the upper Kern Canyon can complete by that time and that the Kern Canyon fault has been inactive for at least 3.5 million years.

On page 140 —

" Thus during the pliocene the southern Sierra Nevada had a local relief of 4,000 - 6,000 ft (Dalrymple 1963

page 141 — " Quaternary volcanic rocks (those less than a million years) are predominantly in three volcanic fields . . . . . The third is around the headwaters of the south fork of the Kern River.

page 142 — The Tooway Volcanic field at the headwaters of the south fork of the Kern R. include several well-preserved basaltic andesite cones and flows along Golden Trout Creek as well as two isolated symmetrical tablete (?) domes. Templeton Mt and Monache Mt. each about 1,500 ft high (With 1,501" " Page 145 Flows along golden Trout creek extend to the floor of the Kern River Canyon at the south end of Sequoia park. On these upper surfaces are scattered giant quartz-monzonite boulders which may be glacial erratics and patches of gravel thought to be glacial outwashes, both of a pre Wisconsin glaciation. "

It seems to me this must be the volcanic flow that separated the south fork from ~~Golden Trout~~ Golden Trout Creek. Since it was glaciated pre-Wisconsin, the golden must have gotten into golden Trout Creek

sometime around the Wisconsin Glacial period
And the map shows that Goldentrout Creek,
The south Fork and headwaters of Little Kern
were not covered by the "Wisconsin" Glacier
but Big Arroyo and others were. Perhaps
this dates the golden to the Wisconsin
period or late Pleistocene. The
Big Arroyo and Calvin Lake were fishless
because of the glaciation. By this
time - 10,000 years ago? - the Sierra
Nevada were at their present height.

If the goldens were present at
this time they could have been spread on
all ~~of~~ the glacial rivers leading
into the great Valley including
the Mc Cloud.

Now enters the rainbows and
with the warming period 6000 years ago
they explored the "goldens" in all
lower areas because they are a
warmer water trout and better adapted
to "new" conditions except in
upper Kern & Mc Cloud, + (South
fork of Battle Creek). Else
where we find hybrids —

upper Feather River etc. Therefore the present goldeen trouts and the Mc Cloud river cut-throats are derived from a common Ancestor.

Where did this ancestral form come from?

(1) Eastern Oregon

(2) Colorado River basin — chromosomes are same.

(4) maybe it evolved in California? why not.

I find it hard to believe that the Mc Cloud form originated in Eastern Oregon and the goldens came from the colorado system. Once a bright colored trout got into the great Valley it would have spread completely from one end to the other. There would be nothing to keep them apart. I'll be willing to bet that the McCloud form has the same chromosome amt (or close to) the goldens.

The very low gillraker count in the sheepheaven spring fish could be due to genetic drift. Notice

that the gill rakers, scale counts are very uniform (little variation). This is a very small stream and the population of trout may not be over 50-100 fish and could have at times been quite reduced in number. It is certainly a highly inbreed strain. The fish in the other streams are more variable.

I hope you can get some chromosome material this summer. This reminds me - one of the lab technicians here told me a friend of his at U.C. had done some chromosome work on salamanders. using body tissues. Have you seen this or know of this work.

Will stick this in the mail. Ask Sally if she wants some iris, dahlias, gladiolus, bulbs.

Best

Alan.

date on map = Davis Crk. — Pit) — McCloud.

* Sacgrist Lost R. - lava flow which isolates this stream is 2000 yrs. old. - prob. whole fauna destroyed.

C. A. S. Phila, 1872

—— & Ute Crk.

→ Cope; Aiken, Rothschild - - parties coll. - Ann. Rept. Chief Engr. - Wheeler Surv. 1874 - Appendix - (one of them) - in back app. I-2 / complete itinerary of Cope's collection - obtained S. plenuticus at Ft. Garland: - July 29, 1874. — 50 Fowler's 1912 - reference to Ute Crk. U. M. ex - -

ca 1970
[calforma] #01

Brook Trout

Salvelinus fontinalis (Mitchill)

Identification. Brook trout are distinguished from other trout by the combination of (1) dark olive green back with lighter colored wavy lines (vermiculations), (2) red spots on the sides surrounded by blue halos, and (3) white edges on the pectoral, pelvic and anal fins. The mouth is large and slightly oblique with the maxillary extending past the posterior margin of the eye. Teeth are present in both jaws, on the head of the vomer, on the tongue and palatine bones, but absent from the shaft of the vomer and basibranchial bones. There are 110-132 scales in the lateral line, 10-14 rays in the dorsal fin, 9-12 in the anal fin, 11-14 in the pectoral fins and 8-10 in the pelvic fins. Spawning males are deep bodied with hooked lower jaws (kype), while the females develop a protruding genital papilla. Both sexes may become brightly colored when spawning, with dusky to black bellies, red sides and red lower fins. Young fish have 8-12 wide parr marks, some as wide as the eye, and usually a few red, yellow, or blue spots.

Names. Brook trout are frequently called Eastern brook trout in California and speckled trout in Canada. Brook char would actually be a better name since most members of the genus Salvelinus are called chars while most members of the genus Salmo are called trout. When Mitchill described the species in 1815, however, from a stream in New York, he placed it in the genus Salmo, from which it was not removed until 1878, by D. S. Jordan. Salvelinus is the Latinized version of an ancient Scandinavian word for char while fontinalis means living in springs.

Distribution. Brook trout are native to the northern half of the eastern United States and to eastern Canada. A few populations are native as far south

as Georgia, in Appalachian mountain streams. The first introductions into California were 6000 trout brought in by the California Fish Commission in 1872. Between 1872 and 1879 thousands of eggs were imported from New Hampshire and Wisconsin, to be raised in the hatchery at Berkeley. By 1890 they were being raised in large numbers and had been distributed throughout the state (McAfee, 1966). They are now established in mountain (mostly Sierra-Nevada) streams and lakes from the San Bernadino Mountains north to the Oregon border. Only a few populations exist in coastal streams.

Life History. Brook trout are fish of clear cold lakes and streams. Despite the continuous and widespread planting they have received throughout California, populations have become established mostly in small spring fed headwater streams and in isolated mountain lakes. These are the coldest of California's trout waters, so it is not surprising to find that brook trout are among the most cold tolerant of salmonids, feeding at temperatures as low as 3-4°C, albeit sluggishly. They seem to prefer temperatures of 14-19°C but can ~~strive~~ survive temperatures up to 26°C, if acclimated to them (Carlander, 1969). However, growth is poor or nonexistant at temperatures much above 19°C. ~~In lakes, when the surface waters warm up in the summer, they seek out the colder deep waters or spring areas.~~

In streams, brook trout often hold territories which they defend against all other trout, including individuals of other species. Such territories are generally located behind rocks that break the current, permitting the trout to stay in back eddies without expending much energy. A trout holding a territory has exclusive rights to the invertebrates that drift over it or live in it. In lakes, brook trout tend to swim about as individuals, schooling only when alarmed. However, faceplate observations in Chiquito Lake, Madera County

(elevation 1700 m) during August, 1973, showed that they will congregate in large numbers over springs, presumably attracted to the lower water temperatures.

The main food of brook trout in streams is terrestrial insects and aquatic insect larvae. Both types of food are taken primarily as drift on or close to the surface of the water. They are not particularily selective in their feeding, but they concentrate on whatever organisms are most abundant. Brook trout also do some bottom feeding, indicated by the fact that in Sagehen Creek 20 percent of the summer diet is sculpins (Dietsch, 1959). The diet of brook trout in lakes is similar to the stream diet, except young trout feed heavily on zooplankton and fish tend to be more important in diet of large trout. Feeding in both lakes and streams has definite daily and seasonal rhythyms. Brook trout will feed anytime there is sufficient light to see their prey but most intensive feeding occurs in the evening, when insects are most active, and in early morning. Little feeding takes place in the winter and there is frequently a period in midsummer when the pace of feeding slackens due to high water temperatures. This is particularily noticeable in shallow "meadow" lakes and in small streams.

Growth in brook trout is highly dependent on length of the growing season, water temperature, population density, and availability of food, although other factors, such as water chemistry, the presence of other trout species, heredity, and fishing pressure also frequently affect growth. In California the fastest growth occurs in lakes and streams of moderate elevations that do not contain large populations of other fishes or of brook trout. In such situations they will reach 15 cm TL by the end of their first year, 18-20 cm TL by the end of their second year, and 23-25 cm TL by the end of their third year. Somewhat slower growth, however, is typical of most California populations, so the trout seldom exceed 30 cm TL (340 gms). The

largest brook trout from California, caught in 1932 from Silver Lake, Mono County, was over 60 cm TL and weighed 4.4 kg (9 lbs. 12 oz). On the opposite end of the size spectrum are brook trout from Bunny Lake, Mono County, where overcrowding has produced stunted fish that are only about 25 cm TL even though they are nearly 15 years old (McAfee, 1966). The Bunny lake trout are the oldest brook trout on record from anywhere. Brook trout that live longer than 4 or 5 years are very uncommon.

Going along with this short life span is a generally early age of maturity. Male brook trout may spawn at the end of their first summer of life, at less than 10 cm TL, which females may mature at the end of their second summer, at 11-12 cm TL. It is more common, however, for the males to mature in their second or third year, at 12-15 cm TL and females to mature in their third or fourth year at 15-20 cm TL.

Unlike most other California trout, brook trout are fall spawners, the actual time depending on water temperatures. Usually they spawn in California from mid-September to early January, at water temperatures of 4-11°C. However, some reproductive activity was observed in Frying Pan Lake, a high altitude lake in Madera County, in mid-August, when water temperatures were considerably higher.

Spawning sites are chosen by females, who seek out areas with the following characteristics, in approximate order of importance: (1) upwelling through the bottom, (2) water temperatures colder than the surrounding water, (3) pea to walnut sized gravel, and (4) nearby cover. Thus the preferred site for a redd construction is a gravel bottomed spring in a stream, close to an undercut bank or log. Such a site presumably assures maximum egg survival since the upwelling and coarse gravel ~~assure~~ provide constant flow around the eggs, the cold,

constant temperatures slow development so the eggs will not hatch before spring, and the cover offers protection from predators for the brilliantly colored spawners. Frequently one or more of the ideal site characteristics may be missing from areas where brook tour are established. They will then spawn in sub-optimal areas since usually enough eggs will survive to assure continuance of the population. Thus brook trout have been observed spawning in gravel riffles, sandy bottomed springs, and gravel bottomed shallows of lakes. Their adaptability to lake conditions in particular has permitted brook trout to maintain populations in mountain lakes that lack the accessible inlets or outlets most other salmonids require.

Once a female has chosen a spawning site, she begins to dig the redd by turning on her side and shoving up gravel with rapid movements of her tail. Usually this behavior does not begin unless there are males in the vicinity. The males are attracted to the digging female and one quickly become dominant, defending the redd site against all other males. Often redds are located in territories already determined by [illegible]. The female chases away other females although the male will also perform this task on occasion. As the female digs, the male courts constantly by swimming along side her, nudging and quivering. When the redd is complete (the size depends on the size of the female), the female swims slowly to the bottom of the redd and the male quickly swims along side her, quivering. Together they swim over the bottom of the redd, releasing eggs and sperm simultaneously, the milt visible as a white cloud. The female almost immediately beings to sweep gravel over the eggs with her tail. This new digging activity not only ~~offers~~ covers the newly spawned eggs but serves to start a new redd just upstream from the old one. Since only 15-60 eggs are laid at one time and since wild brook trout females contain anywhere from 50 to 2700 eggs, each female has to repeatedly dig new redds. In California, the average fecundity seems to be between 200 and 600

#06

(McAfee, 1966). Males also spawn repeatedly, usually with more than one female, and females frequently switch mates between spawnings. Spawning activity can occur at any time of the day and night but tends to peak in the early morning or at dusk.

Because the eggs have to overwinter at low water temperatures, development time is long, usually 100-144 days at water temperatures of 2-5°C. At 13°C, however, development only takes about 35 days (McAfee, 1966). For the first 3-4 weeks after hatching, the alevins remain in the gravel, living off food stored in the yolk sac. They emerge from the gravel in late April and May, gradually becoming more active as the yolk sac is absorbed and the water warms up. The fry in streams move into the shallow edges, among emergent plants, or into the back waters of pools where they feed on small crustaceans. In lakes, they move into shallow water as well, concentrating in areas somewhat protected from wave action.

Brook trout occasionally hybridize in the wild with brown trout, producing offspring known as tiger trout, a name which seems to fit both the hybrid's striped color pattern and its voracious feeding habits. Such hybrids are usually sterile. In hatcheries, brook trout have been crossed with both rainbow trout and lake trout. The brook trout-lake trout cross has resulted in the splake trout, a fertile hybrid that has been stocked in a number of lakes in the eastern United States and Canada.

Status. Brook trout are the principal species of game fish in over 1,000 lakes and 1,400 miles of stream in California (McAfee, 1966). In most of these waters their populations are self sustaining since only small numbers are still raised in California hatcheries, compared to the number of rainbow trout raised. This has not always been the case. In the 1890's and early

1900's large numbers were raised and planted, many in the fishless waters of the high Sierras. The planting was done by fisheries workers, foresters, and laymen enthusiastic about the beautiful colors, edibility, and angling qualities of brook trout but unfortunately ignorant of their biology. Although they are the only trout that will perpetuate itself in many mountain lakes without tributaries for spawning, they also tend to overpopulate these lakes, resulting in large numbers of small fish barely worth fishing for. Part of the problem may be caused by the inability of larger fish to survive the long winters after using their reserves for spawning. Thus, a common management practice for book trout lakes that do have tributaries suitable for spawning is to poison out the brook trout and then plant rainbow or golden trout.

In streams brook trout are sometimes a problem because they can compete with native trouts, even displacing some of the rarer forms. In Long Canyon Creek, Tulare County, brook trout have almost completely replaced golden trout. However, in nearby Soda Springs Creek, Little Kern Golden trout have managed to hold their own, outnumbering brook trout by 10 to 1.

Detailed suggestions for managing brook trout in California can be found in McAfee (1966).

References. Carlander, 1969; Dietsch, 1959; Evermann and Bryant, 1919; Embody, 1934; Hale and Hilden, 1969; McAfee, 1966; Maciolek and Pister, 1955; Moyle, 1970; Mullan, 1958; Reimers, 1958; Wales, 1956, 1957, 1958.

R.B.

All pertinent data in Table 14 - but little that can be compared.

THE RESOURCES AGENCY OF CALIFORNIA
Department of Fish and Game

THE FISHERY AT BEARDSLEY RESERVOIR, TUOLUMNE COUNTY, CALIFORNIA, 1962-1967[1/]

ROBERT R. TREANOR and STEPHEN J. NICOLA
Inland Fisheries Branch

SUMMARY

The trout fishery at Beardsley Reservoir, Tuolumne County, was monitored from 1961 through 1967. Use, catch and success rates generally increased from 1961 through 1964; however, continuous and heavy discharge of runoff during the winter and spring of 1964-65 caused a severe decline in the fishery in 1965. The fishery recovered substantially in 1966 but declined again in 1967.

During this time an average of 6,012 anglers fished a total of 29,971 hours and harvested 8,163 trout per year. Fully 93.6% of the trout caught were marked rainbow trout planted as fingerlings. Between 30 and 50% of the total annual use and catch was recorded during the first month of the trout season, of which about one-half occurred on the opening weekend. Catch per hour of trout was highest in October, followed by May and September. The catch per hour of boat anglers averaged 1.8 times that of shore anglers. The average total annual yield of trout was 5.4 lb per acre.

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1/ Submitted January 1971
Inland Fisheries Administrative Report No. 71-6.

INTRODUCTION

Since 1961 the Coldwater Reservoir Study has been monitoring the fishery at Beardsley Reservoir, Tuolumne County, in order to evaluate the effects of various management practices on fishing quality. From 1961 through 1967 we planted one wild strain and six domestic strains of rainbow trout to determine which strain would provide the best fishing. Our experiments were also designed to determine the best time of year and size of trout to plant. The results of this study are presented by Cordone and Nicola (1970), who report on the four main strains of trout tested (Kamloops, Shastas, Mt. Whitneys and Virginias). During this period, comprehensive information was collected on the fishery created at Beardsley by these planting experiments. The purpose of this report is to summarize the major aspects of that fishery from 1962 through 1967, including information on the harvest of three strains of domestic trout, and five groups of Kamloops and Shastas planted in 1967, not treated by Cordone and Nicola (1970).

Beardsley Reservoir

Beardsley Reservoir was formed in 1957 by an earth and rock dam on the Middle Fork Stanislaus River in Tuolumne County, California. Its physical characteristics and operation are described by Cordone and Nicola (1970), and its limnology is described by Nicola and Borgeson (1970).

METHODS

The methods of census and fish marking used in this study are described in detail by Cordone and Nicola (1970). The creel survey, excluding 1962, sampled an average 76.2% of the annual total of angler hours (Table 1). The three rainbow strains not reported on by Cordone and Nicola are the Hot Creek strain, the Coleman-Kamloops strain, and a hybrid of the Mt. Whitney domestics and the wild Kamloops. Only six groups of these fish, totaling 55,000, were planted (Table 2). The Coleman-Kamloops strain is a domesticated strain of Kamloops developed at the Coleman National Fish Hatchery, California. The Hot Creek strain was developed from fall-spawning rainbow trout at Hot Creek State Hatchery in Mono County, California.

THE BEARDSLEY FISHERY

Total use, catch, and success varied considerably between 1962 and 1967 (Tables 3 through 8, Figure 1). The total number of anglers ranged from 4,360 to 7,602, and the total angler hours varied from 23,194 to 36,044. The average angler fished almost 5 hours per trip. The total catch of trout varied from 3,299 to 11,789. Angler success varied similarly.

These variations were not haphazard, however (Figure 1). From 1962 through 1964 total use increased steadily, while the total catch increased slightly in 1963 and sharply in 1964. It appeared that these parameters would have continued to increase were it not for a precipitous decline in the fishery in 1965. This decline was a direct result of prolonged and continuous heavy discharge from runoff of rain and melting snow from late December 1964 through July 1965. The effect of this discharge was to cause a heavy loss of trout over the spillway, and highly turbid conditions in the reservoir. The latter made it difficult to catch those trout remaining in the reservoir.

In 1966, total use increased somewhat, but total catch increased greatly. This response was due, we believe, to the fact that fingerlings planted in 1965 were planted under conditions where few trout from previous years were present in the reservoir. Hence intraspecific competition was less and survival and growth of the 1965 groups was enhanced. Another year of heavy runoff and spill in 1967 once again depressed total catch.

Total catch per hour and pounds per angler responded similarly to changes in use and catch from 1962 through 1967. The general trend in total catch per hour increased slightly or remained the same, but there appeared to be a downward trend in the pounds harvested per angler.

Catch Composition

The Beardsley Reservoir fishery was supported mainly by the harvest of rainbow trout planted as fingerlings. This can be demonstrated best by the catch from 1965 through 1967, when the influence of unmarked planted trout, which were common during the first three years of the study, is minimal (Tables 3 through 8). Of the average total annual catch, 93.6% by number and 90.7% by weight were marked rainbow trout of known hatchery origin. Unmarked rainbow trout comprised 4.5% by number and 4.1% by weight of the average total annual catch, while wild brown trout (S. trutta) comprised only 1.9% of the catch by number and 5.2% by weight.

Opening Weekend Statistics

A large proportion of the annual use and catch occurred on the opening weekend of trout season (Table 9). These proportions are significant when one considers that opening weekend represented only 1.1% of the total days in the trout season.

Monthly Percentages of Total Seasonal Effort and Catch

Seasonal patterns of use and catch were very evident during each year. In virtually all years, the greatest use and catch (between 30 and 50% of the annual totals) took place during the opening month of trout season (Table 10). Fifty percent of the total trout caught were taken during the first month of the season. After the high success during the first month, there was a decline in the catch until September and October. Use also dropped after the first month and didn't increase until October.

Total Annual Yield

The total yield in pounds per acre for four of the six years did not deviate significantly from the mean (Table 11). The two exceptions were the low of 2.41 lb per acre in 1965, and the high of 7.92 lb per acre in 1964. Although more fish were caught in 1966 than in 1964, their total weight was less (Figure 1). The low yields in 1965 and 1967 corresponded to the heavy runoff and spillway discharge observed in those years.

Catch Per Hour

Although there was considerable variation from year to year, catch per hour tended to be highest in October followed by May and then September (Table 12). Catch per hour was consistently low in June, July, and August. The total annual catch per hour was lowest in 1965 and 1967, years of heavy spillway discharge.

Boat anglers had a higher catch per hour than shore anglers for all years since 1964, when records for boat and shore anglers were first separated (Table 13). The catch per hour for boat anglers tended to be highest in October, followed by May and September (Table 13). For shore anglers the catch per hour was highest in October, followed by May and June. The poorest catch per hour for shore anglers was in August, while July was the slowest for boat anglers. Boat anglers were approximately 3 times more successful than shore anglers in August and September, but both groups had more nearly equal success in June, July, and October.

Harvest of Miscellaneous Rainbow Trout Strains

Few of the groups of rainbow trout not reported on by Cordone and Nicola (1970) were harvested at a very high rate (Table 14). None of the groups of Hot Creeks, Coleman-Kamloops or Whitney x Kamloops approached the success of Kamloops and Shastas described by Cordone and Nicola (1970). Although these tests were not extensive enough to accurately quantify their potential in Beardsley, our experience with these strains in other reservoirs (unpublished data) leads us to believe that planting them in reservoirs as fingerlings should be avoided.

The harvest of Kamloops planted at 0.8 per ounce in May 1967 was higher than the average for Kamloops planted at that time of year from 1962 to 1966. The harvest of the other groups of Kamloops and the Shastas was unexplicably below the average for these strains from 1962-1966 (Cordone and Nicola, 1970).

REFERENCES

Cordone, Almo J. and Stepehn J. Nicola. 1970. Harvest of four strains of rainbow trout, Salmo gairdnerii, from Beardsley Reservoir, California. Calif. Fish Game 56(4):271-287.

Nicola, Stephen J. and David P. Borgeson. 1970. The limnology and productivity of three California coldwater reservoirs. Calif. Fish Game 56(1):4-20.

table 14 shows no dif. between returns of whitney x kamloop hybrids x shastas when both stocked in 1967
and Coleman-Kamloops stocked in 1964 returned ($\frac{\text{lbs. stocked}}{\text{lbs. caught}}$) about 5 X that of 67 Shasta stocking.

TABLE 1

Beardsley Reservoir Annual Creel Census Sampling Levels

Percentage checked of	1962	1963	1964	1965	1966	1967
Weekend[1/] days	96	100	100	95	89	98
Weekday days	93	40	43	37	39	42
All days	94	59	60	55	55	59
Total angler hours	97	77	79	79	70	76

[1/] Includes major holidays (Memorial Day, July 4th, and Labor Day); other holidays were considered weekdays.

TABLE 2

Number, Size and Mark of Each Strain of Rainbow Trout
Planted in Beardsley Reservoir, 1961-1967

Date	Species and strain[1]	Number	No. per ounce	Mark[2]
April 22, 1963	RT-H	10,000	3.0	Ad-RM
April 16, 1964	RT-H	10,000	5.4	D-RM
Aug. 31, 1964	RT-W x RT-K	5,000	17.5	RV-LM
July 29, 1966	RT-KC	10,000	5.0	LV-LM
Aug. 9, 1967	RT-KC	10,000	7.6	D-Ad
Sept. 14, 1967	RT-KC	10,000	3.4	D-Ad-LV

Apr. - Sept. dif. stocking dates

size dif.

[1] RT-H = Hot Creek strain, RT-W = Whitney strain, RT-K = wild Kamloops strain, RT-KC = Coleman Kamloops strain.

[2] Ad = adipose, D = dorsal, M = maxillary, V = ventral, L = left, R = right.

TABLE 3

Estimated Total Use and Catch at Beardsley Reservoir, 1962

1962	May[1/]	June	July	August	September	October	Season totals
Use							
Total anglers	1,483	1,220	624	550	374	693	4,944
Total hours	8,480	6,970	3,022	2,273	2,078	4,054	26,877
Hours per angler	5.7	5.7	4.8	4.1	5.6	5.8	5.4
Catch[2/]							
Total trout	2,652 (1,755.6)	1,203 (630.6)	616 (304.5)	714 (323.2)	899 (414.9)	1,355 (485.9)	7,439 (3,914.7)
Total RT	2,583 (1,658.1)	1,175 (593.3)	603 (289.9)	709 (322.1)	878 (404.0)	1,326 (471.1)	7,274 (3,738.5)
Marked RT	841 (553.8)	331 (171.3)	195 (85.9)	256 (127.3)	243 (105.6)	584 (196.6)	2,450 (1,240.5)
Unmarked RT	1,742 (1,104.3)	844 (422.0)	408 (204.0)	453 (194.8)	635 (298.4)	742 (274.5)	4,824 (2,498.0)
Total Bn	69 (97.5)	28 (37.3)	13 (14.6)	5 (1.1)	21 (10.9)	29 (14.8)	165 (176.2)
Success							
Trout per angler	1.79	0.99	0.99	1.30	2.40	1.96	1.50
Pounds per angler	1.18	0.52	0.49	0.59	1.11	0.70	0.79
Trout per hour	0.31	0.17	0.20	0.31	0.43	0.33	0.28

1/ Season began on April 28. Data for April 28, 29, and 30 are combined with May.
2/ Pounds in parentheses.

TABLE 4

Estimated Total Use and Catch at Beardsley Reservoir, 1963

1963	May	June	July	August	September	October	Season totals
Use							
Total anglers	2,721	960	794	688	531	640	6,334
Total hours	14,594	4,319	3,870	3,356	2,697	3,595	32,431
Hours per angler	5.4	4.5	4.9	4.9	5.1	5.6	5.1
Catch[1/]							
Total trout	3,676 (2,066.3)	577 (386.3)	637 (309.1)	702 (374.8)	963 (336.1)	1,510 (489.1)	8,065 (3,961.7)
Total RT	3,582 (1,988.3)	509 (312.2)	606 (297.9)	671 (345.0)	931 (326.2)	1,472 (470.9)	7,771 (3,740.5)
Marked RT	1,473 (891.6)	227 (120.4)	351 (129.6)	452 (168.9)	765 (221.6)	1,310 (360.7)	4,578 (1,892.8)
Unmarked RT	2,109 (1,096.7)	282 (191.8)	255 (168.3)	219 (175.2)	166 (104.6)	162 (110.2)	3,193 (1,846.8)
Total Bn	94 (78.0)	68 (74.1)	31 (11.2)	31 (29.8)	32 (9.9)	38 (18.2)	294 (221.2)
Success							
Trout per angler	1.35	0.60	0.80	1.02	1.81	2.36	1.27
Pounds per angler	0.76	0.40	0.39	0.54	0.63	0.76	0.62
Trout per hour	0.25	0.13	0.16	0.21	0.36	0.42	0.25

[1/] Pounds in parentheses.

TABLE 5

Estimated Total Use and Catch at Beardsley Reservoir, 1964

1964	May	June	July	August	September	October	Season totals
Use							
Total anglers	1,889	1,562	1,121	1,145	1,030	855	7,602
Total hours	11,122	7,380	4,651	4,516	4,417	3,958	36,044
Hours per angler	5.9	4.7	4.1	3.9	4.3	4.6	4.7
Catch[1/]							
Total trout	6,148 (3,419.7)	1,670 (912.4)	467 (181.2)	535 (261.6)	1,165 (443.4)	1,470 (487.7)	11,455 (5.706.0)
Total RT	6,031 (3,312.1)	1,628 (877.5)	450 (167.8)	504 (238.4)	1,142 (427.1)	1,454 (475.5)	11,209 (5,498.4)
Marked RT	5,488 (2,926.6)	1,535 (817.1)	422 (150.7)	488 (229.0)	1,110 (414.0)	1,420 (456.1)	10,463 (4,993.5)
Unmarked RT	543 (385.5)	93 (60.4)	28 (17.1)	16 (9.4)	32 (13.1)	34 (19.4)	746 (504.9)
Total Bn	117 (107.6)	42 (34.9)	17 (13.4)	31 (23.2)	23 (16.3)	16 (12.2)	246 (207.6)
Success							
Trout per angler	3.25	1.07	0.42	0.47	1.13	1.72	1.51
Pounds per angler	1.81	0.58	0.16	0.23	0.43	0.57	0.75
Trout per hour	0.55	0.23	0.10	0.12	0.26	0.37	0.32

[1/] Pounds in parentheses

TABLE 6

Estimated Total Use and Catch at Beardsley Reservoir, 1965

1965	May	June	July	August	September	October	Season totals
Use							
Total anglers	2,096	625	598	459	282	300	4,360
Total hours	11,871	2,960	2,689	2,377	1,421	1,876	23,194
Hours per angler	5.7	4.7	4.5	5.2	5.0	6.2	5.3
Catch[1/]							
Total trout	1,130 (817.9)	223 (162.2)	182 (141.4)	250 (139.5)	319 (128.7)	1,195 (346.7)	3,299 (1,736.4)
Total RT	1,083 (736.6)	212 (146.2)	163 (99.2)	241 (130.9)	317 (126.4)	1,189 (344.4)	3,205 (1,583.7)
Marked RT	1,050 (702.9)	189 (134.7)	156 (85.6)	213 (118.0)	273 (114.1)	1,088 (311.1)	2,969 (1,466.4)
Unmarked RT	33 (33.7)	23 (11.5)	7 (13.6)	28 (12.9)	44 (12.3)	101 (33.3)	236 (117.3)
Total Bn	47 (81.3)	11 (16.0)	19 (42.2)	9 (8.6)	2 (2.3)	6 (2.3)	94 (152.7)
Success							
Trout per angler	0.54	0.36	0.30	0.54	1.13	3.98	0.76
Pounds per angler	0.39	0.26	0.24	0.30	0.46	1.16	0.40
Trout per hour	0.10	0.08	0.07	0.10	0.22	0.64	0.14

[1/] Pounds in parentheses.

TABLE 7

Estimated Total Use and Catch at Beardsley Reservoir, 1966

1966	May[1/]	June	July	August	September	October	Season totals
Use							
Total anglers	2,244	648	1,011	756	684	657	6,000
Total hours	12,482	3,420	4,917	3,456	3,230	2,975	30,480
Hours per angler	5.6	5.3	4.9	4.6	4.7	4.5	5.1
Catch[2/]							
Total trout	6,362 (2,494.6)	756 (296.4)	1,102 (402.2)	642 (221.7)	1,489 (414.9)	1,438 (379.3)	11,789 (4,209.1)
Total RT	6,275 (2,381.6)	737 (287.1)	1,076 (386.3)	623 (209.3)	1,485 (413.1)	1,435 (370.9)	11,631 (4,048.3)
Marked RT	6,101 (2,320.2)	692 (274.1)	975 (359.0)	584 (196.4)	1,413 (395.1)	1,401 (359.0)	11,166 (3,903.8)
Unmarked RT	174 (61.4)	45 (13.0)	101 (27.3)	39 (12.9)	72 (18.0)	34 (11.9)	465 (144.5)
Total Bn	87 (113.0)	19 (9.3)	26 (15.9)	19 (12.4)	4 (1.8)	3 (8.4)	158 (160.8)
Success							
Trout per angler	2.84	1.17	1.09	0.85	2.18	2.19	1.96
Pounds per angler	1.11	0.46	0.40	0.29	0.61	0.58	0.70
Trout per hour	0.51	0.22	0.22	0.18	0.46	0.48	0.39

[1/] Season began on April 30. Data for this day are combined with May.

[2/] Pounds in parentheses.

TABLE 8

Estimated Total Use and Catch at Beardsley Reservoir, 1967

1967	May[1/]	June	July	August	September	October	Season totals
Use							
Total anglers	2,653	1,368	1,232	719	388	475	6,835
Total hours	14,011	5,473	4,918	2,599	1,718	2,081	30,800
Hours per angler	5.3	4.0	4.0	3.6	4.4	4.4	4.5
Catch[2/]							
Total trout	4,280 (2,395.1)	615 (368.1)	774 (469.6)	273 (136.8)	431 (198.3)	557 (242.2)	6,930 (3,810.1)
Total RT	4,216 (2,306.8)	584 (340.5)	752 (422.7)	244 (116.2)	422 (197.1)	543 (231.4)	6,761 (3,614.7)
Marked RT	4,070 (2,223.6)	550 (323.2)	704 (406.4)	214 (107.5)	408 (193.9)	526 (224.1)	6,472 (3,478.7)
Unmarked RT	146 (83.2)	34 (17.3)	48 (16.3)	30 (8.7)	14 (3.2)	17 (7.3)	289 (136.0)
Total Bn	64 (88.3)	31 (27.6)	22 (46.9)	29 (20.6)	9 (1.2)	14 (10.8)	169 (195.4)
Success							
Trout per angler	1.61	0.45	0.63	0.38	1.11	1.17	1.01
Pounds per angler	0.90	0.27	0.38	0.19	0.51	0.51	0.56
Trout per hour	0.31	0.11	0.16	0.10	0.25	0.27	0.22

[1/] Season began on April 29. Data for April 29 and 30 are combined with May.

[2/] Pounds in parentheses.

TABLE 9

Opening Weekend Angling Compared with Seasonal Totals at Beardsley Reservoir, 1962-1967[1/]

	1962			1963			1964[2/]		
	Opening weekend	Season totals	Opening as % of total	Opening weekend	Season totals	Opening as % of total	Opening weekend	Season totals	Opening as % of total
Anglers	666	4,944	13.5	1,204	6,333	19.0	502	7,062	6.6
Angler hours	3,525	26,877	13.1	6,919	32,432	21.3	2,766	36,044	7.7
Hours per angler	5.3	5.4		5.7	5.1		5.5	4.7	
Total trout	1,128	7,439	15.2	2,518	8,065	31.2	2,919	11,338	25.8
Rainbow trout	1,093	7,274	15.0	2,486	7,771	32.0	2,879	11,092	26.0
Marked rainbow	376	2,450	15.4	1,042	4,578	22.8	2,724	10,463	26.0
Unmarked rainbow	717	4,824	14.9	1,444	3,193	45.2	155	746	20.8
Brown trout	35	165	21.2	32	294	10.9	40	246	16.3
Trout per angler	1.69	1.50		2.09	1.27		5.81	1.50	
Trout per hour	0.32	0.28		0.36	0.25		1.06	0.32	

TABLE 9 (cont'd)

Opening Weekend Angling Compared with Seasonal Totals at Beardsley Reservoir, 1962-1967

	1965			1966			1967		
	Opening weekend	Season totals	Opening as % of total	Opening weekend	Season totals	Opening as % of total	Opening weekend	Season totals	Opening as % of total
Anglers	1,095	4,360	25.1	988	6,000	16.5	524	6,835	7.7
Angler hours	6,980	23,194	30.1	5,341	30,478	17.5	2,924	30,800	9.5
Hours per angler	6.4	5.3		5.4	5.1		5.6	4.5	
Total trout	525	3,298	15.9	3,751	11,789	31.8	1,656	6,930	23.9
Rainbow trout	510	3,204	15.9	3,710	11,631	31.9	1,647	6,761	24.4
Marked rainbow	501	2,968	16.9	3,635	11,166	32.6	1,610	6,472	24.9
Unmarked rainbow	9	236	3.8	75	465	16.1	37	289	12.8
Brown trout	15	94	16.0	41	158	26.0	9	169	5.3
Trout per angler	0.48	0.76		3.80	1.96		3.2	1.0	
Trout per hour	0.08	0.14		0.70	0.39		0.57	0.22	

1/ Opening weekends as follows: 1962 - April 28, 29; 1963 - May 4, 5; 1964 - May 2, 3; 1965 - May 1, 2; 1966 - April 30, May 1; 1967 - April 29, 30

2/ Snow closed road on May 3, 1964. Percentages reflect opening day only.

TABLE 10

Monthly Percentages of Total Seasonal Effort and Catch at Beardsley Reservoir, 1962-1967

	May	June	July	August	September	October
1962[1/]						
Anglers	30.0	24.7	12.6	11.1	7.6	14.0
Angler hours	31.6	25.9	11.2	8.5	7.7	15.1
Total trout	35.6	16.2	8.3	9.6	12.1	18.2
Rainbow trout	35.5	16.2	8.3	9.7	12.1	18.2
Brown trout	41.8	17.0	7.9	3.0	12.7	17.6
1963						
Anglers	43.0	15.2	12.5	10.9	8.4	10.1
Angler hours	45.0	13.3	11.9	10.3	8.3	11.1
Total trout	45.6	7.2	7.9	8.7	11.9	18.7
Rainbow trout	46.1	6.5	7.8	8.6	12.0	18.9
Brown trout	32.0	23.1	10.5	10.5	10.9	12.9
1964						
Anglers	24.8	20.5	14.7	15.1	13.5	11.2
Angler hours	30.9	20.5	12.9	12.5	12.3	11.0
Total trout	53.2	14.7	4.1	4.7	10.3	13.0
Rainbow trout	53.3	14.7	4.1	4.5	10.3	13.1
Brown trout	47.6	17.1	6.9	12.6	9.3	6.5
1965						
Anglers	48.1	14.3	13.7	10.5	6.5	6.9
Angler hours	51.2	12.8	11.6	10.2	6.1	8.1
Total trout	34.3	6.8	5.5	7.6	9.7	36.2
Rainbow trout	33.8	6.6	5.1	7.5	9.9	37.1
Brown trout	50.0	11.7	20.2	9.6	2.1	6.4
1966[1/]						
Anglers	37.4	10.8	16.8	12.6	11.4	11.0
Angler hours	40.9	11.2	16.1	11.3	10.6	9.8
Total trout	54.0	6.4	9.3	5.4	12.6	12.2
Rainbow trout	54.0	6.3	9.3	5.4	12.8	12.3
Brown trout	55.1	12.0	16.5	12.0	2.5	1.9

TABLE 10 (cont'd)

Monthly Percentages of Total Seasonal Effort and Catch at Beardsley Reservoir, 1962-67

	May	June	July	August	September	October
1967[1/]						
Anglers	38.8	20.0	18.0	10.5	5.7	6.9
Angler hours	45.5	17.8	16.0	8.4	5.6	6.8
Total trout	61.8	8.9	11.2	3.9	6.2	8.0
Rainbow trout	62.4	8.6	11.1	3.6	6.2	8.0
Brown trout	37.8	18.3	13.0	17.2	5.3	8.3
Mean, all years[2/]						
Anglers	36.3	17.7	14.9	12.0	9.1	10.0
Angler hours	40.4	17.0	13.4	10.3	8.7	10.3
Total trout	49.5	10.3	7.7	6.4	10.8	15.4
Rainbow trout	49.7	10.1	7.6	6.3	10.8	15.5
Brown trout	42.5	17.7	11.4	11.0	8.1	9.4

[1/] In 1962, season began on April 28. Data for April 28, 29, and 30 are combined with May. In 1966, the season began on April 30. The data are combined with May. In 1967, the season began on April 29. Data for April 29 and 30 are combined with May.

[2/] Unweighted.

TABLE 11

Estimated Total Annual Yield of Trout from Beardsley Reservoir, 1962-1967[1/]

Year	Marked rainbow		Unmarked rainbow[2/]		Brown trout		Total trout	
	Total pounds	Pounds per acre	Total pounds	Pounds per acre	Total pounds	Pounds per acre	Total pounds	Pounds per acre
1962	1,240.5	1.72	2,498.0	3.47	176.2	0.24	3,914.7	5.44
1963	1,893.7	2.63	1,846.8	2.56	221.2	0.31	3,961.7	5.50
1964	4,993.5	6.94	504.9	0.70	207.6	0.29	5,706.0	7.92
1965	1,466.4	2.04	117.3	0.16	152.7	0.21	1,736.4	2.41
1966	3,903.8	5.42	144.5	0.20	160.8	0.22	4,209.1	5.85
1967	3,478.7	4.83	136.0	0.19	195.4	0.27	3,810.1	5.29
Unweighted means	2,829.4	3.93	874.6	1.21	185.6	0.26	3,889.7	5.40

[1/] Based on the maximum surface area of 720 surface acres.

[2/] The high yield of unmarked rainbow trout in 1962 and 1963 is due to the fact that a large number of fingerlings planted in 1960 and 1961 were not marked. The yield from 1965 to 1967 more accurately indicates the contribution of wild rainbow trout to the annual yield.

TABLE 12

Catch Per Hour of Trout, By Month, at
Beardsley Reservoir, 1962-1967

	May	June	July	August	September	October	All months
1962[1/]	0.31	0.17	0.20	0.31	0.43	0.33	0.28
1963	0.25	0.13	0.16	0.21	0.36	0.42	0.25
1964	0.54	0.23	0.10	0.12	0.26	0.37	0.32
1965	0.10	0.08	0.07	0.11	0.22	0.64	0.14
1966[1/]	0.51	0.22	0.22	0.19	0.46	0.48	0.39
1967[1/]	0.31	0.11	0.16	0.10	0.25	0.27	0.22
Unweighted means	0.34	0.16	0.15	0.17	0.33	0.42	0.27

[1/] 1962, 1966, and 1967 April data combined with May.

TABLE 13

Catch Per Hour of Trout for Boat and Shore Anglers
at Beardsley Reservoir, 1964-1967

		May	June	July	August	September	October	Season totals
1964	Boat	0.587	0.244	0.087	0.148	0.294	0.310	0.339
	Shore	0.386	0.178	0.131	0.061	0.160	0.584	0.244
1965	Boat	0.103	0.074	0.074	0.121	0.245	0.664	0.157
	Shore	0.053	0.081	0.016	0.027	0.067	0.242	0.058
1966[1/]	Boat	0.547	0.236	0.255	0.238	0.595	0.528	0.433
	Shore	0.353	0.130	0.130	0.059	0.129	0.372	0.227
1967[1/]	Boat	0.356	0.112	0.134	0.123	0.292	0.290	0.260
	Shore	0.116	0.112	0.188	0.066	0.100	0.126	0.128
Unweighted means for all years	Boat	0.398	0.166	0.138	0.158	0.356	0.448	0.297
	Shore	0.227	0.125	0.116	0.053	0.114	0.331	0.164
Ratio of boat to shore catch/hr		1.753	1.320	1.190	2.981	3.123	1.354	1.811

[1/] In 1966 and 1967 the season began in April. These data are combined with May.

TABLE 14

Harvest of Miscellaneous Rainbow Strains Planted in
Beardsley Reservoir, 1966-1967

Strain	Date	No. per oz. at release	No. planted	No. caught	Percentage caught of no. planted	Lb. planted	Lb. caught	Lb. caught / lb. planted
Hot Crk. rainbow (domesticated long time) RT-H	April 1963	3.0	10,000	129	1.29	208.3	35.5	0.2
RT-H	April 1964	5.4	10,000	73	0.73	115.7	13.7	0.1
cross RT-W x RT-K	Aug. 1964	17.5	5,000	124	2.48	17.9	50.6	2.8
Domestic Kamloops RT-KC	July 1966	5.0	10,000	674	6.74	125.0	289.95	2.3
RT-KC	Aug. 1967	7.6	10,000	102	1.02	82.2	33.75	0.4
RT-KC	Sept. 1967	3.4	10,000	38	0.38	183.8	10.81	0.06
Shasta ?? RT-S	Aug. 1967	11.3	10,000	63	0.63	55.3	32.42	0.6
RT-S	Sept. 1967	3.8	10,000	26	0.26	164.5	8.22	0.05
regular Kamloops RT-K	May 1967	0.8	5,000	1,469	29.38	390.6	898.31	2.3
RT-K	May 1967	3.8	5,000	413	8.26	82.2	236.47	2.9
RT-K	May 1967	3.8	5,000	483	9.66	82.2	311.28	3.8

↕ what is difference between these 2 ?

Data not very comparable. Hot Crk. evidently worthless (as expected) but single plant of Kamloop x Rt. cross well above average, however no other 64 plants to compare with.
Domestic Kamloops about same return as Shastas(?) for Aug & Sept. 67 plants - but both well below return of May plants of regular(?) Kamloops.

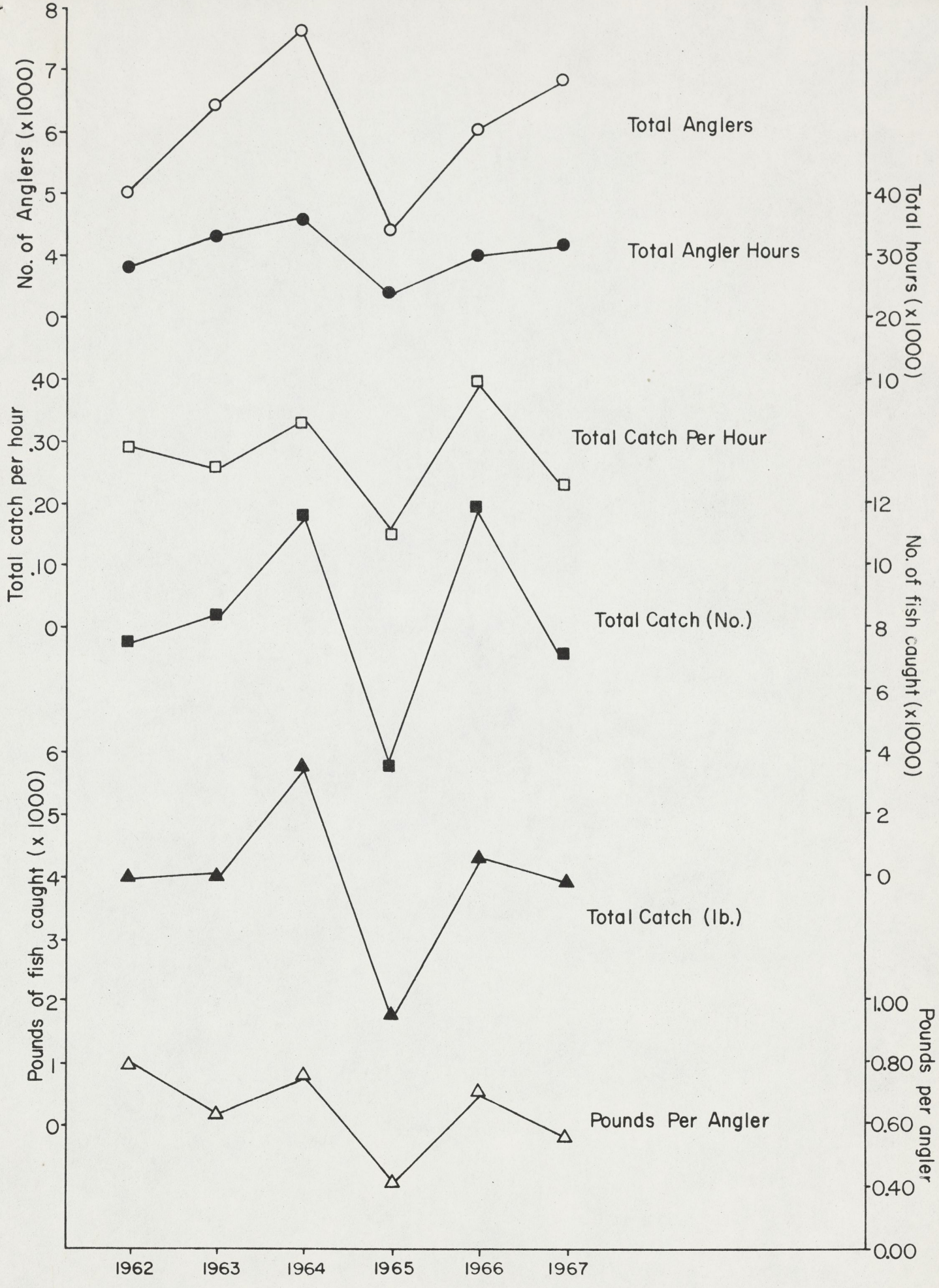


FIGURE 1. Total annual use, catch, and success at Beardsley Reservoir between 1962 and 1967.

See p. 136

LAMPETRA (ENTOSPHENUS) LETHOPHAGA, NEW SPECIES, THE NONPARASITIC DERIVATIVE OF THE PACIFIC LAMPREY

CARL L. HUBBS

TRANSACTIONS

OF THE SAN DIEGO SOCIETY OF NATURAL HISTORY

VOL. 16, NO. 6 30 APRIL 1971

initiated the Japanese records of *L. tridentata* by listing a specimen from Yahutugawa (river) in the Okhotsk Sea drainage of Hokkaido. Nemoto (1955: 69–70) stated the range of the species as "the broad region from the Arctic as far south as southern California and down to about 35° N Latitude in the western side of the Northern Pacific," but gave no supporting documentation for either the Arctic or for the southwestern limit, other than the questionable basis of finding, in the western North Pacific, whales bearing scars showing the tooth marks of *L. tridentata.* Aoyagi (1957), however, reported the capture of a specimen of this species in central Honshu, near 36° N latitude, in Kinugawa (river) at Atsutamura in Tochigi-ken. A further extension of range of the species has now come to light: Dr. O. Okamura has obtained a specimen from Yoshinogawa (river) on Shikoku Island in southern Japan; Tamotsu Iwai (pers. comm., 1970) has verified the identification.

The occurrence of the nonparasitic representative of the *Entosphenus* group in the adjacent basins of the Pit and Klamath rivers is not unique, for these stream systems harbor a number of other endemic fishes, some of which are sympatric with *Lampetra lethophaga.* Klamath endemics were described by Gilbert (1898) and by Evermann and Meek (1898). One of these species, *Catostomus rimiculus* Gilbert (1898: 3) was described from the Klamath River system only but it was later found (Snyder, 1908b: 161) to inhabit also the Rogue River system, which adjoins the Klamath River drainage basin (Figure 3); it may well have crossed over the divide by some fluvial connection. The peculiarities and endemism of the Klamath and Pit river systems were summarized by Hubbs and Miller (1948: 67–71). *Catostomus microps* is a Pit endemic (Rutter, 1908: 120–121) and *Cottus pitensis* Bailey and Bond (1963: 20–24) is known only from drainages of the Pit River and the contiguous Little Sacramento River. An additional indication of residual endemism in the fish fauna of the area under consideration appears to be coming to light: Behnke (1970: 241) has referred to "a group of previously undescribed trout native to several desiccating basins in southern Oregon extending to the Pit and McCloud rivers of northern California."

DESCRIPTION AND COMPARISONS

The specifications, here adopted, of meristic and morphometric characters, involving definitions and methods, are essentially those proposed by Hubbs and Trautman (1937: 27–43, figs. 1–5). They have been adopted also by Hubbs and Potter (in press) in their account of the distribution, phylogeny, and taxonomy of lampreys.

Chief concern pertains to the designation and to the method of counting of the lingual, oral, and disc teeth, which have been illustrated for *Lampetra (Entosphenus) tridentata* by Hubbs (1947, fig. 3; 1963, fig. 2), by Vladykov and Follett (1958, fig. 1; 1965, fig. 1; 1967, fig. 2), and by Hubbs and Potter (in press, fig. 7). Special points regarding the cusps on the lingual laminae (one transverse and two longitudinal) and on the oral laminae (the supraoral and the infraorbital) are discussed below, in the description of the dentition.

The concept of the circumoral row or series of teeth proposed by Hubbs and Trautman, primarily on the basis of the generalized dentition of *Ichthyomyzon,* seems quite applicable to the *Entosphenus* group, particularly because the posterior circumorals are so definitely aligned with the lateral circumorals, just outside the infraoral lamina. Furthermore, the lateral and posterior circumorals intergrade, through the frequent and unique bicuspid structure, and often through the increasing dilation outward, of one or more of the most lateral and most anterior of the posterior circumorals. Although the alignment of the posterior and lateral elements in a circumoral row is clear, the alignment and method of counting of the anterior connective is complicated by the tendency of all the anterior teeth in this group to alternate (in quincunx), so that a rather arbitrary distinction is involved, as is described below. The alignment and nomenclature of the inner disc teeth

Ana system of streams in southern California, and the derivatives of *Lampetra (Lethenteron) japonica* (Von Martens), ranging from northern China and southern Japan through the coastal regions of Siberia to Alaska (and in northeastern North America). Sufficient material is known to render it highly probable that any other regional occurrences of any nonparasitic derivative of *Lampetra (Entosphenus) tridentata* are at most few and limited.

The known distribution of the nonparasitic lampreys around the North Pacific appears to be complementary. The ranges of the widespread nonparasitic representatives of the subgenera *Lethenteron* and *Lampetra* apparently do not overlap, and although *L. lethophaga* of the subgenus *Entosphenus* occurs about midway in the range of the Pacific-drainage representatives of subgenus *Lampetra,* no trace of that subgenus has been found in the Pit or Klamath systems, either by me, or by Carl E. Bond (pers. comm., 1971).

It is noteworthy that no nonparasitic forms of the *Entosphenus* complex have been discovered in other parts of the long range of *Lampetra tridentata* around the periphery of the North Pacific (Figure 5), which extends southward from Bering Sea and Unalaska (Jordan and Gilbert, 1899: 434; McPhail and Lindsey, 1970: 58), and from Bering Island (Svetovidova, 1948; Berg, 1948, Addenda; 1962: 494). The limits of the known distribution of the parasitic form (or forms) have been expanded southward on both sides of the Pacific. On the American side it has been taken in streams as far south as southern California and in the ocean off Baja California, Mexico (Hubbs, 1967). On the Asiatic side there are several records from Japan, stated below. There seems to be no valid report of *L. tridentata* from the mainland of Asia (Lindberg and Legeza, 1959: 17–18 and 1967: 20–21), where *L. japonica* holds forth (the record of *"Entosphenus tridentatus"* from Kamchatka by Jordan and Evermann, 1900: 3231, pl. 1, fig. 4, was apparently based on the ammocete that was listed by Jordan and Gilbert, 1899: 434, from a river near Petropaulski, Kamchatka, as *"Entosphenus camtschaticus,"* though on circumstantial grounds it seems more probable that it was an example of *L. japonica*). Okada and Ikeda (1938: 140–141)

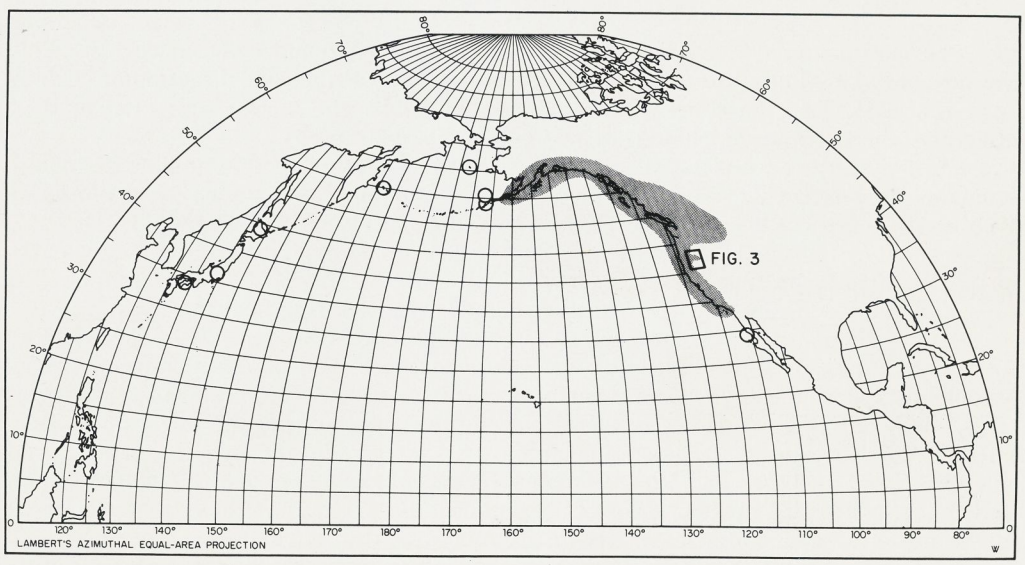


Figure 5. Distribution of *Lampetra tridentata* around margin of North Pacific Ocean. Assumed usual range stippled; record stations beyond these limits ringed; area shown in Figure 3 indicated.

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
EDWARD P. CLIFF, CHIEF

AMADOR DISTRICT

ELDORADO NATIONAL FOREST

CALIFORNIA REGION

1966

Scale 0 1 2 3 4 5 Miles

LEGEND

- National Forest Boundary
- Adjacent National Forest Boundary
- Interstate Highway (80)
- U. S. Highway (80)
- California State Highway (94)
- Forest Route Number (3N41)
- Main Motor Road
- Good Motor Road
- Poor Motor Road
- Trail
- Railroad
- Transmission Line
- Scenic Point
- Boat Landing
- Trailer Space
- Resort
- Winter Sports Area
- Supervisor's Headquarters—Placerville, Calif.
- District Ranger Station
- Forest Service Station
- Triangulation Station
- Permanent Lookout Station
- Triangulation Station & Permanent Lookout Station
- Heliport
- Flight Strip or Emergency Landing Field
- Airway Light Beacon, flashing
- Sawmill—Stationary
- Mine, Gravel Pit or Quarry
- House, Cabin or other Building
- Improved Campground
- Improved Picnic Area
- Camp Site
- Pack Station
- Pasture

Report fires here

Report Forest Fires to nearest Forest Station, Peace Officer or Telephone Operator.

The Mokelumne River is a municipal water supply. Observe sanitary rules.

Location of Eldorado Supervisor's Headquarters — Placerville (COLOMA 7 MILES, SACRAMENTO 43 MILES, JACKSON 33 MILES, LAKE TAHOE 60 MILES)

LEAVE A CLEAN CAMP AND A DEAD FIRE

Winter Location of Amador Ranger Station — Dec.–May — Jackson (LUMBERYARD 8 & 37 MILES, PLACERVILLE 33 MILES, STATE POLICE 37 MILES, STOCKTON 40 MILES)

Summer Location of Amador Ranger Station June–Nov. — Lumberyard (JACKSON 37 MILES, SILVER LAKE 17 MILES)

R. 13 E. R. 14 E. R. 15 E. R. 16 E. R. 17 E. R. 18 E. R. 19 E.

120°30′ 20′ 10′ 120°00′ 50′

T. 12 N. T. 11 N. T. 10 N. T. 9 N. T. 8 N. T. 7 N.

40′ 50′ 38° 30′

AGRICULTURE—FOREST SERVICE—SAN FRANCISCO

UNIVERSITY OF CALIFORNIA, DAVIS

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO

SANTA BARBARA • SANTA CRUZ

COLLEGE OF AGRICULTURAL AND
ENVIRONMENTAL SCIENCES
WILDLIFE AND FISHERIES BIOLOGY
AGRICULTURAL EXPERIMENT STATION

DAVIS, CALIFORNIA 95616

March 20, 1974

Dr. Robert J. Behnke
Colorado Cooperative Fishery Unit
Colorado State University
Fort Collins, Colorado 80521

Dear Dr. Behnke:

I am in the process of writing a book on the inland fishes of California, to be published by the University of California Press, a task which is nearly completed except for the Salmonidae. The book will include an illustration and life history account of each species but will be very light on systematics, mostly because it is an area in which I have little experience. Thus, one of the problems I have run up against is how to treat the redband trout (Salmo sp.). My sources in California Department of Fish and Game tell me you have decided not to describe it as a distinct species because of its close affinities to and hybridization with rainbow trout. I have nevertheless been considering having a separate account of it in the book because it does seem to represent an interesting California native that may once have deserved species status before man started mucking around with its environment. To do so, I would need to use a summary of your redband trout data, which California Department of Fish and Game has in its files. I would not do so, of course, without your permission, although I would have a hard time getting any other suitable information before this summer. The account, incidentally, will not be a formal species description but more of a how-to-identify affair. Enclosed is my account of brook trout as an example. Any other redband trout information or opinions you could share with me would be greatly appreciated.

You might also be interested to know that I have agreed to undertake a survey of the McCloud River system starting this summer. The survey will be funded by Trout Unlimited and conducted under the aegis of The Nature Conservancy which has just acquired, as a gift, a substantial piece of the river. With a team of graduate students, I will be looking for the McCloud Dolly Vanden (Salvelinus sp.) and conducting ecological studies on all the fishes. One of my students, who has the patience for systematics, will be taking at least a preliminary look at all the rainbow trout we collect, especially those from small tributary streams, to see if there are any populations distinct

enough to manage as separate entities. Our overall objective is to devise a management plan for the TNC section of river that will provide quality trout fishing and also meet the goals of TNC. If you would like us to save any trout for your systematic studies, please let me know.

Sincerely,

Peter B. Moyle
Assistant Professor of
Fisheries Biology

PBM:pjb
Enclosure

UNIVERSITY OF CALIFORNIA
P. B. Moyle
Animal Physiology
DAVIS, CALIFORNIA 95616

Dr. Robert J. Behnke
Colorado Cooperative Fishery Unit
Colorado State University
Fort Collins, Colorado 80521

Managing Cal Trout
Apr. 1998

- barbless hooks

- Little Truckee - Trout.

p. 2 Steelhead genetically identical to resident rainbow trout.
- how can be endan. Trout

p. 11, 12 - triple production of catchable trout by 2010.
1. not inc. + license sales
2. % equity $ - 85% - 90%
- ecosystem mgt
- stewardship

- p. 16 - economics
- see - Sm

- E. M. -

Sacrame...
- Bill Dill
- John Hewitson
- Christine Arena
- wc. T.U.
Calif.
• Barrett McInerny

Dr. Robert Behnke
Dept. of Fish and Wildlife Biology
Colorado State University
Fort Collins, CO 80523

STATE OF CALIFORNIA—THE RESOURCES AGENCY PETE WILSON, *Governor*

DEPARTMENT OF FISH AND GAME
1416 NINTH STREET
P.O. BOX 944209
SACRAMENTO, CA 94244-2090

April 9, 1998

You are encouraged to participate in the development of a strategic plan for managing California's resident trout resources and fisheries. The California Department of Fish and Game (Department) is currently developing a strategic plan for managing resident trout throughout the State and we are soliciting the recommendations and comments of interested individuals and groups. The plan will provide management goals and strategies addressing the issues facing resident trout resources and fisheries during the next 10 years.

The Strategic Plan for Trout Management is in its early developmental stage, and the current draft is attached for your review and comment. The draft is a framework document representing strategic issues and goals developed from conversations with Department of Fish and Game trout biologists and fishery managers. We are now soliciting comments and ideas from a broad range of perspectives including anglers, educators, local governments and agencies, business owners, and others interested in California's trout resources and fisheries. This information will be integrated into the final version of the plan.

Strategic planning is an exercise in envisioning how the Department should be managing the State's trout resources and fisheries in the future. We need to consider strategies for protecting trout resources as the State's population continues to expand, and as the associated demands on the resources and fisheries increase during the next decade. Examples of questions we should be asking are, a) " are there potential problems on the horizon?", b) "are current practices adequate to address these issues in the future?", and c) "what is important to you about California's trout resources?".

This is a participatory process where interested persons from all perspectives are welcomed and encouraged to provide suggestions or comments. Please direct responses or questions regarding the attached plan to Mr. James Hopelain by June 1, 1998, via any of the methods noted at the top or bottom of this letter.

Sincerely,

Timothy C. Farley

Timothy C. Farley, Chief
Inland Fisheries Division

James Hopelain Telephone: (916) 653-7584 Fax: (916) 653-8256 E-mail: jhopelai@hq.dfg.ca.gov

California Department of Fish and Game

Strategic Plan for Trout Management

Charting a Course for the Future

Trout are California's most popular and widespread fishery resource. They occur in over 18,000 miles of the State's cooler streams and are the principal sport fish in 3,581 cold water lakes and reservoirs. According to the most recent statewide angler survey, approximately 60 percent of California's licensed anglers fish primarily for trout. Recreational trout fishing has a significant impact on the State's economy generating about $3 billion in total personal income revenues, and accounting for over 92,000 jobs [1/]. The recreational popularity and economic significance of California's trout resources deserves effective, responsive, and forward-thinking management.

Our Mission

The mission of the Department of Fish and Game is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public

This strategic plan is for resident trout management only. Two items deserve definition to set the stage for understanding the purpose and scope of this plan: 1) what is a strategic plan?, and 2) what is a resident trout?

Strategic planning. Strategic planning is a participatory process that looks toward the future and considers options for dealing with threats and opportunities. It requires a clear vision of organizational mission, mandates, and responsibilities. In addition, it requires identification of an organization's strengths, weaknesses, opportunities and threats. The process includes participation by internal and external parties to identify and discuss strategic issues and alternatives to address those issues. An issue is considered strategic if it a) affects an organization's mandates or responsibilities, b) has a consequence for not doing something about it, c) is something the organization really can do something about, and d) has more than one solution or a range of solutions.

A strategic plan contains high priority issues, and potential solutions in the form of goals and strategies. It does not contain operational objectives and detail. For example, if an issue includes the problem that managers do not have current and sound resource status information for basing sound and credible decisions, the goal might indicate that resource assessment information will be updated. One of the strategies to achieve the goal could be increased angler surveys. The details of where, how or when the surveys will be conducted are not included. These details would be included in a separate operational plan and implemented at a later date.

1/ Source: McWilliams, B. and G. Goldman. 1994. Commercial and Recreational Fishing in California, Their Impact on the State Economy. Univ. of Calif., Berkeley, Dept. Of Agriculture and Natural Resources.

Resident trout. The scope of this plan includes all species and subspecies of resident (non-anadromous) forms of salmonids. The exception is steelhead, the anadromous form of coastal rainbow trout, which will be discussed later. Presently there are eleven species or subspecies of trout native to California, and three non-native species of trout existing within State waters. This plan covers management of these 14 trout species. In addition, it covers two species of Pacific salmon used in lake and reservoir management and utilized by the traditional trout angler. These salmon species are chinook and Kokanee (a landlocked sockeye salmon).

The two anadromous forms of trout are coastal cutthroat trout and steelhead trout. Coastal cutthroat trout are confined to the northwest portion of California in coastal streams and rivers from the Eel River northward. Their management is generally contained in anadromous salmonid policy and they are typically isolated geographically from resident forms of trout. Steelhead trout are another matter.

Steelhead are genetically identical to resident coastal rainbow trout (*Oncorhynchus mykiss irideus*). It is generally accepted that coastal rainbow trout present in stream reaches with migration routes open to the ocean have a high potential of exhibiting an anadromous life cycle, thus a steelhead. Coastal rainbow trout existing upstream of migration barriers are considered landlocked and are thus considered "resident" coastal rainbow trout, but could exhibit steelhead characteristics if given the opportunity to reach the ocean. Steelhead management in California is guided by the Department's *Steelhead Restoration and Management Plan for California.* The scope of this strategic plan will integrate resident trout management with the *Steelhead Restoration and Management Plan for California,* where appropriate.

The purpose of this plan is to identify key issues that will be facing trout management during the next 10 years, and to develop goals and strategies to address those issues. We want to prepare a plan for the future that enables trout managers to meet public trust responsibilities of protecting and maintaining fishery resources, use sound ecosystem management principles, and provide diverse angling and recreational opportunities.

The California Department of Fish and Game (DFG) completed a department-wide strategic plan in 1995 to guide it in fulfilling its mission and its vision for the future. This plan was based upon four themes:

1. Public Service, Outreach, and Education,
2. Cooperative Approaches to Resource Stewardship and Use,
3. Manage Wildlife from a Broad Habitat Perspective,
4. Organizational Vitality.

The Department-wide strategic plan contains many goals and strategies that are pertinent to trout management, either generally or specifically. The goals and strategies identified in this document, the Strategic Plan for Trout Management, can be linked to themes, goals and strategies in the Department-wide strategic plan. In that sense, this Strategic Plan for Trout Management could be considered as a supplement to the Department-wide strategic plan.

ISSUE: HABITAT PROTECTION AND RESTORATION.

The number one goal identified by a group of trout resource and trout fishery management experts within the DFG was **"to protect, restore, and enhance waters and riparian habitat for all trout species".** Trout habitat in California has been adversely affected for decades by population growth, various land-use practices, water diversion, and land development. While past problems have been recognized, and in some cases corrective measures taken, adverse impacts continue to persist. Restoration or enhancement of habitat degraded from past land-use practices is an important issue today, but will be even more vital as an increasing population places more demands upon the State's natural resources. California had an estimated population of 32.4 million in 1996. By the year 2010 the projected population in California will be nearly 41 million, a 23 percent increase. Even with prudent planning, a population increase of this magnitude will place additional burdens and demands on all natural resources, especially water. Maintaining healthy trout populations will require protecting or minimizing adverse effects on trout habitat within watersheds affected by additional urban or residential land development, timber harvest, or agricultural uses. If the Department, landowners and resource users do not work together to protect and enhance existing trout habitat, natural sustaining trout populations will decline as more demands are placed upon natural resources throughout the State.

GOAL 1. PROVIDE HABITAT CONDITIONS FOR VIABLE TROUT POPULATIONS.

Strategy 1.1 **Identify trout habitat in need of restoration and prioritize for work-plan development.**

Strategy 1.2 **Collaborate with organized watershed groups or private landowners to maximize the potential for healthy and self-sustaining trout habitat.**

Strategy 1.3 **Collaborate with other state, federal, and local government agencies to develop guidance for activities, general plans, zoning regulations, and land-use guidelines that maximize the potential for healthy and self-sustaining trout habitat.**

Strategy 1.4 **Work with landowners, water agencies and regulatory agencies to achieve sufficient water quantity and quality in rivers, streams, and lakes to support healthy salmonid populations (e.g. provide comments during FERC re-licensing process)**

ISSUE: ECOSYSTEM MANAGEMENT.

Although the target species identified for management in this document are resident (non-anadromous) trout and salmon, we cannot effectively or responsibly manage a species without consideration of many ecosystem factors and relationships. A species depends upon and interacts with diverse biological and physical features making up the ecosystem in which they live. Ecosystem management includes addressing these broad biological and physical factors with the objective of achieving natural dynamics and biodiversity. By focusing on ecosystem health in general, the end result should ultimately benefit the aquatic and riparian environments, including the fish and wildlife species dependent upon these habitats. This means that if we want healthy streams we often have to look beyond the stream to the entire watershed. Encouraging land and resource users to consider and appreciate physical and biological relationships within the ecosystem is an essential foundation for ecosystem management.

An ecosystem approach to managing resources is often a concept that is difficult to accept for those controlling or contributing to funding sources that are focused on a particular species. For example, Lahontan cutthroat trout enthusiasts understandably would like to see their dollars and efforts used directly to benefit Lahontan cutthroat trout. However, funding a broad-scope meadow restoration project that would provide more lasting benefits to trout than direct, short-term actions applied to the stream, might appear to some as detached and an ineffective use of resources. Fisheries managers have the task of assisting the public to understand how indirect ecosystem approaches to fisheries management ultimately benefit a particular fish species, and can have long lasting benefits.

Ecosystem management requires cooperation of many disciplines including fishery managers. Resource users and managers are often not aware of the impacts their practices have on the aquatic environment. Although fishery managers have little direct control within an ecosystem beyond the stream channel and riparian zones, they do have the capability of recognizing and identifying perturbations within the watershed that adversely affect fish habitat. Collaborative discussions concerning these practices and their impacts to fisheries habitat often lead to modifications that reduce or mitigate ecosystem impacts while still allowing the resource user or land manager to achieve their desired goal. Ecosystem management is, therefore, a cooperative and collaborative effort among all players within the defined ecosystem.

If fishery managers do not become involved in ecosystem management, the potential for inefficient use of project funds and poor project results is high, particularly within the riparian and stream channel zones.

GOAL 2. USE AN ECOSYSTEM APPROACH TO TROUT MANAGEMENT.

Strategy 2.1 **Identify aspects within a watershed that if improved or modified would restore or sustain healthy trout populations.**

Strategy 2.2 **Integrate trout habitat management with other resource management and land-use practices occurring within watershed ecosystems (e.g., participate in NCCP, HCP, and FERC relicensing processes when and where appropriate).**

GOAL 3. MAINTAIN OR RESTORE BIODIVERSITY WITHIN AQUATIC ECOSYSTEMS TO RESEMBLE UNDISTURBED SYSTEMS.

Strategy 3.1 **Develop an ecosystem or watershed classification system that provides recommended levels of trout management, biodiversity management, and resource utilization according to ecosystem conditions and species sensitivity .**

Strategy 3.2 **Select key watersheds or ecosystems containing sensitive species or intact natural systems that would most benefit from trout management based on biodiversity principles.**

Strategy 3.3 **Trout management practices will be implemented that consider natural diversity of aquatic communities.**

ISSUE: GENETIC INTEGRITY OF NATIVE TROUT POPULATIONS.

Native trout species in California have evolved over many centuries and have become adapted to specific environmental conditions. Native trout are part of California's natural resource heritage; we have a responsibility to protect and maintain this heritage. Preserving the genetic integrity of our native trout requires management practices that maximize genetic variability. Hybridization should be prevented and inbreeding minimized within unique and irreplaceable pure genetic populations.

In some cases, protecting and maintaining genetically distinct native trout may not be enough if populations are few and small. Continued existence may require, in addition to protection and maintenance, increase and expansion of populations throughout significant portions of their native habitats. A substantial decline in the range of a species could affect normal evolutionary mechanisms by producing disjunct, isolated populations subject to inbreeding, genetic drift, and natural or man-caused catastrophes. Small fragmented populations are vulnerable to a loss of genetic variability resulting from significant reductions in population size (bottlenecking), from random genetic drift, and from inbreeding caused by frequent matings of siblings or close relatives. Loss of genetic variability within a population reduces the population's ability to adapt to changes or survive challenges within their habitat.

GOAL 4. MAINTAIN GENETIC INTEGRITY AND DIVERSITY OF NATIVE TROUT POPULATIONS.

Strategy 4.1 Identify specific aquatic habitats that support genetically distinct native trout, and protect and maintain genetic integrity and variability of these important native species.

Strategy 4.2 Conduct or promote genetic research to better describe native stocks, identify introgressed or hybridized populations, and conduct genetic monitoring to ensure continued genetic integrity and variability of native trout populations.

Strategy 4.3 Develop collection and archiving protocols, and data analysis and reporting standards for future genetic studies.

Strategy 4.4 Expand the numbers and ranges of threatened native trout populations to levels that will assure their continued existence and potential source for fisheries recreation.

Strategy 4.5 Eradicate or control non-native fish species which threaten the genetic integrity or future viability of native trout populations.

ISSUE: AVAILABILITY OF DIVERSE ANGLING OPPORTUNITIES.

Trout anglers comprise a diverse group with a broad spectrum of experience and desires. Some examples of the ranges of angler preferences include:

a. Easily accessible, close to home vs remote, away from other anglers,
b. Consumption of catch vs catch-and-release,
c. Use of bait vs artificial lures or flies,
d. Fewer but larger fish vs more plentiful but smaller fish.
e. Native trout vs non-native trout,
f. Wild trout vs hatchery produced trout,
g. Stream fishing vs lake fishing.

The list of contrasting angling styles and preferences is nearly endless. Fisheries managers in California must recognize the needs and preferences of the trout angler and continue striving to provide diverse angling opportunities to meet those needs. Continued attraction of anglers will require a good quality hatchery fish and maintenance of healthy, self-sustaining trout populations. Fishery managers will have to achieve a balance of self-sustaining and hatchery supported fisheries to satisfy the diverse angling preferences that exist statewide. If we do not provide opportunities for all anglers to satisfy their angling preferences, the loss of anglers to other forms of recreation will continue.

GOAL 5. PROVIDE DIVERSE TROUT ANGLING OPPORTUNITIES THROUGHOUT THE STATE.

Strategy 5.1 Maximize benefits to the angler for put-and-take managed waters. (This strategy will require evaluation of planting allotments and locations to make the most efficient use of hatchery fish in terms of return to the angler.)

Strategy 5.2 Identify and manage appropriate waters for native and/or non-native trout or salmon to provide a diversity of angling opportunities while maintaining healthy self-sustaining or put-and-grow supplemented fisheries.

Strategy 5.3 **Manage designated wild trout waters according to management plans prepared for each specific wild trout water and according to California Fish and Game Commission policy.**

Strategy 5.4 **Identify and manage specific waters for self-sustaining trout populations.**

Strategy 5.5 **Modify the Trout and Steelhead Management Conservation Act of 1979 so that a minimum of 500 miles of stream and 20 lakes are managed as catch-and-release fisheries by the year 2000.**

Strategy 5.6 **Identify and manage a portion of wild trout or catch-and-release streams as "fast action" waters where trout are generally smaller than those in trophy-trout waters but catch rates are significantly higher.**

Strategy 5.7 **Identify additional waters within 50 miles of major urban areas suitable for high-yield, put-and-take trout management.**

ISSUE: MANAGEMENT BASED ON CURRENT RESOURCE ASSESSMENT DATA.

Sound fisheries management requires up-to-date information regarding the status of fish populations and their use. Several factors are necessary to fully understand a fish population and its dynamics, but three basic items of information are essential to manage a fish population for recreational fishing: 1) population abundance and a description of size or age class composition in the population , 2) whether or not the population is increasing , decreasing, or stable, and 3) how much harvest can the population withstand without harm to the population. This basic information is lacking for most of the trout waters presently being managed. Resource assessment has been identified as the number one priority need by Department biologists and

managers but is relatively expensive and time consuming to obtain. We are now faced with outdated information for the majority of our trout waters. Without adequate and current information, management decisions will lack professional credibility and scientific support.

GOAL 6. FISHERY MANAGEMENT DECISIONS WILL BE BASED ON UP-TO-DATE, SCIENTIFICALLY COLLECTED INFORMATION.

Strategy 6.1 **Initiate a program within each Region that monitors trout waters for population status, angler use and angler success at regular intervals.**

Strategy 6.2 **Conduct habitat inventories in trout watersheds to be used as a basis for habitat protection and restoration strategies.**

Strategy 6.3 **Initiate investigations or studies that are designed to answer specific questions critical to effectively managing California's trout resources.**

Strategy 6.4 **Monitor stocked (put-and-take and put-and-grow) and unstocked waters for percentage return of trout to angler's creel, catch per angler hour, survival of stocked trout, and angler satisfaction.**

Strategy 6.5 **Evaluate current planting locations, allotments, and angler catch to determine if hatchery trout are being used efficiently by providing the greatest benefit to the angling public.**

Strategy 6.6 **Identify and assess potential of additional waters appropriate for put-and-grow fisheries.**

Strategy 6.7 **Collaborate with other agencies, landowners, and interested private groups and individuals in the development of standardized data collection and data exchange protocols that will result in more effective trout management.**

Strategy 6.8 Incorporate resource databases from all available sources with geographic information system technology for visual and spatial display and analysis of the status of trout and related resources.

Strategy 6.9 Develop a classification system that categorizes trout waters according to specific management principles.

ISSUE: PUBLIC INTEREST IN RECREATIONAL FISHING.

Although the State's population is expected to increase 23 percent by 2010, other changes in demographic characteristics may result in a much smaller increase in the number of recreational anglers. Since 1974, fishing license sales in California have dropped from about 10 percent to about 4 percent of the State's population. Decreased interest in fishing is not unique to California; it has been observed in other parts of the nation. A lack of "free" time, competing recreational opportunities, an aging population, increased minority populations with different cultural attitudes towards recreational fishing, and fewer traditional, two-parent families are all factors considered by many researchers that are contributing to a reduced proportion of anglers in the population. Some of these factors and other factors, such as lack of time and increased urbanization of society, may also contribute to decreased angling frequency among traditional anglers. The DFG and various portions of society have vested political and economic interests in seeking to promote trout fishing among non-traditional angling segments of the population, while serving the needs of the traditional angling constituent.

GOAL 7. INCREASE INTEREST IN TROUT ANGLING AMONG ALL SEGMENTS OF CALIFORNIA'S POPULATION.

Strategy 7.1 Collaborate with fishing organizations and fishing tackle and equipment manufacturers to develop promotional campaigns that increase awareness of fishing as an enjoyable and inexpensive form of recreation.

Strategy 7.2 Publish and distribute information on the Internet and through guide booklets and maps that help the public find and utilize fishing opportunities.

Strategy 7.3 Promote a variety of available trout angling opportunities, the value of each native or wild trout population, and the quality of hatchery-produced trout in California.

Strategy 7.4 Provide more fish and fishing opportunities to increase angler participation.

Strategy 7.5 Investigate creative marketing and license pricing scenarios that would stimulate more anglers to purchase licenses.

ISSUE: ANGLER NEEDS AND DESIRES.

Fishery managers have the ability to maintain healthy, natural trout populations or provide quality hatchery-produced trout where demand is high. The public has several choices of how to use the available trout resources and the DFG has a responsibility to attempt to provide fishing opportunities that meet angler desires. We currently lack a mechanism that systematically surveys trout anglers for what they want or expect from their fishing experiences. Feedback is typically received from the more vocal or politically aggressive anglers and/or organizations by letter and telephone but not from the majority of the angling public. A system is needed that allows all segments of the trout angling community to communicate their desires to the DFG.

GOAL 8. INCREASE COMMUNICATION AND FEEDBACK WITH TROUT ANGLERS.

Strategy 8.1 Systematically survey trout anglers regarding satisfaction with their trout fishing experience, what they want, and what they expect.

Strategy 8.2 Provide a mechanism for anglers and the general public to easily contact DFG for information regarding trout angling (e.g., 800 telephone number, Internet, postcards, etc.).

ISSUE: ABILITY TO MEET FUTURE HATCHERY TROUT DEMANDS

We anticipate that demand for hatchery-produced trout will continue at least at its current level through 2010. According to a recent report contracted by the DFG (*California Trout Needs*

Assessment and Facilities Evaluation" by FishPro, 1994), fully meeting estimated increased angler demand will require a 300 percent increase (triple current amount) in production of catchable trout by the year 2010. Others believe increased demand for catch-and-release angling is out-pacing the increased demand for catchable trout. If both of these predictions are accurate, hatchery products in the form of catchable-size trout for put-and-take fisheries and fingerling or subcatchable-size trout for put-and-grow fisheries will have to increase above current levels. However, simply maintaining existing production goals may be a problem in the future. The average age of all DFG trout hatcheries is over 40 years old which means the ability to sustain current production goals would require significant hatchery facility upgrades and maintenance during the next 10 years. In addition to meeting production goals, hatchery managers are increasingly concerned with product (fish) quality. Some facility upgrades would be required to increase quality of trout produced. If demand for hatchery-produced trout increases above the DFG's present production capacity, and funds are not available for capital improvements, then supplemental production from other sources should be sought. Given sufficient lead time, private hatcheries may have the ability to provide trout for a portion of DFG programs, if necessary.

GOAL 9. DETERMINE FUTURE ANGLER DEMAND FOR TROUT.

Strategy 9.1 Develop a method that tracks and predicts angler demand for various types of trout fishing experiences including urban fisheries, harvest fisheries, catch-and-release fisheries, wild trout fisheries, and hatchery supported fisheries..

GOAL 10. MAXIMIZE HATCHERY PRODUCTION EFFICIENCY AND CAPABILITY.

Strategy 10.1 Upgrade hatchery facilities with modern and efficient equipment.

Strategy 10.2 Provide a safe working environment by ensuring facilities and equipment are in good repair and properly maintained.

Strategy 10.3 Provide regular and effective training to hatchery personnel in use and maintenance of equipment, new technologies, and safety practices.

Strategy 10.4 **Establish perpetual program to improve fish culture methods and techniques.**

Strategy 10.5 **Develop and incorporate improved disease prevention and treatment regimes.**

Strategy 10.6 **Improve hatchery water quality to improve culture efficiency and product quality.**

Strategy 10.7 **Optimize production and distribution cost efficiency for each hatchery to achieve the lowest cost per pound of fish at the highest quality.**

Strategy 10.8 **Upgrade hatchery work force ability by upgrading minimum hiring qualifications.**

GOAL 11. FULLY MEET CATCHABLE AND OTHER HATCHERY TROUT PRODUCT DEMANDS.

Strategy 11.1 **Utilize private grown trout products to close the gap between demand and Department production capability.**

Strategy 11.2 **Encourage creative techniques for resort owners and sportsman groups to supplement numbers of catchables reared in hatcheries (e.g., cage culture, other grow-out methods for subcatchables grown to catchable size).**

Strategy 11.3 **Improve strains and hybrids of trout produced at hatcheries through scientifically proven techniques to more effectively meet management goals and objectives.**

Strategy 11.4 **Develop a program of improving, safeguarding, and monitoring genetic characteristics of trout strains used as Department broodstock.**

Strategy 11.5 Develop alternative sources for supplemental funding of hatchery operations for facilities not able to operate at capacity because of budget constraints. Investigate formation of partnerships with public and private entities with a vested interest related to trout fishing.

GOAL 12. PRODUCE TROUT OF THE HIGHEST QUALITY.

Strategy 12.1 Encourage experimentation with innovative techniques and new technologies for rearing and distributing trout more efficiently while ensuring the highest quality product.

Strategy 12.2 Establish realistic production goals consistent with each individual hatchery's ability to produce a healthy and attractive product.

Strategy 12.3 Customize catchable trout sizes to increase quality of angling experience and more fully meet management needs.

ISSUE: PUBLIC EDUCATION REGARDING TROUT BIOLOGY AND ECOSYSTEM INTERACTIONS

According to 1990 estimates (FishPro 1994), about 9 percent of the State's population participates in angling. This estimate includes license buyers, children under 16 years of age, and illegal non-license buyers. By the year 2010, angling participation is expected to decline to about 7 percent of the population. In other words, the vast majority of the State's population do not show any interest in angling. Probably only a fraction of those participating in angling have a basic understanding of fish biology, life cycles, habitat requirements, and relationships with other plant and animal species within the ecosystem, including humans. Additionally, an unknown portion of the population not participating in angling is involved in other recreational or industrial activities affecting environmental and ecological aspects. Many of these activities directly or indirectly affect fishery resources, such as various domestic and industrial water uses, land development, timber harvest, agricultural and mining activities, water sports, and some aesthetic interests. Because a broad array of domestic, industrial and recreational activities affect

fish habitat to some degree, we have a vested interest and declared goals for increasing the awareness among our angling related stakeholders, and the public in general, of how certain activities adversely impact fishery and other aquatic resources.

GOAL 13. FOSTER PUBLIC STEWARDSHIP OF OUR NATURAL RESOURCES IN GENERAL, AND OUR TROUT RESOURCES IN PARTICULAR, THROUGH INCREASING THE PUBLIC'S UNDERSTANDING OF FISH BIOLOGY, FISHERIES MANAGEMENT, AND SPECIES INTERACTIONS WITHIN THE ECOSYSTEM.

Strategy 13.1 **Improve the current supply of informational brochures, leaflets, and videos pertaining to trout biology, trout management and general ecology.**

Strategy 13.2 **Develop additional displays, educational material, and training programs to promote the value of recreational fishing, and the importance of resource stewardship.**

Strategy 13.3 **Provide training and educational materials to Department representatives for the purpose of teaching all segments of our society about fishery resources, their value, and their uses.**

Strategy 13.4 **Identify examples of quality resource stewardship among a broad spectrum of resources users and promote these as models for others to follow or build upon.**

ISSUE: UNSTABLE AND INADEQUATE FUNDING.

Although this is a Department-wide problem, not just a trout issue, funding issues need to be identified that relate specifically to trout management, and subsequently addressed with goals and strategies. Absent appropriate funding, many of the goals and strategies identified above will not be achieved. Creative ideas and schemes are necessary that will provide adequate funding for programs developed as a result of this plan.

Parking lot for undeveloped or miscellaneous ideas

Item 1. We need to put a dollar value on trout fishing in terms of benefit to the economy, expenditures of anglers, and costs of management. This economic study would include cost comparisons of hatchery versus wild trout. John Dienstadt recommended economic information. I am not sure where this fits in the strategic plan other than establishing cost-benefit data for various sizes of hatchery-produced trout.

C:\User\Trout\plan\S_Plan_3.wpd

NATIVE AND INTRODUCED TROUT IN CALIFORNIA

RESIDENT TROUT

Native to California

Common Name	Scientific Name
Coastal rainbow trout	*Oncorhynchus mykiss irideus*
Eagle Lake rainbow trout	*O. m. aquilarum*
Kern River rainbow trout	*O. m. gilberti*
Little Kern golden trout [1]	*O. m. whitei*
Volcano Creek (S.F. Kern) golden trout	*O. m. aquabonita*
McCloud River redband trout	*O. m.* subspecies[2]
Goose Lake redband trout	*O. m.* subspecies[2]
Warner Lakes redband trout	*O. m.* subspecies[2]
Lahontan cutthroat trout [1]	*O. clarki henshawi*
Paiute cutthroat trout [1]	*O. c. seleniris*
Bull trout (char)[3]	*Salvelinus confluentus*

Non native trout and salmon

Common Name	Scientific Name
Brown trout	*Salmo trutta*
Brook trout	*Salvelinus fontinalis*
Lake trout	*Salvelinus namaycush*
Kokanee (sockeye salmon)	*Oncorhynchus nerka*

ANADROMOUS TROUT

Native to California

Common Name	Scientific Name
Steelhead trout	*Oncorhynchus mykiss irideus*
Coastal cutthroat trout	*Oncorhynchus clarki clarki*

1/ Federally listed as a Threatened species.

2/ California Department of Fish and Game presently recognizes these subspecies of redband trout, however, there is controversy among fishery scientists regarding redband taxonomy. These subspecies are waiting "official" description in the scientific literature and further clarification by geneticists and fish taxonomists.

3/ Listed as a State Endangered species. May be extinct in California.

GLOSSARY OF TERMS

Anadromous. Characterizes the life cycle of a fish that spawns in freshwater and spends a significant portion of its adult life in the ocean. Steelhead trout are anadromous.

Biodiversity. Biological diversity. The natural variety of plants and animals that includes 1) genetic diversity, 2) species diversity, 3) ecosystem diversity, and 4) landscape diversity. Optimum biodiversity is that which occurs naturally in an undisturbed system. The key words are "natural and undisturbed". It concerns biological integrity within a system and not necessarily a large variety of species. Managers should be concerned with the loss of natural biodiversity rather than absolute numbers of species.

Catchable trout. Refers to a size category of hatchery-produced trout. Although the Fish and Game Operations Manual defines "catchable" trout as six-per-pound or larger, current policy dictates catchable trout weigh one-half pound each, on average (about eight inches in length). Catchable trout are used in put-and-take managed fisheries, and are expected to be harvested by anglers soon after planting.

Catch-and-release. This is a management strategy and fishing technique where captured fish are immediately released back into the water. Effective catch-and-release angling requires fishing gear consisting of barbless hooks and artificial lures (i.e., no bait). Catch-and-release allows anglers the opportunity to enjoy trout fishing in waters that cannot support significant harvest.

Domesticated trout. Strains of hatchery-produced trout that have been reproduced and reared in the hatchery environment for several generations. These strains generally exhibit qualities that are suitable within the fish culture environment, and can withstand the rigors of handling and planting.

Ecosystem. A broad scale landscape that includes all biological, chemical, and physical elements and their dynamic interactions with one another. An example of an ecosystem is an entire watershed, ridge top to ridge top. Examples of sub-ecosystems within the greater watershed ecosystem include stream, riparian, and forest ecosystems. These systems are interconnected and "upslope" systems generally influence systems "downslope". Because the stream ecosystem is the most "downslope" system, the condition of the stream ecosystem generally indicates if other sub-systems and processes within the entire ecosystem are functioning properly.

Fingerling. A trout approximately 2 ½ to 4 inches in length and weighing 16 per pound or smaller. This size category is used in put-and-grow managed fisheries, and is used exclusively in the aerial planting program.

Genetic bottleneck. A relatively large reduction in population size that can remove genetic variation from a population and also may increase the frequency of harmful genetic components.

Genetic drift. The random change of genetic component (allele) frequency within a population. This has the greatest effect on small populations where the chance loss of any individual could result in reduction of genetic variability.

Hatchery trout. This term is generally reserved for domesticated strains of trout reared to a catchable-size and used in put-and-take fisheries. However, technically it can include any trout, (wild or native) hatched and reared in a hatchery environment.

Inland trout. Non-anadromous trout or trout populations existing above barriers that prevent migration to the ocean. Same as resident trout.

Native trout. Trout species present in streams and watersheds within California prior to European settlement, and that have defined a natural range without human intervention.

Non-native trout. Trout species that have been introduced into waters of California from original sources outside of California or outside of their historic range.

Put-and-take management. This management technique is used in waters that are easily accessed by the general public, where angling demand is high, and where habitat conditions are not suitable to support a high-demand fishery. Catchable-size trout are planted in selected waters and at least half of the trout released are expected to be harvested soon after planting.

Put-and-grow management. This management technique is used in waters were reproduction capability is limited but habitat conditions support good growth and survival of juveniles and adults. Trout smaller than catchables are planted in appropriate waters where they will utilize existing food resources to grow to a larger size. Hatchery-produced fingerlings or sub-catchables are used in put-and-grow managed waters.

Resident trout. Trout that do not emigrate from freshwater. Non-anadromous trout. Resident trout typically remain within the stream and/or lake system in which they originated.

Steelhead trout. Coastal rainbow trout (*Oncorhynchus mykiss irideus*) that exhibit an anadromous life cycle.

Sub-catchable trout. A hatchery-produced trout less than six inches in length and weighing between 6.1 and 16 fish per pound. This size category of trout is used in put-and-grow managed fisheries where planted trout are expected to survive and grow to a larger size before being harvested by anglers.

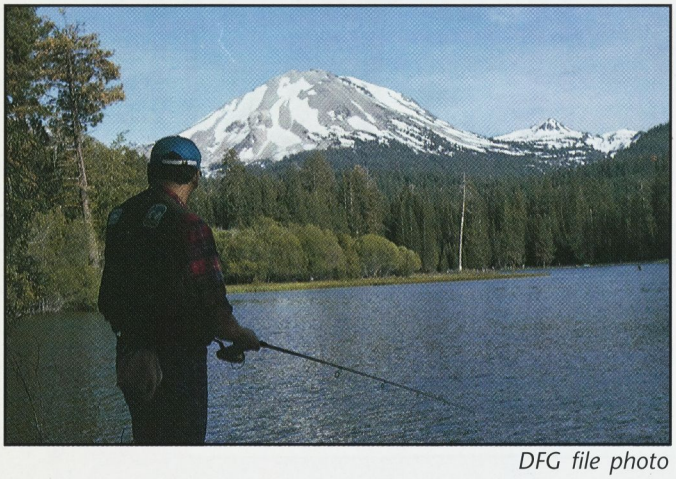
Wild trout. Includes any trout (native or non-native) that is a product of parents that spawned naturally and has spent its entire life in a natural stream environment. May include the offspring of hatchery trout that reproduced in the natural environment.

California Department of Fish and Game

Trout Management

Providing diverse fishing opportunities

Trout are California's primary and most widespread fishery resource. They occur in over 18,000 miles of the state's cooler streams and are the principal sport fish in 3,581 cold water lakes and reservoirs. Trout angling is the most popular type of angling in California, representing about 60 percent of freshwater angling effort statewide. In contrast, the second-most popular fishing is for black bass, and accounts for about 12 percent of the statewide angling demand. Economically, trout fishing in California generates an estimated $3 billion in personal income, accounting for 92,400 jobs.



DFG file photo

The California Department of Fish and Game (DFG) is responsible for managing the state's trout resources and providing a diversity of angling opportunities. Efforts are underway to review current trout management strategies and to plan for the future. All resident trout and inland salmon management strategies and programs will be coordinated under one encompassing strategic trout management plan. The strategic plan will provide direction and goals to meet increasing resource demands, diverse angler desires, and future demographic changes.

Inland Trout Program

Presently, trout are managed under five types of fishery management strategies:

1. Put-and-Take Fisheries. This management technique is employed in waters that are easily accessed by the general public and where angling demand is high. It is supported chiefly by hatchery-produced trout weighing about one-half pound each and measuring about 12 inches in length. These fish are planted in about 780 (four percent) of the 18,000 stream miles and about 300 (eight percent) of the 3,581 cold water lakes and reservoirs suitable for resident trout in California. At least 50 percent of planted "catchable-size" trout are expected to be caught by anglers shortly after stocking. These fisheries provide good quality family-type fishing or fishing opportunities in easily accessible areas where anglers have a high expectation of harvesting some fish. As an added bonus for anglers, hatchery-produced trophy-size trout (larger than two pounds each) are released in limited quantities into selected waters.

2. Put-and-Grow Fisheries. These fisheries are supported by hatchery-produced trout stocked at about three to six inches in length. This strategy is used in waters where spawning habitat is limited but fish habitat otherwise provides for suitable trout growth and survival. Many of these fish are expected to survive for more than one season thereby providing trophy-size fish in subsequent years. This management technique is used for aerial stocking of over 700 high mountain lakes, and for inland (non-anadromous) salmon fisheries.

3. Wild Trout Managed Fisheries. Management guidelines for wild trout waters are contained in policies established by the California Fish and Game Commission. These guidelines state that, "designated wild trout waters should provide a quality experience by providing the angler with an opportunity to fish in aesthetically pleasing and environmentally productive waters with trout populations whose numbers or sizes are largely unaffected by the angling process." Hatchery-produced strains of wild or semi-wild trout may be used to supplement populations, if necessary, but no domesticated strains of catchable-size trout are allowed. Designated wild trout waters are managed principally by protecting, maintaining, and rehabilitating habitat, and adopting appropriate angling regulations. Presently, approximately 604 miles of stream throughout the state and three lakes comprising 81 surface acres are managed as designated wild trout waters.

4. Catch-and-Release Fisheries. This strategy is employed in waters where trout production and fishing quality is improved by limiting harvest. California practices a modified form of catch-and-release management that encourages a zero harvest of trout in designated catch-and-release waters. However, regulations allow for a daily bag limit of one or two trout in many of these waters. Gear is often restricted to artificial lures with barbless hooks to enhance survival of released fish. Catch-and-release is often employed as a management tool in put-and-grow and wild trout managed fisheries. Presently, 37 stream segments totaling 395 miles, and 13 lakes comprising 6,854 surface acres are specifically managed as designated catch-and-release waters.

5. Threatened Native Trout Management. The primary objective of this program is to protect or restore the state's native species of trout. Three native trout species are currently federally listed as threatened while all others are considered unique or species of special concern. One native species, the bull trout, no longer exists in California. Restoration efforts often involve managing small, remnant populations and, when

Inland Trout of California

Historic Ranges, Designated Wild Trout Waters, Trout Planting Locations

Volcano Creek Golden Trout
Oncorhynchus mykiss aguabonita
California's State Fish

Little Kern River Golden Trout
Oncorhynchus mykiss whitei
Federally Listed Threatened

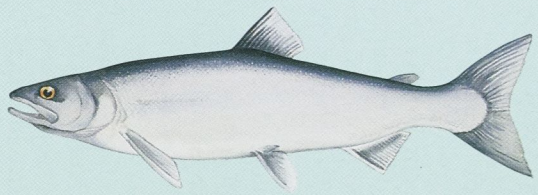
Kern River Rainbow Trout
Oncorhynchus mykiss gilberti

Lahontan Cutthroat Trout
Oncorhynchus clarki henshawi
Federally Listed Threatened

Paiute Cutthroat Trout
Oncorhynchus clarki seleniris
Federally Listed Threatened

Coastal Rainbow Trout
Oncorhynchus mykiss irideus

BrownTrout
Salmo trutta
Non-native



Kokanee Salmon
Oncorhynchus nerka
Non-native

Brook Trout
Salvelinus fontinalis
Non-native

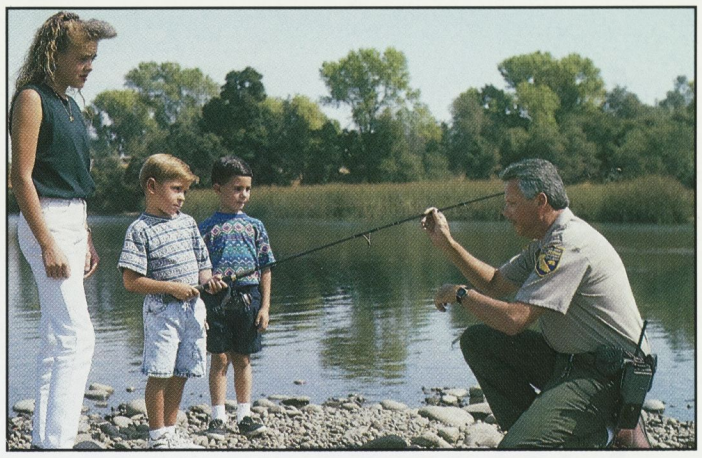
Legend

Historic ranges of native trout
- Coastal Rainbow/Steelhead Trout
- Coastal Cutthroat Trout (overlaps steelhead range)
- Bull Trout
- McCloud River Redband Trout
- Goose Lake Redband Trout
- Warner Lake Redband Trout
- Eagle Lake Rainbow Trout
- Lahontan Cutthroat Trout
- Paiute Cuttroat Trout
- Volcano Creek Golden Trout
- Little Kern Golden Trout
- Kern River Rainbow Trout
- Trout historically not present

- ▲ DFG Trout Hatchery
- DFG Trout Planting Locations (excluding aerial)
- Designated Wild Trout and/or Catch-and-Release Water

Concept and text by James S. Hopelain, California Department of Fish and Game (DFG). Map by Michael Byrne, GIS Specialist with DFG. Trout illustrations by Joseph R. Tomelleri. Kokanee illustrated by B.J. Lewis.

DFG file photo



DFG file photo

necessary, establishing or relocating populations. A few native populations are managed by the Wild Trout Program or regulated with catch-and-release regulations. A new program is being developed to increase the public's awareness of native trout species and to identify angling opportunities in waters where healthy native populations exist.

Inland Salmon Program

In addition to trout, California anglers have the opportunity to enjoy fishing for kokanee and chinook salmon in lakes and reservoirs. Salmon are managed as put-and-grow fisheries in lakes where salmon better use food sources than trout.

The kokanee salmon is a landlocked subspecies of sockeye salmon that provides excellent fishing and quality eating. Presently, 17 lakes and reservoirs are managed with kokanee. Approximately 1.5 million kokanee, three to four inches in length, are planted each year. Typically they reach a size of 8 to 10 inches in length after the first year and 12 to 16 inches by the second year. Growth rates are variable and largely affected by population density, zooplankton abundance, and water temperature. Most kokanee are caught by boat anglers trolling lures.

Up to 500,000 chinook salmon from Feather River Hatchery are planted in several reservoirs in northern California each year. Most chinook are planted as yearlings (about six inches long) and typically attain a size of about 14 to 18 inches (two to 2.5 pounds) by the end of their second year.

Hatchery System

Fourteen trout hatcheries or facilities throughout the state produce over 16 million trout weighing, in total, slightly over 4 million pounds. The majority of the poundage consists of 8 million catchable-size trout for put-and-take fisheries. The remaining fish produced consist of trout for put-and-grow managed fisheries.

The annual budget for the trout hatchery program is about $7 million including employment of 95 permanent personnel. The newest facility was completed in 1968 (American River Hatchery in Sacramento County) and the oldest is over 100 years old (Mt. Shasta Hatchery in Siskiyou County).

Trout are stocked in streams, lakes and reservoirs using specialized trucks and a specially equipped airplane. Frequency of stocking varies from weekly, monthly, annually, or every two or three years depending on angler demand or management strategy.

The DFG's freshwater fisheries and stocking programs are also available at *http://www.dfg.ca.gov/ifd/index.html.*

Additional general information on trout management can be obtained from:

California Department of Fish and Game
Inland Fisheries Division
1416 9th Street, 12th Floor
Sacramento, CA 95814
(916) 653-6194

For more specific information regarding trout fishing locations or hatcheries in your area, contact your Department of Fish and Game Regional Office.

For trout information at DFG Regional Offices:

Region 1
(Northern California)
601 Locust Street
Redding, CA 96001
(916) 225-2300

Region 2
(Central Valley and foothills)
1701 Nimbus Road, Suite A
Rancho Cordova, CA 95670
(916) 358-2939

Region 3
(Northern coast)
P.O. Box 47
Yountville, CA 94599
(707) 944-5500

Region 4
(San Joaquin Valley and Eastern Sierra)
1234 East Shaw Avenue
Fresno, CA 93710
(209) 243-4005, ext 158

Region 5
(Southern California)
330 Golden Shore, Suite 50
Long Beach, CA 90802
(562) 590-5151

X-Sender: carena@mail.tu.org
X-Mailer: Windows Eudora Pro Version 3.0 (32)
Date: Wed, 29 Apr 1998 14:23:48 -0400
To: fwb@picea.cnr.colostate.edu
From: Christine Arena <carena@tu.org>
Subject: CFG comments

Bob:

TU recently hired Steve Trafton as a full-time conservation coordinator to staff our California office. I forwarded to Steve your comments to James Hopelain/Calif. Dept. of Fish & Game. If you'd like to follow up with Steve, following is his contact info.:

Steve Trafton, California Policy Coordinator
TU California Office
828 San Pablo Avenue, Suite 244
Albany, CA 94706
E-mail: trafton@ziplink.net
Phone: (510) 528-5390
Fax: (510) 528-7880

Christine

[May 1998]

DOW not rebut directly to FRA

— re. Charlie Myer

— in the long haul.
bit of background — —

— What percent proportion of total fishery — 1. Proportion Charter
matter economics a better one
true costs - diff ? comp.
2. Total employees

catchables - no. lbs. 3. % catchable trout
in pond 5/lb. 2/lb.
[illegible] [illegible] 700,— 18,000
20. 2.
% angler days
[illegible]

— John Townsend
cc - Nev. 15/1:00

TROUT UNLIMITED

Bob,

Lots of genetics & other perspectives that would benefit from your input.

J.

30 April 1998

Bob,

I alert you to the opportunity to comment on California Department of Fish and Game's "draft" *Strategic Plan for Trout Management* (attached) and ask that you consider submitting written comments directly to the Department (c/o Mr. James Hopelain, Inland Fisheries Division, CDFG). I seek your participation because I believe that there is a general need to provide technically sound and dispassionate professional comment to the state on fish management and conservation issues. Clearly, because of your background and expertise, we hope you can critique and assist with a technically rigorous and independent assessment of the plan's thoroughness and consistency with the best available resource principles.

This attached Plan is partly a consequence of more than a decade of criticism from many quarters, including Trout Unlimited, that the CDFG trout propagation and stocking programs receive an inordinately disproportionate effort (funding, focus, and personnel) compared with their wild and native trout management programs. It has also been argued that the propagation programs operate in ignorance of their biological effects on resident fish communities; this led to a law suit under California's Environmental Quality Act to study and report on stocking's environmental impact. Conversely, CDFG maintains that each element of their management programs is operated with the fullest consideration of biological, economic, and recreational benefits. We wish to assure that planning and management actions are consistent with the long-term conservation of the resource. If the Plan is safe and sound, we all benefit. If the Plan has flaws or gaps, we can help the agency recognize these. Thus, I appeal to your sense of professional interest and commitment to the resource in asking for your help.

Based upon issues raised in the TU law suit (which was withdrawn when the state agreed to file a now past due environmental review), the following mutually agreed upon issues were to be addressed in the review: 1) genetic effects (i.e., loss of diversity) on viability and persistence of native endangered species; 2) ecological interference effects of stocked trout on native or wild trout; 3) acclimation or domestication effects; 4) water quality or local habitat degradation downstream from present facilities; 5) the introduction and spread of debilitating diseases to native and wild populations mediated through culture and stocking; 6) the economic effects from operating the hatchery program usurping an inordinate proportion of management effort and funding; 7) return to creel rates are low or unknown and are therefore

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prohibitively expensive as self-paying enterprises. These issues were defined largely with the valuable technical advice from a number of fisheries and conservation experts. We hope to assure that these are still valid and that they will be addressed in planning.

In summary, I invite you to take the opportunity to identify any strengths or weaknesses of the plan, especially in light of modern fisheries conservation principles and the likelihood such a plan will satisfy the Department's mission "to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public." Please note the June 1, 1998 deadline imposed by the state (although there may be some flexibility if you contact CDFG ahead of time). If there is any way in which I can facilitate your participation, please let me know. I would appreciate a copy of any comments you send so that I may summarize the range of technical concerns and issues for TU's members.

Thank you in advance for your participation in this endeavor.

Regards,

John Epifanio
Resource Scientist

Send review and comments to:

Mr. James Hopelain
Department of Fish and Game
1416 Ninth Street
P.O. Box 944209
Sacramento, CA 94244-2090

phone: 916-653-7584
e-mail: jhopelai@hq.dfg.ca.gov

STATE OF CALIFORNIA—THE RESOURCES AGENCY PETE WILSON, *Governor*

DEPARTMENT OF FISH AND GAME
1416 NINTH STREET
P.O. BOX 944209
SACRAMENTO, CA 94244-2090

April 9, 1998

You are encouraged to participate in the development of a strategic plan for managing California's resident trout resources and fisheries. The California Department of Fish and Game (Department) is currently developing a strategic plan for managing resident trout throughout the State and we are soliciting the recommendations and comments of interested individuals and groups. The plan will provide management goals and strategies addressing the issues facing resident trout resources and fisheries during the next 10 years.

The Strategic Plan for Trout Management is in its early developmental stage, and the current draft is attached for your review and comment. The draft is a framework document representing strategic issues and goals developed from conversations with Department of Fish and Game trout biologists and fishery managers. We are now soliciting comments and ideas from a broad range of perspectives including anglers, educators, local governments and agencies, business owners, and others interested in California's trout resources and fisheries. This information will be integrated into the final version of the plan.

Strategic planning is an exercise in envisioning how the Department should be managing the State's trout resources and fisheries in the future. We need to consider strategies for protecting trout resources as the State's population continues to expand, and as the associated demands on the resources and fisheries increase during the next decade. Examples of questions we should be asking are, a) " are there potential problems on the horizon?", b) "are current practices adequate to address these issues in the future?", and c) "what is important to you about California's trout resources?".

This is a participatory process where interested persons from all perspectives are welcomed and encouraged to provide suggestions or comments. Please direct responses or questions regarding the attached plan to Mr. James Hopelain by June 1, 1998, via any of the methods noted at the top or bottom of this letter.

Sincerely,

Timothy C. Farley

Timothy C. Farley, Chief
Inland Fisheries Division

James Hopelain Telephone: (916) 653-7584 Fax: (916) 653-8256 E-mail: jhopelai@hq.dfg.ca.gov

California Department of Fish and Game

Strategic Plan for Trout Management

Charting a Course for the Future

Trout are California's most popular and widespread fishery resource. They occur in over 18,000 miles of the State's cooler streams and are the principal sport fish in 3,581 cold water lakes and reservoirs. According to the most recent statewide angler survey, approximately 60 percent of California's licensed anglers fish primarily for trout. Recreational trout fishing has a significant impact on the State's economy generating about $3 billion in total personal income revenues, and accounting for over 92,000 jobs [1/]. The recreational popularity and economic significance of California's trout resources deserves effective, responsive, and forward-thinking management.

Our Mission

The mission of the Department of Fish and Game is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public

This strategic plan is for resident trout management only. Two items deserve definition to set the stage for understanding the purpose and scope of this plan: 1) what is a strategic plan?, and 2) what is a resident trout?

Strategic planning. Strategic planning is a participatory process that looks toward the future and considers options for dealing with threats and opportunities. It requires a clear vision of organizational mission, mandates, and responsibilities. In addition, it requires identification of an organization's strengths, weaknesses, opportunities and threats. The process includes participation by internal and external parties to identify and discuss strategic issues and alternatives to address those issues. An issue is considered strategic if it a) affects an organization's mandates or responsibilities, b) has a consequence for not doing something about it, c) is something the organization really can do something about, and d) has more than one solution or a range of solutions.

A strategic plan contains high priority issues, and potential solutions in the form of goals and strategies. It does not contain operational objectives and detail. For example, if an issue includes the problem that managers do not have current and sound resource status information for basing sound and credible decisions, the goal might indicate that resource assessment information will be updated. One of the strategies to achieve the goal could be increased angler surveys. The details of where, how or when the surveys will be conducted are not included. These details would be included in a separate operational plan and implemented at a later date.

1/ Source: McWilliams, B. and G. Goldman. 1994. Commercial and Recreational Fishing in California, Their Impact on the State Economy. Univ. of Calif., Berkeley, Dept. Of Agriculture and Natural Resources.

Resident trout. The scope of this plan includes all species and subspecies of resident (non-anadromous) forms of salmonids. The exception is steelhead, the anadromous form of coastal rainbow trout, which will be discussed later. Presently there are eleven species or subspecies of trout native to California, and three non-native species of trout existing within State waters. This plan covers management of these 14 trout species. In addition, it covers two species of Pacific salmon used in lake and reservoir management and utilized by the traditional trout angler. These salmon species are chinook and Kokanee (a landlocked sockeye salmon).

The two anadromous forms of trout are coastal cutthroat trout and steelhead trout. Coastal cutthroat trout are confined to the northwest portion of California in coastal streams and rivers from the Eel River northward. Their management is generally contained in anadromous salmonid policy and they are typically isolated geographically from resident forms of trout. Steelhead trout are another matter.

Steelhead are genetically identical to resident coastal rainbow trout (*Oncorhynchus mykiss irideus*). It is generally accepted that coastal rainbow trout present in stream reaches with migration routes open to the ocean have a high potential of exhibiting an anadromous life cycle, thus a steelhead. Coastal rainbow trout existing upstream of migration barriers are considered landlocked and are thus considered "resident" coastal rainbow trout, but could exhibit steelhead characteristics if given the opportunity to reach the ocean. Steelhead management in California is guided by the Department's *Steelhead Restoration and Management Plan for California.* The scope of this strategic plan will integrate resident trout management with the *Steelhead Restoration and Management Plan for California,* where appropriate.

The purpose of this plan is to identify key issues that will be facing trout management during the next 10 years, and to develop goals and strategies to address those issues. We want to prepare a plan for the future that enables trout managers to meet public trust responsibilities of protecting and maintaining fishery resources, use sound ecosystem management principles, and provide diverse angling and recreational opportunities.

The California Department of Fish and Game (DFG) completed a department-wide strategic plan in 1995 to guide it in fulfilling its mission and its vision for the future. This plan was based upon four themes:

1. Public Service, Outreach, and Education,
2. Cooperative Approaches to Resource Stewardship and Use,
3. Manage Wildlife from a Broad Habitat Perspective,
4. Organizational Vitality.

The Department-wide strategic plan contains many goals and strategies that are pertinent to trout management, either generally or specifically. The goals and strategies identified in this document, the Strategic Plan for Trout Management, can be linked to themes, goals and strategies in the Department-wide strategic plan. In that sense, this Strategic Plan for Trout Management could be considered as a supplement to the Department-wide strategic plan.

ISSUE: HABITAT PROTECTION AND RESTORATION.

The number one goal identified by a group of trout resource and trout fishery management experts within the DFG was **"to protect, restore, and enhance waters and riparian habitat for all trout species"**. Trout habitat in California has been adversely affected for decades by population growth, various land-use practices, water diversion, and land development. While past problems have been recognized, and in some cases corrective measures taken, adverse impacts continue to persist. Restoration or enhancement of habitat degraded from past land-use practices is an important issue today, but will be even more vital as an increasing population places more demands upon the State's natural resources. California had an estimated population of 32.4 million in 1996. By the year 2010 the projected population in California will be nearly 41 million, a 23 percent increase. Even with prudent planning, a population increase of this magnitude will place additional burdens and demands on all natural resources, especially water. Maintaining healthy trout populations will require protecting or minimizing adverse effects on trout habitat within watersheds affected by additional urban or residential land development, timber harvest, or agricultural uses. If the Department, landowners and resource users do not work together to protect and enhance existing trout habitat, natural sustaining trout populations will decline as more demands are placed upon natural resources throughout the State.

GOAL 1. PROVIDE HABITAT CONDITIONS FOR VIABLE TROUT POPULATIONS.

Strategy 1.1 **Identify trout habitat in need of restoration and prioritize for work-plan development.**

Strategy 1.2 **Collaborate with organized watershed groups or private landowners to maximize the potential for healthy and self-sustaining trout habitat.**

Strategy 1.3 **Collaborate with other state, federal, and local government agencies to develop guidance for activities, general plans, zoning regulations, and land-use guidelines that maximize the potential for healthy and self-sustaining trout habitat.**

Strategy 1.4 **Work with landowners, water agencies and regulatory agencies to achieve sufficient water quantity and quality in rivers, streams, and lakes to support healthy salmonid populations (e.g. provide comments during FERC re-licensing process)**

ISSUE: ECOSYSTEM MANAGEMENT.

Although the target species identified for management in this document are resident (non-anadromous) trout and salmon, we cannot effectively or responsibly manage a species without consideration of many ecosystem factors and relationships. A species depends upon and interacts with diverse biological and physical features making up the ecosystem in which they live. Ecosystem management includes addressing these broad biological and physical factors with the objective of achieving natural dynamics and biodiversity. By focusing on ecosystem health in general, the end result should ultimately benefit the aquatic and riparian environments, including the fish and wildlife species dependent upon these habitats. This means that if we want healthy streams we often have to look beyond the stream to the entire watershed. Encouraging land and resource users to consider and appreciate physical and biological relationships within the ecosystem is an essential foundation for ecosystem management.

An ecosystem approach to managing resources is often a concept that is difficult to accept for those controlling or contributing to funding sources that are focused on a particular species. For example, Lahontan cutthroat trout enthusiasts understandably would like to see their dollars and efforts used directly to benefit Lahontan cutthroat trout. However, funding a broad-scope meadow restoration project that would provide more lasting benefits to trout than direct, short-term actions applied to the stream, might appear to some as detached and an ineffective use of resources. Fisheries managers have the task of assisting the public to understand how indirect ecosystem approaches to fisheries management ultimately benefit a particular fish species, and can have long lasting benefits.

Ecosystem management requires cooperation of many disciplines including fishery managers. Resource users and managers are often not aware of the impacts their practices have on the aquatic environment. Although fishery managers have little direct control within an ecosystem beyond the stream channel and riparian zones, they do have the capability of recognizing and identifying perturbations within the watershed that adversely affect fish habitat. Collaborative discussions concerning these practices and their impacts to fisheries habitat often lead to modifications that reduce or mitigate ecosystem impacts while still allowing the resource user or land manager to achieve their desired goal. Ecosystem management is, therefore, a cooperative and collaborative effort among all players within the defined ecosystem.

If fishery managers do not become involved in ecosystem management, the potential for inefficient use of project funds and poor project results is high, particularly within the riparian and stream channel zones.

GOAL 2. USE AN ECOSYSTEM APPROACH TO TROUT MANAGEMENT.

Strategy 2.1 **Identify aspects within a watershed that if improved or modified would restore or sustain healthy trout populations.**

Strategy 2.2 **Integrate trout habitat management with other resource management and land-use practices occurring within watershed ecosystems (e.g., participate in NCCP, HCP, and FERC relicensing processes when and where appropriate).**

GOAL 3. MAINTAIN OR RESTORE BIODIVERSITY WITHIN AQUATIC ECOSYSTEMS TO RESEMBLE UNDISTURBED SYSTEMS.

Strategy 3.1 **Develop an ecosystem or watershed classification system that provides recommended levels of trout management, biodiversity management, and resource utilization according to ecosystem conditions and species sensitivity .**

Strategy 3.2 **Select key watersheds or ecosystems containing sensitive species or intact natural systems that would most benefit from trout management based on biodiversity principles.**

Strategy 3.3 **Trout management practices will be implemented that consider natural diversity of aquatic communities.**

ISSUE: GENETIC INTEGRITY OF NATIVE TROUT POPULATIONS.

Native trout species in California have evolved over many centuries and have become adapted to specific environmental conditions. Native trout are part of California's natural resource heritage; we have a responsibility to protect and maintain this heritage. Preserving the genetic integrity of our native trout requires management practices that maximize genetic variability. Hybridization should be prevented and inbreeding minimized within unique and irreplaceable pure genetic populations.

In some cases, protecting and maintaining genetically distinct native trout may not be enough if populations are few and small. Continued existence may require, in addition to protection and maintenance, increase and expansion of populations throughout significant portions of their native habitats. A substantial decline in the range of a species could affect normal evolutionary mechanisms by producing disjunct, isolated populations subject to inbreeding, genetic drift, and natural or man-caused catastrophes. Small fragmented populations are vulnerable to a loss of genetic variability resulting from significant reductions in population size (bottlenecking), from random genetic drift, and from inbreeding caused by frequent matings of siblings or close relatives. Loss of genetic variability within a population reduces the population's ability to adapt to changes or survive challenges within their habitat.

GOAL 4. MAINTAIN GENETIC INTEGRITY AND DIVERSITY OF NATIVE TROUT POPULATIONS.

Strategy 4.1 **Identify specific aquatic habitats that support genetically distinct native trout, and protect and maintain genetic integrity and variability of these important native species.**

Strategy 4.2 **Conduct or promote genetic research to better describe native stocks, identify introgressed or hybridized populations, and conduct genetic monitoring to ensure continued genetic integrity and variability of native trout populations.**

Strategy 4.3 **Develop collection and archiving protocols, and data analysis and reporting standards for future genetic studies.**

Strategy 4.4 **Expand the numbers and ranges of threatened native trout populations to levels that will assure their continued existence and potential source for fisheries recreation.**

Strategy 4.5 **Eradicate or control non-native fish species which threaten the genetic integrity or future viability of native trout populations.**

ISSUE: AVAILABILITY OF DIVERSE ANGLING OPPORTUNITIES.

Trout anglers comprise a diverse group with a broad spectrum of experience and desires. Some examples of the ranges of angler preferences include:

a. Easily accessible, close to home vs remote, away from other anglers,
b. Consumption of catch vs catch-and-release,
c. Use of bait vs artificial lures or flies,
d. Fewer but larger fish vs more plentiful but smaller fish.
e. Native trout vs non-native trout,
f. Wild trout vs hatchery produced trout,
g. Stream fishing vs lake fishing.

The list of contrasting angling styles and preferences is nearly endless. Fisheries managers in California must recognize the needs and preferences of the trout angler and continue striving to provide diverse angling opportunities to meet those needs. Continued attraction of anglers will require a good quality hatchery fish and maintenance of healthy, self-sustaining trout populations. Fishery managers will have to achieve a balance of self-sustaining and hatchery supported fisheries to satisfy the diverse angling preferences that exist statewide. If we do not provide opportunities for all anglers to satisfy their angling preferences, the loss of anglers to other forms of recreation will continue.

GOAL 5. PROVIDE DIVERSE TROUT ANGLING OPPORTUNITIES THROUGHOUT THE STATE.

Strategy 5.1 Maximize benefits to the angler for put-and-take managed waters. (This strategy will require evaluation of planting allotments and locations to make the most efficient use of hatchery fish in terms of return to the angler.)

Strategy 5.2 Identify and manage appropriate waters for native and/or non-native trout or salmon to provide a diversity of angling opportunities while maintaining healthy self-sustaining or put-and-grow supplemented fisheries.

Strategy 5.3 **Manage designated wild trout waters according to management plans prepared for each specific wild trout water and according to California Fish and Game Commission policy.**

Strategy 5.4 **Identify and manage specific waters for self-sustaining trout populations.**

Strategy 5.5 **Modify the Trout and Steelhead Management Conservation Act of 1979 so that a minimum of 500 miles of stream and 20 lakes are managed as catch-and-release fisheries by the year 2000.**

Strategy 5.6 **Identify and manage a portion of wild trout or catch-and-release streams as "fast action" waters where trout are generally smaller than those in trophy-trout waters but catch rates are significantly higher.**

Strategy 5.7 **Identify additional waters within 50 miles of major urban areas suitable for high-yield, put-and-take trout management.**

ISSUE: MANAGEMENT BASED ON CURRENT RESOURCE ASSESSMENT DATA.

Sound fisheries management requires up-to-date information regarding the status of fish populations and their use. Several factors are necessary to fully understand a fish population and its dynamics, but three basic items of information are essential to manage a fish population for recreational fishing: 1) population abundance and a description of size or age class composition in the population , 2) whether or not the population is increasing , decreasing, or stable, and 3) how much harvest can the population withstand without harm to the population. This basic information is lacking for most of the trout waters presently being managed. Resource assessment has been identified as the number one priority need by Department biologists and

managers but is relatively expensive and time consuming to obtain. We are now faced with outdated information for the majority of our trout waters. Without adequate and current information, management decisions will lack professional credibility and scientific support.

GOAL 6. FISHERY MANAGEMENT DECISIONS WILL BE BASED ON UP-TO-DATE, SCIENTIFICALLY COLLECTED INFORMATION.

Strategy 6.1 **Initiate a program within each Region that monitors trout waters for population status, angler use and angler success at regular intervals.**

Strategy 6.2 **Conduct habitat inventories in trout watersheds to be used as a basis for habitat protection and restoration strategies.**

Strategy 6.3 **Initiate investigations or studies that are designed to answer specific questions critical to effectively managing California's trout resources.**

Strategy 6.4 **Monitor stocked (put-and-take and put-and-grow) and unstocked waters for percentage return of trout to angler's creel, catch per angler hour, survival of stocked trout, and angler satisfaction.**

Strategy 6.5 **Evaluate current planting locations, allotments, and angler catch to determine if hatchery trout are being used efficiently by providing the greatest benefit to the angling public.**

Strategy 6.6 **Identify and assess potential of additional waters appropriate for put-and-grow fisheries.**

Strategy 6.7 **Collaborate with other agencies, landowners, and interested private groups and individuals in the development of standardized data collection and data exchange protocols that will result in more effective trout management.**

Strategy 6.8 Incorporate resource databases from all available sources with geographic information system technology for visual and spatial display and analysis of the status of trout and related resources.

Strategy 6.9 Develop a classification system that categorizes trout waters according to specific management principles.

ISSUE: PUBLIC INTEREST IN RECREATIONAL FISHING.

Although the State's population is expected to increase 23 percent by 2010, other changes in demographic characteristics may result in a much smaller increase in the number of recreational anglers. Since 1974, fishing license sales in California have dropped from about 10 percent to about 4 percent of the State's population. Decreased interest in fishing is not unique to California; it has been observed in other parts of the nation. A lack of "free" time, competing recreational opportunities, an aging population, increased minority populations with different cultural attitudes towards recreational fishing, and fewer traditional, two-parent families are all factors considered by many researchers that are contributing to a reduced proportion of anglers in the population. Some of these factors and other factors, such as lack of time and increased urbanization of society, may also contribute to decreased angling frequency among traditional anglers. The DFG and various portions of society have vested political and economic interests in seeking to promote trout fishing among non-traditional angling segments of the population, while serving the needs of the traditional angling constituent.

GOAL 7. INCREASE INTEREST IN TROUT ANGLING AMONG ALL SEGMENTS OF CALIFORNIA'S POPULATION.

Strategy 7.1 Collaborate with fishing organizations and fishing tackle and equipment manufacturers to develop promotional campaigns that increase awareness of fishing as an enjoyable and inexpensive form of recreation.

Strategy 7.2 Publish and distribute information on the Internet and through guide booklets and maps that help the public find and utilize fishing opportunities.

Strategy 7.3 Promote a variety of available trout angling opportunities, the value of each native or wild trout population, and the quality of hatchery-produced trout in California.

Strategy 7.4 Provide more fish and fishing opportunities to increase angler participation.

Strategy 7.5 Investigate creative marketing and license pricing scenarios that would stimulate more anglers to purchase licenses.

ISSUE: ANGLER NEEDS AND DESIRES.

Fishery managers have the ability to maintain healthy, natural trout populations or provide quality hatchery-produced trout where demand is high. The public has several choices of how to use the available trout resources and the DFG has a responsibility to attempt to provide fishing opportunities that meet angler desires. We currently lack a mechanism that systematically surveys trout anglers for what they want or expect from their fishing experiences. Feedback is typically received from the more vocal or politically aggressive anglers and/or organizations by letter and telephone but not from the majority of the angling public. A system is needed that allows all segments of the trout angling community to communicate their desires to the DFG.

GOAL 8. INCREASE COMMUNICATION AND FEEDBACK WITH TROUT ANGLERS.

Strategy 8.1 Systematically survey trout anglers regarding satisfaction with their trout fishing experience, what they want, and what they expect.

Strategy 8.2 Provide a mechanism for anglers and the general public to easily contact DFG for information regarding trout angling (e.g., 800 telephone number, Internet, postcards, etc.).

ISSUE: ABILITY TO MEET FUTURE HATCHERY TROUT DEMANDS

We anticipate that demand for hatchery-produced trout will continue at least at its current level through 2010. According to a recent report contracted by the DFG (*California Trout Needs*

Assessment and Facilities Evaluation" by FishPro, 1994), fully meeting estimated increased angler demand will require a 300 percent increase (triple current amount) in production of catchable trout by the year 2010. Others believe increased demand for catch-and-release angling is out-pacing the increased demand for catchable trout. If both of these predictions are accurate, hatchery products in the form of catchable-size trout for put-and-take fisheries and fingerling or subcatchable-size trout for put-and-grow fisheries will have to increase above current levels. However, simply maintaining existing production goals may be a problem in the future. The average age of all DFG trout hatcheries is over 40 years old which means the ability to sustain current production goals would require significant hatchery facility upgrades and maintenance during the next 10 years. In addition to meeting production goals, hatchery managers are increasingly concerned with product (fish) quality. Some facility upgrades would be required to increase quality of trout produced. If demand for hatchery-produced trout increases above the DFG's present production capacity, and funds are not available for capital improvements, then supplemental production from other sources should be sought. Given sufficient lead time, private hatcheries may have the ability to provide trout for a portion of DFG programs, if necessary.

GOAL 9. DETERMINE FUTURE ANGLER DEMAND FOR TROUT.

Strategy 9.1 Develop a method that tracks and predicts angler demand for various types of trout fishing experiences including urban fisheries, harvest fisheries, catch-and-release fisheries, wild trout fisheries, and hatchery supported fisheries..

GOAL 10. MAXIMIZE HATCHERY PRODUCTION EFFICIENCY AND CAPABILITY.

Strategy 10.1 Upgrade hatchery facilities with modern and efficient equipment.

Strategy 10.2 Provide a safe working environment by ensuring facilities and equipment are in good repair and properly maintained.

Strategy 10.3 Provide regular and effective training to hatchery personnel in use and maintenance of equipment, new technologies, and safety practices.

Strategy 10.4 **Establish perpetual program to improve fish culture methods and techniques.**

Strategy 10.5 **Develop and incorporate improved disease prevention and treatment regimes.**

Strategy 10.6 **Improve hatchery water quality to improve culture efficiency and product quality.**

Strategy 10.7 **Optimize production and distribution cost efficiency for each hatchery to achieve the lowest cost per pound of fish at the highest quality.**

Strategy 10.8 **Upgrade hatchery work force ability by upgrading minimum hiring qualifications.**

GOAL 11. FULLY MEET CATCHABLE AND OTHER HATCHERY TROUT PRODUCT DEMANDS.

Strategy 11.1 **Utilize private grown trout products to close the gap between demand and Department production capability.**

Strategy 11.2 **Encourage creative techniques for resort owners and sportsman groups to supplement numbers of catchables reared in hatcheries (e.g., cage culture, other grow-out methods for subcatchables grown to catchable size).**

Strategy 11.3 **Improve strains and hybrids of trout produced at hatcheries through scientifically proven techniques to more effectively meet management goals and objectives.**

Strategy 11.4 **Develop a program of improving, safeguarding, and monitoring genetic characteristics of trout strains used as Department broodstock.**

Strategy 11.5 Develop alternative sources for supplemental funding of hatchery operations for facilities not able to operate at capacity because of budget constraints. Investigate formation of partnerships with public and private entities with a vested interest related to trout fishing.

GOAL 12. PRODUCE TROUT OF THE HIGHEST QUALITY.

Strategy 12.1 Encourage experimentation with innovative techniques and new technologies for rearing and distributing trout more efficiently while ensuring the highest quality product.

Strategy 12.2 Establish realistic production goals consistent with each individual hatchery's ability to produce a healthy and attractive product.

Strategy 12.3 Customize catchable trout sizes to increase quality of angling experience and more fully meet management needs.

ISSUE: PUBLIC EDUCATION REGARDING TROUT BIOLOGY AND ECOSYSTEM INTERACTIONS

According to 1990 estimates (FishPro 1994), about 9 percent of the State's population participates in angling. This estimate includes license buyers, children under 16 years of age, and illegal non-license buyers. By the year 2010, angling participation is expected to decline to about 7 percent of the population. In other words, the vast majority of the State's population do not show any interest in angling. Probably only a fraction of those participating in angling have a basic understanding of fish biology, life cycles, habitat requirements, and relationships with other plant and animal species within the ecosystem, including humans. Additionally, an unknown portion of the population not participating in angling is involved in other recreational or industrial activities affecting environmental and ecological aspects. Many of these activities directly or indirectly affect fishery resources, such as various domestic and industrial water uses, land development, timber harvest, agricultural and mining activities, water sports, and some aesthetic interests. Because a broad array of domestic, industrial and recreational activities affect

fish habitat to some degree, we have a vested interest and declared goals for increasing the awareness among our angling related stakeholders, and the public in general, of how certain activities adversely impact fishery and other aquatic resources.

GOAL 13. FOSTER PUBLIC STEWARDSHIP OF OUR NATURAL RESOURCES IN GENERAL, AND OUR TROUT RESOURCES IN PARTICULAR, THROUGH INCREASING THE PUBLIC'S UNDERSTANDING OF FISH BIOLOGY, FISHERIES MANAGEMENT, AND SPECIES INTERACTIONS WITHIN THE ECOSYSTEM.

Strategy 13.1 Improve the current supply of informational brochures, leaflets, and videos pertaining to trout biology, trout management and general ecology.

Strategy 13.2 Develop additional displays, educational material, and training programs to promote the value of recreational fishing, and the importance of resource stewardship.

Strategy 13.3 Provide training and educational materials to Department representatives for the purpose of teaching all segments of our society about fishery resources, their value, and their uses.

Strategy 13.4 Identify examples of quality resource stewardship among a broad spectrum of resources users and promote these as models for others to follow or build upon.

ISSUE: UNSTABLE AND INADEQUATE FUNDING.

Although this is a Department-wide problem, not just a trout issue, funding issues need to be identified that relate specifically to trout management, and subsequently addressed with goals and strategies. Absent appropriate funding, many of the goals and strategies identified above will not be achieved. Creative ideas and schemes are necessary that will provide adequate funding for programs developed as a result of this plan.

Parking lot for undeveloped or miscellaneous ideas

Item 1. We need to put a dollar value on trout fishing in terms of benefit to the economy, expenditures of anglers, and costs of management. This economic study would include cost comparisons of hatchery versus wild trout. John Dienstadt recommended economic information. I am not sure where this fits in the strategic plan other than establishing cost-benefit data for various sizes of hatchery-produced trout.

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NATIVE AND INTRODUCED TROUT IN CALIFORNIA

RESIDENT TROUT

Native to California

Common Name	Scientific Name
Coastal rainbow trout	*Oncorhynchus mykiss irideus*
Eagle Lake rainbow trout	*O. m. aquilarum*
Kern River rainbow trout	*O. m. gilberti*
Little Kern golden trout [1]	*O. m. whitei*
Volcano Creek (S.F. Kern) golden trout	*O. m. aquabonita*
McCloud River redband trout	*O. m.* subspecies[2]
Goose Lake redband trout	*O. m.* subspecies[2]
Warner Lakes redband trout	*O. m.* subspecies[2]
Lahontan cutthroat trout [1]	*O. clarki henshawi*
Paiute cutthroat trout [1]	*O. c. seleniris*
Bull trout (char)[3]	*Salvelinus confluentus*

Non native trout and salmon

Common Name	Scientific Name
Brown trout	*Salmo trutta*
Brook trout	*Salvelinus fontinalis*
Lake trout	*Salvelinus namaycush*
Kokanee (sockeye salmon)	*Oncorhynchus nerka*

ANADROMOUS TROUT

Native to California

Common Name	Scientific Name
Steelhead trout	*Oncorhynchus mykiss irideus*
Coastal cutthroat trout	*Oncorhynchus clarki clarki*

1/ Federally listed as a Threatened species.

2/ California Department of Fish and Game presently recognizes these subspecies of redband trout, however, there is controversy among fishery scientists regarding redband taxonomy. These subspecies are waiting "official" description in the scientific literature and further clarification by geneticists and fish taxonomists.

3/ Listed as a State Endangered species. May be extinct in California.

GLOSSARY OF TERMS

Anadromous. Characterizes the life cycle of a fish that spawns in freshwater and spends a significant portion of its adult life in the ocean. Steelhead trout are anadromous.

Biodiversity. Biological diversity. The natural variety of plants and animals that includes 1) genetic diversity, 2) species diversity, 3) ecosystem diversity, and 4) landscape diversity. Optimum biodiversity is that which occurs naturally in an undisturbed system. The key words are "natural and undisturbed". It concerns biological integrity within a system and not necessarily a large variety of species. Managers should be concerned with the loss of natural biodiversity rather than absolute numbers of species.

Catchable trout. Refers to a size category of hatchery-produced trout. Although the Fish and Game Operations Manual defines "catchable" trout as six-per-pound or larger, current policy dictates catchable trout weigh one-half pound each, on average (about eight inches in length). Catchable trout are used in put-and-take managed fisheries, and are expected to be harvested by anglers soon after planting.

Catch-and-release. This is a management strategy and fishing technique where captured fish are immediately released back into the water. Effective catch-and-release angling requires fishing gear consisting of barbless hooks and artificial lures (i.e., no bait). Catch-and-release allows anglers the opportunity to enjoy trout fishing in waters that cannot support significant harvest.

Domesticated trout. Strains of hatchery-produced trout that have been reproduced and reared in the hatchery environment for several generations. These strains generally exhibit qualities that are suitable within the fish culture environment, and can withstand the rigors of handling and planting.

Ecosystem. A broad scale landscape that includes all biological, chemical, and physical elements and their dynamic interactions with one another. An example of an ecosystem is an entire watershed, ridge top to ridge top. Examples of sub-ecosystems within the greater watershed ecosystem include stream, riparian, and forest ecosystems. These systems are interconnected and "upslope" systems generally influence systems "downslope". Because the stream ecosystem is the most "downslope" system, the condition of the stream ecosystem generally indicates if other sub-systems and processes within the entire ecosystem are functioning properly.

Fingerling. A trout approximately 2 ½ to 4 inches in length and weighing 16 per pound or smaller. This size category is used in put-and-grow managed fisheries, and is used exclusively in the aerial planting program.

Genetic bottleneck. A relatively large reduction in population size that can remove genetic variation from a population and also may increase the frequency of harmful genetic components.

Genetic drift. The random change of genetic component (allele) frequency within a population. This has the greatest effect on small populations where the chance loss of any individual could result in reduction of genetic variability.

Hatchery trout. This term is generally reserved for domesticated strains of trout reared to a catchable-size and used in put-and-take fisheries. However, technically it can include any trout, (wild or native) hatched and reared in a hatchery environment.

Inland trout. Non-anadromous trout or trout populations existing above barriers that prevent migration to the ocean. Same as resident trout.

Native trout. Trout species present in streams and watersheds within California prior to European settlement, and that have defined a natural range without human intervention.

Non-native trout. Trout species that have been introduced into waters of California from original sources outside of California or outside of their historic range.

Put-and-take management. This management technique is used in waters that are easily accessed by the general public, where angling demand is high, and where habitat conditions are not suitable to support a high-demand fishery. Catchable-size trout are planted in selected waters and at least half of the trout released are expected to be harvested soon after planting.

Put-and-grow management. This management technique is used in waters were reproduction capability is limited but habitat conditions support good growth and survival of juveniles and adults. Trout smaller than catchables are planted in appropriate waters where they will utilize existing food resources to grow to a larger size. Hatchery-produced fingerlings or sub-catchables are used in put-and-grow managed waters.

Resident trout. Trout that do not emigrate from freshwater. Non-anadromous trout. Resident trout typically remain within the stream and/or lake system in which they originated.

Steelhead trout. Coastal rainbow trout (*Oncorhynchus mykiss irideus*) that exhibit an anadromous life cycle.

Sub-catchable trout. A hatchery-produced trout less than six inches in length and weighing between 6.1 and 16 fish per pound. This size category of trout is used in put-and-grow managed fisheries where planted trout are expected to survive and grow to a larger size before being harvested by anglers.

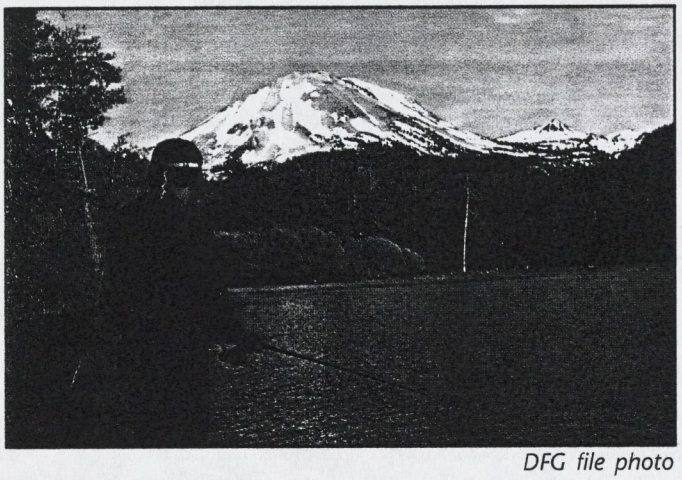
Wild trout. Includes any trout (native or non-native) that is a product of parents that spawned naturally and has spent its entire life in a natural stream environment. May include the offspring of hatchery trout that reproduced in the natural environment.

California Department of Fish and Game

Trout Management

Providing diverse fishing opportunities

Trout are California's primary and most widespread fishery resource. They occur in over 18,000 miles of the state's cooler streams and are the principal sport fish in 3,581 cold water lakes and reservoirs. Trout angling is the most popular type of angling in California, representing about 60 percent of freshwater angling effort statewide. In contrast, the second-most popular fishing is for black bass, and accounts for about 12 percent of the statewide angling demand. Economically, trout fishing in California generates an estimated $3 billion in personal income, accounting for 92,400 jobs.



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The California Department of Fish and Game (DFG) is responsible for managing the state's trout resources and providing a diversity of angling opportunities. Efforts are underway to review current trout management strategies and to plan for the future. All resident trout and inland salmon management strategies and programs will be coordinated under one encompassing strategic trout management plan. The strategic plan will provide direction and goals to meet increasing resource demands, diverse angler desires, and future demographic changes.

Inland Trout Program

Presently, trout are managed under five types of fishery management strategies:

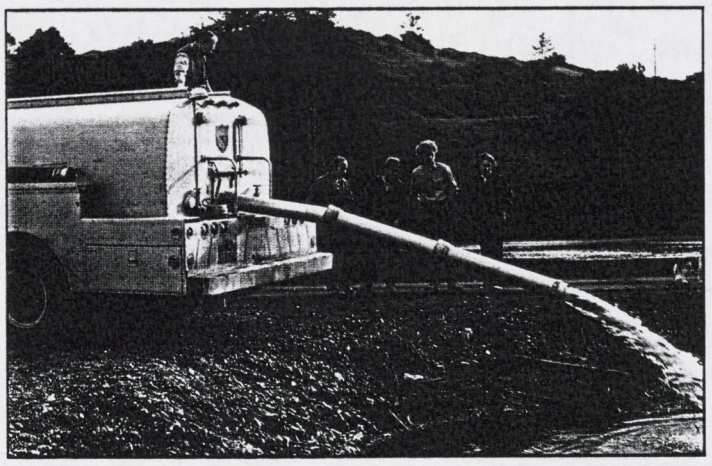
1. Put-and-Take Fisheries. This management technique is employed in waters that are easily accessed by the general public and where angling demand is high. It is supported chiefly by hatchery-produced trout weighing about one-half pound each and measuring about 12 inches in length. These fish are planted in about 780 (four percent) of the 18,000 stream miles and about 300 (eight percent) of the 3,581 cold water lakes and reservoirs suitable for resident trout in California. At least 50 percent of planted "catchable-size" trout are expected to be caught by anglers shortly after stocking. These fisheries provide good quality family-type fishing or fishing opportunities in easily accessible areas where anglers have a high expectation of harvesting some fish. As an added bonus for anglers, hatchery-produced trophy-size trout (larger than two pounds each) are released in limited quantities into selected waters.

2. Put-and-Grow Fisheries. These fisheries are supported by hatchery-produced trout stocked at about three to six inches in length. This strategy is used in waters where spawning habitat is limited but fish habitat otherwise provides for suitable trout growth and survival. Many of these fish are expected to survive for more than one season thereby providing trophy-size fish in subsequent years. This management technique is used for aerial stocking of over 700 high mountain lakes, and for inland (non-anadromous) salmon fisheries.

3. Wild Trout Managed Fisheries. Management guidelines for wild trout waters are contained in policies established by the California Fish and Game Commission. These guidelines state that, "designated wild trout waters should provide a quality experience by providing the angler with an opportunity to fish in aesthetically pleasing and environmentally productive waters with trout populations whose numbers or sizes are largely unaffected by the angling process." Hatchery-produced strains of wild or semi-wild trout may be used to supplement populations, if necessary, but no domesticated strains of catchable-size trout are allowed. Designated wild trout waters are managed principally by protecting, maintaining, and rehabilitating habitat, and adopting appropriate angling regulations. Presently, approximately 604 miles of stream throughout the state and three lakes comprising 81 surface acres are managed as designated wild trout waters.

4. Catch-and-Release Fisheries. This strategy is employed in waters where trout production and fishing quality is improved by limiting harvest. California practices a modified form of catch-and-release management that encourages a zero harvest of trout in designated catch-and-release waters. However, regulations allow for a daily bag limit of one or two trout in many of these waters. Gear is often restricted to artificial lures with barbless hooks to enhance survival of released fish. Catch-and-release is often employed as a management tool in put-and-grow and wild trout managed fisheries. Presently, 37 stream segments totaling 395 miles, and 13 lakes comprising 6,854 surface acres are specifically managed as designated catch-and-release waters.

5. Threatened Native Trout Management. The primary objective of this program is to protect or restore the state's native species of trout. Three native trout species are currently federally listed as threatened while all others are considered unique or species of special concern. One native species, the bull trout, no longer exists in California. Restoration efforts often involve managing small, remnant populations and, when



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necessary, establishing or relocating populations. A few native populations are managed by the Wild Trout Program or regulated with catch-and-release regulations. A new program is being developed to increase the public's awareness of native trout species and to identify angling opportunities in waters where healthy native populations exist.

Inland Salmon Program

In addition to trout, California anglers have the opportunity to enjoy fishing for kokanee and chinook salmon in lakes and reservoirs. Salmon are managed as put-and-grow fisheries in lakes where salmon better use food sources than trout.

The kokanee salmon is a landlocked subspecies of sockeye salmon that provides excellent fishing and quality eating. Presently, 17 lakes and reservoirs are managed with kokanee. Approximately 1.5 million kokanee, three to four inches in length, are planted each year. Typically they reach a size of 8 to 10 inches in length after the first year and 12 to 16 inches by the second year. Growth rates are variable and largely affected by population density, zooplankton abundance, and water temperature. Most kokanee are caught by boat anglers trolling lures.

Up to 500,000 chinook salmon from Feather River Hatchery are planted in several reservoirs in northern California each year. Most chinook are planted as yearlings (about six inches long) and typically attain a size of about 14 to 18 inches (two to 2.5 pounds) by the end of their second year.

Hatchery System

Fourteen trout hatcheries or facilities throughout the state produce over 16 million trout weighing, in total, slightly over 4 million pounds. The majority of the poundage consists of 8 million catchable-size trout for put-and-take fisheries. The remaining fish produced consist of trout for put-and-grow managed fisheries.

The annual budget for the trout hatchery program is about $7 million including employment of 95 permanent personnel. The newest facility was completed in 1968 (American River Hatchery in Sacramento County) and the oldest is over 100 years old (Mt. Shasta Hatchery in Siskiyou County).

Trout are stocked in streams, lakes and reservoirs using specialized trucks and a specially equipped airplane. Frequency of stocking varies from weekly, monthly, annually, or every two or three years depending on angler demand or management strategy.

The DFG's freshwater fisheries and stocking programs are also available at *http://www.dfg.ca.gov/ifd/index.html.*

Additional general information on trout management can be obtained from:

California Department of Fish and Game
Inland Fisheries Division
1416 9th Street, 12th Floor
Sacramento, CA 95814
(916) 653-6194

For more specific information regarding trout fishing locations or hatcheries in your area, contact your Department of Fish and Game Regional Office.

For trout information at DFG Regional Offices:

Region 1
(Northern California)
601 Locust Street
Redding, CA 96001
(916) 225-2300

Region 2
(Central Valley and foothills)
1701 Nimbus Road, Suite A
Rancho Cordova, CA 95670
(916) 358-2939

Region 3
(Northern coast)
P.O. Box 47
Yountville, CA 94599
(707) 944-5500

Region 4
(San Joaquin Valley and Eastern Sierra)
1234 East Shaw Avenue
Fresno, CA 93710
(209) 243-4005, ext 158

Region 5
(Southern California)
330 Golden Shore, Suite 50
Long Beach, CA 90802
(562) 590-5151